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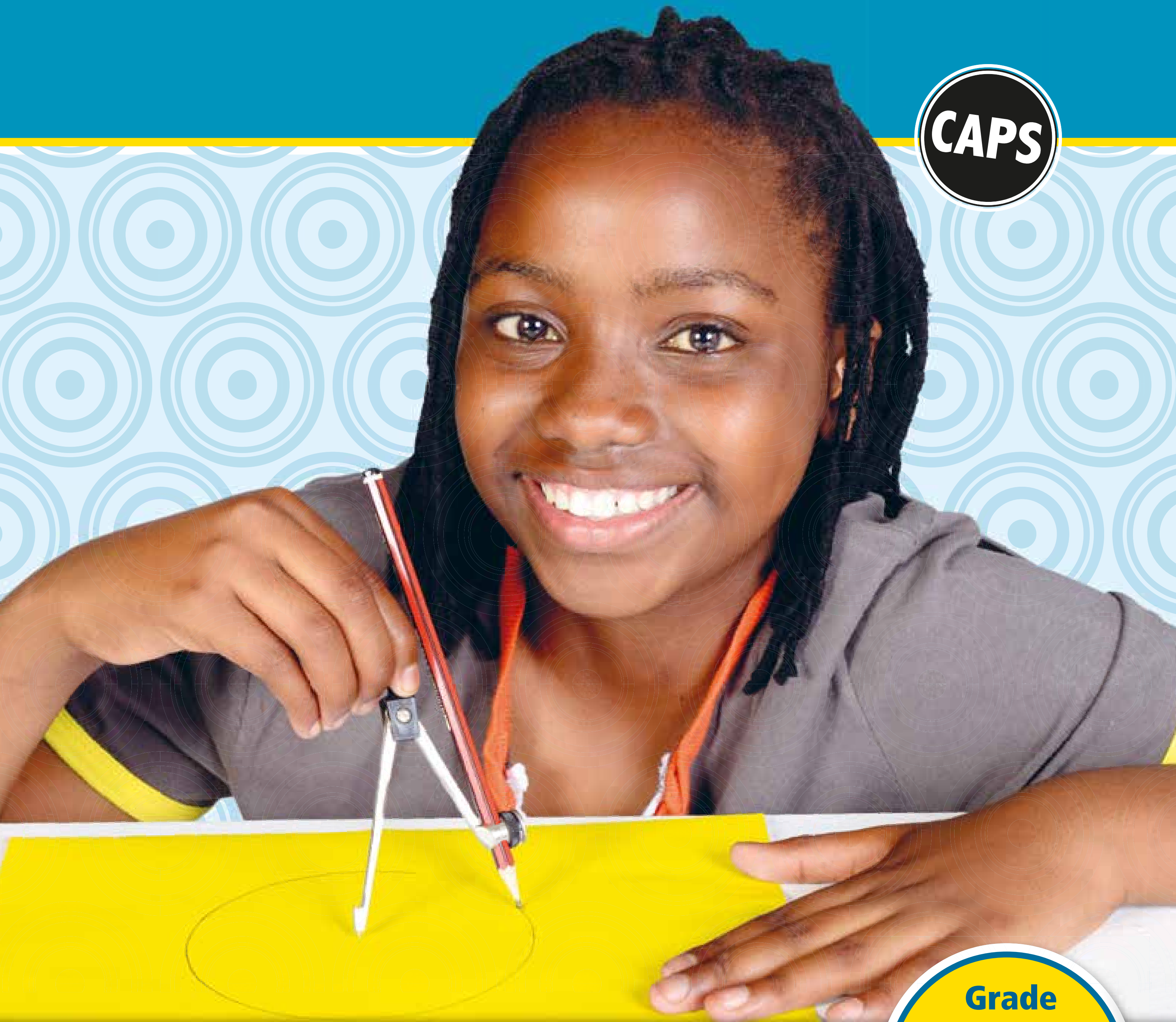
Mathematics



CAPS

Teacher's Guide

Grade 6

Zonia C Jooste • Karen Press • Moeneba Slamang
Clarice Smuts

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CAMBRIDGE UNIVERSITY PRESS

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Cambridge, New York, Melbourne, Madrid, Cape Town,
Singapore, São Paulo, Delhi, Mexico City

Cambridge University Press
The Water Club, Beach Road, Granger Bay, Cape Town 8005, South Africa

www.cup.co.za

First published 2012

ISBN 978-1-107-28396-1

Editor: Inge du Plessis
Typesetter: Laura Brecher
Illustrators: Sue Beattie, Laura Brecher
Cover photographer: Robyn Minter

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1. Introduction

The amended *National Curriculum and Assessment Policy Statements* for Grades R–12 came into effect in January 2012. They replaced the *National Curriculum Statements Grades R–9* (2002) and the *National Curriculum Statements Grades 10–12* (2004). The *National Curriculum and Assessment Policy Statement* (CAPS) for Intermediate Phase Mathematics (Grades 4–6) replaces the Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines that were used before then.

The instructional time for subjects in the Intermediate Phase is given in the table below.

Table 1 Instructional time for Intermediate Phase subjects

Subject	Time allocation per week (hours)
Home Language	6
First Additional Language	5
Mathematics	6
Science and Technology	3, 5
Social Sciences	3
Life Skills:	4
Creative Arts	1, 5
Physical Education	1, 5
Religion Studies	1

The Mathematics curriculum: aims and skills

The aims of the National Curriculum for Mathematics, as set out in the CAPS, are to develop the following qualities in learners:

- a critical awareness of how mathematical relationships are used in social, environmental, cultural and economic relations
- confidence and competence to deal with any mathematical situation without being hindered by a fear of mathematics
- a spirit of curiosity and a love for mathematics
- an appreciation of the beauty and elegance of mathematics
- recognition that mathematics is a creative part of human activity
- deep understanding of concepts needed to make sense of mathematics
- acquisition of specific knowledge and skills necessary for:
  - the application of mathematics to physical, social and mathematical problems
  - the study of related subject matter (e.g. other subjects)
  - the further study of mathematics.

The CAPS lists the following specific skills that learners must acquire to develop their essential mathematical skills:

- correct use of the language of mathematics
- ability to understand and use number vocabulary, number concept and calculation and application skills
- ability to listen, communicate, think, reason logically and apply the mathematical knowledge gained
- ability to investigate, analyse, represent and interpret information
- ability to pose and solve problems
- awareness of the important role that mathematics plays in real-life situations, including the personal development of the learner.

Problem-solving and mathematics

This Mathematics course is designed to encourage learner-centred and activity-based learning through problem-solving, an approach that should be applied throughout the course.

Problem-solving is one of the unique features of learning and teaching mathematics. Learners should be able to:

- make sense of problems
- analyse, synthesise (create), determine and execute solution strategies
- estimate, confirm (validate) and interpret the solutions appropriate to the context.

Problem-solving does not necessarily imply solving word problems. Word problems could be examples of extending problems that test learners' mathematical knowledge. These problems involve the use and validation of learned techniques in all the content areas of Intermediate Phase mathematics.

In a problem-solving situation, it may be highly unlikely that learners have had previous instruction on how to tackle the problems they are facing. Learners should invent their own solution strategies using different problem-solving procedures. There are no ready-made recipes or blueprints for searching for and finding problem-solving solutions.

Solutions and strategies are not as obvious in problem-solving situations as they are in word problems. In word problems, it is easy to identify which operations to apply to solve the problem. Problem-solving is not a topic that can be learned. It is a process in which learners can explore situations by applying different skills. Learners construct new meaning by building on previous knowledge and experiences in an active, cooperative environment.

Learners do not learn problem-solving techniques by memorising rules or consulting checklists. You should raise consistent awareness of the different techniques suitable for different problem-solving situations. You could give the problem as a homework task, group activity or introduction to new concepts (knowledge), or deal with it in an oral or written situation that applies to all learners without gender or culture bias. Throughout this course, learners are presented with different possible strategies for solving problems, and are encouraged to choose or develop strategies that work most effectively in given contexts.

Keep in mind that it is important to acknowledge that people are fundamentally different, and experience problem situations differently. Expect learners to apply a wide range of different methods and ideas in the problem-solving process. Monitor learner groups carefully and encourage discussions and arguments while questioning learners about their progress. An important aspect of the learning of mathematics involves creative initiatives by learners to use the strategies and methods they know when they are confronted with new problems, and to experiment with different approaches to solving the problems.

Lead a class discussion on making mistakes, working well together, useful steps to keep in mind during a lesson, and enjoyment as an important part of mathematics activity. Discuss each aspect and ask learners questions such as: How do you feel when you have made a mistake? Why do you feel this way? Explain, for example, what it means to work towards a common goal. Take note of learners who seem reluctant to attempt problems that they find difficult, and help them to use their existing knowledge to solve new problems.

Inclusivity in the mathematics classroom

The ultimate aim of an inclusive school is to contribute towards the development of an inclusive society, where diversity is respected and used as a tool for building a stronger community.

Inclusive education is a process in which barriers to successful learning are identified and then removed for every learner. This starts at the school level, where the physical environment should be designed to accommodate learners who are challenged, where the school principal, the staff and the parents/guardians work together to create a good school ethos and where specialised equipment and/or personnel are provided for these learners.

You should highlight daily the aspects of mathematics that encourage cooperative learning and respect for diversity. Plan activities on an individual, pair or group basis so that you can meet the different needs of learners.

Homogeneous groups or pairs (in which all the learners have more or less the same level of skill and knowledge) are appropriate when the purpose of the group is to assist learners who have a common special educational need. Use homogeneous groups to cope with differentiated learning. For example, learners who have completed a class activity can be given an individual or group extension activity while you work with the rest of the class or with a group that needs more intensive input from you to help them understand and complete an activity. The intention is not for these groups to be fixed groups, but that learners move to different groups according to their needs and progress.

Heterogeneous groups have a number of advantages. These groups consist of learners with diverse backgrounds, gender, languages and abilities. Heterogeneous groups expose learners to new ideas, generate more discussion, and allow explanations to be given and received more frequently – this helps to increase understanding. Peer-tutoring, where two learners with different skills are paired, can be a mutually enriching experience.

Content areas in Intermediate Phase Mathematics

Mathematics in the Intermediate Phase covers five content areas:

- Numbers, operations and relationships
- Patterns, functions and algebra
- Space and shape (geometry)
- Measurement
- Data handling.

Each content area contributes towards the acquisition of specific skills. The table, Mathematics content knowledge, on page 9 in the CAPS document shows the general focus of the Mathematics content areas in curriculum as a whole, and the specific content focus in the Intermediate Phase.

Each content area is divided into topics. All the content areas must be taught every term. The tables for Time allocation per topic on pages 24 (Grade 4), 25 (Grade 5) and 26 (Grade 6) of the CAPS document set out the sequences of topics per term for each grade. This Mathematics course is structured to follow the sequences of topics set out in the CAPS table for each grade, term by term.

The full descriptions of concepts and skills for each content area, as well as additional teaching guidelines, are given in the detailed tables that follow these overview tables in the CAPS document. The Learner Book and Teacher's Guide for this course provide cross references to the relevant sections of these tables; this will help you to check that you are covering the required concepts and skills as you work through the units in the course.

The units in each term of this Mathematics course are clearly structured according to these content areas. At the same time, you will find that opportunities are provided in each content area to use concepts and skills relating to other content areas. For example, learners use concepts and contexts from Measurement, and Space and shape to solve problems in the Numbers, operations and relationships, and Patterns, functions and algebra content areas. In this way, learners are able to integrate the concepts, techniques and problem-solving strategies they learn across all content areas, and increase their awareness of mathematics as a coherent body of knowledge that covers a wide range of contexts and concepts.

Mental mathematics

Mental mathematics is a central part of the Intermediate Phase curriculum content. It should be part of the daily mathematics activity in the classroom throughout the year. In this Mathematics course most content units start with mental mathematics activities. These activities are designed to relate to the content that follows in the main unit, and also to revise skills and problem-solving strategies that learners have used earlier in the year. They are a vital part of the course, as they serve to keep learners actively thinking and talking about mathematics with you and with their peers, on a daily basis.

Weighting of content areas

Mathematics content areas are weighted for two purposes: firstly the weighting gives guidance on the amount of time needed to adequately cover the content in each content area; secondly the weighting gives teachers guidance on the spread of content in the examination (especially in the end-of-year summative assessment).

The weighting of the content is the same for each grade in the Intermediate Phase. The table on the next page shows the weightings, per grade.

Table 2 Weighting of content areas in Intermediate Phase Mathematics

	Weighting of content areas		
Content area	**Grade 4**	**Grade 5**	**Grade 6**
Numbers, operations and relationships*	50%	50%	50%
Patterns, functions and algebra	10%	10%	10%
Space and shape (geometry)	15%	15%	15%
Measurement	15%	15%	15%
Data handling	10%	10%	10%
Total	**100%**	**100%**	**100%**

*The weighting of the Numbers, operations and relationships content area has been increased to 50% for all three grades, in order to ensure that learners are sufficiently numerate when they enter the Senior Phase.

Progression in content areas across the Intermediate Phase

The Intermediate Phase Mathematics curriculum is structured to enable learners to develop their skills and knowledge in each content area in a careful progression from Grade 4 to Grade 6. A summary of this progression is provided on pages 11–22 of the CAPS document.

2. Planning and organising your mathematics teaching

The Teacher's Guide is an essential component of this series. It gives clear guidelines on how to teach the concepts the learners need to master and how to organise activities in the classroom. It contains a collection of photocopiable resources that are required for some of the activities in the Learner's Book. You can also use these resources to repeat activities at different times during the year, if you want to revise particular concepts and methods with learners.

The Learner's Book is structured according to the term-by-term sequence of topics for the grade set out in the CAPS document. Most units are preceded by a mental mathematics section that is integrated with the content to be covered in the unit that follows. You may want to do the mental mathematics activity at one time in the day and then proceed with the next unit later in the day. It is essential to keep to the rhythm of daily mental mathematics activities, so that learners continue to develop and consolidate their mathematical skills.

Resources in the classroom

In the Intermediate Phase learners move from work with concrete apparatus to focus more on written and oral work based on the content in the Learner's Book. However, it is still important that they use concrete apparatus such as flard cards, Dienes blocks and geometric shapes and objects to help them consolidate their understanding of place value, shape, space, pattern, division (sharing) and grouping, and other concepts that they will work with in this phase. The Teacher's Guide indicates what equipment will be useful for this purpose, in relation to each unit of the course.

Learners will also need to have access to instruments and equipment for practical activities in certain content areas, particularly the Measurement content area, where they need to use analogue and digital watches, stopwatches, scales and thermometers, as well as tape measures, trundle wheels, measuring jugs and spoons and droppers. Since much of this equipment is used in Grades 4, 5 and 6, you could arrange with teachers across the phase to have a collection of such equipment available for use by the learners in all three grades.

The photocopiable resources provided in this Teacher's Guide can be used throughout the year to repeat activities such as the mental mathematics games learners play, revising number concepts such as place value.

A teaching strategy that builds conceptual and social skills

The learning experiences in this course are designed for group work, pair work, individual work and for the whole class to do together. This cultivates an ethos of cooperation and working together. Letting learners work together is a very useful and successful teaching strategy. It helps them to develop social skills such as cooperating in teams, taking turns, showing respect and responsibility, as well as listening and communicating effectively through interactive learning.

Helping learners overcome barriers to learning mathematics

Learners who experience barriers to learning mathematics should be given many opportunities for activity-based learning, to help them overcome their barriers at the pace that works for them. They should be given more time to do practical examples, using concrete objects and practical experiences, than other learners. Moving too soon to abstract work may make these learners feel frustrated, and they may then lose mathematical understanding and skills they have developed.

When organising daily classroom activities, allow more time for these learners to complete tasks, use their own strategies to develop their thinking skills, and do assessment activities. You may also need to reduce the number of activities you give to these learners, without leaving out any of the concepts and skills that need to be introduced and consolidated.

Revision work

The term-by-term content schedule for each grade includes periods set aside for revision work. During this period of the term you can repeat activities from units throughout the term, let learners play again the games they played during the Mental Maths units, or design new revision activities using the notes provided for each unit in this Teacher's Guide. Use the revision periods as a way to assess learners' readiness to complete formal assessment tasks for the term.

Assessment

The purpose of assessment is to inform you, the learners and their parents or guardians about their performance. Assessment also serves as a tool for you to reflect on and analyse your own teaching practice, as this has an influence on the learners' performance. You can use your assessment to see whether you need to provide more opportunities for some or all of the learners to develop a particular skill or master a concept in a given topic.

You should develop a well planned process to identify, record and interpret the performance of your learners throughout the year, using both informal and formal assessment methods. Keep a record of the learners' performance on assessment sheets, and summarise this information on a report form or card to give the learners and their parents or guardians at certain times of the year. You may photocopy the various assessment sheets provided in the back of this Teacher's Guide to use in your classroom.

Assessment methods

You can use various methods to assess the learners' progress during the year. Any assessment method involves four steps:

- generate and collect evidence of learners' achievement
- evaluate this evidence
- record your findings
- use this information to understand learners' development and help them improve the process of learning, and also to improve your teaching.

Before you undertake any assessment of learners' work, decide on a set of criteria or standards for what they should be able to understand and do, and base your assessment on these criteria. It is important that you give the learners clear instructions on what you expect of them, so that they can complete the assessment tasks correctly and honestly. Once an assessment task has been completed, discuss your assessment with the learners and give them feedback to help them increase their ability to do the task successfully.

Term-by-term assessment

The term-by-term content guidelines in the CAPS document specify which content areas are to be assessed in each term of the year. This Teacher's Guide includes assessment tasks for all content areas covered in each term. You may choose to do the assessment of a particular content section straight after that section has been completed, or to schedule the assessment at another time during the term. The assessment tasks are resources that you can use as part of your overall assessment plan for the year.

Self-assessment

Throughout the year the mental mathematics sections of the course include activities that learners must complete on a mental maths grid. This is a self-assessment tool that will enable the learners monitor their own achievements, and indicate where they feel they need help with a particular aspect of the content. You should use the completed grids as part of your own assessment of each learner's progress throughout the year.

Formal assessment requirements for Intermediate Phase Mathematics

The table below sets out the formal assessment requirements for Intermediate Phase Mathematics, as specified in the CAPS document.

Table 4 Minimum requirements for formal assessment: Intermediate Phase Mathematics

	Forms of assessment	Number of tasks per year	Minimum requirements per term				Weighting
			Term 1	Term 2	Term 3	Term 4	
School-based assessment (SBA)	Tests	3	1	1	1		**75%**
	Examination	1		1			
	Assignment	2	1			1	
	Investigation	1				1	
	Project	1			1		
	Total	**8**	**2**	**2**	**2**	**2**	
	To be completed before the final examination at the end of the year						
Final examination		1	End of the year				**25%**

Assessing learners who experience barriers to learning

Learners who experience barriers to learning should be given opportunities to demonstrate their competence in ways that suit their needs. You may have to consider using some or all of the following methods when assessing these learners:

- Allow these learners to use concrete apparatus for a longer time than other learners in the class.
- Break up assessment tasks (especially written tasks) into smaller sections for learners who have difficulty concentrating for long periods, or give them short breaks during the task.

- Learners who are easily distracted may need to do their assessment tasks in a separate venue.
- Use a variety of assessment methods, as some learners may not be able to demonstrate what they can do using certain types of assessment.
  For example, a learner may be able to explain a concept orally but have difficulty writing it down.

Reporting learners' performance

Reporting is the process of communicating learners' performance to the learners themselves, and to parents and guardians, schools and other stakeholders. You can use report cards, parent meetings, school visitation days, parent–teacher conferences, phone calls, letters and other appropriate methods to make your reports.

Records of learner performance should provide evidence of the learner's conceptual progression within a grade and her/his readiness to progress to the next grade.

Formal assessment is reported in all grades using percentages. The table below sets out the scale of achievement to be used for recording and reporting levels of competence in the Intermediate Phase. You should also use comments to describe learners' performance, as appropriate.

Table 5 Scale of achievement for the National Curriculum Statement Grades 4–6

Rating code	Description of competence	Percentage
7	Outstanding achievement	80–100
6	Meritorious achievement	70–79
5	Substantial achievement	60–69
4	Adequate achievement	50–59
3	Moderate achievement	40–49
2	Elementary achievement	30–39
1	Not achieved	0–29

3. Lesson plans

Note: For all terms, time for Mental maths activities is included in the time for a unit.

Term 1			
Unit	**Title**	**LB pages**	**Time**
	Content area: Number, operations and relationships **Topic: Whole numbers: Revision of work in previous grades**		**2 hours**
1	Revising number facts	2–4	1 hour
2	Count, order and compare numbers and place value	5–9	1 hour
	Assessment 1.1 Counting, ordering, representing numbers and place value		
	Content area: Patterns, functions and algebra **Topic: Number sentences**		**3 hours**
3	Create number sentences	19–12	1 hour
4	Making number sentences true	12–14	1 hour
5	Number sentences that describe problems	15–17	1 hour
	Assessment 1.2 Number sentences		
	Content area: Number, operations and relationships **Topic: Whole numbers: Addition and subtraction**		**7 hours**
6	Addition and subtraction calculations	18	1 hour
7	Strategies for adding and subtracting	19–20	1 hour
8	Rounding off to estimate	20–22	1 hour
9	More calculation methods	22–23	1 hour
10	Short cuts to calculation	24–25	1 hour
11	Solving real-life problems	25–27	2 hours
	Assessment 1.3 Addition and subtraction of whole numbers		
	Content area: Number, operations and relationships **Topic: Common fractions**		**10 hours**
12	Representing fractions in diagrams	28–29	1 hour
13	Order and count fractions	30–32	1 hour
14	Identify and order fractions	32–34	1 hour
15	Creating equivalent fractions	35–36	1 hour
16	More equivalent fractions	36–38	1 hour
17	Solving problems with fractions	39–40	1 hour
18	Subtracting fractions to solve problems	41–44	1 hour
19	Finding fractions of whole numbers	44–46	1 hour
20	Solving sharing problems	46–48	1 hour
21	More fraction problems	48–50	1 hour
	Assessment 1.4 Common fractions		
	Content area: Measurement **Topic: Time**		**5 hours**
22	Reading analogue and digital time	51–56	1 hour
23	Calculations with watches and stopwatches	56–59	1 hour

Unit	Title	LB pages	Time
24	Calculating time with calendars	60–62	1 hour
25	Time zones	63–65	1 hour
26	The history of measuring time	66–68	1 hour
	Content area: Space and shape **Topic: Properties of 2-D shapes**		**8 hours**
27	Sides of shapes	69	1 hour
28	Polygons: shapes with straight sides	70–71	1 hour
29	Angles	72–76	2 hours
30	Rectangles and parallelograms	76–78	2 hours
31	Building bigger shapes	78–79	2 hours
	Revision	79–80	
	Assessment 1.5 Properties of 2-D shapes		
	Content area: Data handling **Topic: Collect, organise, represent numbers and interpret data**		**10 hours**
32	Collecting and organising data	81–86	4 hours
33	Showing data using graphs	86–93	3 hours
34	Explaining data	94–104	3 hours
	Revision	105–107	
	Assessment 1.6 Collecting, representing, analysing and reporting data		
	Content area: Patterns, functions and algebra **Topic: Numeric patterns**		**4 hours**
35	Numeric patterns in African beadwork	108–110	1 hour
36	Multiplication strategies	111–112	1 hour
37	Spot patterns	113–114	1 hour
38	Using rules	115–116	1 hour
	Assessment 1.7 Number patterns		

Term 2

Unit	Title	LB pages	Time
	Content area: Number, operations and relationships **Topic: Whole numbers: Multiplication**		**6 hours**
1	Place value of large numbers	118–121	1 hour
2	Multiplication with whole numbers	121–124	1 hour
3	Multiplication facts	124–126	1 hour
4	Multiplication patterns	126–127	1 hour
5	Multiplication short cuts	127–129	1 hour
6	Multiplication strategies	129–130	1 hour
	Assessment 2.1 Multiplication of whole numbers		
	Content area: Space and shape **Topic: Properties of 3-D objects**		**5 hours**
7	Surfaces and faces of 3-D objects	131–133	2 hours
8	Pyramids	134–135	1 hour
9	3-D models using nets	136–137	2 hours
	Revision	137–138	
	Content area: Patterns, functions and algebra **Topic: Geometric patterns**		**6 hours**
10	Extending patterns	139–141	1 hour
11	Start number patterns	141–143	1 hour
12	Rules for patterns	143–146	2 hours
13	Rules for some cube patterns	146–148	1 hour
14	A rule for tiles around a pond	148–150	1 hour
15	Rules for groups of tables	150–151	
	Assessment 2.2 Geometric patterns		
	Content area: Space and shape **Topic: Symmetry**		**2 hours**
16	Symmetrical shapes	152–156	2 hours
	Revision	156–157	
	Assessment 2.3 Properties of 3-D objects and symmetry		
	Content area: Numbers, operations and relationships **Topic: Whole numbers: Division**		**8 hours**
17	Basic division	158–159	1 hour
18	Division rules	160	1 hour
19	Dividing by zero	161–164	1 hour
20	Using a calculator to check	164–165	2 hours
21	Division short cuts	166–167	1 hour
22	Division with remainders	167–169	1 hour
23	Real-life problems	169–170	1 hour
	Assessment 2.4 Division of whole numbers		

Unit	Title	LB pages	Time
	Content area: Numbers, operations and relationships **Topic: Decimal fractions**		**10 hours**
24	Decimals and measuring length	171–174	1 hour
25	Decimal fractions	174–176	1 hour
26	More decimal fractions	176–180	1 hour
27	Decimal place value	181–183	1 hour
28	Decimal tenths and hundredths	183–185	1 hour
29	Calculations with decimal fractions	185–188	1 hour
30	Decimal addition with carrying	188–192	1 hour
31	Solving problems with decimals	192–193	1 hour
32	Multiply with decimals	194–195	1 hour
33	Problem-solving: Add, subtract and multiply decimal fractions	195–197	1 hour
	Assessment 2.5 Decimal fractions		
	Content area: Measurement **Topic: Capacity/volume**		**5 hours**
34	Estimating, measuring, recording and comparing volume and capacity	199–204	2 hours
35	Reading capacity and volume levels	204–209	3 hours
	Assessment 2.6 Capacity/volume		

Term 3			
Unit	**Title**	**LB pages**	**Time**
	Content area: Measurement **Topic: Mass**		**5 hours**
1	Estimating, measuring, recording and comparing mass	212–214	1 hour
2	Measuring with analogue and digital scales	214–218	2 hours
3	Measuring with a balance	218–220	2 hours
	Assessment 3.1 Mass		
	Content area: Numbers, operations and relationships **Topic: Whole numbers**		**8 hours**
4	Factors and prime numbers	221–225	1 hour
5	Addition and subtraction	225–227	
6	More addition and subtraction	227–228	1 hour
7	Add and subtract in expanded notation	228–229	1 hour
8	Estimate, then calculate	229–230	1 hour
9	Subtracting 6-digit numbers in expanded notation	230	1 hour
10	Vertical addition and subtraction	231	1 hour
11	More vertical addition and subtraction	231–232	1 hour
12	Solving word problems	232–234	1 hour
	Assessment 3.2 Addition and subtraction of whole numbers		
	Content area: Space and shape **Topic: Viewing objects**		**3 hours**
13	Viewing single objects	235–236	1 hour
14	Viewing groups of objects	237–238	2 hours
	Revision	239	
	Content area: Space and shape **Topic: Properties of 2-D shapes**		**4 hours**
15	Describing and drawing shapes	240–243	2 hours
16	Circles	243–246	2 hours
	Revision	247	
	Content area: Space and shape **Topic: Transformations**		**3 hours**
17	Words to describe patterns	248–250	1 hour
18	Patterns in nature	250–251	
19	Patterns in cultural objects	251–252	1 hour
20	Patterns from everyday items	252–253	1 hour
	Revision	253	
	Assessment 3.3 Viewing objects, 2-D shapes and transformations		
	Content area: Measurement **Topic: Temperature**		**1 hour**
21	Estimating, measuring, recording and comparing temperatures	254–259	1 hour
22	Temperature and weather	259–261	
	Assessment 3.4 Temperature		

Unit	Title	LB pages	Time
	Content area: Numbers, operations and relationships **Topic: Percentages**		**5 hours**
23	Percentages	262–265	1 hour
24	Representing percentages on a pie chart	265–267	1 hour
25	Percentages of money	268–269	1 hour
26	Percentage and decimal fractions	269	1 hour
27	Using a calculator to work out percentages	270–271	1 hour
	Assessment 3.5 Percentages		
	Content area: Data handling **Topics: Collecting, organising, representing, analysing, interpreting and reporting data**		**9 hours**
28	Collecting and organising data	272–274	2 hours
29	Showing data using graphs	274–281	3 hours
30	Explaining data	281–292	4 hours
	Revision	292–295	
	Assessment 3.6 Data handling		
	Content area: Patterns, functions and algebra **Topic: Numeric patterns**		**5 hours**
31	Patterns and primes	296–297	1 hour
32	Rules for creating sequences	298–299	1 hour
33	Finding patterns in number grids	300–301	1 hour
34	Finding rules in flow diagrams	301–303	1 hour
35	Rules in tables	304–305	1 hour
	Assessment 3.7 Numeric patterns		
	Content area: Measurement **Topic: Length**		**5 hours**
36	Measuring length	306–312	2 hours
37	Converting between mm, cm, m and km	312–318	3 hours
	Assessment 3.8 Length		

Term 4			
Unit	**Title**	**LB pages**	**Time**
	Content area: Numbers, operations and relationships **Topic: Whole numbers: Place value and multiplication**		**6 hours**
1	Place value and powers of 10	320–323	1 hour
2	Multiplication and ratio	323–326	1 hour
3	Basic multiplication facts	327–328	1 hour
4	Multiplication rules	329–330	1 hour
5	Vertical multiplication	331–332	1 hour
6	Solving word problems	332–333	1 hour
	Assessment 4.1 Multiplication of whole numbers		
	Content area: Numbers, operations and relationships **Topic: Common fractions**		**5 hours**
7	Fun with fractions	335–336	1 hour
8	Fractions of wholes	336–337	1 hour
9	Representations of fractions	337–338	1 hour
10	Fractions and ratio	339–341	1 hour
11	Fractions, decimals and percentages	341–342	1 hour
	Assessment 4.2 Common fractions		
	Content area: Space and shape **Topic: Properties of 3-D objects**		**5 hours**
12	Describing and sorting 3-D objects	343–344	2 hours
13	Faces, edges and vertices	345–346	1 hour
14	Models of 3-D objects	347–348	2 hours
	Content area: Measurement **Topic: Area, perimeter and volume**		**8 hours**
15	Perimeter	349–355	2 hours
16	Area	355–360	2 hours
17	Volume	360–364	3 hours
18	The history of measurement	365–369	1 hour
	Assessment 4.3 Perimeter, area and volume		
	Content area: Numbers, operations and relationships **Topic: Whole numbers: Division**		**7 hours**
19	Whole number division facts	370–372	1 hour
20	Proportional sharing and unit rate	372–373	1 hour
21	Division word problems	374	1 hour
22	Ratio and division	375–376	1 hour
23	More division	376–377	1 hour
24	More division strategies	377	1 hour
25	Long division	378	1 hour
	Assessment 4.4 Division of whole numbers		

Unit	Title	LB pages	Time
	Content area: Patterns, functions and algebra Topic: Number sentences		3 hours
26	Revising number rules	379–380	1 hour
27	Equations that balance	380–381	1 hour
28	Solving real-life problems	382–383	1 hour
	Assessment 4.5 Number sentences		
	Content area: Space and shape **Topic: Transformations**		**3 hours**
29	Describing patterns	384	30 minutes
30	Enlarging and reducing shapes	385–394	2 hours 30 minutes
	Revision	394–395	
	Content area: Space and shape **Topic: Position and movement**		**2 hours**
31	Objects on a grid	396	1 hour
32	Working with maps	397–398	1 hour
	Revision	398–399	
	Assessment 4.6 Properties of 3-D objects, transformations, and location and directions		
	Content area: Data handling **Topic: Probability**		**2 hours**
33	Possible outcomes	400–402	1 hour
34	Recording actual outcomes	402–404	1 hour
	Revision	404	
	Assessment 4.7 Probability		

TERM 1

Whole numbers

Learner's Book page 2

Counting, ordering, comparing, representing numbers and place value

Tell the learners that they will work with whole numbers during the first two units of the course (these units can be covered in the first week of the term).

Remind them that they have worked with place value, counting, ordering, comparing and representing whole numbers up to 6-digit numbers in Grade 5. They have done addition and subtraction with up to 5-digit numbers and multiplied and divided up to 3-digit by 2-digit numbers.

This year they will work with whole numbers up to 9-digit numbers. They will do addition and subtraction with numbers up to 6-digits, multiply up to 4- by 3-digit numbers and divide up to 3- by 2-digit numbers.

They will do mental calculations before each lesson and perform an assessment task at the end of the units. They will start this term's work with some fun number activities to revise basic operation facts and different number properties.

Unit 1 Revising number facts

MENTAL MATHS

Learner's Book page 2

This unit is an opportunity for learners to recall and revise their skills at working with whole numbers, while you assess their ability to use these skills and to do mental calculations. Allow the learners to perform the activities as a whole class, in groups, pairs or individually.

They first play the *I have ...* basic operations game as a class to practise the four basic operations. The game helps learners to develop listening skills, their ability to work as a team, tolerance and fluency in mental calculations. Copy the template in the back of this Teacher's Guide onto stiff paper and laminate it so that the cards can be used on a regular basis.

You should allow learners to play this game on a regular basis. Check which learners struggle with the mental calculations and let them use some of the calculations on the cards to practise calculation skills. For example, for 9 + 6, they should build up 10s first to see that 9 + 1 + 5 = 15.

Rules of the *I have …* game

There are 40 cards. If you have fewer than 40 learners, give some learners 2 cards. If you have more than 40 learners, let some of them work in pairs. Take a card and start the chain. Read the statement, for example, 'I have 8. Who has 4 more?' The learner with the card who has the answer to the question reads his/her statement next, i.e. 'I have 12. Who has half of this?' and so on. You need to caution learners that they have to concentrate and listen carefully. They should speak loudly and clearly enough. Discourage them from shouting out the answers. The chain ends when your original statement is the answer to the last question, i.e. 'I have 8'. The game can be played as often as you have time. It develops listening skills, mental calculation skills and concepts such as more than, less than, halving, doubling, plus and minus. It also encourages learners to work together as a class. Everyone has to calculate because they might have to answer next.

Activity 1.1

Learner's Book page 2

Find out how many learners have cell phones and how they use them. Discuss the advantages and disadvantages of cell phones. Tell the learners that they will learn to calculate the digital sum of a cell phone number.

This activity will help enhance their understanding of the *associative property* of numbers, i.e. grouping numbers to calculate smarter. Ask the learners to look at the 7-digit number on the cell phone screen in question 1. Ask them to add the 7 numbers on the screen; then to add the digits in the answer; then to add again until they have a 1-digit solution – that is the digital sum of the phone number. For example:

$4 + 6 + 8 + 1 + 3 + 9 + 7 = \blacksquare$
$(4 + 6) + (9 + 1) + (7 + 3) + 8 = 38$
$3 + 8 = 11$
$1 + 1 = 2$

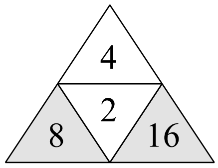
The digital sum of the cell phone number is 2.

The learners then calculate the digital sums of the numbers on the cell phone displays in (a) to (e).

For question 2, ask the learners to explore the multiplication triangle. Let them explain how it works. They complete the triangles individually so you can check their multiplication skills. Ask them to find other relationships, for example division as the inverse of multiplication. They also apply the commutative property when they swap numbers to get the same solutions.

For example:

$2 \times 4 = 8$	$4 \times 2 = 8$
$2 \times 8 = 16$	$8 \times 2 = 16$
$8 \div 2 = 4$	$8 \div 4 = 2$
$16 \div 8 = 2$	$16 \div 2 = 8$



In question 3 the learners explore the numbers in the addition cross. They perform addition and subtraction to find the missing numbers in the crosses. Ask them to look for other relationships, for example:

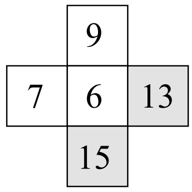
$7 + 6 = 13$	$6 + 7 = 13$	$13 - 6 = 7$	$13 - 7 = 6$
$9 + 6 = 15$	$6 + 9 = 15$	$15 - 6 = 9$	$15 - 9 = 6$

They apply the commutative property and realise that when you swap the numbers in addition it does not change the answer.

Ask them to explore subtraction in this way so they can see that commutativity does not comply with subtraction, i.e.:

$13 - 6 = 7 \qquad 7 - 13 \neq 6$

They can check this on a calculator.



In question 4, the learners complete the magic squares to find the magic sums in the rows, columns and diagonals of each square (see templates). They apply addition and subtraction skills. You should encourage them to apply effective addition strategies, such as the associative property, breaking up of numbers and building up of groups of 10 and multiples of 10, for example:

$8 + 5 + 2 = 8 + 2 + 5 = 15$

$13 + 10 + 7 = 13 + 7 + 10 = 30$

$150 = 64 + 50 + \blacksquare$	or	$64 + 50 = 50 + 50 + 14$
$150 - 50 = 100$		$= 114$
$100 - 60 = 40$		$114 + 6 = 120$
$40 - 4 = 36$		$120 + 30 = 150$
		$30 + 6 = 36$

In question 5 ask the learners to explore the numbers on the cell phone and computer keys. They should notice that the numbers on the phone keypad start from 1, while those on the computer keypad are arranged in a different way. Ask them to find out how the numbers are arranged on the keypads of a fax machine and a landline telephone. Let them look at the numbers in the rows, columns and diagonals to find patterns. They should note that there is a difference of 3 between the numbers in the columns. They identify the even, odd, square, counting, natural, rectangular and triangular numbers to which they have been introduced in Grade 4 and 5. Find out if they remember that zero is a whole, counting and even number. You could ask them to extend the number patterns they observe.

In question 6 the learners are introduced to prime numbers. They explore the first few prime numbers as numbers that have only two factors, the number itself and 1, and compare these with numbers that have more factors. They will do more work with prime numbers and factors in Term 3.

1. a) $7 + 6 + 5 + 9 + 1 + 4 + 3 = (7 + 3) + (6 + 4) + (9 + 1) + 5$
$= 35$
$3 + 5 = 8$

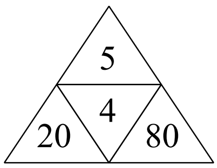
b) $2 + 8 + 3 + 5 + 7 + 5 + 9 = (8 + 2) + (7 + 3) + (5 + 5) + 9$
$= 39$
$3 + 9 = 12$
$1 + 2 = 3$

c) $8 + 3 + 4 + 6 + 7 + 9 + 1 = (7 + 3) + (6 + 4) + (9 + 1) + 8$
$= 38$
$3 + 8 = 11$
$1 + 1 = 2$

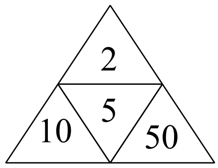
d) $2 + 7 + 0 + 1 + 4 + 9 + 8 = (8 + 2) + (9 + 1) + 7 + 4 + 0$
$= 31$
$3 + 1 = 4$

e) $5 + 6 + 7 + 9 + 9 + 3 + 6 = (9 + 6) + (9 + 6) + (7 + 3) + 5$
$= 45$
$4 + 5 = 9$

2. a)



b)



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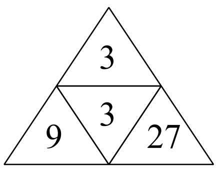
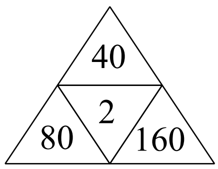
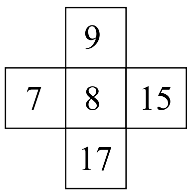


d)



3. a)



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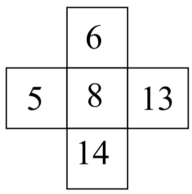

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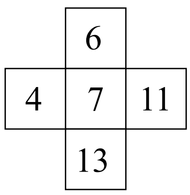
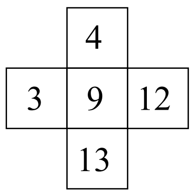


d)



4. a)

8	1	6
3	5	7
4	9	2

sum = 15

b)

12	11	7
5	10	15
13	9	8

sum = 30

c)

64	63	23
9	50	71
77	37	36

sum = 150

When the learners have completed their squares, ask them to look for a relationship between the number in the centre of a square and the magic number. They should find that the number is one third of the magic sum, i.e.:

$$15 \div 5 = 3$$
$$30 \div 10 = 3$$
$$150 \div 50 = 3$$

or $3 \times 5 = 15$

$$3 \times 10 = 30$$
$$3 \times 50 = 150$$

When you explain the relationship, point out that you apply the inverse operation for division or multiplication.

5. a)

1; 4; 7; ...	Count in intervals of 3
2; 5; 8; ...	Count in intervals of 3
3; 6; 9; ...	Count in multiples of 3
1; 5; 9; ...	Count in intervals of 4
3; 5; 7; ...	Count in intervals of 2, or uneven numbers
0; 1; 2; 3; ...	Counting numbers
1; 2; 3; ...	Natural numbers

b)

(i)	Even numbers:	0; 2; 4; 6; 8
(ii)	Odd numbers:	1; 3; 5; 7; 9
(iii)	Square numbers:	1; 4; 9
(iv)	Counting numbers:	0; 1; 2; 3; 4; 5; 6; 7; 8; 9 (also whole numbers)
(v)	Natural numbers:	1; 2; 3; 4; 5; 6; 7; 8; 9
(vi)	Rectangular numbers:	2; 6
(vii)	Triangular numbers:	1; 3; 6

c) Zero is a counting, whole and even number

6. a) Factors of 12: 1; 2; 3; 4; 6; 12
Factors of 13: 1; 13

b) No, it has only one factor.

c) Yes, except for 2. By definition, a prime number has only two factors, the number 1 and itself. If a number is even, 2 will always be a factor of that number, so an even number (except for 2) can never be a prime number.

Unit 2 Count, order and compare numbers and place value

MENTAL MATHS

Learner's Book page 5

Give each learner a copy of the Mental Maths grid in the back of this Teacher's Guide. They should paste this page into their workbooks. They will record solutions to written mental maths calculations on the grid and use their outcomes to monitor their own progress. You could use peer assessment to check solutions, but you should also monitor learners' performance so that you could plan interventions.

For this activity, the learners compare numbers by finding numbers more and less as indicated.

Solutions

1. 100 less than 8 459 → **8 359**
2. 11 less than 801 → **790**
3. 8 less than 4 901 → **4 893**
4. 7 less than 200 001 → **199 994**
5. 12 more than 88 → **100**
6. 500 more than 1 356 → **1 856**
7. 12 less than 200 → **188**
8. 9 less than 10 000 → **9 991**
9. 7 more than 997 → **1 004**
10. 14 more than 1 987 → **2 001**

Activity 2.1

Learner's Book page 5

Tell the learners that they will use counting skills to find the total number of objects in each part of question 1. They count the number of counters, the coins, bottles of milk and glasses. Let them record their counting strategies and compare these during class feedback, to decide and negotiate the most effective strategies. The learners should realise that triangular numbers are named after the way the number of objects can be arranged in triangles. Square numbers can be arranged in squares, rectangular numbers can be arranged in rectangles and triangular numbers can be arranged in triangles. Give the learners copies of the number lines to fill in the missing numbers in question 2 (see templates). They count and fill in numbers up to 6-digit numbers.

In question 3 they order and compare 6-digit numbers. They write numbers in ascending and descending order, as well as in expanded notation.

In question 5, remind the learners that they have dealt with consecutive numbers in Grade 4 and 5. You could refresh their memories by listing some consecutive numbers:

0; 2; 4; 6; ...   consecutive even numbers
91; 93; 95; ...   consecutive uneven numbers, and so on.

In question 6 they use grouping to find the sum of the numbers 1 to 9. They use the Gauss method, which is named after the mathematician Carl Friedrich Gauss, who invented the strategy when he was still at school. You could extend the activity by asking the learners to find the sum of the numbers from 1 to 50 or from 1 to 100.

For question 6(b), tell the learners they have to find the number value of each shape in the grid to calculate the sum of the shapes in the rows and columns. You could give them a hint that they should start investigating the value of the triangles because together they should have a sum of 8; $2 + 2 + 2 + 2 = 8$ so the value of one triangle is 2. They then find the value of one rhombus in row 1. They have to reason that $2 + ■ + ■ + ■ = 11$; $11 – 2 = 9$ so that $2 + 3 + 3 + 3 = 11$. The value of a rhombus is 3. You could ask them to use a blank copy of the grid or squared paper to substitute the shapes by their number values to check solutions or they could write number sentences to show the solutions.

In (c), the learners have to find out which volume of water each child fetched. Let them struggle on their own before you give them a hint. They have to realise that they must find the sum of the capacities of the buckets, and then divide this by 2 to find out which pails of water each one carried. There are two possible solutions.

Solutions

1. a) The learners might apply repeated addition, doubling or multiplication using the distributive property. They could break up numbers to calculate the total number of counters.

$$\begin{aligned} 15 + 15 + 15 + 15 + 15 + 15 &= 30 + 30 + 30 \\ &= 3 \times 30 \\ &= 90 \end{aligned}$$

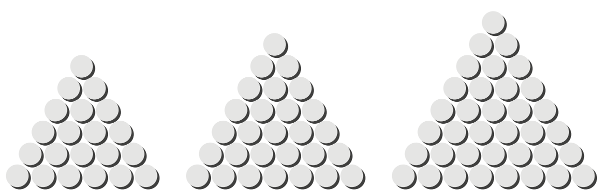
$$\begin{aligned} 10 + 10 &= 2 \times 10 \\ &= 20 \end{aligned}$$

$$\begin{aligned} 6 + 6 + 6 &= 3 \times 6 \\ &= 18 \end{aligned}$$

$$\begin{aligned} 90 + 20 + 18 &= (90 + 10) + (20 + 8) \\ &= 128 \text{ counters} \end{aligned}$$

$$\begin{aligned} \text{or } (6 \times 15) + (2 \times 10) + (3 \times 6) &= 3 \times (2 \times 15) + 20 + 18 \\ &= 3 \times 30 + 38 \\ &= 90 + 38 \\ &= (90 + 10) + 28 \\ &= 128 \text{ counters} \end{aligned}$$

b)



21 28 36

c) Ask the learners to use brackets to show the order in which they calculate the number of coins. They treat the money amounts like whole numbers during the calculation process and write the solutions in money amounts. They calculate the amounts for the different groups of coins and then find the total amount by breaking up and grouping (associative property) numbers.

R5 coins → $(5 \times 5) + (3 \times 5) = 25 + 15$
$= R40$

R2 coins → $(10 \times 2) + (10 \times 2) + (4 \times 2) = R48$

50c coins → $3 \times (10 \times 50) + (7 \times 50) = (3 \times 500) + 350$
$= 1\,500 + 350$
$= R18,50$

20c coins → $2 \times (20 \times 10) + (5 \times 20) = 2 \times 200 + 100$
$= 500$
$= R5,00$

10c coins → $5 \times (10 \times 10) + (5 \times 10) = 5 \times 100 + 50$
$= 550$
$= R5,50$

5c coins → $4 \times (10 \times 5) + (9 \times 5) = 4 \times 50 + 45$
$= 245$
$= R2,45$

Total amount:
R40 + R48 + R18,50 + R5,00 + R5,50 + R2,45
= (R40 + R48) + (R18,50 + 50c) + (R10 + R2,45)
= R88 + R19 + R12,45
= (R88 + R12) + R19,45
= R119,45

d) The learners count the number of bottles in a filled crate first, i.e. the number of bottles in a 4 × 6 array. They find the total number of bottles by grouping (associative property) numbers that add up to multiples of 10.

$5 \times (4 \times 6) = 5 \times 24$
$= 100 + 20$
$= 120$ bottles in 5 full crates

$120 + 12 + 10 + 8 = 120 + 10 + 12 + 8$
$= 150$ bottles altogether

e) They determine the number of glasses in the cabinet by associating numbers that add up to multiples of 10.

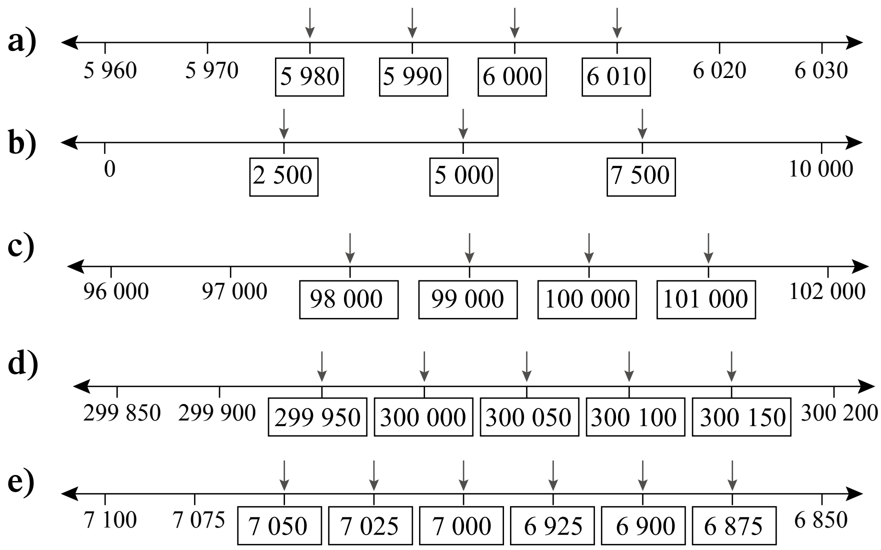
$16 + 14 + 12 + 11 + 8 + 10 + 4 + 9$

$= (16 + 14) + (12 + 8) + (11 + 9) + 10 + 4$

$= 30 + 20 + 20 + 14$

= 84 glasses altogether

2. The learners count on and back in 10s, 25s, 50s and 1 000s. In (b) they find half, a quarter and three-quarters of 10 000 by adding and subtracting 2 500 to and from 5 000. Check whether they are able to bridge powers of 10, i.e. 1; 10; 100; 1 000; 10 000 and so on.



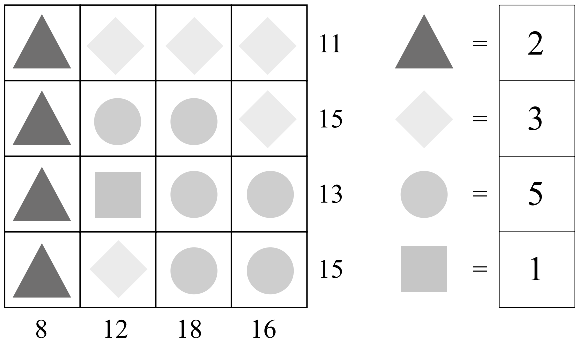
3. **a)** 698 779; 718 778; 718 797; 777 189; 917 612; 917 898
   b) 541 602; 514 206; 451 026; 415 206; 154 026; 145 620
   c) 718 797 → 700 000 + 10 000 + 8 000 + 700 + 90 + 7
   698 779 → 600 000 + 90 000 + 8 000 + 700 + 70 + 9
   718 778 → 700 000 + 10 000 + 8 000 + 700 + 70 + 8
   917 898 → 900 000 + 10 000 + 7 000 + 800 + 90 + 8
   777 189 → 700 000 + 70 000 + 7 000 + 100 + 80 + 9
   917 612 → 900 000 + 10 000 + 7 000 + 600 + 10 + 2
   145 620 → 100 000 + 40 000 + 5 000 + 600 + 20
   415 206 → 400 000 + 10 000 + 5 000 + 200 + 6
   514 206 → 500 000 + 10 000 + 4 000 + 200 + 6
   541 602 → 500 000 + 40 000 + 1 000 + 600 + 2
   451 026 → 400 000 + 50 000 + 1 000 + 20 + 6
   154 026 → 100 000 + 50 000 + 4 000 + 20 + 6

4. Some learners would probably want to count in 24s to start solving this problem. They should however discover that there is only one number ending in 24 between 0 and 100, between 100 and 200 and so on. They should therefore count in 100s from 24 to 424. You could extend this activity by using smaller numbers, for example ‘How many numbers ending in 2 do you get between 0 and 50?’ and so on.

5. There are four possibilities that learners could apply in counting from 1 003 to get the number of the couple in red. The instruction states that the numbers should be consecutive but does not state the type of numbers.
   1 003; 1 004; 1 005; 1 006; 1 007; **1 008** (counting on in consecutive natural or counting numbers)
   1 003; 1 002; 1 001; 1 000; 999; **998** (counting back in consecutive natural or counting numbers)
   1 003; 1 001; 999; 997; 995; **993** (counting back in consecutive odd numbers)
   1 003; 1 005; 1 007; 1 009; 1 011; 1 013 (counting on in consecutive odd numbers)

6. **a)** 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9
= (1 + 9) + (2 + 8) + (3 + 7) + (4 + 6) + 5
= 10 + 10 + 10 + 10 + 5
= 4 × 10 + 5
= 45

b)



Rows:
2 + 3 + 3 + 3 = 11
2 + 5 + 5 + 3 = 15
2 + 1 + 5 + 5 = 13
2 + 3 + 5 + 5 = 15

Columns:
2 + 2 + 2 + 2 = 8
3 + 5 + 1 + 3 = 12
3 + 5 + 5 + 5 = 18
3 + 3 + 5 + 5 = 16

c) 9 + 8 + 7 + 5 + 3 + 2 = (8 + 2) + (7 + 3) + (9 + 1) + 4
= 10 + 10 + 10 + 4
= 34 litres
34 ÷ 2 = 17 litres Or half of 34 = 17 litres
Each one carries 17 litres.
Jack: 9 + 8 = 17 Jill: 7 + 3 + 5 + 2 = 17
Jack: 8 + 7 + 2 = 17 Jill: 9 + 5 + 3 = 17

Activity 2.2

Learner's Book page 8

For question 1 and 2, the learners identify the numbers represented on the place value boards and write the numbers in words.

In question 3, let the learners use calculators. If you do not have calculators available they could do the activity without them. They should notice that there are no spaces between the thousands and hundreds because this is how numbers are displayed on calculators. They enter the number on the first display on a calculator. They add one number at a time (multiples of powers of 10, i.e. 1, 10, 100, 1 000, 10 000 and so on) to get the numbers on the rest of the displays. Let them write down the numbers that they add.

For question 4, ask the learners to write the first number and the new numbers they have created in expanded notation. Remind them to put spaces between the hundreds and thousands as we represent numbers in our number system.

In question 5, the learners have to determine which multiples of powers of 10 have been added to the first number in a pair to create the second number. They should know by now what the powers of 10 are. They identify the place value of digits that have changed and find the sum of the numbers. Check whether the learners are able to identify and work with millions. Assist them if they are not able to. Tell them they will work with millions in Term 2.

Question 1 and 2

a) 401 562
Four hundred and one thousand five hundred and sixty-two

b) 933 309
Nine hundred and thirty-three thousand three hundred and nine

c) 600 546
Six hundred thousand five hundred and forty-six

d 808 715
Eight hundred and eight thousand seven hundred and fifteen

e) 200 087
Two hundred thousand and eighty-seven

f) 111 222
One hundred and eleven thousand two hundred and twenty-two

3. 714 823 + **200 000** → 914 823 + **50** → 914 873 + **40 000** → 954 873 + **4 000** → 958 873

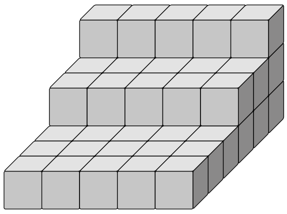
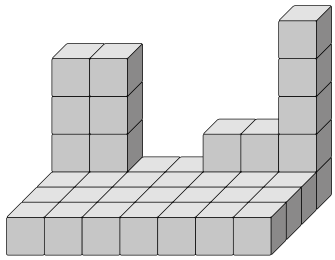
4. 714 823 → 700 000 + 10 000 + 4 000 + 800 + 20 + 3
914 823 → 900 000 + 10 000 + 4 000 + 800 + 20 + 3
914 873 → 900 000 + 10 000 + 4 000 + 800 + 70 + 3
954 873 → 900 000 + 50 000 + 4 000 + 800 + 50 + 3
958 873 → 900 000 + 50 000 + 8 000 + 800 + 50 + 3

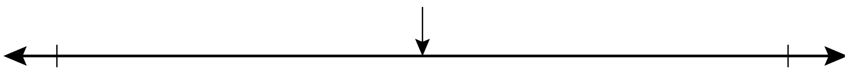
5. **a)** 7 050 → 7 859: 800 + 9 = 809
b) 14 604 → 17 674: 3 000 + 70 = 3 070
c) 260 153 → 569 153: 300 000 + 9 000 = 309 000
d) 114 378 → 117 388: 3 000 + 10 = 3 010
e) 2 876 921 → 5 976 921: 3 000 000 + 100 000 = 3 100 000

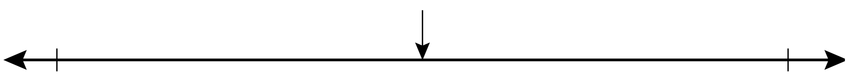
Assessment 1.1: Counting, ordering, representing and place value

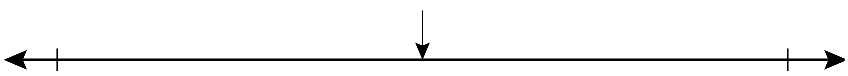
The learners will apply number properties to calculate more easily, represent different kinds of numbers in sequences, count objects, fill in missing numbers on number lines and compare numbers.

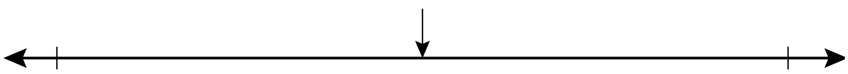
Assessment 1.1 Counting, ordering, representing numbers and place value

1. Group the numbers to calculate the solutions easier.
   a) 3 + 9 + 5 + 8 + 7 + 1 + 2 = ■
   b) 12 + 13 + 18 + 17 + 7 = ■
   c) 45 – 8 – 5 – 2 = ■
   d) 80 – 6 – 9 – 11 – 4 = ■
   e) 84 + 22 – 11 + 9 – 14 = ■
2. Write down:
   a) the even numbers from 98 to 108.
   b) the odd numbers between 120 and 132
   c) the counting numbers smaller than 5
   d) the natural numbers smaller than 6
   e) the even numbers smaller than 10.
3. How many boxes are there in each stack?
   a)
   
   b)
   
4. Fill in the missing numbers in the sequences.
   a) 236 237 ■ ■ ■ ■ 242
   b) 7 050 7 025 ■ ■ ■ ■ ■ 5 075
   c) 9 996 9 998 ■ ■ ■ ■ ■ 10 010
   d) 99 995 99 997 ■ ■ ■ ■ ■ 100 011
   e) 300 100 300 050 ■ ■ ■ ■ ■ 200 750
5. Write these numbers in ascending order:
   98 900 89 009 98 009 98 090 89 090 89 900
6. Which number is the following?
   a) between 99 999 and 100 001 **b)** 10 less than 10 005
   c) 8 more than 60 995 **d)** 9 less than 5 000
   e) 100 less than 70 000
7. To which numbers do the arrows point on each number line?

a)

50 100

b)

500 1 000

c)

5 000 6 000

d)

10 000 10 500

1. **a)** 3 + 9 + 5 + 8 + 7 + 1 + 2 = ■
   (7 + 3) + (9 + 1) + (8 + 2) + 5 = 35

   b) 12 + 13 + 18 + 17 + 7 = ■
   (18 + 12) + (17 + 13) + 7 = 67

   c) 45 – 8 – 5 – 2 = ■
   (45 – 5) – (8 + 2) = 40 – 10
   = 30

   d) 80 – 6 – 9 – 11 – 4 = ■
   80 – (9 + 6) – (11 + 4) = 80 – 30
   = 50

   e) 84 + 22 – 11 + 9 – 14 = ■
   (84 – 14) + (22 – 11) + 9 = 70 + 11 + 9
   = 90

2. **a)** Even numbers from 98 to 108: 98; 100; 102; 104; 106; 108

   b) Odd numbers between 120 and 132:
   121; 123; 125; 127; 129; 131

   c) Counting numbers smaller than 5: 0; 1; 2; 3; 4

   d) Natural numbers smaller than 6: 1; 2; 3; 4; 5

   e) Even numbers smaller than 10: 8; 6; 4; 2; 0

3. **a)** (6 × 5) + (3 × 5) + (1 × 5)
   = 30 + 15 + 5
   = 50 boxes
   = 40 boxes

   b) (4 × 7) + (3 × 2) + (1 × 2)+ (1 × 4)
   = 28 + 6 + 2 + 4
   = 28 + 2 + 6 + 4

4. **a)** 236; 237; 238; 239; 240; 241; 242

   b) 7 050; 7 025; 7 000; 6 975; 6 950; 6 925; 6 900

   c) 9 996; 9 998; 10 000; 10 002; 10 004; 10 006; 10 008;
   10 010

   d) 99 995; 99 997; 99 999; 100 001; 100 003; 100 005;
   100 007; 100 009

   e) 300 100; 300 050; 300 000; 299 950; 299 900; 299 850;
   299 800; 200 750

5. 89 009; 89 090; 89 900; 98 009; 98 090; 98 900

6. **a)** 100 000 **b)** 9 995
   c) 61 003 **d)** 4 991
   e) 69 900

7. **a)** 75 **b)** 750
   c) 5 500 **d)** 10 250

Number sentences

Learner's Book page 10

Remind the learners that they have worked with number sentences in Grade 4 and 5. They will now use number sentences in work they do with whole numbers, common fractions, expressions and equations. They write and create number sentences to describe problem situations. They solve number sentences by inspection, trial and improvement and substitution. This will help the learners to develop an understanding of algebraic concepts, a topic they will engage in at high school level. Tell the learners that they will spend three lessons on the topic (three units in the Learner's Book) and perform an assessment task at the end of the lessons. They will apply knowledge of basic number concepts developed in work they did with whole numbers.

Unit 3 Create number sentences

In this unit and in the mental maths section they will do some fun activities. As a start, ask the learners to solve the two problems in the box. Encourage them to write number sentences to show how they solve the problems. After feedback, you should tell the learners that when birds and rabbits get a fright, they all fly or run away! Use this opportunity to talk about logical, critical and creative thinking. Sometimes we need plain common sense to solve mathematical problems – not only numbers!

MENTAL MATHS

Learner's Book page 10

Remind the learners that they have created number sentences when they worked with 'I think of a number ...' problems in the previous grades. Make up your own problem, for example, 'I think of a number. I multiply it by 7 and subtract 8. My answer is 27.' Ask the learners to write the number sentence on the board. They could either solve the problem by trial and improvement or work in 'reverse' using inverse operations, i.e. $\blacksquare \times 7 - 8 = 27$ or $(27 + 8) \div 7 = \blacksquare$. The learners should realise the importance of knowing the multiplication and division tables and basic addition and subtraction bonds because they often apply these methods when working with different mathematical topics.

1. Ask the learners to think of a number. They should not reveal the number to anyone. They then double the number, subtract 2, halve it, add 1, take away the number that they originally thought of, add 10 and then halve the number.

Each learner's answer should be 5. Let them try again with other numbers. Those who get different answers probably did not concentrate or listen properly. Encourage the learners to use the problem at home with their friends, siblings or parents.

In question 2, the learners use the numbers 1 to 10 and write number sentences on the board to show their calculations and check whether the answer is always 5. The strategy involves 'undoing' operations, by doubling and halving, adding and subtracting consistently.

Examples

8	**4**
8 + 8 = 16	4 + 4 = 8
16 – 2 = 14	8 – 2 = 6
14 ÷ 2 = 7	6 ÷ 2 = 3
7 + 1 = 8	3 + 1 = 4
8 – 8 = 0	4 – 4 = 0
0 + 10 = 10	0 + 10 = 10
10 ÷ 2 = **5**	10 ÷ 2 = **5**

Activity 3.1

Learner's Book page 11

In the following activity, the learners work in groups to create number sentences with the number and operation cards provided in question 1. They may only use the numbers once in each number sentence, but the operation signs more than once. Let them practise by working together to create a number sentence with 34 as an answer. This activity allows learners to explore and practise the four basic operations. As an extension, they can make up their own solutions and ask others to create number sentences to get the answers. To do this, they first create the number sentences to get the numbers themselves. Ask the learners to explore the reasoning of the children in the Learner's Book. One performed the operations in the correct order (multiplication before subtraction) while the other first subtracted and then multiplied (getting an incorrect result). They used the same operations in a different order. The learners have to realise that the order of operations is important. You first multiply and divide (in the order of appearance) and then subtract and add (in the order of appearance). They should know by now that, whatever the operation, if it is in brackets, it is done first. Do not give them the rule – they have to explore and investigate themselves. They can do this with the help of their calculators.

The problem in question 2 allows the learners to understand the significance of the order of operations. In question 2(a) Sam adds and then multiplies – the solution is incorrect. Lungisile uses the correct order, with the brackets indicating which operation should be performed first. Ask the learners to assess the solutions and explain which one is incorrect. They judge the reasonableness of the solutions by using the information in the problem. The answer cannot be 120 because there are 162 learners and 20 boys in each of the four classes so that $120 + 80 = 200$. $82 + 80 = 162$, so 82 is correct. Ask them to read what Sam and Lungisile say about sequential and scientific calculators. They should understand that the scientific calculator is programmed to give the correct answer no matter the order in which you enter the calculations. The sequential calculator, on the other hand, performs the operations as you enter them. If you enter $19 + 21 \times 3$, it will give you the incorrect solution (120) instead of 82. You should have these calculators available to allow learners to explore the concept of the order of operations. Ask the learners to perform calculations on the calculator of a cell phone to find out whether it performs operations in the correct order as on a scientific calculator.

In question 3 the learners solve the problems using the correct order of operations. Encourage them to use brackets to show the operations that they will perform first.

1. **a)** $9 \times 4 - 2 = 34$ **b)** $(9 - 2) \times 4 = 28$
c) $4 \times 6 - 9 + 2 = 17$ **d)** $6 \times 9 \div 2 - 1 = 26$
e) $(9 \times 2 \div 6) + 1 \times 4 = 13$ **f)** $(4 + 6) \times 9 \div 2 + 1 = 46$
g) $(6 + 9) \times (4 + 1) - 2 = 73$ **h)** $(2 + 4) \times 6 + 9 = 45$

NOTE

If learners apply the order of operations incorrectly, they will get $8 + 3 \times 5$ $= 11 \times 5 = 55$, which is incorrect. You could ask them to perform the operations in the correct and incorrect order to develop their understanding of the importance of the concept, but also to convince themselves that they will get incorrect solutions if they do not apply the rules correctly.

2. **a)** Total number of boys in Grade 6: $4 \times 20 = 80$
Total number of girls: $162 - 80 = 82$ or
Total number of girls:
$19 + (3 \times 21) = 19 + 63$
$= 20 + 62$ (building up numbers)
$= 82$

b) Sam is wrong. The calculation above shows there are 82 girls. Sam incorrectly added 19 and 21 to get 40 and then multiplied by 3 to get the incorrect answer.

3. **a)** $8 + (3 \times 5) = 15 + 8$
$= 15 + 5 + 3$

b) $15 + (15 \div 3) = 15 + 5$
$= 20$

c) $(2 \times 3) + (4 \times 5) = 6 + 20$
$= 26$

d) $(40 \div 8) \times 4 + 12 = (5 \times 4) + 12$
$= 20 + 12$
$= 32$

e) $80 - (10 \times 3) = 80 - 30$
$= 50$

f) $17 + 8 - (4 \div 2) \times 8 = 17 + 8 - (2 \times 8) = 25 - 16$
$= 25 - 5 - 11$
$= 20 - 11$
$= 9$

g) $(9 \times 8) \div 3 + 16 = (72 \div 3) + 16$
$= 24 + 16$
$= 24 + 6 + 10$
$= 40$

h) $(75 \div 3) - (20 \div 4) = 25 - 5$
$= 20$

i) $150 - 50 + 120 = 100 + 120$
$= 220$

j) $23 + 27 - (100 \div 2) = 23 + 27 - 50$
$= 50 - 50$
$= 0$

Unit 4 Making number sentences true

MENTAL MATHS

Learner's Book page 12

The learners will work with calculations with brackets to enhance and develop their understanding that calculations in brackets are done first. They have been introduced to the terms expression and equation in Grade 5. Ask them to solve the two expressions. For $3 \times 4 + 5$ they do multiplication before addition so that the solution is 17. In the second expression they do the operation in brackets first so that $3 \times 9 = 27$. They should note that brackets and the order of operations are important in calculations.

In question 2, ask them to solve the equations with multi-operations to find out how they are different. If they follow the correct order of operations for $45 + 30 \div 10 - 5 = \blacksquare$ they should get: $45 + 3 - 5 = 37$.

For $(45 + 30) \div (10 - 5) = \blacksquare$ they should get $75 \div 5 = 15$.

For question 3, ask the learners to record the solutions to the problems on their Mental Maths grid. They fill in missing numbers to make the equations balance. You should monitor their performance. Some learners might find these types of problems challenging.

1. $3 \times 4 + 5 = 12 + 5 = 17$
$3 \times (4 + 5) = 3 \times 9 = 27$

2. $45 + 30 \div 10 - 5 = 45 + 3 - 5 = 37$
$(45 + 30) \div (10 - 5) = 75 \div 5 = 15$

3.
a) $(\mathbf{7} \times 5) + 2 = 37$
b) $10 + (3 \times \mathbf{9}) = 37$
c) $\mathbf{9} \times 2 = 3 \times (3 + 3)$
d) $20 - (\mathbf{2} \times 6) = 8$
e) $26 - (\mathbf{16} \div 2) = 18$
f) $100 = (80 \div 2) + 60$
g) $\mathbf{9} + (9 \times 9) = 90$
h) $(\mathbf{100} \div 25) \times 8 = 32$
i) $40 - (\mathbf{28} \div 7) = 36$
j) $25 \times (18 \div \mathbf{6}) = 75$

Activity 4.1

Learner's Book page 13

In this activity, the learners solve equations. They can work on their own or slower learners can work in pairs with stronger ones.

In question 1 they use inverse operations to perform the operations. In some of the problems they use trial and improvement. In 1(c) for example, they ask 'What do I multiply with 3 and subtract 26 from to give 10?'

In question 2 they have to fill in the correct operations. They do this by trial and improvement. Remind them to insert brackets to show the operations they perform first.

In question 3 they use trial and improvement or inverse operations to determine the unknown, i.e. the placeholder ■ that will balance the equations. They also work with money amounts in expanded form.

They perform inverse operations and the distributive property in question 4 while working with multiples of 10, 100, 1 000 and 10 000. Tell them that the taking away of zeros actually involves division by 10 (or 100 or 1 000 in other cases), for example ■ × 80 = 64 000 → 64 000 ÷ 80 → 6 400 ÷ 8 = 800. This activity will enhance and develop their understanding of the relationship between multiplication and division.

In question 5, the learners write equations for the statements and solve them. They should apply effective calculation strategies using the distributive property and compensation. Remind learners to deal with money amounts as they would with whole numbers. They convert solutions to money amounts again.

1. Encourage the learners to keep equal signs in an equation below each other. This is a skill they have to practise. You could ask them to substitute the place holders with the solutions to check whether the equations balance.

a) ■ × 6 – 37 = 101
101 + 37 ÷ 6 = 138 ÷ 6
= 23
23 × 6 – 37 = 101

b) ■ × 5 – 14 = 56
56 + 14 ÷ 5 = 70 ÷ 5
= 14
14 × 5 – 14 = 56

c) 3 × ■ – 26 = 10
10 + 26 = 36
36 ÷ 3 = 12
3 × **12** – 26 = 10

d) 4 × ■ – 15 = 9
9 + 15 = 24
24 ÷ 4 = 6
4 × **6** – 15 = 9

e) 17 = 4 × ■ – 11
4 × 7 = 28
28 – 11 = 17
17 = 4 × **7** – 11

f) 3 × ■ + 12 = 30
30 – 12 = 18
18 ÷ 3 = 6
3 × **6** + 12 = 30

g) 8 × ■ + 10 = 82
82 – 10 = 72
72 ÷ 8 = 9
8 × **9** + 10 = 82

h) 12 × ■ + 10 = 94
94 – 10 = 84
84 ÷ 12 = 7
12 × **7** + 10 = 94

i) $99 \div \blacksquare - 13 = 20$
$20 + 13 = 33$
$33 \times 3 = 99$
$99 \div \mathbf{3} - 13 = 20$

j) $200 \div \blacksquare \times 2 = 100$
$100 \div 2 = 50$
$50 \times 4 = 200$
$200 \div \mathbf{4} \times 2 = 100$

2. a) $6 \times 5 + 5 = 35$
b) $5 + 4 \times 9 = 41$
c) $75 \div 15 \times 3 = 15$
d) $7 \times 8 - 6 = 50$
e) $9 \times 9 + 19 = 100$
f) $50 \times 8 - 250 = 150$

3. a) $(3 \times \blacksquare) + 12 = \blacksquare + 20$
$(3 \times \mathbf{4}) + 12 = \mathbf{4} + 20$
$24 = 24$

b) $40 + (2 \times \blacksquare) = (15 \times \blacksquare) + 1$
$40 + (2 \times \mathbf{3}) = (15 \times \mathbf{3}) + 1$
$46 = 46$

c) $20 + (2 \times \blacksquare) = 5 + (5 \times \blacksquare)$
$20 + (2 \times \mathbf{5}) = 5 + (5 \times \mathbf{5})$
$30 = 30$

d) $(8 \times \blacksquare) = 100 + (3 \times \blacksquare)$
$(8 \times \mathbf{20}) = 100 + (3 \times \mathbf{20})$
$160 = 160$

e) $R967 = (\blacksquare \times R100) + (\blacksquare \times R10) + (\blacksquare \times R5) + (\blacksquare \times R2)$
$= (9 \times R100) + (6 \times R10) + (1 \times R5) + (1 \times R2)$
$= R900 + R60 + R5 + R2$
$= R967$

f) $R1\ 859 = (\blacksquare \times R200) + (\blacksquare \times R20) + (\blacksquare \times R10) + (\blacksquare \times R5)$
$+ (\blacksquare \times R1)$
$= (5 \times R200) + (40 \times R20) + (5 \times R10) + (1 \times R5)$
$+ (4 \times R1)$
$= R1\ 000 + R800 + R50 + R4$
$= R1\ 859$

4. a) $80 \times \blacksquare = 320$
$320 \div 80 \rightarrow 32 \div 8 = 4$
$80 \times \mathbf{4} = 320$

b) $80 \times \blacksquare = 3\ 200$
$3\ 200 \div 80 \rightarrow 320 \div 8 = 40$
$80 \times \mathbf{40} = 3\ 200$

c) $\blacksquare \times 80 = 64\ 000$
$64\ 000 \div 80 \rightarrow 6\ 400 \div 8 = 800$
$\mathbf{800} \times 80 = 64\ 000$

d) $64\ 000 \div \blacksquare = 8$
$64\ 000 \div 8 = 8\ 000$
$64\ 000 \div \mathbf{8\ 000} = 8$

e) $70 \times 70 = (7 \times 7) \times 100$
$= \mathbf{4\ 900}$

f) $\blacksquare \times 70 = 350$
$350 \div 70 \rightarrow 35 \div 7 = 5$
$\mathbf{5} \times 70 = 350$

g) $70 \times \blacksquare = 6\ 300$
$6\ 300 \div 70 \rightarrow 630 \div 7 = 90$
$70 \times \mathbf{90} = 6\ 300$

h) $70 \times \blacksquare = 630\ 000$
$630\ 000 \div 70 \rightarrow 63\ 000 \div 7 = 9\ 000$
$70 \times \mathbf{9\ 000} = 630\ 000$

i) $180 \div 90 \rightarrow (180 \div 10) \div (90 \div 10)$
$= 18 \div 9$
$180 \div 90 = \mathbf{2}$

j) $1\ 800 \div 900 = (1\ 800 \div 100) \div (900 \div 100)$
$= 18 \div 9$
$1\ 800 \div 900 = \mathbf{2}$

5. a) $(4 + 5) \times 8 = 9 \times 8$
$= 72$

b) $(15 + 35) \div 5 = 50 \div 5$
$= 10$

c) $6 \times 8 \div 4 - 7 = 48 \div 4 - 7$
$= 12 - 7$
$= 5$

d) $(100 - 75) \times 2 + 57 - 8$
$= 25 \times 2 + 57 - 8$
$= 50 + 57 - 8$
$= 107 - 8$
$= 99$

e) $(350 + 650) \times 2 \div 500$
$= 1\ 000 \times 2 \div 500$
$= 2\ 000 \div 500$
$= 4$

f) (1 × R4,98) + (4 × R3,39)
= R4,98 + (4 × R3) + (4 × 40c) – 4c
= R5 – 2c + R12 + 160c – 4c
= R18,60 – 6c
= R18,54

g) (3 × R9,29) + (2 × R6,69) + (1 × R9,99)
= (3 × R9,30) + (2 × R6,70) + R10 – (3c + 2c + 1c)
= R27,90 + R12 + R1,40 + R10 – (3c + 2c + 1c)
= R27+ R12 + 11 + R1,30 – 6c
= R51,24

h) (4 × R19,98) + (2 × R19,95)
= (4 × R20) + (2 × R20) – (4 × 2c) – (2 × 5c)
= R80 + R40 – 8c – 10c
= R120 – 18c
= R119,82

Activity 4.2

Learner's Book page 14

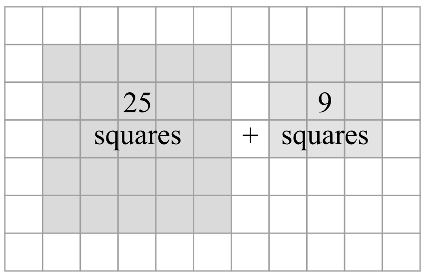
Ask the learners to work in groups. If there is not enough time to complete the activity, let them finish it for homework.

In question 2 they work with square numbers. In Grade 5 they worked with the area model for multiplication and with square units. You could therefore introduce them to 2 as an exponent, i.e. $1 \times 1 = 1^2$; $2 \times 2 = 2^2$; $3 \times 3 = 3^2$ meaning 1 squared, and so on. Explain to them that numbers in superscript indicate exponents, for example 2^3 and 2^4 means $2 \times 2 \times 2 = 8$ and $2 \times 2 \times 2 \times 2 = 16$. They will use this knowledge in higher grades. They have to find two square numbers that will equal each given total. Give each learner a copy of the square paper in the back of this Teacher's Guide so they can investigate the squares in a practical way.

1. **a)** 1 minute = 60 seconds
Length of tape = 20 cm × 60 = 1 200 cm
1 200 ÷ 100 = 12 m

b) 1 hour = 60 minutes
Length of tape = 1 200 cm × 60
= 72 000 cm
72 000 ÷ 100 = 720 m

2. The learners have to identify square numbers with the sums as indicated. Ask them to write equations and then they have to represent the numbers as squares on squared paper. They would probably use trial and improvement to determine the square numbers. Encourage the learners to look for more than one solution. The solutions below show some of the possibilities and an example of representing the numbers on squared paper.



a) $34 \rightarrow 25 + 9 = (5 \times 5) + (3 \times 3)$
$= 5^2 + 3^2$

or

$16 + 9 + 9 = (4 \times 4) + (3 \times 3) + (3 \times 3)$
$= 4^2 + 3^2 + 3^2$

b) $38 \rightarrow 4 + 9 + 25 = (2 \times 2) + (3 \times 3) + (5 \times 5)$
$= 2^2 + 3^2 + 5^2$

or

$16 + 9 + 9 + 4 = (4 \times 4) + (3 \times 3) + (3 \times 3) + (2 \times 2)$
$= 4^2 + 3^2 + 3^2 + 2^2$

c) $52 \rightarrow 25 + 25 + 1 + 1 = (5 \times 5) + (5 \times 5) + (1 \times 1) + (1 \times 1)$
$= 5^2 + 5^2 + 1^2 + 1^2$

or

$$\begin{aligned} 49 + 13 &= (7 \times 7) + 9 + 4 \\ &= (7 \times 7) + (3 \times 3) + (2 \times 2) \\ &= 7^2 + 3^2 + 2^2 \end{aligned}$$

Did you know? Learner's Book page 14

Go through the information with the learners to develop their general mathematical knowledge. The next number in the sequence is: 12 × 12 × 12 × 12 (124) or 1 728 × 12 = 20 736

Unit 5 Number sentences that describe problems

MENTAL MATHS

Learner's Book page 15

The learners work with arrays to enhance and develop their understanding of the application of the distributive property to calculate more easily. They also apply the commutative property when the numbers are swapped in the number sentences. Ask them to create number sentences to describe the arrangement of counters in question 1(a). They should notice that the counters of square numbers can be rotated while the arrangements stay the same. If the counters of non-square numbers are rotated, the number sentence changes. The arrangements of counters in (i), (ii), (iii) and (vii) indicate square numbers. The numbers in (iv) to (vi) are rectangular numbers. Ask the learners why the numbers are called square and rectangular numbers. In (b) they write number sentences for each of the four basic operations.

In question 2 the learners apply the distributive and commutative property to complete the equations. Ask them to write the solutions on their Mental Maths grid.

In question 3 they apply inverse operations to investigate the relationship between multiplication and division.

1. **a)** The learners share their observations with the class. The arrays that form squares are square numbers so that, for example, 4 × 4 remains 4 × 4 if the square is rotated. If you rotate the array (rectangle) showing, for example, 3 × 6 to show 6 × 3, the number of counters remains the same but the rectangle is oriented differently.

b) The learners should write number sentences entailing the four basic operations for each array to demonstrate the relationship between addition and multiplication and subtraction and division. They should know through previous learning experiences that multiplication is a short form for repeated addition and division is a short form for subtraction. They also get practice in identifying inverse operations and the use of the commutative property.

(i)	$4 + 4 + 4 + 4 = 16$	$4 \times 4 = 16$
	$16 - 4 - 4 - 4 - 4 = 0$	$16 \div 4 = 4$
(ii)	$3 + 3 + 3 = 9$	$3 \times 3 = 9$
	$9 - 3 - 3 - 3 = 0$	$9 \div 3 = 3$
(iii)	$5 + 5 + 5 + 5 + 5 = 25$	$5 \times 5 = 25$
	$25 - 5 - 5 - 5 - 5 - 5 = 0$	$25 \div 5 = 5$
(iv)	$3 + 3 + 3 + 3 + 3 + 3 = 18$	$6 \times 3 = 18$
	$18 - 3 - 3 - 3 - 3 - 3 - 3 = 0$	$18 \div 6 = 3$
(v)	$6 + 6 + 6 = 18$	$3 \times 6 = 18$
	$18 - 6 - 6 - 6 = 0$	$18 \div 3 = 6$
(vi)	$3 + 3 + 3 + 3 = 12$	$4 \times 3 = 12$
	$12 - 3 - 3 - 3 - 3 = 0$	$12 \div 4 = 3$
(vii)	$4 + 4 + 4 = 12$	$3 \times 4 = 12$
	$12 - 4 - 4 - 4 = 0$	$12 \div 3 = 4$

2. The learners should realise that for (j) there is more than one solution. For example:
$12 = (1 \times 12) + (1 \times 12)$; $12 = (2 \times 3) + (2 \times 3)$;
$12 = (3 \times 3) + (1 \times 3)$ and so on.

a) $4 \times 4 = (2 \times 4) + (2 \times 4)$
b) $3 \times 3 = (2 \times 3) + (1 \times 3)$
c) $5 \times 5 = (3 \times 5) + (2 \times 5)$
d) $3 \times 6 = (2 \times 6) + (1 \times 6)$
e) $3 \times 6 = 6 \times 3$
f) $6 \times 3 = (3 \times 3) + (3 \times 3)$
g) $3 \times 4 = 4 \times 3$
h) $3 \times 4 = (1 \times 4) + (2 \times 4)$
i) $4 \times 3 = 3 \times 4$
j) $12 = (2 \times 2) + (4 \times 2)$

3.

a)	$4 \times 4 = 16$	$16 \div 4 = 4$
b)	$3 \times 3 = 9$	$9 \div 3 = 3$
c)	$5 \times 5 = 25$	$25 \div 5 = 5$
d)	$6 \times 3 = 18$	$18 \div 3 = 6$
e)	$3 \times 6 = 18$	$18 \div 6 = 3$
f)	$3 \times 4 = 12$	$12 \div 3 = 4$
g)	$4 \times 3 = 12$	$12 \div 4 = 3$

Activity 5.1

Learner's Book page 16

The learners work with real-life simulations. They complete flow diagrams and write number sentences to describe the problem situations. They should realise that the basic cost has to be added after they have multiplied to find the cost of different packs of posters. They work with multiples of 10 and 100, doubling and the distributive property. Ask the learners to use brackets to show which calculations they perform first. They have to find out which printer gives the best deal. They should realise that although it may appear that Prompt Printing is cheaper than Perfect Printers, they can get double the quantity of posters at Perfect Printers, making them the cheaper of the two.

1. Completed table

Number of packs	Cost in rand
1	R70
2	R90
3	R110
4	R130
5	R150
10	R250
25	R550

2. Number of packs → $\times$ 20 → + 50 → Cost in rands

3. $(1 \times 20) + 50 = R70$ $\quad$ $(2 \times 20) + 50 = R90$
$(3 \times 20) + 50 = R110$ $\quad$ $(4 \times 20) + 50 = R130$
$(5 \times 20) + 50 = R150$ $\quad$ $(10 \times 20) + 50 = R250$
$(25 \times 20) + 50 = R550$

4. **a)** $(6 \times 20) + 50 = 120 + 50$
$= R170$

b) $(12 \times 20) + 50 = (12 \times 2 \times 10) + 50$
$= 420 + 50$
$= R470$

c) $(15 \times 20) + 50 = (15 \times 2 \times 10) + 50$
$= 300 + 50$
$= R350$

d) $(100 \times 20) + 50 = 2\ 000 + 50$
$= R2\ 050$

e) $(150 \times 20) + 50 = (15 \times 2 \times 100) + 50$
$= 3\ 000 + 50$
$= R3\ 050$

f) $(1\ 000 \times 20) + 50 = 20\ 000 + 50$
$= R20\ 050$

5. Allow the learners to discuss the problems and use their own strategies to calculate the number of poster packs that could be bought with the given amounts. They might find the application of inverse operations problematic because:

$(200 - 50) \div 20 = 150 \div 20$
$= 7\frac{1}{2}$

And $(200 \div 20) - 50 = 10 - 50$, which is impossible at Grade 6 level.

If they are stuck, show them the following strategy, i.e. doubling and combining amounts. Let them use and extend the table they have completed in question 1 or create and use the list below. The learners have to decide which option is the cheaper one. They should consider that they only pay the basic fee once when they have bigger numbers printed. They could also apply trial and improvement. In the solutions below are some possibilities.

1 pack → (1 × 20) + 50 = R70
2 packs → (2 × 20) + 50 = R90
3 packs → (3 × 20) + 50 = R110
4 packs → (4 × 20) + 50 = R130
5 packs → (5 × 20) + 50 = R150
6 packs → (6 × 20) + 50 = R170
7 packs → (7 × 20) + 50 = R190
8 packs → (8 × 20) + 50 = R210
9 packs → (9 × 20) + 50 = R230
10 packs → (10 × 20) + 50 = R250
20 packs → (20 × 20) + 50 = R450 and so on.

a) R200 → 2 packs + 3 packs = R110 + R90
= R200
That's 5 packs.
Or they can get 7 packs for R190 and R10 change.

b) R500 → 9 packs + 10 packs = R230 + R250
= R480 and R20 change
That's 19 packs.
Or they can get: 2 packs @ R90 and 3 packs @ R110 = R200
4 packs @ R130 and 6 packs @ R170 = R300
That's 15 packs.

c) 4 ten-packs (40 packs) = R250 × 4
= R1 000
Or 40 packs → (40 × 20) + 50 = R850 and 5 packs = R150
That's 45 packs.

d) 25 packs → (25 × 20) + 50 = R550 and R50 change

e) 60 packs → (60 × 20) + 50 = R1 250; that's too much.
58 packs → (58 × 20) + 50 = R1 160 + R50
= R1 210; they owe R10
57 packs → (57 × 20) + 50 = R1 190 and they get R10 change.

6.

Number of posters	Prompt Printing (2 posters per pack)	Perfect Printers (4 posters per pack)
4	50 + 2 × 20 = R90	65 + 1 × 25 = R90
8	50 + 4 × 20 = R130	65 + 2 × 25 = R115

a) Perfect Printers are cheaper than Prompt Printing if you need 4 or more posters.

b)

Number of posters	Prompt Printing	Perfect Printers
7 packs	R120	R108,75
8 packs	R130	R115,00
9 packs	R140	R121,25
14 packs	R190	R152,50
16 packs	R210	R165
18 packs	R230	R177,50
28 packs	R330	R240
32 packs	R370	R265

Assessment 1.2: Number sentences

The learners will apply the knowledge developed in the previous three units to solve the problems. They solve problems involving multi-calculations in which they have to apply the correct order of operations, solve problems in brackets first, work with number properties, and use the additive and multiplicative property of 1 and the additive property of zero (they have worked with these properties in Grades 4 and 5). They match equivalent expressions and write equations to describe problems.

Assessment 1.2 Number sentences

1. Solve the following equations.

a) $32 \div (2 \times 4) + 12 =$ ■
b) $(35 + 65) \times (7 \times 7) =$ ■
c) $(250 \div 10) + (500 \div 10) =$ ■
d) $(20 \times 4) - (20 \times 3) =$ ■
e) $20 \times 20 \div 10 + 59 + 8 =$ ■

2. Which of the expressions below is equivalent to 24×25?

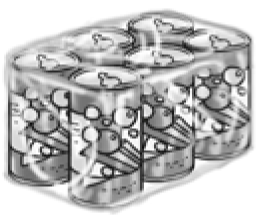
a) $24 \times 20 + 5$
b) $(20 \times 4) + (20 \times 5)$
c) $(20 \times 20) + (4 \times 5)$
d) $(24 \times 100) \div 4$
e) $(20 + 4) \times (20 + 5)$

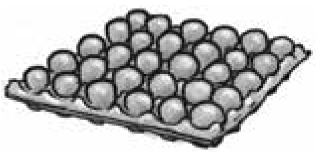
3. Solve the following.

a) $26 \times 1 =$ ■
b) $10 \div 10 =$ ■
c) $234 \div 234 =$ ■
d) $1 \times 18 =$ ■
e) $32 \times 1 \times 1 =$ ■
f) $81 - 3 + 3 =$ ■
g) $7 + 14 - 7 =$ ■
h) $9 - 9 + 27 =$ ■
i) $25 \times 0 + 0 =$ ■
j) $34 + 6 -$ ■ $= 34$

4. Regroup the numbers to calculate more easily.

a) $15 \times 3 \times 2 =$ ■
b) $12 \times 6 \times 5 =$ ■
c) $300 \div 15 \div 10 =$ ■
d) $15 + 9 + 15 + 7 + 1 + 3 =$ ■
e) $48 - 19 - 8 =$ ■





5. Write equations for each problem to show how you solve it.

a) How many cans of cool drink are there in 2 cases with 9 six-packs of cans in each case?

b) There are 30 eggs in a tray. How many eggs are there in 3 boxes containing 6 trays of eggs each?

c) If a half dozen eggs costs R6,50, how many half dozens can you buy with R40?

d) Zeena is a scientist doing research on the wildlife on an island. She left some cats on the island. When she returned to the island after two months, she found that there were 276 more cats than before. The number of cats is now 4 times more than before. How many cats did Zeena leave on the island after her first visit?

1. a) $32 \div (2 \times 4) + 12 = 32 \div 8 + 12$
$= 4 + 12$
$= 16$

b) $(35 + 65) \times (7 \times 7) = 100 \times 49$
$= 4\ 900$

c) $(250 \div 10) + (500 \div 10) = 25 + 50$
$= 75$

d) $(20 \times 4) - (20 \times 3) = 80 - 60$
$= 20$

e) $20 \times 20 \div 10 + 59 + 8 = 400 \div 10 + 59 + 8$
$= 40 + 59 + 8$
$= 107$

2. a) $24 \times 20 + 5 = 485$

b) $(20 \times 4) + (20 \times 5) = 80 + 100$
$= 180$

c) $(20 \times 20) + (4 \times 5) = 400 + 20$
$= 420$

d) $(24 \times 100) \div 4 = 2\ 400 \div 4$
$= 600$

e) $(20 + 4) \times (20 + 5) = 24 \times 25$
$= 600$

$24 \times 25 = (24 \times 100) \div 4 = (20 + 4) + (20 + 5 = 600)$

3. a) $26 \times 1 = 26$
b) $10 \div 10 = 1$
c) $234 \div 234 = 1$
d) $1 \times 18 = 18$
e) $32 \times 1 \times 1 = 32$
f) $81 - 3 + 3 = 81$
g) $7 + 14 - 7 = 14$
h) $9 - 9 + 27 = 27$
i) $25 \times 0 + 0 = 0$
j) $34 + 6 - 6 = 34$

5. a) $15 \times 3 \times 2 = 15 \times 2 \times 3$
$= 30 \times 3$
$= 90$

b) $12 \times 6 \times 5 = 12 \times 5 \times 6$
$= 60 \times 6$
$= 360$

c) $300 \div 15 \div 10 = 300 \div 10 \div 15$
$= 30 \div 15$
$= 2$

d) $15 + 9 + 15 + 7 + 1 + 3 = (15 + 15) + (9 + 1) + (7 + 3)$
$= 30 + 10 + 10$
$= 50$

e) $48 - 19 - 8 = 48 - 8 - 10 - 9$
$= 30 - 9$
$= 21$

6. a) $9 \times 6 \times 2 = \blacksquare$
$= 9 \times 12$
$= 108$ cans of cool drink

b) $30 \times 6 \times 3 = \blacksquare$
$= 30 \times 3 \times 6$
$= 90 \times 6$
$= 540$ eggs

c) $R40 = \blacksquare \times R6{,}50$

$1 \times \frac{1}{2}$ dozen = R6,50

$2 \times \frac{1}{2}$ dozen = R13

$4 \times \frac{1}{2}$ dozen = R26

$6 \times \frac{1}{2}$ dozen = R39

$6 \times R6{,}50 = (6 \times 6) + (50c \times 6)$
$= R36 + 300c$
$= R39$

You can buy six $\frac{1}{2}$ dozens of eggs with R40.

d) $\blacksquare \times 4 = 276$

$276 \div 4 = (200 \div 4) + (76 \div 4)$
$= 50 + 19$
$= 69$

$69 \times 4 = (60 \times 4) + (9 \times 4)$
$= 240 + 36$
$= 276$

Zeena left 69 cats on the island.

Whole numbers

Learner's Book page 18

Tell the learners that they will work with addition and subtraction during the next six units. They will add and subtract up to 5-digit numbers and use their Mental Maths grids to record solutions to addition and subtraction facts that they have to recall instantaneously. They will perform an assessment task on what they have learned about addition and subtraction.

Unit 6 Addition and subtraction calculations

MENTAL MATHS

Learner's Book page 18

Play the *I have ...* addition and subtraction game with the class. Copy and laminate the template in the back of this Teacher's Guide. Play the game as often as possible to allow learners to practise basic addition and subtraction.

I have 8. Who has 4 more?	I have 12. Who has half of this?

Activity 6.1

Learner's Book page 18

Give the learners a copy of the *One-minute addition and subtraction* table in the back of this Teacher's Guide. They write the solutions to as many addition and subtraction calculations as they can in one minute while you keep time. You can repeat this activity often to sharpen learners' basic addition and subtraction calculation skills

1. 16	**2.** 36	**3.** 14
4. 140	**5.** 11	**6.** 31
7. 15	**8.** 45	**9.** 14
10. 44	**11.** 9	**12.** 29
13. 7	**14.** 27	**15.** 7
16. 7	**17.** 8	**18.** 48
19. 11	**20.** 41	

Activity 6.2

Learner's Book page 18

The learners use their own strategies to add and subtract up to 5-digit numbers. You can use this opportunity to assess the addition and subtraction strategies with which learners are familiar and prefer to use.

1. 1 002	**2.** 5 674	**3.** 10 802	**4.** 24 998
5. 7 869	**6.** 444	**7.** 3 777	**8.** 2 888
9. 5 374	**10.** 7 429		

Unit 7 Strategies for adding and subtracting

MENTAL MATHS

Learner's Book page 19

The learners solve addition and subtraction problems involving multiples and powers of 10. They do this in preparation for the strategies they will apply to calculate with larger numbers in the main lesson, where they will break up numbers according to place value.

Encourage the learners to use effective mental calculation strategies; for example, to subtract 15 from 100, they subtract 20 (a known fact) and then add 5. For 2 000 minus 150, subtract 200 and then add 50, and so on. They apply compensation, and break down numbers to subtract easily. Ask the learners to explain the relationships they observe when adding multiples of 10 and powers of 10.

1. **a)** 100 – 15 = 100 – 20 + 5
= 85

b) 2 000 – 150 = 2 000 – 200 + 50
= 1 850

c) 100 – 75 = 100 – 80 + 5
= 25

d) 3 000 – 750 = 3 000 – 1 000 + 250
= 2 250

e) 100 – 55 = 100 – 60 + 5
= 45

f) 5 000 – 550 = 5 000 – 600 + 50
= 4 450

g) 220 – 40 = 220 – 20 – 20
= 180

h) 2 220 – 440 = 2 220 – 220 – 220
= 2 000 – 200 – 20
= 1 780

i) 405 – 45 = 405 – 5 – 40
= 360

j) 4 005 – 405 = 4 005 – 5 – 400
= 3 600

2. Tell the learners to look for relationships among the 1- and 2-digit numbers to add the multiples of powers of 10 effectively. They build up numbers to do this or use the basic addition facts which are non-multiples of 10. Remind the learners that we do not only add zeros but rather multiply by 10, 100 or 1 000.

a) 7 + 8 = 7 + 3 + 5
= 15

b) 70 + 80 = (7 + 8) × 10
= 150

c) $700 + 800 = (7 + 8) \times 100$
$= 1\ 500$

d) $7\ 000 + 8\ 000 = (7 + 8) \times 1\ 000$
$= 15\ 000$

e) $16 + 9 = 16 + 4 + 5$
$= 25$

f) $160 + 90 = (16 + 9) \times 10$
$= 250$

g) $1\ 600 + 900 = (16 + 9) \times 100$
$= 2\ 500$

h) $23 + 8 = 23 + 7 + 1$
$= 31$

i) $230 + 80 = (23 + 8) \times 10$
$= 310$

j) $2\ 300 + 800 = (23 + 8) \times 100$
$= 3\ 100$

Activity 7.1

Learner's Book page 19

In question 1 the learners explore and explain the given addition and subtraction strategies. They should realise the importance of knowing the place value and values of digits in numbers and how the different topics they deal with in mathematics are related. You could ask them if they know other addition and subtraction strategies that they find easier to use.

In question 2 they use the suggested strategies to solve the problems.

1. a)

$$\begin{array}{rcl}
35\ 657 & = & 30\ 000 + 5\ 000 + 600 + 50 + 7 \\
+\ 489 & = & 400 + 80 + 9 \\
\underline{+\ 22\ 456} & = & \underline{20\ 000 + 2\ 000 + 400 + 50 + 6} \\
 & & 50\ 000 + 7\ 000 + 1\ 400 + 180 + 22 \\
 & = & 50\ 000 + 7\ 000 + 1\ 000 + 400 + 100 + 80 + 20 + 2 \\
 & = & 50\ 000 + 8\ 000 + 500 + 100 + 100 + 2 \\
 & = & 50\ 000 + 8\ 000 + 600 + 2 \\
 & = & \underline{58\ 602}
\end{array}$$

b)

$$\begin{array}{rcl}
7\ 869 & = & 7\ 000 + 800 + 60 + 9 \\
+\ 329 & = & 300 + 20 + 9 \\
\underline{+\ 23\ 464} & = & \underline{20\ 000 + 3\ 000 + 400 + 60 + 4} \\
 & = & 20\ 000 + 10\ 000 + 1\ 500 + 140 + 202 \\
 & = & 30\ 000 + 1\ 000 + 500 + 100 + 40 + 20 + 2 \\
 & = & 30\ 000 + 1\ 000 + 600 + 60 + 2 \\
 & = & \underline{31\ 662}
\end{array}$$

c) 12 345 = 10 000 + 2 000 + 300 + 40 + 5
+ 11 476 = 10 000 + 1 000 + 400 + 70 + 6
+ 5 670 = 5 000 + 600 + 70
= 20 000 + 8 000 + 1 300 + 180 + 11
= 20 000 + 8 000 + 1 000 + 300 + 100 + 80 + 10 + 1
= 20 000 + 9 000 + 4 000 + 90 + 1
= 29 491

d) 45 123 = 40 000 + 5 000 + 100 + 20 + 3
+ 8 946 = 8 000 + 900 + 40 + 6
+ 15 364 = 10 000 + 5 000 + 300 + 60 + 4
= 50 000 + 18 000 + 1 300 + 120 + 13
= 50 000 + 10 000 + 8 000 + 1 000 + 300 + 100 + 20 + 10 + 3
= 60 000 + 9 000 + 400 + 30 + 3
= 69 433

e) 33 415 = 30 000 + 3 000 + 400 + 10 + 5
24 765 = 20 000 + 4 000 + 700 + 60 + 5
22 544 = 20 000 + 2 000 + 500 + 40 + 4
= 70 000 + 9 000 + 1 600 + 110 + 14
= 70 000 + 9 000 + 1 000 + 600 + 100 + 10 + 10 + 4
= 70 000 + 10 000 + 700 + 20 + 4
= 80 000 + 700 + 20 + 4
= 80 724

2. a) 22 543 = 20 000 + 2 000 + 500 + 40 + 3
− 13 678 = 10 000 + 3 000 + 600 + 70 + 8
= 10 000 + 11 000 + 1 400 + 130 + 13
10 000 + 3 000 + 600 + 70 + 8
= 8 000 + 800 + 60 + 5
= 8 865

b) 76 165 = 70 000 + 6 000 + 100 + 60 + 5
– 35 476 = 30 000 + 5 000 + 400 + 70 + 6
= 70 000 + 5 000 + 1 000 + 150 + 15
30 000 + 5 000 + 400 + 70 + 6
40 000 + 600 + 80 + 9
= 40 689

c) 10 421 = 10 000 + 400 + 20 + 1
8 653 = 8 000 + 600 + 50 + 3
9 000 + 1 300 + 110 + 11
8 000 + 600 + 50 + 3
1 000 + 700 + 60 + 8
= 1 768

d) 98 542 = 90 000 + 8 000 + 500 + 40 + 2
– 54 654 = 50 000 + 4 000 + 600 + 50 + 4
90 000 + 7 000 + 1 400 + 130 + 12
50 000 + 4 000 + 600 + 50 + 4
40 000 + 3 000 + 800 + 80 + 8

$$= 43\,888$$

e)
$$\begin{array}{rrrrrrr}
89\,034 & = & 80\,000 + & 9\,000 + & & 30 + & 4 \\
-\ 37\,546 & = & 30\,000 + & 7\,000 + & 500 + & 40 + & 6 \\
\hline
& & 80\,000 + & 8\,000 + & 900 + & 120 + & 14 \\
& & 30\,000 + & 7\,000 + & 500 + & 40 + & 6 \\
\hline
& & 50\,000 + & 1\,000 + & 400 + & 80 + & 8 \\
& = & 51\,488 & & & &
\end{array}$$

Unit 8 Rounding off to estimate

MENTAL MATHS

Learner's Book page 20

Tell the learners that they will practise and apply estimation skills, which they will use to check the reasonableness and correctness of solutions. Remind them that estimation is not about making wild guesses. We make an estimation to predict the size of the answer that we expect. Estimation is a human activity we often apply in real life. They use real-life examples to practise their estimation skills.

1. **a)** The plant's height is about 4 times the caterpillar's length.
   b) The plant is about 8 cm tall: 4 × 2 = 8 cm
2. The height of the fridge is about three times its width.
   55 × 3 = (50 × 3) + (5 × 3)
   = 150+ 15
   = 165
   The fridge is about 165 cm tall.
3. Sally ±20
   Nozuko ±60
   Haadiya ±100
4. The length of the braai fork is about three times the length of the table fork.
   84 ÷ 3 = 26
   The length of the table fork is about 26 cm.
5. **a)** 180÷ 10 = 18 coal trucks
   b) 180 ÷ 60 = 6 carriages
6. **a)** 60 °C: S **b)** 30 °C: R
   c) 80 °C: P **d)** 20 °C: Q

Activity 8.1

Learner's Book page 21

Tell the learners that they have worked with estimation and rounding off of numbers in previous grades. To make accurate estimates, you round off numbers to the nearest 5, 10, 100, 1 000 or 10 000. Write some numbers on the board and ask the learners to explain how they round off numbers.

They estimate the solutions to the problems in question 2 and then calculate the accurate solutions to find out how effective their estimates were. You could ask one half of the class to do the estimations and the other half to do the accurate calculations. They then compare solutions.

In questions 3 and 4, the learners draw a table like this to compare the estimates and solutions. They use their own strategies to calculate the accurate solutions. They complete the table and try to make a generalisation about good estimates, for example, when the difference is less than 5 or 10.

	Accurate solutions	Estimates	Differences
a)	178	180	2
b)	167	170	3
c)	240	240	0 etc.

In question 5 the learners round off to the nearest 5, 10, 100, 1 000 or 10 000 to find out which strategy is more effective. They calculate the accurate solutions to check the effectiveness of the estimates.

In question 6 the learners select the best estimates from lists provided for calculations and explain their selections.

1. Class discussion

2. **a)**
$$\begin{array}{rcr} 86 & \rightarrow & 90 \\ \underline{+\ 92} & \rightarrow & \underline{90} \\ & & 180 \end{array}$$

b)
$$\begin{array}{rcr} 78 & \rightarrow & 80 \\ \underline{+\ 89} & \rightarrow & \underline{90} \\ & & 170 \end{array}$$

c)
$$\begin{array}{rcr} 167 & \rightarrow & 170 \\ \underline{+\ 73} & \rightarrow & \underline{70} \\ & & 240 \end{array}$$

d)
$$\begin{array}{rcr} 345 & \rightarrow & 350 \\ \underline{+\ 86} & \rightarrow & \underline{90} \\ & & 440 \end{array}$$

e)
$$\begin{array}{rcr} 554 & \rightarrow & 550 \\ \underline{+\ 694} & \rightarrow & \underline{690} \\ & & 1\ 240 \end{array}$$

f)
$$\begin{array}{rcr} 1\ 423 & \rightarrow & 1\ 420 \\ \underline{+\ 428} & \rightarrow & \underline{430} \\ & & 1\ 850 \end{array}$$

g)
$$\begin{array}{rcr} 2\ 604 & \rightarrow & 2\ 600 \\ \underline{+\ 3\ 401} & \rightarrow & \underline{3\ 400} \\ & & 6\ 000 \end{array}$$

h)
$$\begin{array}{rcr} 9\ 367 & \rightarrow & 9\ 370 \\ \underline{+\ 2\ 331} & \rightarrow & \underline{2\ 330} \\ & & 11\ 700 \end{array}$$

i)
$$\begin{array}{rcr} 12\ 234 & \rightarrow & 12\ 230 \\ \underline{+\ 12\ 451} & \rightarrow & \underline{12\ 450} \\ & & 24\ 680 \end{array}$$

j)
$$\begin{array}{rcr} 24\ 052 & \rightarrow & 24\ 050 \\ \underline{+\ 24\ 078} & \rightarrow & \underline{24\ 080} \\ & & 48\ 130 \end{array}$$

3. **a)** 178 **b)** 167
c) 240 **d)** 431
e) 1 248 **f)** 1 851
g) 6 005 **h)** 11 698
i) 24 685 **j)** 48 130

4. Most of the estimated answers are very close to the actual answers. In one or two cases the difference is 8 or 9.

5. Calculations

	To the nearest ...	5	10	100	1 000	10 000
a)	34 562 – 12 476	34 560 − 12 475 22 085	34 560 − 12 480 22 080	34 600 − 12 500 22 100	35 000 − 12 000 23 000	30000 − 10 000 20 000
b)	67 234 – 23 458	67 235 − 23 460 43 775	67 230 − 23 460 43 770	67 200 − 23 500 43 700	67 000 − 23 000 44 000	70 000 − 20 000 50 000
c)	71 567 – 45 284	71 570 − 45 285 26 285	71 570 − 45 280 26 290	71 600 − 45 300 26 300	72 000 − 45 000 27 000	70 000 − 50 000 20 000
d)	89 128 – 58 249	89 130 − 58 250 30 880	89 130 − 58 250 30 880	89 100 − 58 200 30 900	89 000 − 58 00 31 000	90 000 − 60 000 30 000

6. a) **(i)** 545 + 680
(ii) 2 875 + 1 125
(iii) 13 670 – 9 490
(iv) 51 525 – 25 245

b) For the learners to explain the best estimates, they have to calculate the accurate solutions and find the differences between these and the best estimates they have chosen. Ask them to identify the method of estimation for each estimate.

(i) 546 + 678 = 1 224
500 + 700 = 1 200 (nearest 100)
550 + 680 = 1 230 (nearest 10)
545 + 680 = 1 225 (nearest 5)
550 + 670 = 1 220 (rounded up and down to the nearest 10)
Estimate 3 is the best estimate because the difference is 1.

(ii) 2 873 + 1 124 = 3 997
2 900 + 1 100 = 4 000 (nearest 100)
3 000 + 1 000 = 4 000 (nearest 1 000)
2 870 + 1 120 = 3 990 (nearest 10)
2 875 + 1 125 = 4 000 (nearest 5)
Estimates 1, 2 and 4 are the best estimates. The difference is 3.

(iii) 13 672 – 9 489 = 4 183
14 000 – 9 000 = 5 000 (nearest 100)
13 670 – 9 490 = 4 180 (nearest 10)
13 675 – 9 490 = 4 185 (nearest 5)
13 700 – 9 500 = 4 200 (nearest 100)
Estimate 3 is the best estimate. The difference is 2.

(iv) 51 523 – 25 247 = 26 276
51 500 – 25 200 = 26 300 (nearest 100)
52 000 – 25 000 = 27 000 (nearest 1 000)
51 520 – 25 250 = 26 270 (nearest 10)
51 525 – 25 245 = 26 280 (nearest 5)
Estimate 4 is the best estimate. The difference is 4.

It appears that rounding off to the nearest 5 gives the best estimates for addition and subtraction but this might not always be the case. You could ask the learners to investigate this generalisation using smaller numbers. Let them round off to the nearest 5 and 10 to compare the effectiveness of the estimates.

nearest 5	**nearest 10**
26 + 23 = 49 → 25 + 25 = 50	30 + 20 = 50
24 + 27 = 51 → 25 + 25 = 50	20 + 30 = 50
93 + 93 = 186 → 95 + 95 = 190	90 + 90 = 180
97 – 53 = 44 → 95 – 55 = 40	100 – 50 = 50
63 – 27 = 35 → 65 – 25 = **40**	60 – 30 = **30**

In the last calculation rounding off to the nearest 5 and 10 give the best estimate. Generalising that rounding off to the nearest 5 always gives the best estimate is therefore not true. We could say that it often gives the best estimate.

Unit 9 More calculation methods

MENTAL MATHS

Learner's Book page 22

Ask the learners to explore the calculations and the 'checks' for accuracy. They will apply the opposite (inverse) operations to check their solutions for the addition and subtraction calculations. Encourage the learners to use effective calculation strategies. They apply strategies such as compensation, breaking down numbers, using near doubles, and adding the same number to both numbers.

1. The learners should notice that Phumzile uses the inverse operations for addition and subtraction to check his solutions.

2.

Calculations:	Checks:
a) 129 + 71 = 129 + 1 + 70 = 200	200 – 71 = 200 – 70 – 1 = 129
b) 94 – 57 = 94 – 4 – 50 – 3 = 37	57 + 37 = 50 + 30 + 7 + 7 = 94

c)	234 + 268 = 234 + 260 + 6 + 2 = 494 + 6 + 2 = 502	502 – 268 = 502 – 2 – 260 – 6 = 240 – 6 = 234
d)	153 + 157 = 150 + 150 + 10 = 310	310 – 157 = 310 – 10 – 140 – 7 = 160 – 7 = 153
e)	125 – 78 = 125 – 25 – 50 – 3 = 47	78 + 47 = 70 + 40 + 15 = 125
f)	246 – 97 = 249 – 100 = 149	149 + 97 = 149 + 1 + 50 + 40 + 6 = 246
g)	267 – 69 = 267 – 67 – 2 = 198	198 + 69 = 198 + 2 + 67 = 267
h)	437 + 435 = 435 + 435 + 2 = 872	872 – 435 = 870 – 435 + 2 = 437
i)	894 – 452 = 890 – 450 + 4 – 2 = 442	442 + 452 = 440 + 450 + 4 = 894
j)	672 + 338 = 670 + 330 + 10 = 1 010	1 010 – 672 = 1 010 – 10 – 660 – 2 = 340 – 2 = 338

Activity 9.1

Learner's Book page 23

The learners explore and discuss the given strategies. You should ensure that each learner understands the strategies before they are expected to apply them. Let them use the strategies to solve the addition and subtraction problems. The learners ask their partners to check their solutions by applying the inverse operations. Learners should understand that, although they are introduced to and apply different strategies, they can use whichever strategies they prefer, especially when they are allowed to use their own strategies and during assessment tasks.

1. **a)** The learners should realise that you add and subtract numbers to calculate easier, i.e. applying compensation (take away and give back). Let them explore and discuss the strategies. Ensure that all the learners make sense of the compensation strategy. You could use smaller numbers to assist slow learners, for example, 20 – 9 = 20 – 10 + 1 and so on. They should select numbers to avoid carrying so that the intermediate steps in the procedures are done mentally. They build up numbers to work with multiples of 10. You could share the strategies below with the learners during feedback. In the second strategy the vertical column method is used to calculate the sum.

b) **(i)**

5 356 + 3 443 = 8 799
67 – 43 = 24
8 799 + 1 + 23 = 8 823
5 356 + 3 467 = 8 823

5 356 + 4 = 5 360
3 467 – 4 = 3 463
5 356 + 3 467 = 8 823

(ii)

8 425 + 2 375 = 10 800
10 800 + 3 = 10 803
8 425 + 2 378 = 10 803

8 425 + 75 = 8 500
2 378 – 75 = 2 303
8 425 + 2 378 = 10 803

(iii)

12 627 + 8 303 = 20 930
20 930 + 70 = 21 000
12 627 + 8 373 = 21 000

12 627 + 3 = 12 630
8 373 – 3 = 8 370
12 627 + 8 373 = 21 000

(iv)

26 582 + 15 408 = 41 990
41 990 + 10 = 42 000
42 000 + 60 = 42 060
26 582 + 15 478 = 42 060

26 582 + 8 = 26 590
15 478 – 8 = 15 470
26 582 + 15 478 = 42 060

(v)

77 215 + 2 250 = 79 465
79 465 + 5 + 2 = 79 472
77 215 + 2 257 = 79 472

77 215 + 5 = 77 220
2 257 – 5 = 2 252
77 215 + 2 257 = 79 472

2. The learners should realise that they have to round off the second number to the nearest 10 to subtract easier. They break up numbers to prevent decomposition.

(i) 6 367 – 4 248 = ■
6 367 – 4 240 = 2 127
2 127 – 7 – 1 = 2 119
6 367 – 4 248 = 2 119

(ii) 8 426 – 2 119 = ■
8 426 – 2 110 = 6 316
6 316 – 6 – 3 = 6 307
8 426 – 2 119 = 6 307

(iii) 14 538 – 12 356 = ■
14 538 – 12 330 = 2 208
2 208 – 26 = 2 208 – 8 – 10 – 8
= 2 182
14 538 – 12 356 = 2 182

(iv) 23 642 – 11 482 = ■
23 642 – 11 442 = 12 200
12 200 – 40 = 12 160
23 642 – 11 482 = 12 160

(v) 15 954 – 3 567 = ■
15 954 – 3 540 = 12 414
12 414 – 27 = 12 414 – 14 – 10 – 3
= 12 387
15 954 – 3 567 = 12 387

Unit 10 Short cuts to calculation

MENTAL MATHS

Learner's Book page 24

Tell the learners that they have practised using short cuts in calculations since Grade 4. They will explore and use some short cuts again. Encourage them to do the calculations mentally and to explain what happens in their heads while they are calculating.

In question 2 they apply the short cuts to calculations. It is important that learners discuss and explain the strategies they apply.

In question 3 they use the calculations in the boxes to solve the problems below each box. Tell them that they do not have to do any calculations; they solve the problems by looking for relationships. For example, 235 + 230 is 5 more than 230 + 230 = 460.

1. **a)** The learner breaks up a number to make a multiple of 10.
b) The learner breaks up numbers to use near doubles.
c) The learner breaks up the number into its place value parts.
d) The learner subtracts 100 instead of 99 because 99 + 1 = 100.
e) The learner adds 100 instead of 99, because 99 = 100 – 1. She adds 1 and then subtracts 1, so she is using compensation.

2. **a)** 34 + 58 = 34 + 6 + 52
= 40 + 52
= 92

b) 92 + 89 = 90 + 90 + 2 – 1
= 181

c) 125 + 99 = 125 + 100 – 1
= 224

d) 500 – 99 = 500 – 100 + 1
= 401

e) 679 + 99 = 679 + 100 – 1
= 778

f) 400 – 145 = 400 – 150 + 5
= 255

g) 326 + 325 = 325 + 325 + 1
= 651

h) 484 + 487 = 480 + 480 + 11
= 971

i) 500 – 225 = 500 – 200 – 25
= 275

j) 800 – 375 = 800 – 300 – 75
= 425

3. a) 230 + 230 = 460
235 + 230 = ■

b) 27 + 16 = 43
28 + 17 = 45

c) 400 – 100 = 300
400 – 99 = 301

d) 2 000 – 200 = 1 800
2 000 – 199 = 1 801

Activity 10.1

Learner's Book page 24

The learners use the short cut strategies in the mental maths activity in this unit to solve the addition and subtraction problems. They use doubling, breaking up of numbers and building up of multiples of 10 to solve problems involving bigger numbers.

In question 2 they use effective strategies to solve problems in financial contexts. They apply doubling, compensation and rounding off amounts to the nearest rand. You can encourage them to work without the commas and insert the commas again in the solutions, since they have not worked with decimal fraction calculations yet.

1. a) 2 356 + 5 367
2 350 + 5 350 = 7 700
7 700 + 6 + 17 = 7 723

b) 18 148 + 1 267
18 148 + 142 = 18 290
18 290 + 125 = 18 290 + 110 + 15
= 18 415

c) 23 456 + 23 458
23 450 + 23 450 = 46 900
46 900 + 6 + 8 = 46 914

d) 14 329 + 14 326
14 320 + 14 320 = 28 640
28 640 + 9 + 6 = 28 655

e) 10 000 – 256
10 000 – 250 = 9 750
9 750 – 6 = 9 744

f) 9 000 – 567
9 000 – 500 = 8 500
8 500 – 60 = 8 440
8 440 – 7 = 8 433

g) 4 592 – 99
4 592 – 100 + 1 = 493

h) 12 487 – 199
12 487 – 200 + 1 = 12 288

i) 15 734 – 499
15 734 – 500 + 1 = 15 235

j) 27 576 + 399

27 576 + 400 – 1 = 27 175

2. Fruit juice: R32,99
3 299 × 2 = 3 300 + 3 300 – 2
= 6 598
= R65, 98

Sardines: R14,95
1 495 × 2 = 1 500 + 1 500 – 10
= 2 990
= R29,90

Pizza: R28,98
2 898 × 2 = 2 900 + 2 900 – 4
= 5 796
= R57,96

Chicken livers: R6,99
699 × 2 = 700 + 700 – 2
= 1 398
= R13,98

Rice: R12,99
1 299 × 2 = 1 300 + 1 300 – 2
= 2 598
= R25,98

Butter: R21,49
2 149 × 2 = 2 150 + 2 150 – 2
= 4 298
= R42,98

Unit 11 Solving real-life problems

MENTAL MATHS

Learner's Book page 25

Tell the learners that they will solve real-life problems involving addition and subtraction. They solve the problems on their own and write the solutions on their Mental Maths grids. They fill in the outcomes on the grid and use the graph to monitor their progress in mental calculation. Tell them that they should try to improve their results.

They work with small numbers that involve contexts that they will work with in the main lesson.

Ask the learners to apply the strategies they have used in Unit 10 to solve the problems. They use near doubles, building up and breaking down numbers.

1. 56 + 48 = 50 + 40 + 14
= 104 tomatoes
2. 545 + 549 = 545 + 545 + 4
= R1 094
3. R40 – R35,99 = R40 – R36 + 1 c
= R4,01
4. R7,99 + R6,99 = R8 + R7 – 2c
= R14,98
5. 300 – 199 = 300 – 200 + 1
= 101 km
6. 58 + 69 = 58 + 2 + 60 + 7
= 127 km
7. R158 + R156 = 150 + 150 + 14
= R314
8. 1 000 – 889 = 1 000 – 890 + 1
= 111 stamps
9. 467 + 462 = 460 + 460 + 9
= 929 books
10. 256 + 256 = 250 + 250 + 12
= 512 books

Activity 11.1

Learner's Book page 26

Tell the learners that they should use their own strategies to solve the following word problems. The strategies could involve the ones that they practised previously or their own intuitive strategies. You could ask them to work in pairs, groups or on their own. They present their strategies and solutions to the class during feedback. Tell them that they should use the strategies and short cuts they have learned so far.

1. 8 580 – 4 378 = 4 202 apples picked towards the end of the week.
2. 7 595 + 7 585 = 15 180 grapevines planted during two months

3. 5 000 – 1 999 = 3 001 rotten pears were given to the pigs
4. R30 000 – R15 995 = R14 005 is needed.
5. R15 990 + R15 995 = R31 985 is enough to buy the tractor.
6. R1 775 + R1 775 = R3 550 for two weeks
   Double R3 550 = R7 100 for four weeks
7. 16 568 – 9 589 = 6 979 kg more than the sheep.
8. 59 kg – 40 kg = 19 kg is the dog's mass.
9. 2 467 + 2 856 + 2 675 = 7 998 eggs altogether.
10. 1 448 – 1 256 = 192 km further.

Assessment 1.3: Addition and subtraction of whole numbers

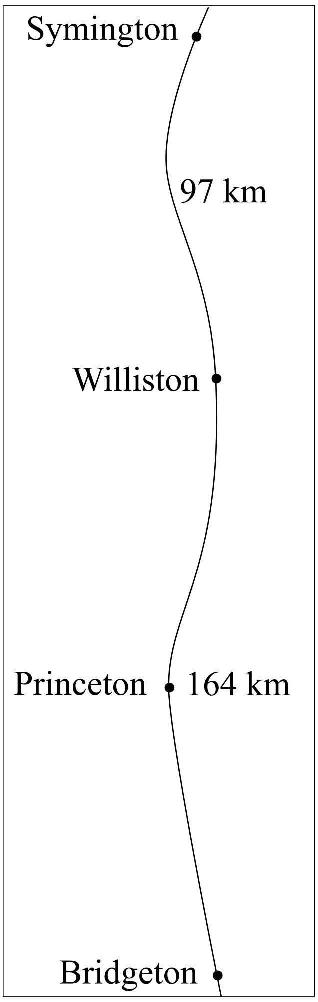
The learners can use their own strategies or the strategies they have practised during the past few units. They will apply the knowledge they have developed during the units in which they practised addition and subtraction. They will use properties of numbers, calculation strategies they have learned or their own intuitive strategies, look for relationships to do calculations to solve problems. and use estimation skills to find the best estimates.

1. Solve the following:

a) 37 + 29 = ■ 29 + 37 = ■
b) 56 + 28 = ■ 28 + 56 = ■
c) 86 + 2 345 = 2 345 + ■
d) 125 + 175 = ■ + 125 = ■
e) 1 075 + 225 = ■
f) 17 + 221 = ■
g) 430 + 360 = ■
h) 2 260 + 140 = ■
i) 950 + 50 = ■
j) 720 + 80 = ■

2. Calculate:

a) 15 – 8 = ■
b) 55 – 8 = ■
c) 550 – ■ = 470
d) 234 + ■ = 260
e) 150 – 25 = 125 150 – ■ = 126
f) 300 – 75 = 225 300 – ■ = 224
g) 50 – 9 = ■
h) 500 – 9 = ■



3. Calculate:

a) 124 + ■ = 400 **b)** 85 – 17 = ■
c) 5 400 – 1 800 = ■ **d)** 430 – 90 = ■
e) 3 324 – 2 000 = ■ **f)** 510 – 313 = ■
g) 1 575 – 450 = ■

4. The scale drawing (left) shows the distances between towns.

a) How far is Bridgeton from Symington?
b) The distance between Bridgeton and Williston is 164 km. Approximately how far is Princeton from Bridgeton?

5. Johan weighs 67 kg. His father weighs 102 kg. How much more than Johan does his father weigh?

6. Mapetla's father is 167 cm tall. If Mapetla is 129 cm tall, how much taller is his father?

7. Which is the best estimate for each of these calculations? Write down the letter of the estimate you choose.

a) 5 679 + 443
A. 5 700 + 400
B. 5 680 + 440
C. 5 680 + 445
D. 6 000 + 400

b) 2 307 – 582
A. 2 300 – 600
B. 2 310 – 580
C. 2 305 – 580
D. 2 000 – 1 000

8. Use your own methods to solve the following.

a) 13 999 + 14 999 = ■ **b)** 15 342 – 12 784 = ■
c) 40 674 + 2 456 + 359 = ■ **d)** 21 999 – 14 999 = ■

1. a) 37 + 29 = 66 29 + 37 = 66
b) 56 + 28 = 84 28 + 56 = 84
c) 86 + 2 345 = 2 345 + 86
d) 125 + 175 = 175 + 125 = 300
e) 1 075 + 225 = 1 300
f) 17 + 221 = 238
g) 430 + 360 = 790
h) 2 260 + 140 = 2 400
i) 950 + 50 = 1 000
j) 720 + 80 = 800

2. a) 15 – 8 = 7
b) 55 – 8 = 47
c) 550 – 80 = 470
d) 234 + 26 = 260
e) 150 – 25 = 125 150 – 24 = 126
f) 300 – 75 = 225 300 – 74 = 224
g) 50 – 9 = 41
h) 500 – 9 = 491

3. a) 124 + ■ = 400
124 + 6 = 130
130 + 70 = 200
200 + 200 = 400
200 + 70 + 6 = 276
124 + 276 = 400

b) 85 – 17 = 85 – 5 – 10 – 2
= 70 – 2
= 68

c) 5 400 – 1 800 = 5 400 – 1 400
= 4 000 – 400
= 3 600

d) 430 – 90 = 430 – 30 – 60
= 400 – 60
= 340

e) 3 324 – 2 000 = 1 324

f) 510 – 313 = 510 – 310 – 3
= 200 – 3
= 197

g) 1 575 – 450 = 1 125

4. a) 164 km + 97 km = 97 + 3 + 161
= 261 km
Bridgeton is 261 km from Symington.

b) Princeton is halfway between Bridgeton and Williston.

Half of 164 km = 164 km ÷ 2
= 82 km

Princeton is about 82 km from Bridgeton.

5. 102 kg – 67 kg = 102 – 2 – 60 – 5
= 40 – 5
= 35 kg

John's father weighs 35 kg more than John.

6. 167 – 129 = 167 – 130 + 1
= 37 + 1
= 38 cm

Mapetla's father is 38 cm taller than him.

7. **a)** 5 679 + 443 = 6 122
A. 5 700 + 400 = 6 100
B. 5 680 + 440 = 6 120
C. 5 680 + 445 = 6 125
D. 6 000 + 400 = 6 400

b) 2 307 – 582 = 1 725
A. 2 300 – 600 = 1 700
B. 2 310 – 580 = 1 730
C. 2 305 – 580 = 1 725
D. 2 000 – 1 000 = 1 000

B and C are the best estimates. The estimates are closest to the accurate solutions.

8. **a)** 13 999 + 14 999 = (14 000 + 15 000) – 2
= 29 000 – 2
= 28 998

b) 15 342 – 12 784 = 15 342 – 12 342 – 442
= 3 000 – 400 – 40 – 2
= 2 600 – 40 – 2
= 2 560 – 2
= 2 558

c) 40 674 + 2 456 + 359
= (40 600 + 2 400 + 300) + (70 + 50 + 50) + (4 + 6 + 9)
= 43 300 + 170 + 19
= 43 489

d) 21 999 – 14 999 = 22 000 – 15 000
= 7 000

Common fractions

Learner's Book page 28

Ask the learners what they know about fractions and to describe the different fractions they know to the class. Encourage them to describe the difference between a whole number and a fraction. Tell them that they will count, order and represent fractions again during the following units. In this term they will mostly revise fraction concepts they have worked with before, but will also learn some new fraction concepts. They will work with equivalent fractions, do equal sharing with remainders that have to be shared, find fractions of whole numbers, add and subtract fractions and work with fractions in different contexts, for example measurement.

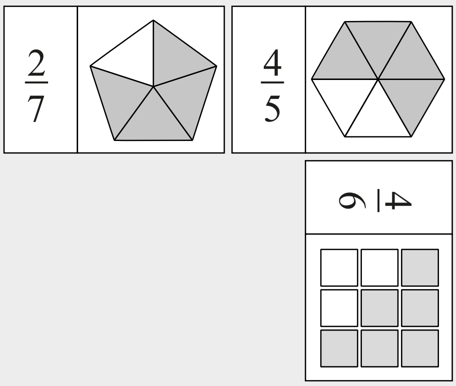
Unit 12 Representing fractions in diagrams

MENTAL MATHS

Learner's Book page 28

The learners play *Fraction Dominoes* in teams of four players. To make the cards, copy and laminate the template in the back of this Teacher's Guide. They have played the game in Grades 4 and 5 so they should be familiar with the rules. The game helps with the development of fraction recognition and representation. Ask them to share their learning experiences with the class after they have played the game.

How to play *Fraction Dominoes*



It is a game for 2, 3, 4 or more players. The game is played like an ordinary domino game. Learners shuffle the cards. Each player takes 7 cards, if they are in a group of 4 players. The player with the card that has $\frac{2}{7}$ as a fraction starts. The next player can now add the diagrammatic representation for $\frac{2}{7}$ on the left or the fraction symbol for the picture of $\frac{4}{5}$. A player that does not have one of these cards knocks and skips a round. The winner is the one who has played all his/her cards first. The rest of the players finish the game.

The game allows learners to identify fraction symbols and their diagrammatic representations. Learners count the fraction parts while they play. Encourage the learners to use the correct terminology for fractions, for example two-sevenths and not 2 over 7. The game further promotes teamwork and mathematical conversation.

Activity 12.1

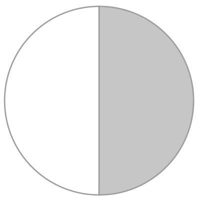
Learner's Book page 28

Ask the learners to draw circles or give them a copy of the shape template in the back of this Teacher's Guide. They will represent fraction parts by shading shapes. They work with proper and mixed fractions in questions 1 and 2.

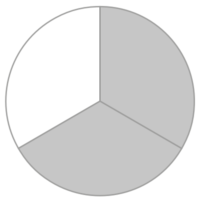
In question 3 the learners identify the different fraction parts that are shaded, and in question 4 they shade different fraction parts of wholes that consist of smaller units.

In question 5 the learners use their own diagrams or copies of shapes to represent fraction parts and to compare fractions.

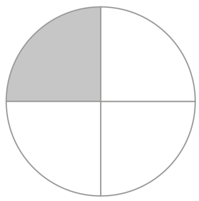
1. a)



b)



c)



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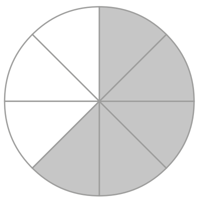

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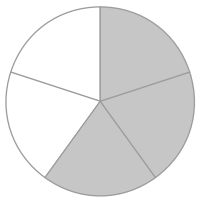
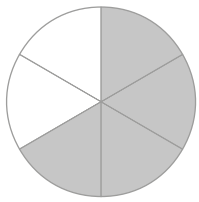
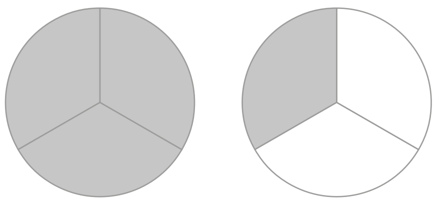


f)



2. a)



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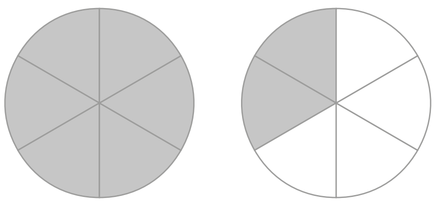
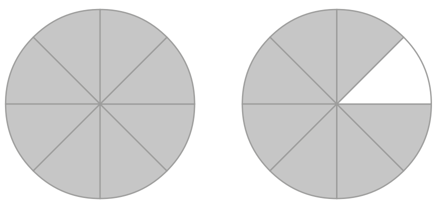


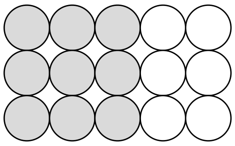
c)



3. a) $\frac{2}{4}$ b) $\frac{4}{7}$ c) $\frac{7}{10}$

d) $\frac{2}{9}$ e) $\frac{7}{12}$ f) $\frac{5}{11}$

4. a)



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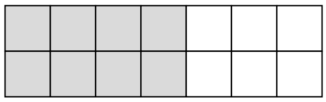

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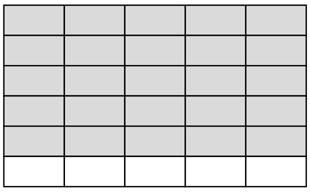

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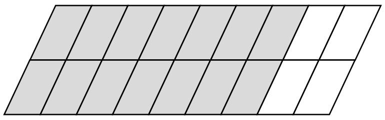
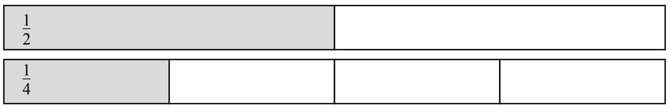
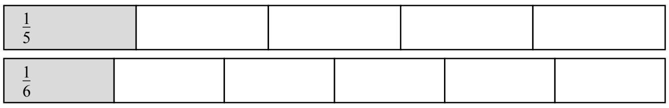


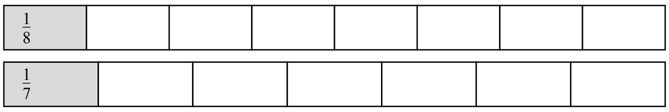
5. a)



b)

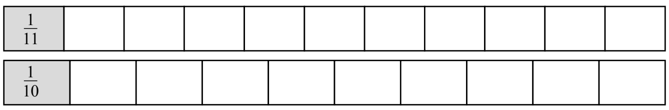


c)

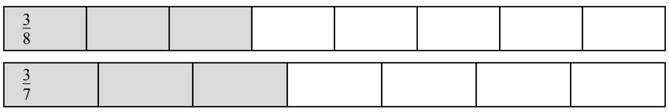


d)

e)

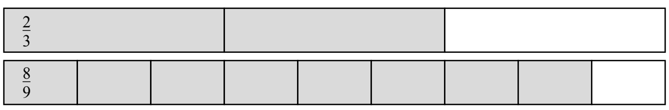


f)



g)

h)



Unit 13 Order and count fractions

MENTAL MATHS

Learner's Book page 30

In question 1 the learners count in fractions and name the next 5 fractions in each sequence. They should notice that the numerators are even and uneven numbers and multiples. Ask them to count in both improper and mixed fractions for example: $\frac{1}{7}$; $\frac{3}{7}$; $\frac{5}{7}$; $\mathbf{\frac{7}{7}}$; $\mathbf{\frac{9}{7}}$; $\mathbf{\frac{11}{7}}$; $\mathbf{\frac{13}{7}}$; $\mathbf{\frac{15}{7}}$ or $\frac{1}{7}$; $\frac{3}{7}$; $\frac{5}{7}$; $\mathbf{1\left(\frac{7}{7}\right)}$; $\mathbf{1\frac{2}{7}}$; $\mathbf{1\frac{4}{7}}$; $\mathbf{1\frac{6}{7}}$; $\mathbf{2\frac{1}{7}}$

The learners have worked with improper and mixed fractions before. Find out if they remember how to convert between the fractions. Let them describe the relationships between the numbers in the fractions. At this stage, they use multiplication and division to do this, and not the cancellation rule. For example, to change $1\frac{1}{2}$ to an improper fraction: $1 \times 2 + 1 = \frac{3}{2}$ and divide to change $\frac{3}{2}$ to a mixed fraction: $3 \div 2 = 1$ rem $1 = 1\frac{1}{2}$.

1. a) $\frac{1}{7}$; $\frac{3}{7}$; $\frac{5}{7}$; $\mathbf{\frac{7}{7}}$; $\mathbf{\frac{9}{7}}$; $\mathbf{\frac{11}{7}}$; $\mathbf{\frac{13}{7}}$; $\mathbf{\frac{15}{7}}$

   $\frac{1}{7}$; $\frac{3}{7}$; $\frac{5}{7}$; $\frac{7}{7}$; $1 + \frac{2}{7}$; $1 + \frac{4}{7}$; $1 + \frac{6}{7}$; $2 + \frac{1}{7}$; $2 + \frac{3}{7}$

   b) $\frac{2}{8}$; $\frac{4}{8}$; $\frac{6}{8}$; $\frac{8}{8}$; $\frac{10}{8}$; $\frac{12}{8}$; $\frac{14}{8}$; $\frac{16}{8}$; $\frac{18}{8}$

   $\frac{2}{8}$; $\frac{4}{8}$; $\frac{6}{8}$; $\frac{8}{8}$; $1 + \frac{2}{8}$; $1 + \frac{4}{8}$; $1 + \frac{6}{8}$; $2 + \frac{2}{8}$

   c) $\frac{3}{9}$; $\frac{6}{9}$; $\frac{9}{9}$; $\frac{12}{9}$; $\frac{15}{9}$; $\frac{18}{9}$; $\frac{21}{9}$

   $\frac{3}{9}$; $\frac{6}{9}$; 1; $1 + \frac{3}{9}$; $1 + \frac{6}{9}$; 2; $2 + \frac{3}{9}$

   d) $\frac{5}{10}$; 1; $1\frac{5}{10}$; 2; $2\frac{5}{10}$; 3; $3\frac{5}{10}$; 4

   $\frac{5}{10}$; $\frac{10}{10}$; $\frac{15}{10}$; $\frac{20}{10}$; $\frac{25}{10}$; $\frac{30}{10}$; $\frac{35}{10}$; $\frac{40}{10}$

   e) $\frac{4}{12}$; $\frac{8}{12}$; $\frac{12}{12}$; $\frac{16}{12}$; $\frac{20}{12}$; $\frac{24}{12}$; $\frac{28}{12}$

   $\frac{4}{12}$; $\frac{8}{12}$; 1; $1 + \frac{4}{12}$; $1 + \frac{8}{12}$; 2; $2 + \frac{4}{12}$

2. The learners explain how they convert between improper and mixed fractions. Let them give examples.

Activity 13.1

Learner's Book page 30

The learners compare and order fractions in question 1.

In question 2 they find out how many fraction pieces there are in whole numbers and in mixed fractions by multiplying and adding. For example, in $2\frac{1}{2}$ cakes that are divided into 12 slices you will get $2 \times 12 + 6$ twelfths, i.e. $\frac{30}{12}$.

In question 3 the learners count in fractions by completing the number chains. Give them copies of the blank chains in the resources section.

In question 4 they determine how many wholes there are in, for example, $\frac{17}{2}$. They divide the fraction parts, i.e. $17 \div 2 = 8$ wholes, remainder 1 $\left(8\frac{1}{2}\right)$.

1. **a)** $\frac{1}{7}$; $\frac{1}{6}$; $\frac{1}{5}$; $\frac{1}{4}$; $\frac{1}{3}$; $\frac{1}{2}$

b) $\frac{1}{20}$; $\frac{1}{12}$; $\frac{1}{11}$; $\frac{1}{10}$; $\frac{1}{9}$; $\frac{1}{8}$

c) $\frac{1}{2}$; $2\frac{1}{4}$; $2\frac{1}{3}$; $2\frac{1}{2}$; $3\frac{1}{10}$; $4\frac{1}{8}$

2. **a)** 3 oranges in halves: $3 \times 2 = 6$ halves

b) $4\frac{3}{4}$ oranges in quarters: $(4 \times 4) + 3 = 19$ quarters

c) $5\frac{1}{2}$ chocolate bars in tenths: $(5 \times 2) + 1 = 11$ halves

d) $2\frac{4}{8}$ cakes in eighths: $(8 \times 2) + 4 = 20$ eighths

e) 6 cakes in ninths: $9 \times 6 = 54$ ninths

f) $2\frac{1}{2}$ cakes in twelfths: $(12 \times 2) + 6 = 30$ twelfths

3. **a)**

$\frac{1}{2} \rightarrow +\frac{1}{2} \rightarrow 1 \rightarrow +\frac{1}{2} \rightarrow 1\frac{1}{2} \rightarrow +\frac{1}{2} \rightarrow 2$

$\rightarrow +\frac{1}{2} \rightarrow 2\frac{1}{2} \rightarrow +\frac{1}{2} \rightarrow 3 \rightarrow +\frac{1}{2} \rightarrow 3\frac{1}{2} \rightarrow +\frac{1}{2}$

$\rightarrow 4 \rightarrow +\frac{1}{2} \rightarrow 4\frac{1}{2} \rightarrow +\frac{1}{2} \rightarrow 5 \rightarrow +\frac{1}{2} \rightarrow 5\frac{1}{2}$

b)

$\frac{1}{4} \rightarrow +\frac{1}{4} \rightarrow \frac{1}{2} \rightarrow +\frac{1}{4} \rightarrow \frac{3}{4} \rightarrow +\frac{1}{4} \rightarrow 1$

$\rightarrow +\frac{1}{4} \rightarrow 1\frac{1}{4} \rightarrow +\frac{1}{4} \rightarrow 1\frac{1}{2} \rightarrow +\frac{1}{4} \rightarrow 1\frac{3}{4} \rightarrow +\frac{1}{4}$

$\rightarrow 2 \rightarrow +\frac{1}{4} \rightarrow 2\frac{1}{4} \rightarrow +\frac{1}{4} \rightarrow 2\frac{1}{2} \rightarrow +\frac{1}{4} \rightarrow 2\frac{3}{4}$

$\rightarrow +\frac{1}{4} \rightarrow 3 \rightarrow +\frac{1}{4} \rightarrow 3\frac{1}{4} \rightarrow +\frac{1}{4} \rightarrow 3\frac{1}{2} \rightarrow +\frac{1}{4}$

$\rightarrow 3\frac{3}{4} \rightarrow +\frac{1}{4} \rightarrow 4$

c)

$\frac{1}{3} \rightarrow +\frac{1}{3} \rightarrow \frac{2}{3} \rightarrow +\frac{1}{3} \rightarrow 1 \rightarrow +\frac{1}{3} \rightarrow 1\frac{1}{3}$

$\rightarrow +\frac{1}{3} \rightarrow 1\frac{2}{3} \rightarrow +\frac{1}{3} \rightarrow 2 \rightarrow +\frac{1}{3} \rightarrow 2\frac{1}{3} \rightarrow +\frac{1}{3}$

$\rightarrow 2\frac{2}{3} \rightarrow +\frac{1}{3} \rightarrow 3 \rightarrow +\frac{1}{3} \rightarrow 3\frac{1}{3} \rightarrow +\frac{1}{3} \rightarrow 3\frac{2}{3}$

$\rightarrow +\frac{1}{3} \rightarrow 4$

d) $\frac{2}{8} \rightarrow +\frac{2}{8} \rightarrow \frac{4}{8} \rightarrow +\frac{2}{8} \rightarrow \frac{6}{8} \rightarrow +\frac{2}{8} \rightarrow 1 \rightarrow +\frac{2}{8} \rightarrow 1\frac{2}{8} \rightarrow +\frac{2}{8} \rightarrow 1\frac{4}{8} \rightarrow +\frac{2}{8} \rightarrow 1\frac{6}{8} \rightarrow +\frac{2}{8} \rightarrow 2 \rightarrow +\frac{2}{8} \rightarrow 2\frac{2}{8} \rightarrow +\frac{2}{8} \rightarrow 2\frac{4}{8} \rightarrow +\frac{2}{8} \rightarrow 2\frac{6}{8} \rightarrow +\frac{2}{8} \rightarrow 3 \rightarrow +\frac{2}{8} \rightarrow 3\frac{2}{8}$

e) $\frac{1}{7} \rightarrow +\frac{1}{7} \rightarrow \frac{2}{7} \rightarrow +\frac{1}{7} \rightarrow \frac{3}{7} \rightarrow +\frac{1}{7} \rightarrow \frac{4}{7} \rightarrow +\frac{1}{7} \rightarrow \frac{5}{7} \rightarrow +\frac{1}{7} \rightarrow \frac{6}{7} \rightarrow +\frac{1}{7} \rightarrow 1 \rightarrow +\frac{1}{7} \rightarrow 1\frac{1}{7} \rightarrow +\frac{1}{7} \rightarrow 1\frac{2}{7} \rightarrow +\frac{1}{7} \rightarrow 1\frac{3}{7} \rightarrow +\frac{1}{7} \rightarrow 1\frac{4}{7} \rightarrow +\frac{1}{7} \rightarrow 1\frac{5}{7} \rightarrow +\frac{1}{7} \rightarrow 1\frac{6}{7} \rightarrow +\frac{1}{7} \rightarrow 2 \rightarrow +\frac{1}{7} \rightarrow 2\frac{1}{7} \rightarrow +\frac{1}{7} \rightarrow 2\frac{2}{7} \rightarrow +\frac{1}{7} \rightarrow 2\frac{3}{7} \rightarrow +\frac{1}{7} \rightarrow 2\frac{4}{7} \rightarrow +\frac{1}{7} \rightarrow 2\frac{5}{7}$

f) $\frac{1}{11} \rightarrow +\frac{1}{11} \rightarrow \frac{2}{11} \rightarrow +\frac{1}{11} \rightarrow \frac{3}{11} \rightarrow +\frac{1}{11} \rightarrow \frac{4}{11} \rightarrow +\frac{1}{11} \rightarrow \frac{5}{11} \rightarrow +\frac{1}{11} \rightarrow \frac{6}{11} \rightarrow +\frac{1}{11} \rightarrow \frac{7}{11} \rightarrow +\frac{1}{11} \rightarrow \frac{8}{11} \rightarrow +\frac{1}{11} \rightarrow \frac{9}{11} \rightarrow +\frac{1}{11} \rightarrow \frac{10}{11} \rightarrow +\frac{1}{11} \rightarrow 1 \rightarrow +\frac{1}{11} \rightarrow 1\frac{1}{11} \rightarrow +\frac{1}{11} \rightarrow 1\frac{2}{11} \rightarrow +\frac{1}{11} \rightarrow 1\frac{3}{11} \rightarrow +\frac{1}{11} \rightarrow 1\frac{4}{11} \rightarrow +\frac{1}{11} \rightarrow 1\frac{5}{11} \rightarrow +\frac{1}{11} \rightarrow 1\frac{6}{11} \rightarrow +\frac{1}{11} \rightarrow 1\frac{7}{11} \rightarrow +\frac{1}{11} \rightarrow 1\frac{8}{11} \rightarrow +\frac{1}{11} \rightarrow 1\frac{9}{11} \rightarrow +\frac{1}{11} \rightarrow 1\frac{10}{11} \rightarrow +\frac{1}{11} \rightarrow 2$

4. a) 17 halves: $17 \div 2 = 8$ wholes remainder $\frac{1}{2}$

b) 13 quarters: $13 \div 4 = 3$ wholes remainder $\frac{1}{4}$

c) 21 fifths: $21 \div 5 = 4$ wholes remainder $\frac{1}{5}$

d) 26 sixths: 26 ÷ 6 = 4 wholes remainder $\frac{2}{6}$

e) 16 sevenths: 16 ÷ 7 = 2 wholes remainder $\frac{2}{7}$

f) 19 ninths: 19 ÷ 9 = 2 wholes remainder $\frac{1}{9}$

g) 25 elevenths: 25 ÷ 11 = 2 wholes remainder $\frac{3}{11}$

h) 34 tenths: 34 ÷ 10 = 3 wholes remainder $\frac{4}{10}$

Unit 14 Identify and order fractions

MENTAL MATHS

Learner's Book page 32

In this activity the learners use cubes to compare fractions cube constructions and to represent fraction parts. If you do not have cubes, you should borrow some from teachers in the Foundation Phase or let the learners make drawings of the cubes.

In question 1 they build a cube rod with 16 cubes. They have to find out into how many different equal parts they can break the rod. Breaking the rod into 2 equal parts will give them two halves; breaking it into 16 single cubes will give them sixteenths. Tell them that they will work with fractions other than halves to twelfths later on. They use rods with 15 and 24 cubes to find more equal parts. Introduce them to fifteenths and twenty-fourths. Ask the learners to look at the representation of $\frac{1}{3}$ in the cuboid.

In question 2 they build a cube construction and represent the different fraction parts as indicated. Allow the learners to discuss their learning experiences.

1. a) 16 ÷ 2 = 8. The rod is broken in halves so that each half has 8 cubes.

b) 16 ÷ 1 = 16. The rod is broken into 16 equal parts so that each part has 1 cube.
16 ÷ 8 = 2. The rod is broken into 8 equal parts so that each part has 2 cubes.
16 ÷ 4 = 4. The rod is broken into 4 equal parts so that each part has 4 cubes.
The more parts you break the rod into, the smaller the number of cubes in the equal parts.
The learners should identify the factors of 15. Ask them to work systematically to find the number of equal parts.

c) 15 ÷ 15 = 1: Fifteen equal parts with 1 cube in each part. Each part is one fifteenth, i.e. $\frac{1}{15}$.
15 ÷ 5 = 3: Five equal parts with 3 cubes in each part. Each part is one fifth, i.e. $\frac{1}{5}$.
15 ÷ 3 = 5: Three equal parts with 5 cubes in each part. Each part is one third, i.e. $\frac{1}{3}$. You can break the rod into 3 different ways to get equal parts.

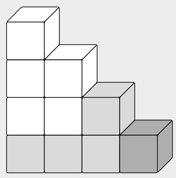
d) 24 ÷ 24 = 1
Twenty-four equal parts with 1 cube in each part. Each part is one twenty-fourth, i.e. $\frac{1}{24}$
24 ÷ 12 = 2
Twelve equal parts with 2 cubes in each part. Each part is one twelfth, i.e. $\frac{1}{12}$
24 ÷ 8 = 3
Eight equal parts with 3 cubes in each part. Each part is one eighth, i.e. $\frac{1}{8}$
24 ÷ 6 = 4
Six equal parts with 4 cubes in each part. Each part is one sixth, i.e. $\frac{1}{6}$
24 ÷ 4 = 6.
Four equal parts with 6 cubes in each part. Each part is one quarter, i.e. $\frac{1}{4}$
24 ÷ 2 = 12
Two equal parts with 12 cubes in each part. Each part is one half, i.e. $\frac{1}{2}$
You can break the rod into 6 different ways to get equal parts.

2. a) The learners have to calculate fractions of a whole number to decide which colours are used in the cube construction that consists of 10 cubes.

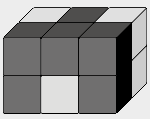
Red cubes: $\frac{1}{2}$ of 10 = 5

Green cubes: $\frac{2}{5}$ of 10 = 4

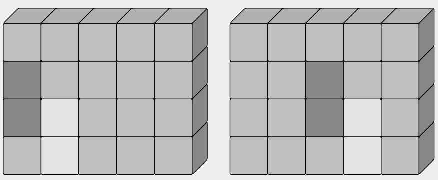
Yellow cubes: $\frac{1}{10}$ of 10 = 1



b) They should realise that they have to add 6 cubes to the construction to create a cuboid. Here is one way of doing it.



c) The learners have to reason that, if $\frac{1}{5}$ are 4 cubes, the cuboid have to consists of 20 cubes because 4 × 5 = 20. They should therefore add 16 green cubes to create a cuboid. Below are two ways of doing it.



The learners continue to work with fraction representations in different shapes.

In question 1, they work with shapes with different numbers of sides and identify the shaded part in each shape. For example, a decagon has 10 sides so that the shaded part is one tenth $\left(\frac{1}{10}\right)$. Let them name the shapes and count the number of equal parts in each shape. Ask the learners to write the fraction symbols for the parts they have shaded in ascending order. They should notice that the more parts the whole is divided into, the smaller the fraction. Give them copies of the blank diagrams in the resources section and ask them to shade more parts, for example $\frac{3}{10}$, $\frac{2}{5}$ and so on.

For question 2, you will need to make copies of the semi-blank number lines in the resources section. The learners fill in the fractions as indicated for each number line. They develop or enhance their understanding of the relationship between fractions with denominators that are multiples and factors of each other.

Ask the learners to use the number lines in question 2 to compare the fractions listed in question 3. They must know what fractions are called that are equal to each other.

For question 4, give the learners copies of the blank pairs of rectangles in the resources section. They divide the shapes according to the number of equal parts indicated in the Learner's Book and shade the fraction parts.

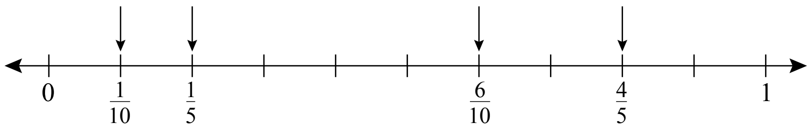
1. a) **(i)** $\frac{1}{4}$ of a rectangle **(ii)** $\frac{1}{5}$ of a pentagon

(iii) $\frac{1}{6}$ of a hexagon **(iv)** $\frac{1}{7}$ of a heptagon

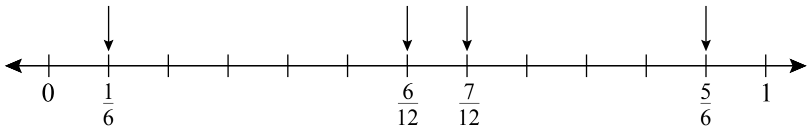
(v) $\frac{1}{8}$ of an octagon **(vi)** $\frac{1}{9}$ of a nonagon

(vii) $\frac{1}{10}$ of a decagon

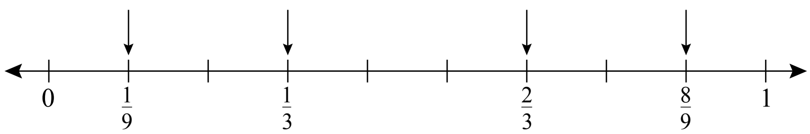
2 a)



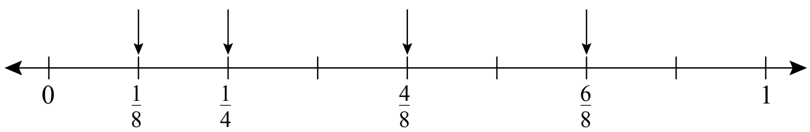
b)



c)



d)



3. a) $\frac{5}{6} = \frac{10}{12}$ b) $\frac{1}{8} < \frac{1}{4}$ c) $\frac{1}{5} = \frac{2}{10}$

d) $\frac{1}{2} = \frac{5}{10}$ e) $\frac{1}{3} > \frac{2}{9}$ f) $\frac{6}{8} = \frac{3}{4}$

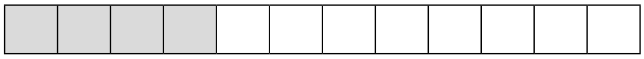
g) $\frac{7}{10} < \frac{4}{5}$ h) $\frac{7}{8} > \frac{3}{4}$ i) $\frac{2}{3} < \frac{7}{9}$

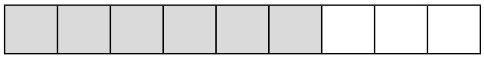
j) $\frac{5}{8} > \frac{1}{2}$

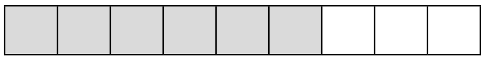
4. a) $\frac{1}{5}$ 

b) $\frac{2}{10}$ 

c) $\frac{2}{6}$ 

d) $\frac{4}{12}$ 

e) $\frac{2}{3}$ 

f) $\frac{6}{9}$ 

Unit 15 Creating equivalent fractions

MENTAL MATHS

Learner's Book page 35

Tell the learners they will work with equivalent fractions. Find out what they remember about equivalent fractions. Use the fraction wall to revise equivalent fractions. Ask the learners to name different fractions with the same value.

In question 1 they compare fraction sizes and indicate which fraction part of the objects they prefer to have. The learners should realise that both fractions are the same. It is important that learners develop a good understanding of equivalent fractions. They will use this knowledge in calculations with fractions later on.

In question 2 the learners copy the grids onto square paper (see resources section) and shade the fraction parts as indicated. They should notice that the same number of parts is being shaded in each pair of shapes. Allow learners to discuss their findings.

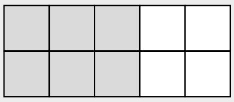
1. The learners should realise that the fractions are equivalent. Each pair of fractions has the same value.

a) $\frac{1}{4} = \frac{2}{8}$ b) $\frac{1}{5} = \frac{2}{10}$

c) $\frac{1}{2} = \frac{6}{12}$ d) $\frac{5}{6} = \frac{10}{12}$

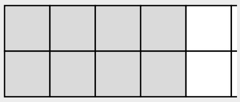
e) $\frac{2}{3} = \frac{6}{9}$

2. a)



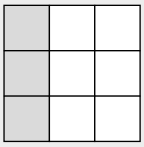
$\frac{3}{5}$

b)



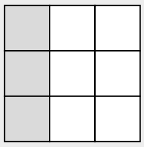
$\frac{6}{10}$

c)



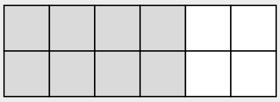
$\frac{1}{3}$

d)



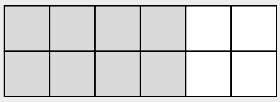
$\frac{3}{9}$

e)



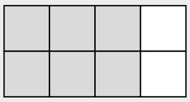
$\frac{4}{6}$

f)



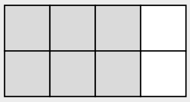
$\frac{8}{12}$

g)



$\frac{6}{8}$

h)



$\frac{3}{4}$

Activity 15.1

Learner's Book page 36

The learners should understand that fractions with the same value are equivalent.

In question 2 they compare fractions using the relationship signs <, > and =.

They use the fraction wall in the mental maths activity to write down 5 pairs of equivalent fractions in question 3. Remind the learners about the rule to create equivalent fractions that they developed in Grade 5. Let them look at the equivalent fractions in question 2 to explore the relationship between the numbers.

For $\frac{1}{5}$ and $\frac{2}{10}$, for example, they should observe that $5 \times 2 = 10$ and $1 \times 2 = 2$ to generalise that the top number (numerator) and bottom number (denominator) are multiplied by the same number. Let them explore the rule.

Ask them to create their own equivalent fractions in question 4 using the rule. They should also use the fraction wall as a reference.

1. Equivalent fractions

2.

a) $\frac{1}{2} > \frac{1}{4}$	**b)** $\frac{1}{2} = \frac{5}{10}$	**c)** $\frac{3}{6} = \frac{2}{4}$
d) $\frac{3}{8} < \frac{3}{4}$	**e)** $\frac{1}{3} = \frac{3}{9}$	**f)** $\frac{3}{4} = \frac{6}{8}$
g) $\frac{3}{5} = \frac{6}{10}$	**h)** $\frac{4}{6} > \frac{1}{2}$	**i)** $\frac{4}{6} = \frac{8}{12}$
j) $\frac{1}{10} < \frac{1}{5}$	**k)** $\frac{2}{3} = \frac{6}{9}$	**l)** $\frac{1}{5} = \frac{2}{10}$
m) $\frac{1}{7} > \frac{1}{8}$	**n)** $\frac{2}{11} < \frac{2}{10}$	**o)** $\frac{1}{2} = \frac{6}{12}$

3. Learners' own work
4. Expect different solutions. Learners might multiply the numerators and denominators by a different number each time. They will also create fractions with denominators that they have not worked with before. This helps to develop their understanding that a whole can be divided into many different fractions. Here are some examples.

a) $\frac{1}{5} \times 2 = \frac{2}{10}$

b) $\frac{1}{6} \times 2 = \frac{2}{12}$

c) $\frac{1}{8} \times 3 = \frac{3}{24}$

d) $\frac{1}{4} \times 3 = \frac{3}{12}$

e) $\frac{1}{10} \times 2 = \frac{2}{20}$

f) $\frac{1}{7} \times 2 = \frac{2}{14}$

g) $\frac{1}{2} \times 4 = \frac{4}{8}$

h) $\frac{2}{9} \times 2 = \frac{4}{18}$

i) $\frac{3}{4} \times 3 = \frac{9}{12}$

j) $\frac{7}{10} \times 10 = \frac{70}{100}$

k) $\frac{3}{5} \times 5 = \frac{15}{25}$

l) $\frac{5}{6} \times 2 = \frac{10}{12}$

m) $\frac{7}{8} \times 2 = \frac{14}{16}$

n) $\frac{5}{7} \times 2 = \frac{10}{14}$

o) $\frac{2}{11} \times 2 = \frac{4}{22}$

Unit 16 More equivalent fractions

MENTAL MATHS

Learner's Book page 36

Tell the learners they will continue to work with equivalent fractions. They have worked mostly with fractions up to twelfths until now. They will now be introduced to fractions with bigger denominators.

In question 1 they explain why the fractions in the lists are equivalent. They should be able to explain that $\frac{3}{4} = \frac{6}{8}$ because $3 \times 2 = 6$ and $4 \times 2 = 8$; $\frac{3}{4} = \frac{12}{16}$ because $4 \times 4 = 16$ and $3 \times 4 = 12$.

In question 2 they look at the size of the blank square in the margin to realise that all the other squares are the same size but divided into different fraction parts. Let them explore the number of parts that each square is divided into and name the parts. They should observe that the more equal parts there are, the smaller each fraction part is. Fifths, for example, are bigger than hundredths. Let the learners try to name each shaded part in the squares. They should understand that the fractions are named according to the number of parts into which the whole is divided.

They should also observe that the different number of parts in the squares is multiples of 5 and 10. Learners require an understanding of $\frac{1}{10}$s and $\frac{1}{100}$s as background knowledge for decimals and percentages in Term 2. Give them copies of the squares in the resources section and ask them to shade more parts, for example $\frac{5}{10}$, $\frac{10}{20}$, $\frac{25}{50}$ and $\frac{50}{100}$.

1. Class discussion

2. **a)** The learners should observe that all the fractions they list on the board have 1 as a numerator. Tell them that these are unitary fractions. They should further observe that the denominators are multiples of 5 and 10. They should discover that the fraction parts become smaller as the whole is divided into more and more equal parts.

b) $\frac{1}{5}$; $\frac{1}{10}$; $\frac{1}{15}$; $\frac{1}{20}$; $\frac{1}{25}$; $\frac{1}{50}$; $\frac{1}{100}$

Activity 16.1

Learner's Book page 37

The learners work with fraction terminology. In question 1 they name the fractions according to the number of equal parts. You can give them copies of the page in their Learner's Book with the sentences, or let them write out the sentences if time allows. Ask them to write the fractions in words and symbols.

In question 2 they use the squares in the mental maths activity of this unit to complete equivalent fractions.

In question 3 they show the relationship between a whole and each of the fraction parts in the squares above.

In question 4 the learners have to sort and group the fractions with the same values.

In question 5 they apply knowledge of equivalent fractions to compare parts of real-life objects and units of measurement. Let them give reasons for their answers. Ask them to share solutions and reflect on their learning experiences.

1. **a)** 2 equal parts, each part is called one half $\left(\frac{1}{2}\right)$

b) 3 equal parts, each part is called one third $\left(\frac{1}{3}\right)$

c) 4 equal parts, each part is called one quarter $\left(\frac{1}{4}\right)$

d) 5 equal parts, each part is called one fifth $\left(\frac{1}{5}\right)$

e) 10 equal parts, each part is called one tenth $\left(\frac{1}{10}\right)$

f) 15 equal parts, each part is called one fifteenth $\left(\frac{1}{15}\right)$

g) 20 equal parts, each part is called one twentieth $\left(\frac{1}{20}\right)$

h) 25 equal parts, each part is called one twenty-fifth $\left(\frac{1}{25}\right)$

i) 50 equal parts, each part is called one fiftieth $\left(\frac{1}{50}\right)$

j) 100 equal parts, each part is called one hundredth $\left(\frac{1}{100}\right)$

k) 12 equal parts, each part is called one twelfth $\left(\frac{1}{12}\right)$

l) 16 equal parts, each part is called one sixteenth $\left(\frac{1}{16}\right)$

2. a) $\frac{1}{5} = \frac{2}{10}$ b) $\frac{1}{5} = \frac{3}{15}$ c) $\frac{1}{5} = \frac{4}{20}$

   d) $\frac{1}{5} = \frac{5}{25}$ e) $\frac{1}{5} = \frac{10}{50}$ f) $\frac{1}{5} = \frac{20}{100}$

   g) $\frac{1}{10} = \frac{2}{20}$ h) $\frac{1}{10} = \frac{5}{50}$ i) $\frac{1}{10} = \frac{10}{100}$

   j) $\frac{1}{25} = \frac{2}{50}$ k) $\frac{1}{25} = \frac{4}{100}$ l) $\frac{1}{50} = \frac{2}{100}$

3. a) $1 = \frac{5}{5}$ b) $1 = \frac{10}{10}$ c) $1 = \frac{15}{15}$

   d) $1 = \frac{20}{20}$ e) $1 = \frac{25}{25}$ f) $1 = \frac{50}{50}$

   g) $1 = \frac{100}{100}$

4. $\frac{1}{4}$; $\frac{2}{8}$; $\frac{4}{16}$; $\frac{25}{100}$ $\frac{1}{3}$; $\frac{2}{6}$; $\frac{3}{9}$; $\frac{4}{12}$ $\frac{1}{10}$; $\frac{2}{20}$; $\frac{3}{30}$

   $\frac{3}{4}$; $\frac{15}{50}$ $\frac{3}{10}$; $\frac{15}{50}$; $\frac{20}{100}$ $\frac{1}{5}$; $\frac{2}{10}$; $\frac{3}{15}$

   $\frac{1}{7}$; $\frac{2}{14}$; $\frac{3}{21}$ $\frac{3}{5}$; $\frac{6}{10}$; $\frac{9}{15}$; $\frac{15}{25}$ $\frac{80}{100}$

5. a) False. $\frac{2}{5}$ m of rope = $\frac{4}{10}$ m of rope.

   b) True. $\frac{1}{2}$ km is the same as $\frac{50}{100}$ km.

   c) False. $\frac{1}{6}$ of 60 min. = 10 min.; $\frac{2}{12}$ of 60 = 10 min.

   d) False. $\frac{3}{5} > \frac{10}{20}$ of a chocolate slab, i.e. $\frac{3}{5} > \frac{1}{2}$.

   e) False. $\frac{9}{10}$ of 100 = 90; $\frac{90}{100}$ of R100 = 90.

Unit 17 Solving problems with fractions

MENTAL MATHS

Learner's Book page 39

Tell the learners that they will add fractions. Pose some questions to stimulate their thinking, for example: If I give $\frac{1}{4}$ of counters to Vuyo and $\frac{1}{4}$ to Marian, what fraction of the counters did I give the two children?

Allow them to play *Fraction Snap* to develop fraction addition skills informally. Copy and laminate the template in the resources section to make the cards. They play in pairs and draw cards. Pairs of cards that make a sum of 2 are kept by the players. The player with the most cards is the winner.

Let them explore and discuss the children's strategies for adding fractions in question 2. They should realise that they have to use the knowledge they have gained about improper, mixed and equivalent fractions. This should demonstrate to them how different mathematical concepts are related so that they perceive mathematics as an integrated whole.

In question 3 they add fractions with the same denominators. Emphasise that they should change solutions that involve improper fractions to mixed fractions and use equivalent fractions where applicable.

2. Class discussion

3. **a)** $1\frac{1}{2} + 1\frac{1}{2} + 2\frac{1}{2} + 2\frac{1}{2} = 8$ **b)** $\frac{2}{8} + \frac{2}{8} + \frac{2}{8} = \frac{6}{8} = \frac{3}{4}$

c) $\frac{3}{4} + \frac{3}{4} = \frac{6}{4} = \frac{3}{2} = 1\frac{1}{2}$ **d)** $\frac{5}{6} + \frac{5}{6} = \frac{10}{6} = 1\frac{4}{6} = 1\frac{2}{3}$

e) $\frac{8}{12} + \frac{8}{12} + \frac{10}{12} = \frac{26}{12} = 2\frac{2}{12} = 2\frac{1}{6}$

Activity 17.1

Learner's Book page 39

The learners apply knowledge of fraction addition to solve the word problems. Ask them to work in groups. They record their strategies on a large sheet of paper and present their work to the class. Allow them to display their work in the classroom. They will use repeated addition and doubling and should convert solutions to mixed and equivalent fractions. The problems involve measurement contexts. You should have a large poster with a fraction wall as reference in the classroom.

For question 2, learners work on their own to solve the fraction additon problems.

The learners do not use algorithms to solve these problems. They apply doubling and combining to solve fraction addition informally. Do the first problem with the learners so that they familiarise themselves with the strategy.

1. **a)** $2\frac{1}{4} + 2\frac{1}{4} = 4\frac{2}{4}$ hours per month

2 months: $8\frac{4}{4} = 9$ hours

4 months: $9 \times 2 = 18$ hours

5 months: $4\frac{2}{4} + 18 = 22\frac{2}{4}$ hours or $22\frac{1}{2}$ hours

10 months: $44\frac{4}{4} = 45$ hours

b) 2 cakes: $1\frac{1}{4} + 1\frac{1}{4} = 2\frac{2}{4}$ or $2\frac{1}{2}$ cups

4 cakes: $2\frac{1}{2} + 2\frac{1}{2} = 5$ cups

6 cakes: $2\frac{1}{2} + 5 = 7\frac{1}{2}$ cups

He needs $7\frac{1}{2}$ cups to bake 6 cakes.

c) skirt: $1\frac{1}{2}$ m

2 skirts: $1\frac{1}{2} + 1\frac{1}{2} = 3$ m

3 skirts: $3 + 1\frac{1}{2} = 4\frac{1}{2}$ m

6 skirts: $4\frac{1}{2} + 4\frac{1}{2} = 9$ m

She makes 6 skirts out of 9 m of material.

d) 60 km: $\frac{3}{4}$ of an hour

120 km: $\frac{3}{4} + \frac{3}{4} = \frac{6}{4} = 1\frac{2}{4}$ or $1\frac{1}{2}$ hours

240 km: $1\frac{1}{2} + 1\frac{1}{2} = 3$ hours

He travels 240 km in 3 hours.

2. a) 1 tart: $\frac{4}{5}$ of a can

2 tarts: $\frac{4}{5} + \frac{4}{5} = \frac{8}{5}$

$= 1\frac{3}{5}$ cans

4 tarts: $1\frac{3}{5} + 1\frac{3}{5} = 2\frac{6}{5}$

$= 3\frac{1}{5}$ cans

5 tarts: $3\frac{1}{5} + \frac{4}{5} = 3\frac{5}{5}$

$= 4$ cans

10 tarts: $4 + 4 = 8$ cans

12 tarts: $8 + 1\frac{3}{5} = 9\frac{3}{5}$ cans

12 tarts can be made with 10 cans of caramel.

b) $\frac{1}{5}$ of the wall: $1\frac{1}{3}$ litre

$\frac{2}{5}$ 2/5 of the wall: $1\frac{1}{3} + 1\frac{1}{3} = 2\frac{2}{3}$ 2/3 litre

$\frac{4}{5}$ of the wall: $2\frac{2}{3} + 2\frac{2}{3} = 4\frac{4}{3}$

$= 5\frac{1}{3}$ litre

$\frac{5}{5}$ of the wall:

$5\frac{1}{3} + 1\frac{1}{3} = 6\frac{2}{3}$ litre of paint is needed to paint the whole wall or $\frac{5}{5}$ of the wall.

c) 1 bow: $\frac{2}{3}$ m

2 bows: $\frac{2}{3} + \frac{2}{3} = \frac{4}{3}$

$= 1\frac{1}{3}$ m

4 bows: $1\frac{1}{3} + 1\frac{1}{3} = 2\frac{2}{3}$ m

5 bows: $2\frac{2}{3} + \frac{2}{3} = 2\frac{4}{3}$

$= 3\frac{1}{3}$ m

10 bows: $3\frac{1}{3} + 3\frac{1}{3} = 6\frac{2}{3}$m

15 bows: $6\frac{2}{3} + 3\frac{1}{3} = 9\frac{3}{3}$

$= 10$ m

She can make 15 bows from 10 m of ribbon.

d) $1 \times 250 = 250$ ml
$2 \times 250 = 500$ ml
$4 \times 250 = 1\ 000$ ml
$7 \times 250 = 1\ 000 + 500 + 250$
$= 1\ 750$ ml
1 000 ml = 1 litre

500 ml = $\frac{1}{2}$ litre

250 ml = $\frac{1}{4}$ litre

$1 + \frac{1}{2} + \frac{1}{4} = 1 + \frac{2}{4} + \frac{1}{4}$

$= 1\frac{3}{4}$ litre

Mandla drinks 1 750 ml or $1\frac{3}{4}$ litre of milk during the week.

3. 10 flapjacks: $1\frac{3}{4}$ cups

20 flapjacks: $1\frac{3}{4} + 1\frac{3}{4} = 2\frac{6}{4}$

$= 3\frac{2}{4}$ or $3\frac{1}{2}$ cups

30 flapjacks: $3\frac{1}{2} + 1\frac{3}{4} = 4\frac{2}{4} + 1\frac{3}{4}$

$= 5\frac{5}{4}$

$= 6\frac{1}{4}$ cups

You need $6\frac{1}{4}$ cups of sugar to make 30 flapjacks.

Unit 18 Subtracting fractions to solve problems

MENTAL MATHS

Learner's Book page 41

Tell the learners that they will work with subtraction of fractions. They will do mental calculations involving sharing of fractions and record fraction subtraction problems out of context on their Mental Maths grid. They subtract fractions from wholes and work with fractions with the same denominators. Ask them to create subtraction and addition number sentences to justify their solutions. They apply inverse operations.

1. **a)** $\frac{4}{4} - \frac{1}{4} = \frac{3}{4}$ chocolate left

Check: $\frac{3}{4} + \frac{1}{4} = \frac{4}{4}$ or 1 whole

b) 12 – 9 = 3 blocks have been eaten

2. **a)** $\frac{4}{4} - \frac{1}{4} = \frac{3}{4}$ chocolate left

Check: $\frac{3}{4} + \frac{1}{4} = \frac{4}{4}$ or 1 whole

b) 16 – 12 = 4 blocks have been eaten

3. **a)** $\frac{6}{6} - \frac{5}{6} = \frac{1}{6}$ was eaten

Check: $\frac{5}{6} + \frac{1}{6} = \frac{6}{6}$ or 1 whole

b) $\frac{6}{6} - \frac{1}{6} = \frac{5}{6}$ is left

c) 18 – 15 = 3 blocks were eaten

Check: $\frac{1}{6}$ of 18 = 3

4. **a)** $\frac{5}{5} - \frac{4}{5} = \frac{1}{5}$ was eaten

Check: $\frac{4}{5} + \frac{1}{5} = \frac{5}{5}$ or 1 whole

b) $\frac{5}{5} - \frac{1}{5} = \frac{4}{5}$ is left

5. **a)** $\frac{6}{6} - \frac{4}{6} = \frac{2}{6}$ or $\frac{3}{3} - \frac{2}{3} = \frac{1}{3}$

Check: $\frac{4}{6} + \frac{2}{6} = \frac{6}{6}$ or $\frac{2}{3} + \frac{1}{3} = \frac{3}{3}$ or 1 whole

b) $\frac{6}{6} - \frac{2}{6} = \frac{4}{6}$ or $\frac{3}{3} - \frac{1}{3} = \frac{2}{3}$ is left

6. **a)** Mpiriri: $\frac{3}{4} - \frac{1}{4} = \frac{2}{4}$ or $\frac{1}{2}$ left

Naledi: $\frac{3}{4} - \frac{1}{4} = \frac{2}{4}$ or $\frac{1}{2}$ left

b) Mpiriri: $\frac{1}{4}$ of 12 = 3 blocks

Naledi: $\frac{1}{4}$ of 16 = 4 blocks

c) Mpiriri: 9 – 3 = 6 blocks left

Naledi: 12 – 4 = 8 blocks left

7. **a)** $1 - \frac{1}{4} = \frac{3}{4}$ **b)** $1 - \frac{1}{3} = \frac{2}{3}$

c) $1 - \frac{1}{5} = \frac{4}{4}$ **d)** $1 - \frac{1}{6} = \frac{5}{6}$

e) $1 - \frac{1}{8} = \frac{7}{8}$ **f)** $2 - \frac{7}{8} - \frac{1}{8} = 1$

g) $2 - \frac{3}{4} - \frac{1}{4} = 1$ **h)** $\frac{7}{8} - \frac{3}{8} = \frac{4}{8}$

i) $2\frac{9}{10} - 1\frac{4}{10} = 1\frac{5}{10}$ **j)** $3\frac{10}{12} - 1\frac{6}{12} = 2\frac{4}{12}$

Activity 18.1

Learner's Book page 42

The learners work with fraction subtraction problems in measurement and other real-life contexts. Ask the learners to show their calculations to justify their solutions. They can also use drawings to illustrate their understanding of the problems, if necessary.

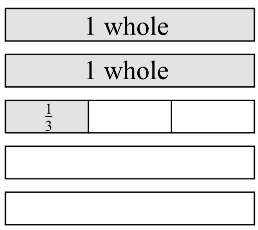
1. **a)** $\frac{2}{12} - \frac{7}{12} = \frac{5}{12}$

$\frac{10}{10} - \frac{7}{10} = \frac{3}{10}$

b) Length of 1 prism: $120 \div 12 = 10$ cm
$7 \times 10 = 70$ cm
Length of 1 cylinder: $70 \div 10 = 7$ cm
$3 \times 7 = 21$ cm

2. $\frac{5}{5} - \frac{2}{5} = \frac{3}{5}$ of the cake is left

3. $5 - 2\frac{1}{3} = 5 - 2 - \frac{1}{3}$
$= 3 - \frac{1}{3}$
$= 2\frac{2}{3}$ chocolate bars left



4. **a)** $4 + 4 + 4 = 12$
8 blocks $= \frac{2}{3}$ of 12 is unwrapped

b) 4 blocks $= \frac{1}{3}$ of 12 is unwrapped

5. **a)** $\frac{10}{10} - \frac{2}{10} = \frac{8}{10}$ or $\frac{5}{5} - \frac{1}{5} = \frac{4}{5}$ is not painted

b) $\frac{10}{10} - \frac{4}{10} = \frac{6}{10}$ or $\frac{5}{5} - \frac{2}{5} = \frac{3}{5}$ is not painted

c) $\frac{10}{10} - \frac{5}{10} = \frac{5}{10}$ or $\frac{1}{2}$ is not painted

6. Tell the learners they can use two or more cards to create subtraction number sentences with a solution of 1. There are various solutions. Below are some possibilities.

$1\frac{1}{4} - \frac{1}{4} = 1$

$1\frac{1}{2} - \frac{1}{2} = 1$

$3\frac{3}{4} - 2\frac{1}{2} - \frac{1}{4} = 3\frac{3}{4} - 2\frac{2}{4} - \frac{1}{4}$

$= 1$

$2\frac{1}{2} - 1\frac{1}{2} = 1$ and so on.

7. $1\frac{1}{4} - \frac{3}{4} \rightarrow (1 \times 4 + 1) - \frac{3}{4} = \frac{5}{4} - \frac{3}{4}$

$= \frac{2}{4}$ or $\frac{1}{2}$

He spends $\frac{1}{2}$ an hour longer on shopping.

8. The learners have worked with fractions of whole numbers before. They have also developed a strategy to calculate fractions of whole numbers in Grade 5. Ask them how they will calculate $\frac{3}{4}$ of 12 without using learning aids. Inform the learners that they will work with fractions of whole numbers in the next unit.

$\frac{4}{5}$ of $100 = 100 \div 5 \times 4$

$= 80$ pages

$\frac{7}{10}$ of $100 = 100 \div 10 \times 7$

$= 70$ pages

$\frac{3}{4}$ of $100 = 100 \div 4 \times 3$

$= 75$ pages

Vuyo is closest to finishing the book. He must only read 20 pages while the other two learners need to read 30 and 25 pages respectively.

9. Allow the learners to work in groups to solve this problem. Let them battle with the problem until you see that they are stuck. Tell the learners that they first have to determine the height of the plant in each year in fractions (tenths). They then find the difference in growth between the years before calculating the total growth from year 1 to year 3. They have to decompose mixed fractions and work with improper fractions to subtract.

a) Year 1: $\frac{8}{10}$ m

Year 2: $1\frac{1}{2}$ m or $1\frac{5}{10}$ m

Year 3: $3\frac{1}{10}$ m

$1\frac{5}{10} - \frac{8}{10} = \frac{15}{10} - \frac{8}{10}$

$= \frac{7}{10}$

The plant has grown $\frac{7}{10}$ m between year 1 and 2.

$3\frac{1}{10} - 1\frac{5}{10} = 2\frac{11}{10} - 1\frac{5}{10}$

$= 1\frac{6}{10}$ m

It has grown $1\frac{6}{10}$ m between year 2 and 3.

$1\frac{6}{10} + \frac{7}{10} = \frac{16}{10} + \frac{7}{10}$

$= \frac{23}{10}$

$= 2\ \frac{3}{10}$ m

The plant has grown $2\frac{3}{10}$ m in two years.

b) $3\frac{1}{10} - 1\frac{5}{10} = \frac{31}{10} - \frac{15}{10}$

$= \frac{16}{10}$

$= 1\ \frac{6}{10}$ m

The plant was $1\frac{6}{10}$ m taller in year 3 than in year 2.

10. a) $\frac{1}{2} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4}$

$= \frac{3}{4}$

$\frac{4}{4} - \frac{3}{4} = \frac{1}{4}$

Jordan ate $\frac{1}{4}$ of the pizza.

b) $\frac{1}{2}$ of 8 = 4 slices

$\frac{1}{4}$ of 8 = 2 slices

Linda ate 4 slices. Jordan and Thabo each ate 2 slices.

Unit 19 Finding fractions of whole numbers

MENTAL MATHS

Learner's Book page 44

The learners will now find fractions of whole numbers. Each group of learners needs 40 counters. By now you should have realised that you need various materials as learning and teaching aids. Prepare these before the time so that you can provide learners with sufficient and effective learning materials to work practically. Once you observe that learners have developed conceptual understanding, they can start working more abstractly.

The learners group the counters as indicated to find fractions of 40. They should observe that the denominators they work with are all factors of 40 (they have worked with factors in Grade 5). They cannot find thirds, sixths, sevenths and ninths of 40 because 40 is not a multiple of these denominators. Ask the learners to reflect on their learning experiences.

When using the strategy to calculate fractions of whole numbers, the learners apply knowledge of number sense, i.e. division, multiplication and the multiplicative property of 1 in some problems. Allow the learners to use the counters. Then ask them to calculate the solutions without the counters.

1. **a)** $20 + 20 = 40$

$\frac{1}{2}$ of $40 = 40 \div 2 \times 1$

$= 20$ counters

b) $10 + 10 + 10 + 10 = 40$

$\frac{1}{4}$ of $40 = 40 \div 4 \times 1$

$= 10$ counters

2. **a)** 3 of 4 groups = 30 counters

$\frac{3}{4}$ of $40 = 40 \div 4 \times 3$

$= 30$

b) 1 of 5 groups = 8 counters

$\frac{1}{5}$ of $40 = 40 \div 5 \times 1$

$= 8$

c) 3 of 5 groups = 24 counters

$\frac{3}{5}$ of $40 = 40 \div 5 \times 3$

$= 24$

d) 1 of 8 groups = 5 counters

$\frac{1}{8}$ of $40 = 40 \div 8 \times 1$

$= 5$

e) 3 of 8 groups = 15 counters

$\frac{3}{8}$ of $40 = 40 \div 8 \times 3$

$= 15$

f) 5 of 8 groups = 25 counters

$\frac{5}{8}$ of $40 = 40 \div 8 \times 5$

$= 25$

g) 1 of 10 groups = 4 counters

$\frac{1}{10}$ of $40 = 40 \div 10 \times 1$

$= 4$

h) 5 of 10 groups = 20 counters

$\frac{5}{10}$ of $40 = 40 \div 10 \times 5$

$= 20$

i) 9 of 10 groups = 36 counters

$\frac{9}{10}$ of 40 = 40 ÷ 10 × 9

= 36

j) 1 of 20 groups = 2 counters

$\frac{1}{20}$ of 40 = 40 ÷ 20 × 1

= 2

3. 3; 6; 7 and 9 are not factors of 40. If you divide 40 counters in 3 equal groups, there will be a remainder. Calculating $\frac{1}{3}$ of 40, for example, is too difficult at this stage.

Activity 19.1

Learner's Book page 45

Ask the learners to work in their groups. They record their strategies on a big sheet of paper and present the work to the class. They explore the suggested strategy. Remind them that they have developed a rule for finding fractions of wholes in Grade 5. Encourage the learners to discuss and explain their strategies and reasoning. They solve problems in and out of context. If you do have learners who are able to perform some procedures mentally, allow them to do so, but also let them explain their thinking and reasoning to the class to motivate other learners who are still dependent on pen and paper.

Let them work on their own to calculate fractions of whole numbers in question 5.

For enrichment, you could ask them to crack the fraction code in question 6. They determine fraction parts of words to form new words. This exercise could also be done in the Language lesson or completed for homework.

1. a) $\frac{1}{10}$ of R100 = 100 ÷ 10 × 1

= R10

$\frac{3}{5}$ of R15 = 15 ÷ 5 × 3

= R9

$\frac{1}{10}$ of R100 > $\frac{3}{5}$ of R15

b) Explaining the process in words:
If you divide R280 into 7 equal parts, you get R40 in each equal part. You have to calculate 3 of the 7 equal parts, which is 40 × 3 = 120.

Explaining the process using calculations:

$\frac{3}{7}$ of R280 = 280 ÷ 7 × 3

= 40 × 3

= R120

2. $\frac{1}{4}$ of the chickens = 12

$\frac{4}{4}$ of the chickens = $12 \div 4 \times 4$ or 4×12
= 48 chickens

3. a) $\frac{1}{3}$ of the learners = 15
$\therefore \frac{2}{3}$ of the learners = 2×15
= 30 learners were present

b) $30 + 15$ or $3 \times 15 = 45$ learners are present when there are no absentees.

4. $\frac{3}{4}$ of $120 = 120 \div 4 \times 3$
$= 30 \times 3$
= 90 pages read

$\frac{1}{4}$ of $120 = 120 \div 4 \times 1$
= 30 pages that she still has to read

Check: $90 + 30 = 120$

5.

a) $\frac{3}{10}$ of 100 = 30	b) $\frac{7}{10}$ of 200 = 140	c) $\frac{2}{5}$ of 50 = 20
d) $\frac{3}{5}$ of 250 = 150	e) $\frac{1}{8}$ of 40 = 5	f) $\frac{5}{8}$ of 240 = 150
g) $\frac{5}{9}$ of 90 = 50	h) $\frac{1}{6}$ of 180 = 30	i) $\frac{5}{12}$ of 24 = 10
j) $\frac{2}{3}$ of 90 = 60	k) $\frac{4}{11}$ of 99 = 36	l) $\frac{1}{25}$ of 100 = 4

6. a) TRI b) AN c) G d) LE
= TRIANGLE

Unit 20 Solving sharing problems

MENTAL MATHS

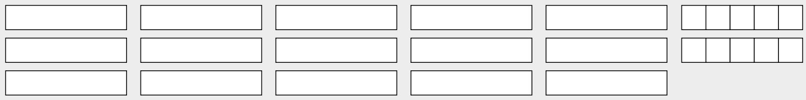
Learner's Book page 46

Tell the learners that they will work with equal sharing of whole numbers that result in remainders that have to be shared equally, too. They can use drawings or strips of paper to represent their strategies. If you have learners who are able to work more abstractly, allow them to work with calculations rather than practical representations. They should share these strategies to encourage other learners to use more advanced and abstract methods.

In question 1, as an alternative strategy (if the learners do not come up with it) you could also suggest that all the bars be cut into $\frac{1}{5}$s so that each child gets $\frac{17}{5}$, which is the same as $3\frac{2}{5}$. Learners who work at a more sophisticated level would probably reason that $17 \div 5 = 3$ rem $2 = 3\frac{2}{5}$. However, they should only use this method once they have a solid understanding of the fraction concept.

Learners apply knowledge of basic division facts to solve the problems.

Learners who are still dependent on practical illustrations might solve the problems as in the example below.



$3 + 3 + 3 + 3 + 3 + \frac{2}{5} + \frac{2}{5} + \frac{2}{5} + \frac{2}{5} + \frac{2}{5}$

Each one gets $3\frac{2}{5}$ of the chocolate bars.

Learners working at a more abstract level might use the following strategies. You could also suggest that they use the strategies to guide them to work more abstractly. They use knowledge of improper, mixed and equivalent fractions to perform the second strategies below.

1. $17 \div 5 = 3$ remainder 2. Each one gets $3\frac{2}{5}$ of the chocolate bars.
2. $14 \div 6 = 2$ remainder 2. Each one gets $2\frac{2}{6}$ of the liquorice strips.
3. $23 \div 7 = 3$ remainder 2. Each one gets $3\frac{2}{7}$ of the fruit rolls.
4. $20 \div 9 = 2$ remainder 2. Each one gets $2\frac{2}{9}$ of the sausage rolls.
5. $25 \div 10 = 2$ remainder 5. Each one gets $2\frac{5}{10}$ or $2\frac{1}{2}$ of the sweets.

Activity 20.1

Learner's Book page 47

Ask the learners to work on their own to solve the equal sharing problems. Allow those who are still working with fractions at a concrete level to make drawings.

For question 1, explain to the learners that $\frac{20}{8}$, for example, is the same as $20 \div 8$. They already know how to convert improper fractions to mixed fractions. Also ask them to write equivalent fractions where applicable.

In question 2 they work in their groups and present their strategies to the class. The learners will probably not complete all the activities in one lesson. They should work together as a class to do these activities during the mental maths session the following day.

1. **a)** $\frac{20}{8} = 2\frac{4}{8} = 2\frac{1}{2}$ loaves each

   b) $\frac{20}{7} = 2\frac{6}{7}$ loaves each

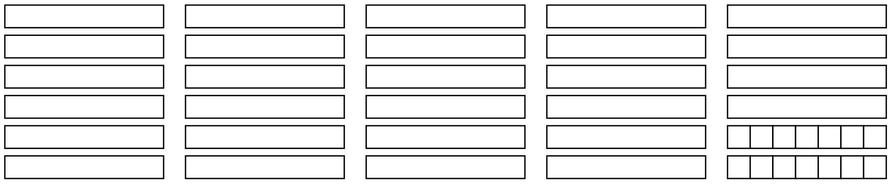
   c) $\frac{20}{9} = 2\frac{2}{9}$ loaves

   d) $\frac{20}{11} = 1\frac{9}{11}$ loaves

e) $\frac{20}{10} = 2$ loaves

f) $\frac{20}{12} = 1\frac{8}{12} = 1\frac{2}{3}$ loaves each

2. a) $\frac{30}{14} = 2\frac{2}{14} = 2\frac{1}{7}$ curry mince salomies each



Each learner gets 2 salomies. There are 2 left that need to be shared equally among 14 children. To do this the learners should decide on the best way to share so that each child gets an equal share. To share the 2 salomies into 14 equal pieces can be done, but it is not very realistic. If learners do this, each child will get $2\frac{2}{14}$ of the salomies. Sharing the 2 salomies into $\frac{1}{7}$s will result in each one getting $2\frac{1}{7}$, which is equivalent to $2\frac{2}{14}$.

b) $\frac{20}{15} = 1\frac{5}{15} = 1\frac{1}{3}$ curry bunnies each

c) $\frac{35}{14} = 2\frac{7}{14} = 2\frac{1}{2}$ oranges each

Unit 21 More fraction problems

Activity 21.1

Learner's Book page 48

You could use some of these activities in the mental maths session. The learners work with fraction problems in various contexts. For some activities, learners could work in groups, pairs or as a whole class.

For questions 2 and 3, suggest that learners apply doubling and combining to solve the problems. They will need copies of the blank tables in the resources section to do question 3(b). They complete the table by calculating the metres of paper and the profit they will make using multiples of 10.

In question 4, they apply knowledge of basic multiplication, division and subtraction facts to solve the problems.

Question 5 involves division of fractions in which you have to use the reciprocal, i.e. swapping the numerator and denominator. However, Grade 6 learners do not work with division of fractions, so ask them to use repeated addition to find the fraction of the pizza that each child gets. Share the strategy in the solution below with them. They add the eighths in the columns.

In question 10, the learners apply repeated addition, doubling and multiplication to calculate the ingredients needed to bake 8 cakes. They also apply the multiplicative property of 1.

1. $\frac{1}{4} + \frac{1}{2} + \frac{1}{2} = \frac{1}{4} + \frac{2}{4} + \frac{2}{4}$

$= \frac{5}{4}$

$= 1\frac{1}{4}$ hour spent on all his chores

11:30 – 1 hour = 10:30

10:30 – $\frac{1}{4}$ hour = 10:15

David should at least start his chores at 10:15.

2. a) 1 pot → $1\frac{1}{3}$ litre

2 pots → $1\frac{1}{3} + 1\frac{1}{3} = 2\frac{2}{3}$ litre

4 pots → $2\frac{2}{3} + 2\frac{2}{3} = 4\frac{4}{3}$

$= 5\frac{1}{3}$ litre

To make 4 pots of soup they use $5\frac{1}{3}$ litres of cream.

b) They use $5\frac{1}{3}$ litres of cream for 4 pots. That's more than 5 litres.

1 pot → $1\frac{1}{3}$ litre

2 pots → $1\frac{1}{3} + 1\frac{1}{3} = 2\frac{2}{3}$ litres

$1\frac{1}{3} + 2\frac{2}{3} = 3\frac{3}{3}$

= 4 litres

They can make 3 pots of soup with 5 litres of cream.

3. a) 1 basket → $\frac{2}{5}$ m

2 baskets → $\frac{2}{5} + \frac{2}{5} = \frac{4}{5}$ m

4 baskets → $\frac{4}{5} + \frac{4}{5} = \frac{8}{5}$

$= 1\frac{3}{5}$ m

5 baskets → $1\frac{3}{5} + \frac{2}{5} = 1\frac{5}{5}$ m

= 2 m

10 baskets → 2 + 2 = 4 m
20 baskets → 4 + 4 = 8 m
20 + 5 baskets → 8 + 2 = 10 m
They can cover 25 baskets with 10 m of paper.

b) Completed table

Number of baskets	Metres of paper	Profit in rands
1	$\frac{2}{5}$ m	R10
2	$\frac{4}{5}$	R20
3	$\frac{6}{5} = 1\frac{1}{5}$	R30
4	$\frac{8}{5} = 1\frac{3}{5}$	R40
5	2 m	R50
6	$2\frac{2}{5}$	R60
8	$3\frac{1}{5}$	R80
10	4 m	R100
12	$4\frac{4}{5}$	R120
16	$6\frac{2}{5}$	R160
20	8 m	R200
24	$9\frac{3}{5}$	R240

4. **a)** $\frac{1}{2}$ of 120 = 120 ÷ 2 × 1
= 60
60 guests are related to the bride.

b) $\frac{3}{4}$ of 120 = 120 ÷ 4 × 3
= 30 × 3
= 90
90 guests are adults.

c) 120 – 90 = 30
30 guests are children. 30 is $\frac{1}{4}$ of 120.

d) $\frac{3}{5}$ of 120 = 120 ÷ 5 × 3
= 24 × 3
= 72
72 guests are female.

e) 120 – 72 = 120 – 20 – 50 – 2
= 48
or
$\frac{2}{5}$ of 120 = 120 ÷ 5 × 2
= 24 × 2
= 48
148 guests are males.

5. $\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{8}{8} = 1$ pizza

$\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{8}{8} = 1$ pizza

$\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{8}{8} = 1$ pizza

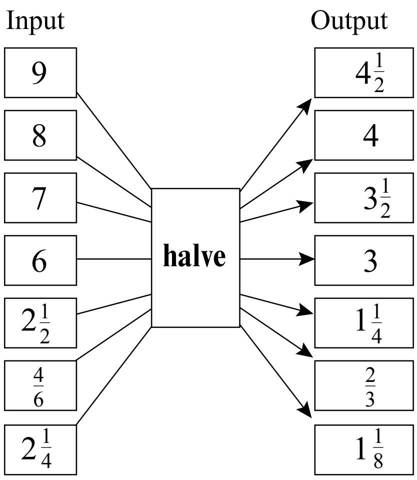
$\frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} = \frac{24}{8}$ or 3 pizzas

Each child gets $\frac{3}{8}$ of the pizzas.

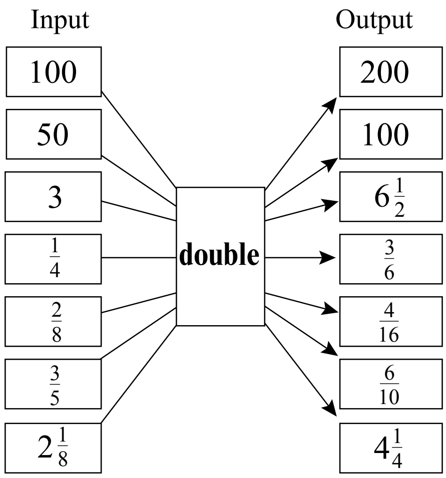
6. **a)** $36 \div 3 = 12$ equal pieces
b) $36 \div 6 = 6$ equal pieces
c) $36 \div 9 = 4$ equal pieces
d) $36 \div 12 = 4$ equal pieces

7. $\frac{1}{10}$ of $220 = 220 \div 10 \times 1$
$= 22 \times 1$
$= 22$
$22 \times 3 = 66$
The jar contains 66 g of coffee when it is $\frac{3}{10}$ full.

8. **a)**



b)



9. $\frac{17}{9} = 17 \div 9$
$= 1\frac{8}{9}$ of a ball of wool

She uses $1\frac{8}{9}$ balls of wool for 1 scarf.

10. Bread flour → 1 cake: $1\frac{1}{2}$ cups
2 cakes: $1\frac{1}{2} + 1\frac{1}{2} = 3$ cups
4 cakes: 6 cups
8 cakes: 12 cups

Cake flour → 8 cakes: $8 \times 1 = 8$ cups

Crushed almonds → 1 cake: $\frac{1}{2}$ cup
4 cakes: $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 2$ cups
8 cakes: 4 cups

Baking powder → 1 cake: 1 teaspoon

8 cakes: $8 \times 1 = 8$ teaspoons

Salt → 1 cake: $\frac{1}{2}$ teaspoon

4 cakes: 2 teaspoons

8 cakes: 4 teaspoons

Cinnamon: 8 cakes: $8 \times 1 = 8$ pinches

Butter → 1 cake: $\frac{1}{4}$ kg

4 cakes: $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{4}{4}$ or 1 kg

8 cakes: 2 kg

Sugar → 1 cake: $2\frac{1}{2}$ cups

4 cakes: $2\frac{1}{2} + 2\frac{1}{2} + 2\frac{1}{2} + 2\frac{1}{2} = 10$ cups

8 cakes: 20 cups

Eggs → 1 cake: 5 eggs

8 cakes: $8 \times 5 = 40$ eggs

Essence → 8 cakes: $8 \times 1 = 8$ teaspoons

Cream → 8 cakes: $8 \times 1 = 8$ cups

Pineapple → 8 cakes: $8 \times 1 = 8$ pineapples

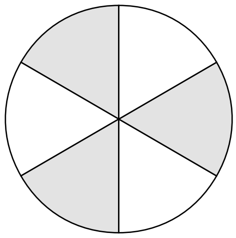
Water → 8 cakes: $8 \times 1 = 8$ cups

Assessment 1.4: Common fractions

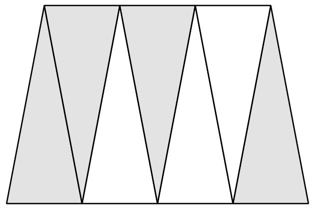
The learners will apply the knowledge they have developed over the previous 10 units. They identify and estimate fraction parts in shapes, find fraction parts of wholes, work with equivalent fractions and equal sharing, and do fraction addition and subtraction calculations.

1. Which fraction parts are shaded in these shapes?

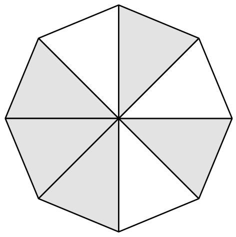
a)



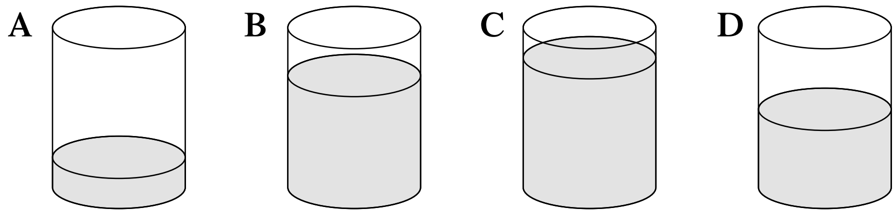
b)



c)



2. Look at these beakers.



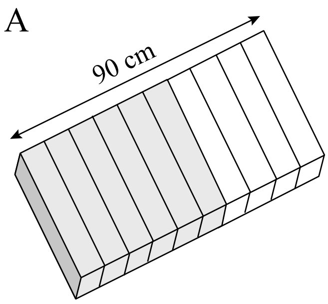
a) Which beaker is $\frac{9}{10}$ full?

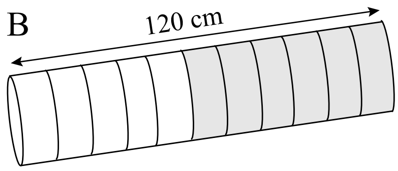
b) Which beaker is $\frac{7}{10}$ full?

c) Which beaker is $\frac{5}{10}$ full?

d) Which beaker is $\frac{2}{10}$ full?

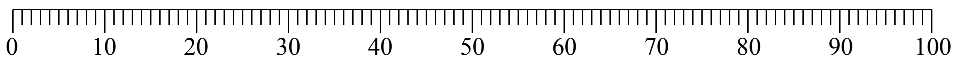
3. a) Which fraction parts are shaded in each diagram?





b) What is the length of each shaded part?

4. The scale below are divided into tenths.



Use the scale to determine:

a) $\frac{4}{10}$ of 90 = ■

b) $\frac{6}{10}$ of 50 = ■

c) $\frac{7}{10}$ of 70 = ■

d) $\frac{8}{10}$ of 80 = ■

e) $\frac{1}{10}$ of 50 = ■

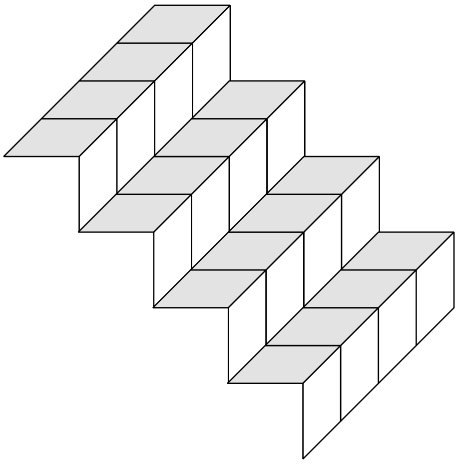
5. Calculate:

a) $\frac{1}{10}$ of 60 = ■

b) $\frac{1}{10}$ of 500 = ■

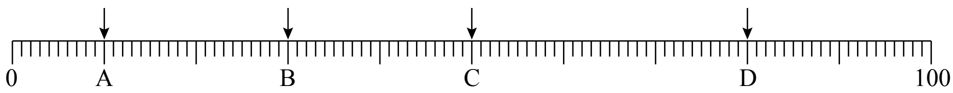
c) $\frac{7}{10}$ of 40 = ■

6. Look at this diagram.



a) How many equal parts is the diagram divided into?
b) How many parts are shaded?
c) What fraction of the diagram is shaded?

7. This number line is marked in tenths. To which fractions do the arrows point?



8. Kim has 248 marbles. She gives $\frac{3}{8}$ of the marbles to her brother.

a) How many marbles does she give to her brother?

b) What fraction of the marbles does Kim have left?

c) How many marbles does she have left?

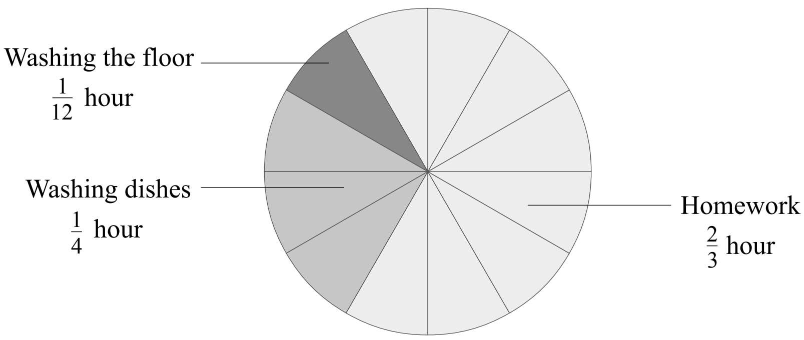
9. Complete.

a) $\frac{1}{2} = \frac{\square}{10}$ **b)** $\frac{1}{5} = \frac{\square}{25}$ **c)** $\frac{2}{10} = \frac{\square}{50}$

d) $\frac{10}{50} = \frac{\square}{100}$ **e)** $\frac{7}{20} = \frac{\square}{100}$

10. Schalk wants to go to the rugby practice. His mother says he must first finish his chores.

The diagram shows Schalk's chores.



a) Which of Schalk's chores takes $\frac{2}{3}$ of an hour?

b) What fraction of an hour does it take him to wash the dishes?

c) How long does it take him to clean the floor?

d) If the rugby practice starts at 16:30, when must Schalk start with his chores to finish in time?

11. Dipuo uses $2\frac{1}{2}$ cups of sugar to make 2 litres of ginger beer.

a) How many litres of ginger beer can she make with 10 cups of sugar?

b) Dipuo wants to make 10 litres of ginger beer. How many cups of sugar does she need?

1. a) $\frac{3}{6}$ **b)** $\frac{4}{7}$ **c)** $\frac{5}{8}$

2. a) C **b)** B **c)** D **d)** A

3. a) $\frac{6}{10}$ and $\frac{7}{12}$

b) $6 \times 9 = 54$ cm and $7 \times 10 = 70$ cm

4. a) $\frac{4}{10}$ of $100 = 40$ **b)** $\frac{6}{10}$ of $100 = 60$

c) $\frac{7}{10}$ of $100 = 70$ **d)** $\frac{8}{10}$ of $100 = 80$

e) $\frac{1}{10}$ of $100 = 10$

5. a) $\frac{1}{10}$ of $60 = 100 \div 10 \times 1$
$= 10 \times 1$
$= 10$

b) $\frac{1}{10}$ of $500 = 500 \div 10 \times 1$
$= 50 \times 1$
$= 50$

c) $\frac{7}{10}$ of $40 = 40 \div 10 \times 7$
$= 4 \times 7$
$= 28$

6. a) 32 equal parts or 8 equal parts

b) 16 of 32 parts or 4 of 8 parts

c) $\frac{16}{32}$ or $\frac{4}{8}$

7. A $\rightarrow \frac{5}{10}$ B $\rightarrow \frac{3}{10}$ C $\rightarrow \frac{8}{10}$ D $\rightarrow \frac{1}{10}$

8. a) $\frac{3}{8}$ of $248 = 248 \div 8 \times 3$
$= 31 \times 3$
$= 93$

Kim gave her brother 93 marbles.

b) $\frac{8}{8} - \frac{3}{8} = \frac{5}{8}$

Kim has $\frac{5}{8}$ of her marbles left.

c) $\frac{5}{8}$ of $248 = 248 \div 8 \times 5$
$= 31 \times 5$
$= 155$

or

$248 - 93 = 250 - 95$
$= 250 - 50 - 40 - 5$
$= 160 - 5$
$= 155$

Kim has 155 marbles left.

9. a) $\frac{1}{2} = \frac{5}{10}$

b) $\frac{1}{5} = \frac{5}{25}$

c) $\frac{2}{10} = \frac{10}{50}$

d) $\frac{10}{50} = \frac{10}{100}$

e) $\frac{7}{20} = \frac{35}{100}$

10. a) Homework

b) $\frac{1}{4}$

c) $\frac{1}{12}$ of an hour

d) $\frac{1}{12}$ h + $\frac{2}{3}$ h + $\frac{1}{4}$ h = 5 min. + 40 min. + 15 min.
= 60 min.

He must start at least 1 hour before the time.

16:30 – 1 hour = 15:30

Schalk must start with his chores at 15:30 or 15:15 if he must travel or walk a distance to the rugby field.

11. a) $2\frac{1}{2}$ cups → 2 litres

5 cups → 4 litres

10 cups → 8 litres

b) 10 cups → 8 litres

$2\frac{1}{2}$ cups → 2 litres

$10 + 2\frac{1}{2} = 12\frac{1}{2}$ cups

Dipuo needs $12\frac{1}{2}$ cups to make 10 litres of ginger beer.

Time

Learner's Book page 51

Learners have worked with time formats and measuring instruments in Grades 4 and 5, and they should already be able to read time using analogue and digital clocks, work with hours, minutes, and seconds, use calendars, and do calculations to determine elapsed time. In Grade 6 they work with the measuring unit centuries for the first time, and also learn about time zones.

Have as many different styles of clocks, watches and calendars as possible available in the classroom for learners to use. They should practise reading time on a range of clock and watch faces and calendars, so that they recognise the essential aspects of these instruments that show the time (minute and hour hands, digital number display, tables setting out dates and days), no matter what the design of the clock or calendar.

Unit 22 Reading analogue and digital time

Learners do a Mental maths activity to practise counting in seconds and minutes, which involves work they have done in the section on Whole numbers – counting on, counting in intervals, counting forwards and backwards. They revise their skills at reading analogue and digital watches and clocks that use different number styles. They practise working with the 12-hour and 24-hour time formats. They choose appropriate units of time for measuring the duration of different activities – seconds, minutes or hours.

MENTAL MATHS

Learner's Book page 51

In question 1, the learners count on and back in different intervals related to numbers used in time measurement. You should focus their attention on the integration of number concepts with other content areas in mathematics. They should understand that a good understanding of basic calculations skills is necessary for solving problems in different areas of maths.

In question 2, they solve fraction problems involving calculating fractions of 60. Ask them to record the solutions on their Mental Maths grids.

1. **a)** Count twelve 5-min. intervals from 0 to 60.
b) Count back twelve 10-min. intervals from 120 to 0.
c) Count five 20-min. intervals from 0 to 120.
d) Count four 15-min. intervals from 0 to 60.
e) Count back six 30-min. intervals from 180 to 0.

2. a) $\frac{1}{2}$ of 60 $= 60 \div 2 \times 1$
$= 30$

b) $\frac{1}{4}$ of 60 $= 60 \div 4 \times 1$
$= 15$

c) $\frac{3}{4}$ of 60 $= 60 \div 4 \times 3$
$= 15 \times 3$
$= 45$

d) $\frac{1}{3}$ of 60 $= 60 \div 3 \times 1$
$= 20$

e) $\frac{2}{3}$ of 60 $= 60 \div 3 \times 2$
$= 20 \times 2$
$= 40$

f) $\frac{1}{5}$ of 60 $= 60 \div 5 \times 1$
$= 12$

g) $\frac{1}{6}$ of 60 $= 60 \div 6 \times 1$
$= 10$

h) $\frac{1}{10}$ of 60 $= 60 \div 10 \times 1$
$= 6$

i) $\frac{5}{10}$ of 60 $= 60 \div 10 \times 5$
$= 6 \times 5$
$= 30$

j) $\frac{1}{12}$ of 60 $= 60 \div 12 \times 1$
$= 5$

Activity 22.1

Learner's Book page 52

1. **a)** 6.25 and 5 seconds **b)** 1.45 and 55 seconds
c) 9.05 and 35 seconds **d)** 4.55 and 40 seconds

2. **a)** seconds **b)** minutes
c) hours **d)** seconds
e) minutes **f)** minutes

3. Learners' own work

4. Learners' own work

Activity 22.2

Learner's Book page 53

1. **a)** 5:42 **b)** 4:46 **c)** 1:52

2. **a)** IIII **b)** IV (iv)

3. **a)** nine minutes to two
b) twenty-six minutes past nine
c) twenty minutes past twelve

4. (b) shows 15 seconds, (c) shows 30 seconds.

5. **a)** 07:15
   b) 10:35
   c) 03:30
   d) 06:49
   e) 08:45
   f) 10:20

6. **a)** one minute to 12
   b) twenty-one minutes to 1
   c) one minute and 10 seconds past 8

7. **a)** twenty past 12 (hour hand points to 12 and minute hand points to 4)
   b) twenty-eight to 12
   c) ten past eleven

8. Learners' own work

Activity 22.3

Learner's Book page 55

1. **a)**

(i) 9:45 am
(ii) quarter to ten in the morning

b)

(i) 02:24
(ii) twenty-four minutes past two in the morning

c)

(i) 11:65
(ii) five minutes past twelve in the morning

d)

(i) 23:51
(ii) nine minutes to midnight

e)

(i) 3:25 pm
(ii) twenty-five past three in the afternoon

f)

(i) 3:25 pm
(ii) twenty-five past three in the afternoon

g)

(i) 10:13 am
(ii) thirteen minutes past ten in the morning

h)

(i) 14:42
(ii) eighteen minutes to three in the afternoon

2. The time is given in the 24-hour format.

3. Watch B could be showing twenty-seven minutes past five in the morning or in the afternoon.
- **a)** 05:27 or 17:27
- **b)** five hours and twenty-five minutes or five twenty-five seventeen hours and twenty-seven minutes or seventeen twenty-seven

4.
- **a)** The hours are numbered from 1 to 24.
- **b)** Learners' own explanations

5.
- **a)** 12:03
- **b)** 22:50
- **c)** 7:55

6.
- **a)** three minutes past twelve in the afternoon
- **b)** twenty past eleven in the evening
- **c)** five to eight in the evening

Unit 23 Calculations with watches and stopwatches

Learner's Book page 56

Learners continue to work with seconds, minutes and hours. They round off time measurements and do calculations to find elapsed time. They continue to identify the most suitable time units for measuring the duration of different activities.

In this unit they also focus on the difference between telling the time – using a watch or clock to say what time it is now – and calculating elapsed time – using a watch or stopwatch to calculate how long it takes to complete a particular action. They use contexts such as timetables, journey lengths and social activities.

They work with stopwatches as well as digital and analogue watches and clocks. If possible, have enough stopwatches in the classroom so that groups of learners can time themselves doing different activities. If only one stopwatch is available, let one group of learners do the activity that requires the stopwatch while the rest of the class does other activities in this unit.

Activities in this unit can be used to discuss topics relating to learners' study habits and after-school activities. For example, they calculate how much time they spend watching TV – this can lead to a discussion about other activities that they could do after school every day. You can add similar activities relating to other activities such as time spent doing housework, homework, playing outdoors, and so on.

MENTAL MATHS

Learner's Book page 56

The learners calculate elapsed time mentally. Let them explain their strategies to the class. Remind them to use effective calculation strategies. They should use adding on, division by 60 (to convert minutes to hours) and apply the associative and commutative properties to add easily.

1. 15:15 – 15:30 = 15 min.
15:30 – 15:45 = 15 min.
15:45 – 15:55 = 5 min.
Zanele's lesson was 35 min. long.

2. 09:30 – 10:00 = 30 min.
10:00 – 18:00 = 8 hours
18:00 – 18:50 = 50 min.
8 hours + 80 min. = 8 + (80 ÷ 60)
= 8 hours + 1 hour + 20 min.
The bus trip took 9 hours 20 min.

3. $20 + 15 + 25 + 45 = (25 + 15) + 45 + 20$
$= 40 + 20 + 45$
$= 105$ min.
$105 \div 60 = 1$ rem. 45
It takes John 1 hour 45 min. to complete his errands.

4. 11:50 – 12:00 = 10 min.
12:00 – 12:15 = 15 min.
The break is 25 min. long.
Or 11 hours + 1 hour + 15 min.
= 11 hours + (60 + 15) min.
= 11 hours 75 min.
– 11 hours 50 min.
25 min.

Activity 23.1

Learner's Book page 57

1. **a)** a watch
b) a stopwatch
c) a watch
d) a stopwatch
2. A stopwatch shows elapsed time while the digital clock shows the actual time.
3. 30 minutes 9:50, 9:20
4. 55 minutes 15:45 + 15 mins = 16:00
5. 203 s (3 mins = 180 s) 3 minutes and 23 seconds

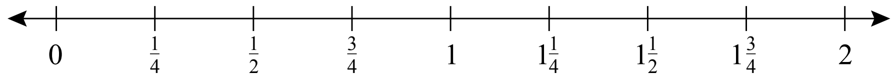
Activity 23.2

Learner's Book page 58

1. **a)** 50 min
b) 2 h
c) 20 min
d) 170 min
2. Learners' own work
3. **a)** 45 min = $\frac{3}{4}$ h
b) 2 h
c) 30 min
d) 165 min = $2\frac{3}{4}$ h
4. 23 min = 15 min + 8 min
8 min is closer to 15 min than to 0 min
So we round 23 min up to 30 min
5. **a)** do not round off
b) round off
c) round off to the nearest minute
d) round off to the nearest minute

6. **a)** 08:52
b) 21:45
c) 11:35
d) 22:15

7.



8. **a)** 7.30 am to 2.50 pm
2.50 pm = 14:50
7.30 am = 07:30
14:50 – 7.30 = 7:20
Time taken = 7 h and 20 min or 7 h 20 min

b) 21:45 to 8:15
21:45 + 2:15 = 24:00 (00:00)
00:00 + 8:15 = 8:15
Time taken = 2:15 + 8: 15 = 10h30 min

c) 12.35 am to 9.45 am
12:35 am + 9:10 takes us to 9:45 am
Time taken = 9 hours and 10 min or 9 h 10 min

d) 9.07 pm to 11:55 pm
11:55 – 9:07 = 2:48
So the activity took 24 h less 2 h 45 min
24 h 00 – 2 h 48 min = 21 h and 12 min or 21 h 12 min

e) 19:15 to 02:45
19:15 + 4: 45 = 24:00 (00:00)
Time taken = 4.45 + 2:45 = 7:30
= 7 h and 30 min or 7 h 30 min

f) 08:11 on Monday to 9:15 on Tuesday
08:11 + 1:04 = 9:15
Time taken = 24 h + 1 h 4 min
= 25 h and 4 min or 25 h 4 min

9. Learners' own work/class discussion

10. **a)** 87 min = 1 h 27 min
b) 125 min = 2 h 5 min
c) 93 min = 1 h 33 min
d) 175 min = 2 h 55 min

11. Learners' own work

Unit 24 Calculating time with calendars

Learner's Book page 60

In the Mental maths section of this unit learners first practise their skills at converting units of time into other units – seconds into minutes, minutes into hours, hours into days, and so on. This is also an opportunity to revise their skills at multiplying and dividing whole numbers. The concept of the **century** is introduced, and learners relate the number of centuries that have passed to the dates that they are familiar with, for example dates that begin with '20' such as 2010 are actually in the 21st century.

They do conversion between time units for days, weeks, months, years, decades and centuries. They use calendars to calculate elapsed time, and to work out on what days particular events fall, based on the number interval of 7 days per week and the number of days in different months.

The calendar-related activities can all be adapted or extended to include dates that are relevant to your learners and to the local community; for example, add questions about how many days it is to the school sports day, how many weeks of the year the local municipal swimming pool is open, and so on.

MENTAL MATHS

Learner's Book page 60

The learners should realise why it is important to know how to multiply with multiples of 10 and multiples of powers of 10. Remind them that they should apply effective calculation strategies, number properties and short cuts they have learned before to solve the problems.

1. **a)** $2 \times 60 = 120$ seconds
b) $5 \times 60 = 300$ seconds
c) $12 \times 60 = 720$ seconds
d) $20 \times 60 = 1\ 200$ seconds
e) $1 \times 60 \times 60 = 3\ 600$ seconds
f) $10 \times 60 \times 60 = 600 \times 60$
$= 360\ 000$ seconds

2. **a)** $3 \times 60 + 12 = 180 + 12$
$= 192$ min.
b) $17 \times 60 = (10 \times 60) + (7 \times 60)$
$= 600 + 420$
$= 1\ 020$ min.
c) $540 \div 60 = (540 \div 10) \div (60 \div 10)$
$= 54 \div 6$
$= 9$ min.
d) $6\ 000$ s $\div 60 = 100$ min.

e) $90 \text{ h } 47 \text{ min.} = (90 \times 60) + 47$
$= 5\ 400 + 47$
$= 5\ 447 \text{ min.}$

f) $24 \times 60 = (20 \times 60) + (4 \times 60)$
$= 1\ 200 + 240$
$= 1\ 440 \text{ min.}$

3. a) $720 \div 60 = 12 \text{ h}$

b) $(1 \times 24) + 12 = 24 + 12$
$= 36 \text{ h}$

c) $7 \times 24 = (7 \times 20) + (7 \times 4)$
$= 140 + 28$
$= 168 \text{ h}$

d) $9\ 000 \div 60 = 150 \text{ h}$

e) $2\ 000 \times 24 = 48\ 000 \text{ h}$

f) $365 \times 24 = 365 \times 25 - 365$
$= (365 \times 100 \div 4) - 365$
$= 36\ 500 \div 4 - 365$
$= 9\ 125 - 365$
$= 9\ 125 - 125 - 240$
$= 9\ 000 - 240$
$= 8\ 760 \text{ h}$

Activity 24.1

Learner's Book page 61

1. a) No, July has 31 days.
   b) April, June, September or November
   c) 2; 9; 16; 23; 30
   d) 26; 19; 12; 5
   e) 5 times
   f) 22 days
   g) Friday the 16th
2. a) Thursday b) Friday
3. a) Monday 26 May b) Thursday 6 June
   c) Learners' own work
4. 29 July to 29 October = 3 months
   29 October to 5 November
   = 8 days (29 October counted as day 1)
   Puppies are 3 months, 1 week and 1 day old.
5. It depends on what day of the week 10 January falls
6. a) 16 months
   b) April 1930 to March 1964 = 34 years
   April 1964 February 1965 = 11 months
   Month taken = (34 × 12) = 419 months

c) October 1845 to September 1850 = 5 years
October 1850 to December 1850 = 3 months
Months taken = (5 × 12) + 3 = 63 months

d) July 1773 to June 1780 = 7 years
Months taken = (7 × 12) + 1 = 85 months

e) May 1890 to April 1911 = 21 years
May 1911 to February 1912 = 10 months
Time taken = (21 × 12) + 10 = 262 months

f) Jan 1675 to December 1759 = 84 years
Jan 1760 to July 1760 = 84 years
Time taken = (84 × 12) + 7 = 1 015 months

7. **a)** 1 year 4 months **b)** 34 years 11 months
c) 5 years 3 months **d)** 7 years 1 month
e) 21 years 10 months **f)** 84 years 7 months

8. **a)** (b); (e) and (f)
b) (b) = 3 decades 4 years 11 months
(e) = 2 decades 1 year 10 months
(f) = 8 decades 4 years 7 months

Unit 25 Time zones

MENTAL MATHS

Learner's Book page 63

In this Mental maths unit you will assist learners in interpreting the information about reading time zones. You could ask the Social Science or Language teacher to enforce understanding and to set comprehension questions. Make sure that the learners understand the concept of Greenwich Mean Time (GMT). They determine the time in the different places if it is 12:00 in London (UK). They use the time zone map and add or subtract hours to and from 12:00.

1. **a)** 14:00 **b)** 19:00 **c)** 09:00
d) 05:00 **e)** 14:00 **f)** 19:00
g) 21:00 **h)** 06:00 **i)** 07:00
j) 14:00

2. Yes

3. Learners' own work

4. and 5.

Beijing; Perth	+ 7
Cairo; Cape Town	+ 2
Denver; Mexico City	– 6
London; Paris	0
Kinshasa	+ 1
Hong Kong	+ 8
Lima; Miami; New York	– 5

6.

+ 3 hours
+ 2 hours
+ 6 hours
– 6 hours
– 5 hours
+ 1 hour
+ 1 hours 5 min
– 4 hours 5 min

7. a) They are in the same time zone.
b) They are in the same time zone.

8. a) New Delhi 18:55
Havana 07:55
New Delhi is 11 hours ahead of Havana

b) Antananarivo 15: 55
Ottawa 07:55
Antananarivo is 8 hours ahead

c) Harare 14:55
New Orleans 06:55
Harare is 8 hours ahead.

9 a) 08:00 **b)** 02:00 **c)** 06:00
d) 10:00 **e)** 09:00 **f)** 14:00

10. If she wants to speak to her daughter at 09:00 of the morning of her birthday, she will have to wait until 19:00 of the evening of her daughter's birthday to phone.

Unit 26 The history of measuring time

Learner's Book page 66

In this unit learners extend their understanding of time measurement as an activity that had developed in different societies throughout history. They examine the methods and instruments that societies have invented to tell the time, using natural phenomena such as the position of the sun, and technological instruments such as water clocks and hourglasses. They compare different instruments for measuring time and discuss when it is appropriate or most efficient to use these instruments.

In Activity 26.1 you will use the mental maths time to assist learners in interpreting and understanding the information about the history of measuring time. Pose questions to check their understanding.

For example, you could ask:

a) How did people tell time before there were modern time measuring instruments?
b) Which instruments did they develop to read and measure time?
c) How do you know that the instruments they developed, worked?

Talk about different time measuring instruments that we use today. Encourage the learners to extend their vocabulary to talk about time measurement and instruments.

The second activity is a crossword puzzle that can be used as an assessment activity to test learners' understanding of time units, conversions and measuring instruments.

Activity 26.1

Learner's Book page 67

1. Learners' own work

2. **a)** sundial, water clock
b) candle clock, hour glass

3. **a)** shadow stick
b) So we know where the sun rises and where it sets.
c) The hours of the day
d) The child's shadow
e) The sun will rise on the left (east) and set on the right (west).
f) The shadows are longer in July than in January.
g) It tells the month as well.

4. **a–c)** On the big loop, west side of the time line

Activity 26.2

Learner's Book page 68

							1 S	2 A	N	D					
			3 S					P				4 D		5 S	
6 D		7 Q	U	A	R	T	E	R				E		E	
I			N					I				C		V	
G			D					L			8 W	A	T	E	R
I		9 S	I	X	T	Y						D		N	
T			A				10 C	A	N	D	11 L	E			
12 A	N	13 A	L	14 O	G	U	E				E				
L		D		N			N		15 Z		A				
		D		E			T		O		F				
						16 S	U	N	N	Y					
							R		E						
							Y								

Properties of 2-D shapes

Learner's Book page 69

The learners have been exploring 2-D shapes by identifying the types of sides, the number of sides and the length of sides of shapes since Grade 4. In this grade, they continue to explore these features of 2-D shapes. They also learn about octagons and parallelograms, as well as naming different types of angles.

Unit 27 Sides of shapes

MENTAL MATHS

Learner's Book page 69

By now, the learners should have a good understanding of the different features of 2-D shapes. They should therefore be able to do the introductory mental maths with ease. However, if they struggle, revise the Grade 5 work with them again. Show them examples of shapes with curved sides only, shapes straight sides only, and shapes with both curved and straight sides. Also show them examples of 2-D shapes with different numbers of sides and sides with different or the same lengths.

The most likely three groups would be:
- shapes with curved sides only: B, E and G
- shapes with curved and straight sides: H, M
- shapes with straight sides only: A, C, D, F, I, J, K, L, N

However, the learners may find different ways to sort the shapes. Accept their answers if their explanations make sense.

Note: You may also want to give the learners copies of the shapes to cut out and physically place into groups. A copy of the shapes for this activity is provided in the resources section.

Activity 27.1

Learner's Book page 69

1. **a)** B, E, G
b) H, M
c) A, C, D, F, I, J, K, L, N
d) F, J, K
e) L: 7 sides
f) F
g) K

Assessment points

- How well are the learners able to describe the types of sides of 2-D shapes?
- Can they describe the number of sides of 2-D shapes?
- Can they recognise sides of 2-D shapes that have the same length?

Unit 28 Polygons: shapes with straight sides

Learner's Book page 70

Remind the learners of the term *polygon*. Remind them about the names of the polygons they have already learned about, as shown in the Learner's Book. Then introduce octagons. A full-page copy of a regular octagon and copies of the other polygons dealt with thus far are provided in the resources section. You could let the learners cut out and work with these shapes as they revise and reinforce their understanding of the different polygons.

MENTAL MATHS

Learner's Book page 70

It is important that learners understand what the prefixes of polygon names mean. This is how they will be able to identify and name polygons.

1. penta- = 5 hexa- = 6 hepta- = 7 octa- = 8

2. **a)** triangle **b)** pentagon
c) heptagon **d)** octagon

3. **A** square **B** hexagon
C regular pentagon **D** heptagon
E octagon **F** triangle
G octagon **H** quadrilateral

Activity 28.1

Learner's Book page 70

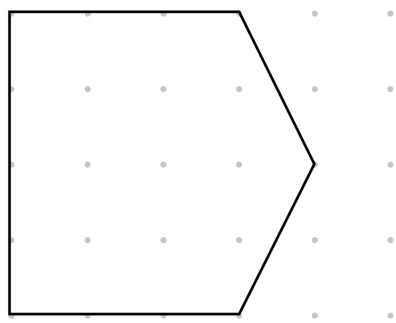
Working with concrete apparatus, even at this level, will help the learners to better visualise the shapes they are learning about. Geoboards are very useful to physically create and manipulate shapes. Make a few geoboards of your own by hammering nails into a block of wood.
The learners can also use string or wool instead of elastic bands to span around the nails as they explore various shapes.

1. **a)** Learners use geoboards to explore various shapes.

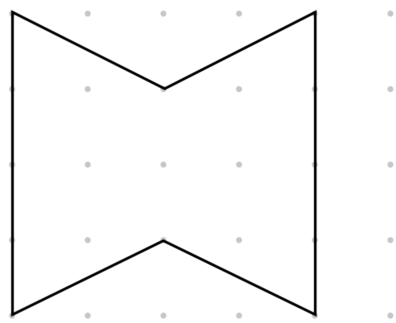
b) A: pentagon B: hexagon C: heptagon
D: octagon E: octagon F: octagon

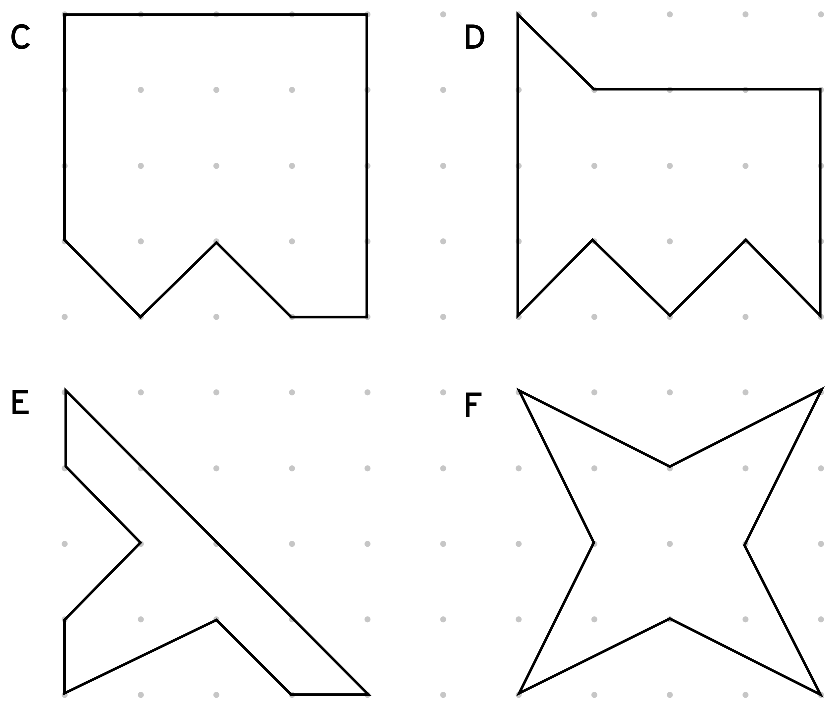
c) The learners could work in pairs and challenge one another to make various 2-D shapes on the geoboard.

2. A

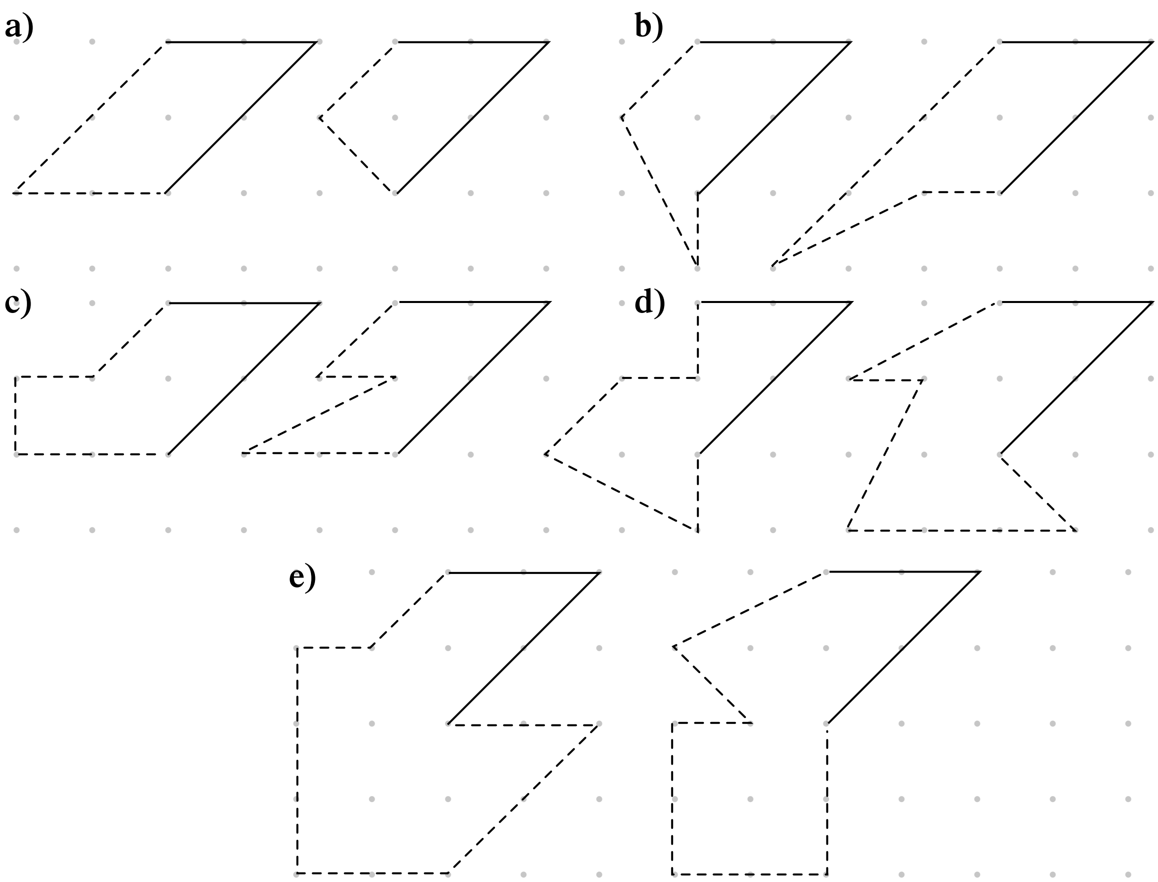


B





3. There are different options. Here are two options for each.



Assessment points

- Are the learners able to name different 2-D shapes correctly?
- How well are they able to recognise different 2-D shapes?
- Can they draw octagons?

Unit 29 Angles

Learner's Book page 72

The learners were introduced to the concept of angles in Grade 5. They learned what right angles are and they identified angles that were bigger or smaller than right angles. In Grade 6, they now learn to name other kinds of angles also, namely acute angles, right angles, obtuse angles, straight angles, reflex angles and revolutions.

Work through the text in the Learner's Book to remind the learners that angles are the amount of turn between two lines.

Right angles

The learners should understand that a right angle is the same as a quarter turn.

MENTAL MATHS

Learner's Book page 72

1. A, B and E are right angles.
2. **A** right angle
   B bigger than a right angle
   C smaller than a right angle
   D smaller than a right angle
   E smaller than a right angle
   F right angle
   G bigger than a right angle
   H bigger than a right angle

Acute, obtuse and straight angles

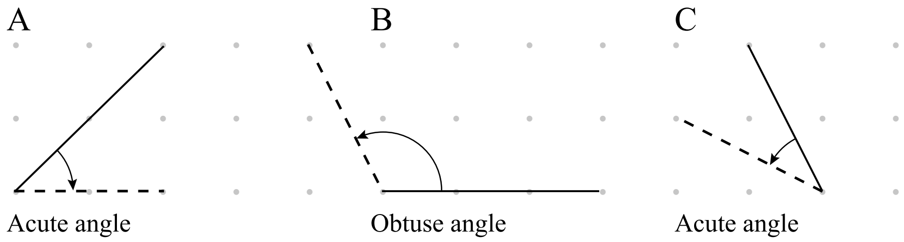
Learners are now introduced to acute and obtuse angles, as angles that are smaller or bigger than right angles. They also learn what a straight angle is.

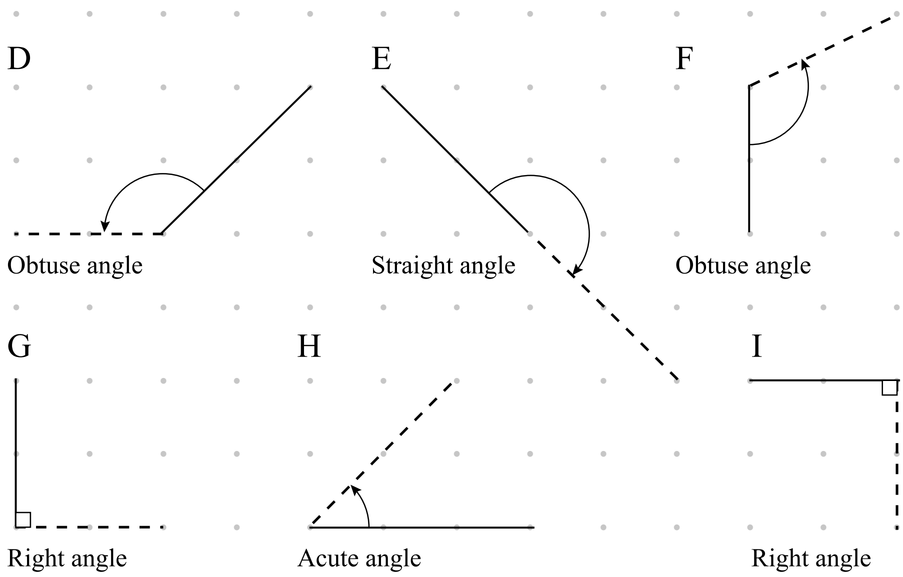
Activity 29.1

Learner's Book page 73

1. **a)** acute **b)** obtuse
   c) acute **d)** obtuse
   e) straight **f)** obtuse
   g) acute **h)** straight

2. There are different options. One option for each is shown below.





Reflex angles and revolutions

Once the learners are able to recognise acute, obtuse and straight angles, introduce reflex angles and a revolution.

Activity 29.2

Learner's Book page 74

1. **a)** reflex angle **b)** reflex angle
   c) revolution **d)** reflex angle
   e) revolution **f)** reflex angle
2. acute angle, right angle, obtuse angle, straight angle, reflex angle, revolution
3. **a)** straight angle **b)** right angle
   c) obtuse angle **d)** acute angle
   e) revolution **f)** reflex angle

Angles in 2-D shapes

Help the learners to see that the corners of 2-D shapes create angles. Let them identify the angles inside the 2-D shape as opposed to the angles outside of the shape.

Activity 29.3

Learner's Book page 75

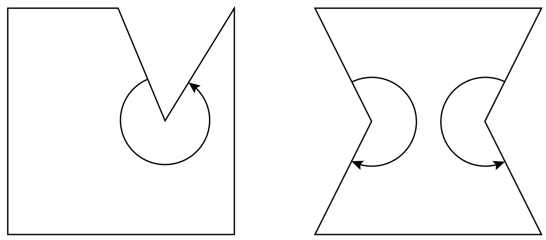
1. **a)** ① acute ② right ③ obtuse ④ acute
   ⑤ right ⑥ right ⑦ acute ⑧ obtuse
   ⑨ acute ⑩ obtuse ⑪ right ⑫ obtuse
   ⑬ obtuse ⑭ obtuse ⑮ obtuse
   b) Both acute
   c) Both acute
   d) This quadrilateral has two acute angles and two *obtuse* angles.
   e) No
   f) No
   g) No

Investigation

Learner's Book page 76

The learners will try these investigations using trial-and-improvement methods. They will try to draw the shapes and make the necessary changes until they arrive at an answer. Let them do their drawings on scrap paper, but present their answers neatly and clearly.

1. A hexagon can have angles that are reflex – if these angles are drawn pointing inwards.



2. The learners will find it impossible to draw a pentagon with all its angles acute. (In higher grades, the learners will find out that the angles inside a pentagon always add up to 540°. There are only five angles in a pentagon, so at least one of its angles must be reflex or two of the angles must be obtuse.)

Assessment points

- Can the learners identify which angles fall inside a 2-D shape?
- How well are the learners able to recognise and name different types of angles inside 2-D shapes?

Unit 30 Rectangles and parallelograms

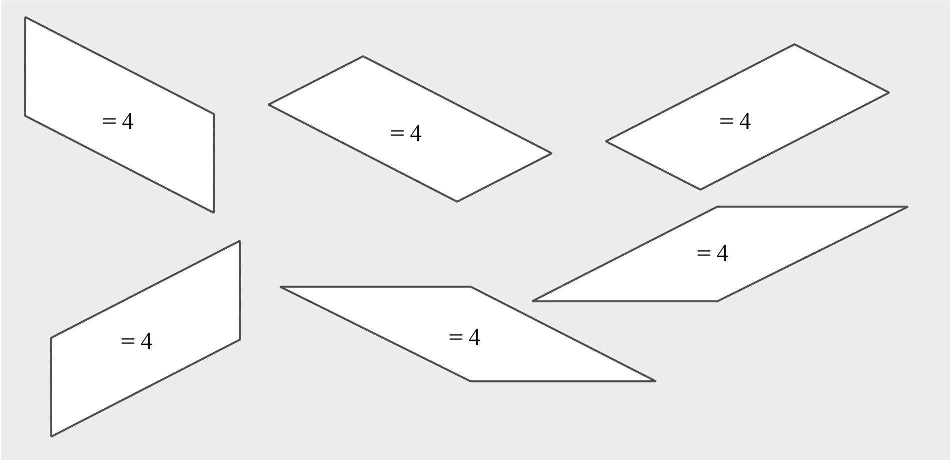
The learners are introduced to parallelograms. First revise the differences between a rectangle and a square before you introduce parallelograms. This will help the learners to describe the features of rectangles and parallelograms more easily.

MENTAL MATHS

Learner's Book page 77

Ask the learners to count the number of parallelograms in the picture. They should understand that the parallelograms are rotated or reflected in different orientations. You could ask them to work in groups and give them copies of the diagram. Some of them will probably have to scribble on it to ensure that they count all the parallelograms. They should discover that there are several hidden or embedded parallelograms. Encourage them to work systematically.

The total number of parallelograms counted is 24. The learners might count more.



Activity 30.1

Learner's Book page 77

1. Learners point out the features of each parallelogram.
2. a) B b) D
3. a) True b) True
4.

	Rectangle	Parallelogram
Number of sides	4	4
Length of sides	Opposite sides equal	Opposite sides equal
Number of angles	4	4
Angles	All angles are right angles	Opposite angles are equal

Activity 30.2

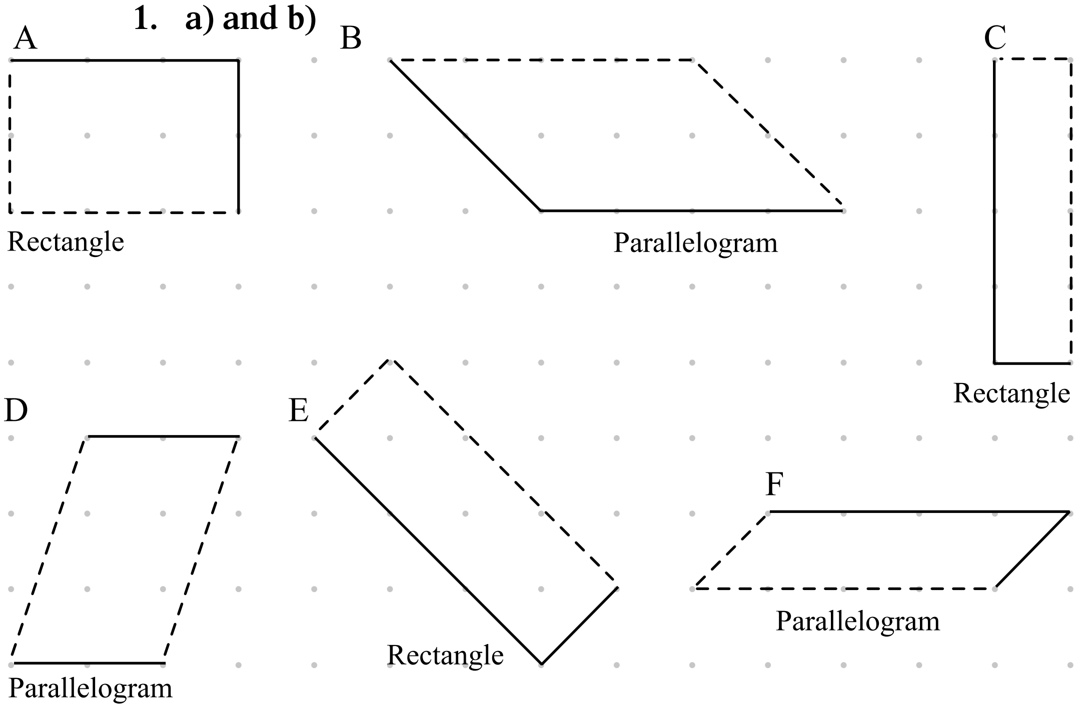
Learner's Book page 77

Let the learners construct and manipulate this simple apparatus as it helps them to understand the properties of parallelograms and to distinguish them from rectangles.

Activity 30.3

Learner's Book page 78

1. a) and b)



Assessment points

- Are the learners able to identify parallelograms?
- Can they tell the differences and similarities between a rectangle and a parallelogram?

Unit 31 Building bigger shapes

As the learners build bigger shapes from smaller ones, they get to know features of the shapes they work with at a concrete level.

MENTAL MATHS

Learner's Book page 79

1. B	**2.** C	**3.** G
4. E, G	**5.** H	**6.** A

Activity 31.1

Learner's Book page 79

Let the learners build the shapes.

Assessment points

- Are the learners able to copy the given composite shapes?
- Can they describe the composite shapes that they build with the smaller shapes?

Revision

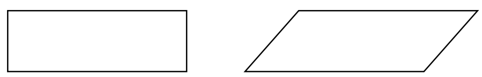
Learner's Book page 79

1. **a)** C **b)** F **c)** G **d)** B
e) D **f)** A **g)** H **h)** G or J

2. Check that the learners use appropriate terminology to describe the shapes.

3. **a)** B, D, E, A, C, F
b) A: straight angle B: acute angle
C: reflex angle D: right angle
E: obtuse angle F: revolution

4. **a)**



Rectangle Parallelogram

b) Any two of the following:
- they have four sides
- they have four angles
- their opposite sides are equal in length

c) Yes, a parallelogram can have angles that are not right angles.

Assignment

Learner's Book page 80

Shape	Name	Number of sides	Type of side(s)	Sides equal in length	Angles (right, acute, obtuse or reflex)
A	Triangle	3	Straight	All 3 sides	3 acute angles
B	Square	4	Straight	All 4 sides	4 right angles
C	Rectangle	4	Straight	2 opposite sides	4 right angles
D	Parallelogram	4	Straight	2 opposite sides	2 acute angles 3 obtuse angles
E	Pentagon	5	Straight	None	2 right angles
F	Hexagon	6	Straight	All 6 sides	6 obtuse angles
G	Heptagon	7	Straight	None	3 acute angles
H	Octagon	8	Straight	All 8 sides	8 obtuse angles
I	Circle	1	Curved	–	–
J	Semi-circle	2	Curved and straight	–	–

Remedial activities

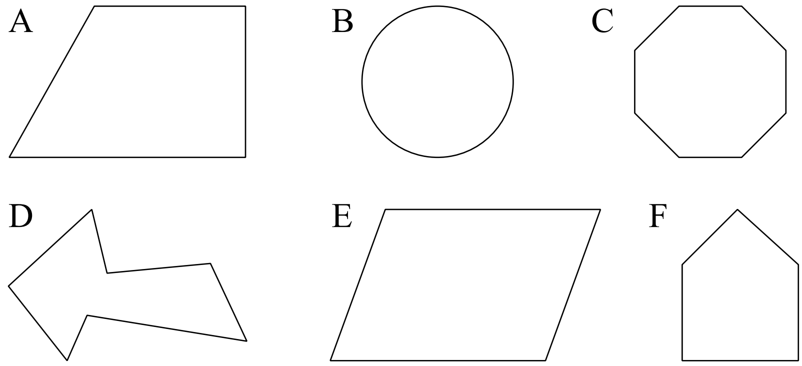
- Let the learners work with cardboard shapes. Make various kinds of shapes, such as three different pentagons, hexagons, heptagons, octagons, squares, rectangles, parallelograms, triangles and other quads, circles, and other shapes with both straight and curved sides. Let the learners sort these cardboard shapes into different groups. Make a big table on the board or on a large sheet of paper. Let the learners paste the shapes into the correct column or row for each type of shape.
- Let the learners make a cardboard tool to help them understand angles better. Let them cut out two strips of cardboard and fix one end of each of the strips together using a split pin. They can use this apparatus to create various types of angles by moving the loose ends of the strips apart. They can see how the one strip can be moved all the way around to create a revolution as it fits directly on top of the other strip.

Extension activities

- Explain what the word *parallel* means and why a parallelogram has that name. Explain that two lines are parallel when they are the same distance apart all the time. The two opposite sides of a parallelogram are parallel. Let the learners look for parallel lines in the classroom or give other examples (for example, the two tracks of a railway line on a straight stretch of track).
- Let the learners explore dividing polygons into triangles by drawing diagonals from one corner of the shape to another. They should find that quadrilaterals can be divided into 2 triangles, pentagons can be divided into 3 triangles, hexagons can be divided into 4 triangles, and so on.

Assessment 1.5 Properties of 2-D shapes

1. **a)** Name each of the shapes below.

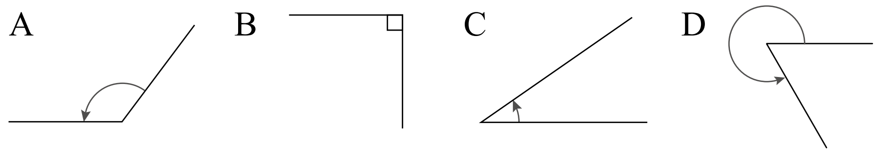


   b) Describe the sides of each shape in terms of:
   (i) the types of sides
   (ii) the number of sides
   (iii) the length of the sides.

2. Draw a shape that matches each of the following descriptions:
   a) It has three straight sides. One of its angles is a right angle.
   b) It has four straight sides. All of its angles are right angles. Its opposite sides are equal.
   c) It has six straight sides. None of its sides are equal.
   d) It has eight straight sides. Two of its angles are right angles.

3. **a)** What is an octagon?
   b) Draw two different octagons.

4. **a)** Name each type of angle in the diagrams below.



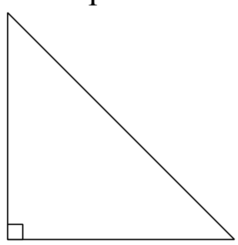
   b) Which angle is smaller than a right angle?
   c) Which angle is bigger than a straight angle but smaller than a revolution?
   d) Which angle is bigger than a right angle but smaller than a straight angle?

1. a) A → quadrilateral
B → circle
C → octagon
D → heptagon
E → quadrilateral or parallelogram
F → pentagon

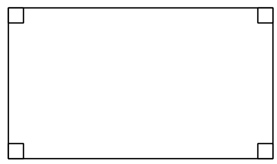
b) A → straight sides only; 4 sides; no sides are equal in length
B → curved side; 1 side
C → straight sides only; 8 sides; all sides are equal in length
D → straight sides only; 7 sides; no sides are equal in length
E → straight sides only; 4 sides; two opposite sides are equal in length
F → straight sides only; 5 sides; no sides are equal in length

2. There are different options for each shape. Here is one option for each shape:

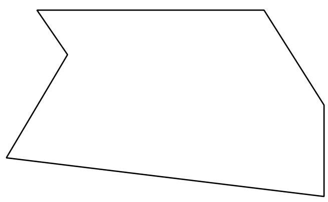
a)



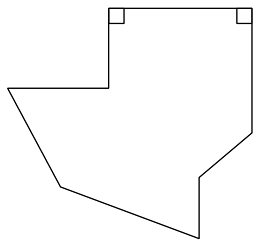
b)



c)



d)



3. a) A shape with 8 straight sides
b) The learners can draw any closed shape that has 8 straight sides.

4. a) A → obtuse angle
B → right angle
C → acute angle
D → reflex angle

b) C → acute angle
c) D → reflex angle
d) A → obtuse angle

Data handling

Learner's Book page 81

In this section, the learners continue the work on Data handling from Grade 5. By now they should be familiar with tally tables, pictographs, bar graphs and pie charts. In Grade 6, they get more practice in reading, drawing and understanding data in these forms.

The three new concepts that are introduced in Grade 6 are: using simple questionnaires with *yes* or *no* answers to collect data, drawing and reading double bar graphs, and finding the median of a set of numerical data.

Unit 32 Collecting and organising data

Remind the learners of the data cycle: we collect data, organise the data, present them in the form of a graph, or in words, analyse or answer questions about the data, and then report on the data by summarising it. Tell the learners that this unit focuses on collecting and organising data.

During this section, the learners will have to collect data from other learners in the school. They can ask other learners to complete the questionnaires during break times. Remember to speak to the other teachers at your school, and ask them to inform their learners that your class may be asking them to complete questionnaires in the next few weeks. They should encourage the other learners to cooperate with and assist your learners.

In today's mental maths session you will assist learners in interpreting and understanding the information about data. Set and pose some comprehension questions to check their understanding. Ask learners to explain what they understand about data, tallies and tables.

Tallies and tables

The learners have been expected to use tally marks and tables since Grade 4, so they should be very familiar with the concepts. However, remind them how to draw up and read tally tables.

Activity 32.1

Learner's Book page 82

Ensure that the learners understand the process and what they are meant to do in question 1. Manage the data collection process so that each learner gets a chance to record tallies for at least 20 other learners.

In question 2, let the learners choose at least four categories to use in their tally tables. It does not matter if the learners' categories differ. They should be able to draw up their own tally tables without much help, but assist those who still struggle. For example, draw an empty table that the learners can copy. Then provide the headings and categories, and ask the learners to write these in the correct places in the table.

Assessment points
• Do the learners know how to use tally marks? • Can they draw up suitable tally tables to collect data? • Can they record the data and add up the totals in a tally table? • Can they order categories of data from smallest to biggest correctly?

Questionnaires

Explain what a questionnaire is. Make or bring examples of questionnaires for the learners to read. At this level, the learners are expected to be able to use questionnaires that have only *yes* or *no* answers.

Demonstrate this kind of question with a range of different examples, and also demonstrate questions where it is not possible to answer *yes* or *no*, for example, 'What is your favourite animal?' or 'How far must you walk to get to school?' Let the class discuss why this type of question is not suitable for a questionnaire. (There could be too many different answers, and the person compiling the questionnaire won't know which possible answers to include in the table.) When learners formulate the questions they want to ask, they should first test whether the answer could be *yes* or *no* by asking a partner, before using it into their questionnaire.

Work through the example provided in the Learner's Book to help the learners understand the concept of a questionnaire and how this fits in with the data collection process.

Activity 32.2

Learner's Book page 84

The format of the questionnaire in the first example is very simple, so the learners should be able to copy it easily. However, a template for the questionnaire is provided in the resources section. To save time in some activities, you may want to make photocopies and provide each learner with a copy to complete.

Be available to help the learners draw up the tally table from the questionnaires. Demonstrate that they should check all the answers on each questionnaire and make tally marks in their tables next to the appropriate categories. Once they have gone through all the questionnaires, they can focus on the tally table and add up the totals for each category.

Activity 32.3

Learner's Book page 84

In this activity, the learners are given the questions to use on a questionnaire that they draw up themselves.

Try to let the learners work through the process on their own. Be available to help those who are unsure of what to do.

Activity 32.4

Learner's Book page 85

In this activity, the learners are given the opportunity to phrase their own questions for the questionnaire. They can use the examples to help them decide on questions. Remind them that the answers to their questions must be only *yes* or *no*.

Here is an example of a questionnaire that the learners could use.

Questionnaire		
Does your household waste water?		
Tick the 'yes' or 'no' box for each question.	**Yes**	**No**
1. Does your household have any leaking taps or pipes?		
2. Does anyone in your household usually not close the taps properly?		
3. Do you use only fresh water to water the garden?		
4. Do you usually water the garden between 10 a.m. and 5 p.m.?		
5. Do you usually fill up the whole bath when you take a bath?		

Assessment points

- Do the learners understand what a questionnaire is?
- Can they use a given questionnaire to collect data?
- Can they use completed questionnaires to draw up a tally table of the data?
- Can they correctly order categories of data from smallest to biggest?

Ordering data

The learners have already had to put data in order when interpreting their tally tables. This section and activity give the learners more practice in ordering data.

Activity 32.5

Learner's Book page 86

1. **a)** B; D; A; C
b) Family B
c) Difference = 19 000 – 8 500 = 10 500 ℓ

2. a)

School	Number of cans collected
Forest Primary	11 352
Mountain Primary	3 520
Bay Primary	8 531
Valley Primary	6 540
Lake Primary	6 540

b) Mountain Primary; Lake and Valley Primary; Bay Primary; Forest Primary
c) Forest Primary
d) Mountain Primary
e) 11 352 – 8 531 = 2 821 more cans collected by Forest Primary

Unit 33 Showing data using graphs

Learner's Book page 86

In this unit the learners practise drawing pictographs, bar graphs and double bar graphs. Double bar graphs are a new concept. However, most learners should not find this type of graph too difficult to understand, if they are already able to work with single bar graphs.

MENTAL MATHS

Learner's Book page 88

The learners use pictures to represent the number of learners and households given in tables. They have to find out how many pictures should be included in pictographs if one picture represents 50 learners and if one picture represents 500 households. To do this they have to divide by 50 and 500.

1. School A: 200 ÷ 50 = 4 pictures
School B: 400 ÷ 50 = 8 pictures
School C: 350 ÷ 50 = 7 pictures
School D: 500 ÷ 50 = 10 pictures

2. Town A: 8 000 ÷ 500 ÷ 1 000 ÷ 500 = 2
8 000 ÷ 500 = 2 × 8 = 16 pictures

Town B: 10 000 ÷ 500 ÷ 1 000 ÷ 500 = 2
10 000 ÷ 500 = 2 × 10 = 20 pictures

Town C: 7 500 ÷ 500 ÷ (2 × 7) + 1 = 15 pictures

Town D: 6 500 ÷ 500 ÷ (2 × 6) + 1 = 13 pictures

Note: Ask the learners which other numbers they could use to reduce the number of pictures. For example, instead of 50 and 500, each picture can represent 100 and 1 000 learners and households. They should, however, consider that they have to use half pictures where the numbers are not multiples of 100 and 1 000, for example 350 and 7 500.

Activity 33.1
Learner's Book page 88

1. a)

City	Number of people living in the city
Durban	$3\frac{1}{2}$ million
Cape Town	$3\frac{1}{2}$ million
Port Elizabeth	1 million
Bloemfontein	$\frac{1}{2}$ million
Johannesburg	4 million

b)

City	Number of people living in the city
Durban	
Cape Town	
Port Elizabeth	
Bloemfontein	
Johannesburg	

 = 1 000 000 people = 500 000 people

c)

City	Number of people living in the city
Durban	
Cape Town	
Port Elizabeth	
Bloemfontein	
Johannesburg	

 = 500 000 people

d) Bloemfontein; Port Elizabeth; Cape Town; Durban; Johannesburg

Assessment points

- Do the learners know what a pictograph is?
- How well are they able to draw a pictograph with many-to-one correspondence?

Learner's Book page 89

Bar graphs

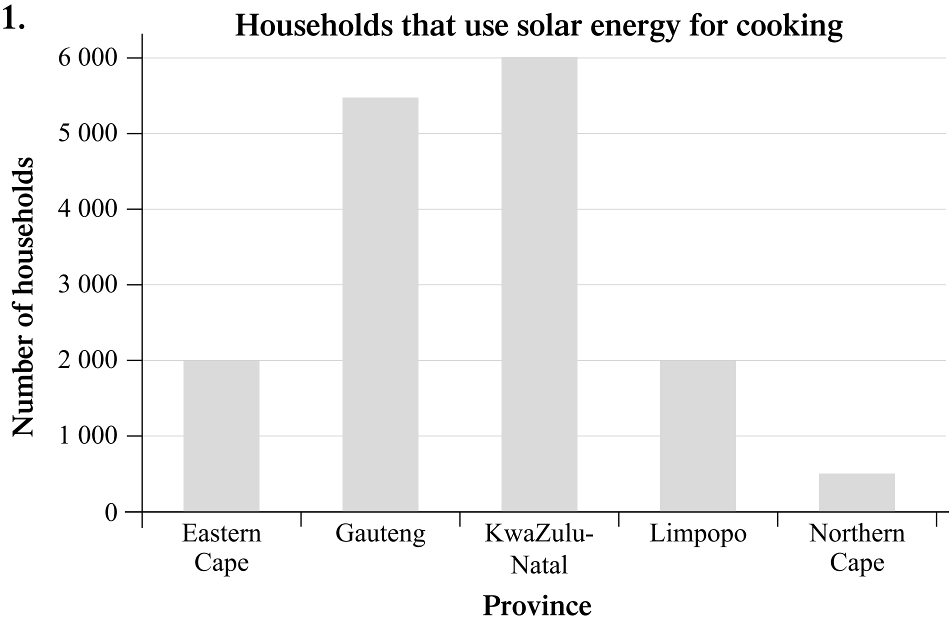
The learners should be familiar with the structure of a bar graph by now. Remind them about the different parts of a bar graph, such as the vertical and horizontal axes, the title of the bar graph and the heights of different bars. Also draw the learners' attention to the numbers on the vertical axis. Talk about how these numbers can be shown in different intervals, or groups of numbers, and that the number intervals must be equal. Relate this to their experience of counting in 2s, 5s 10s, 50s and so on in the work they have done on numbers, operations and relationships activities. Choosing suitable intervals for the vertical axis also involves rounding up to the nearest suitable number for the maximum value on this axis – for example, if the maximum data value is 43, the maximum value shown on the axis could be 45 (if the intervals are in 5s) or 50 (if the intervals are in 10s). The examples in the Learner's Book show the differences in the number intervals on bar graphs.

Activity 33.2

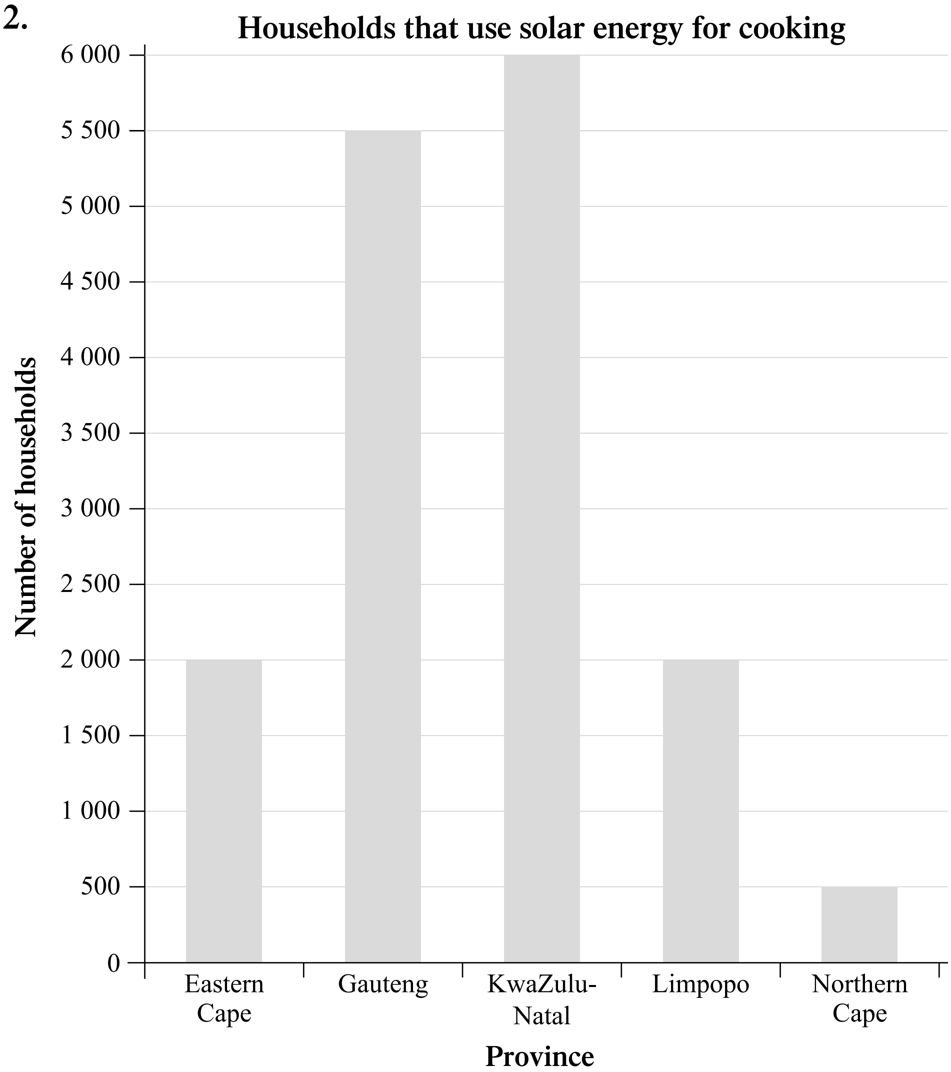
Learner's Book page 90

The learners should realise that the biggest number is 6 000, so the biggest number on the vertical axis should include 6 000.

1.



2\.



Activity 33.3

Learner's Book page 91

In this activity, the learners work through the data cycle on their own.

If the learners use water accounts to find the number of litres used, the water will be measured in kilolitres. Tell them that 1 kilolitre = 1 000 litres (relate this to work they have done on volume of liquids in Grade 5). Let them work with whichever unit they find easiest at this stage. Help them to do conversions if they wish.

The learners should be able to draw a bar graph of the data. The challenge is to decide what number intervals to use on the vertical axis. Tell the learners to work on a sheet of scrap paper first and use trial and improvement methods to work out the best number intervals. They can draw the neat bar graph in their books.

As an extension question, ask the learners whether a questionnaire would be useful to collect the data in this activity. The learners should realise that they need to collect data from five learners only, and they require only one answer from each learner, so a questionnaire is not necessary.

Learner's Book page 92

Double bar graphs

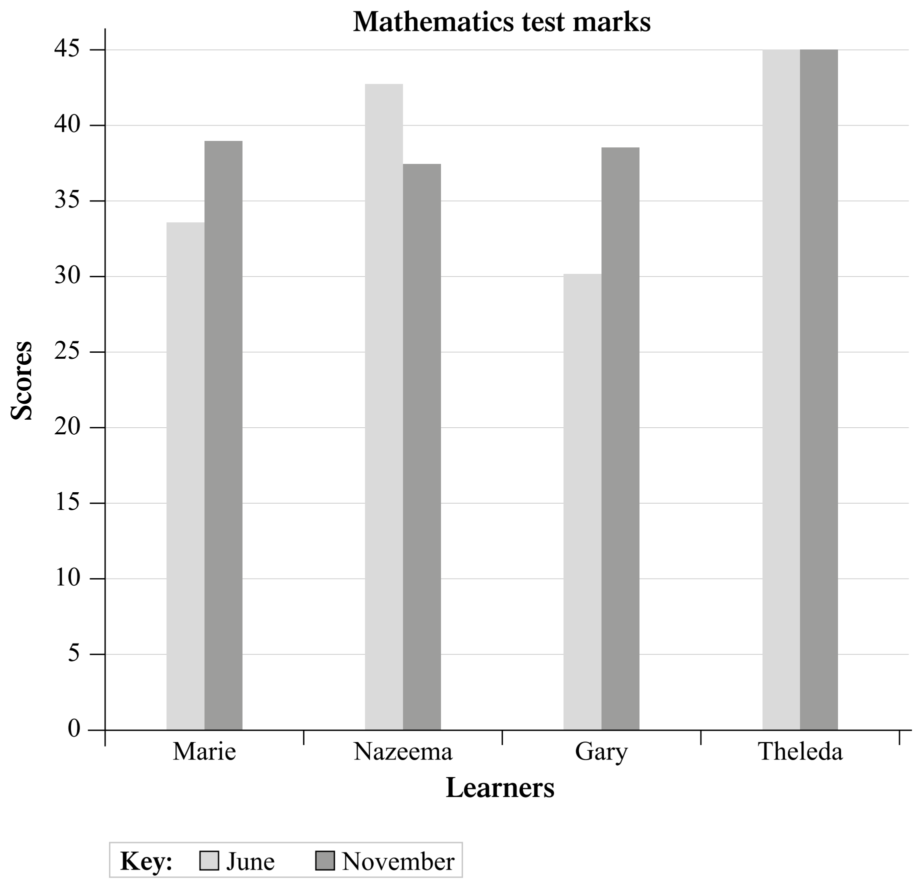
This will be the first time that most of the learners will come across a double bar graph. Work through the annotated diagram and the example in the Learner's Book with them. Once they identify what the two colours on the bars mean, they should be able to read the data easily.

If the learners can draw a bar graph easily, they will have no problem drawing a double bar graph. Work through the example of drawing a double bar graph in the Learner's Book.

Activity 33.4

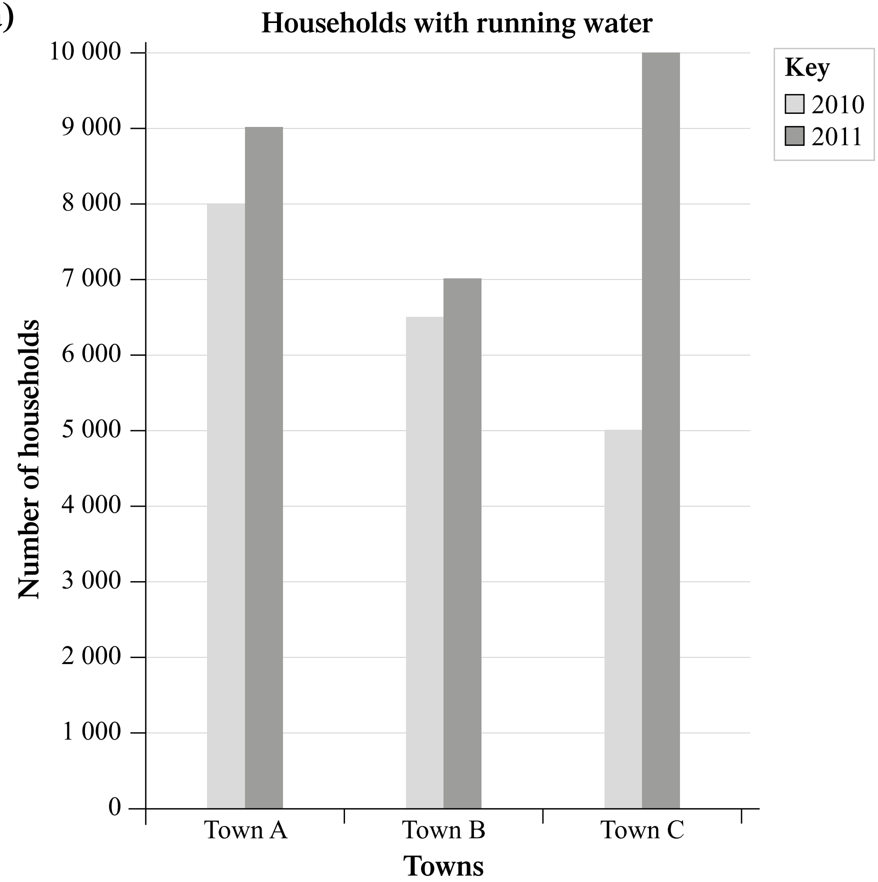
Learner's Book page 93

1. a)



b) Marie and Gary
c) Nazeema
d) Theledi

2. a)



b) fewer

c) yes

d) Town C had 5 000 more households with running water in 2011.

Assessment points

- Can the learners recognise a double bar graph?
- Do the learners understand why a double bar graph needs a key?
- Can they read data from a double bar graph?
- How well are they able to show data using a double bar graph?

Unit 34 Explaining data

Learner's Book page 94

In this unit the learners will practise their skills at interpreting, analysing and reporting data. They will work with data in various forms, such as in words, pictographs, bar graphs, double bar graphs and pie charts. They have worked with all these forms in this term except for pie charts. However, they have already worked with pie charts in Grades 4 and 5, so this type of graph is not new to them.

Read through the notes in the Learner's Book about the kinds of things we look at when explaining data. Do not spend too much time on working through this text because the learners will pick up on these ideas as they work through the activities in this unit. Remember to ask questions that encourage comparing data, drawing conclusions and making predictions, as the learners interpret the data in different examples and activities. Their skills at interpreting data with critical insight will develop as they practise answering such questions in many different data contexts. For example, asking learners to use a given graph or chart to predict what could happen in the future requires them to think about what caused the data shown in the graph (such as people using paraffin because they can't afford electricity for lighting), and whether the same cause will still exist in the future (will more people be able to afford electricity, or will more people get poorer and have to use paraffin?).

Data in words

Remind the learners that when data are presented in paragraphs, it is often easier to make a table of the data. They will need to focus on the categories and the numbers in each category as they read through the data.

Go through the information about explaining data with the learners. Let them work cooperatively as a whole class. Draw the tables on the board and ask the learners to fill in the data. The learners work with multiples of large numbers. You could let them count in 10 000s, 100 000s and 1 000 000s at the beginning of the Data handling mental maths sessions.

MENTAL MATHS

Learner's Book page 95

The learners read information in paragraphs representing data in words. They should order the names of available services, sources of energy and the respective numbers represented in ascending and descending order. Ask them to write the numbers in millions in a shorter form. You can show them how to write 1 700 000 using a decimal comma. Tell them that they will learn about decimal numbers in Term 2.

1. **a)** Internet; computer; telephone; running water; electricity
   b) 4 000; 14 000; 16 000; 17 000; 18 000
   c) 2009
2. **a)** Candles; electricity; paraffin; other
   b) 1 700 000; 12 000 000; 400 000; 350 000
   c) 1 700 000 = 1,7 million
   12 million

Activity 34.1

Learner's Book page 95

1. **a)**

Service	Number of schools using this service
Electricity	17 000
Running water	16 000
Telephone	18 000
Computer	14 000
Internet	4 000

b) Internet; computer; running water; electricity; telephone
c) 2009

2. **a)**

Sources of energy for lighting	Number of households using this source of energy
Candles	1 700 000
Electricity	12 000 000
Paraffin	400 000
Other sources	350 000

b) electricity, candles, paraffin, other
c) Statistics South Africa
c) 2010

Assessment points

- How well are the learners able to make a table of the data presented in the form of a paragraph?
- How well are the learners able to answer questions about the data presented in the form of a paragraph?

Pictographs

The learners should be familiar with pictographs by now. The two pictographs they will work with in this section represent large numbers.

Activity 34.2

Learner's Book page 96

The learners will work with dam storage capacities in the second problem in this activity. The values are very large and some learners will struggle to comprehend them. This will be the first time they work with units of megalitres, which is what dam capacities are measured in. They do not need to know how to calculate and convert megalitres. However, the first problem in this activity, as well as the illustrations, helps the learners to gain an understanding of just how much this quantity is. You can relate the activity to information you or the learners collect about local storage dams in your region; learners could compare the capacities of these dams with the dams listed in the pictograph.

1. **a)** B, C, A, D
   b) B: 1 megalitre
   c) D: $2\frac{1}{2}$ megalitres
2. **a)** Bloemhof Dam; 1 million megalitres
   b) Gariep Dam; 5 million megalitres
   c) Bloemhof Dam, Pongolapoort Dam, Vaal Dam, Sterkfontein Dam (or Sterkfontein, then Vaal), Vanderkloof Dam, Gariep Dam

d) Sterkfontein Dam and Vaal Dam
e) The website of the Department of Water Affairs and Forestry
f) 2011
g) The learners' summaries may differ, but they should all reflect that the data show the largest and smallest values. So an example of a summary would be:

The pictograph shows the capacities of South Africa's largest dams. Of these six dams, Gariep Dam is the largest, with a capacity of 5 million megalitres; and Bloemhof Dam is the smallest, with a capacity of 1 million megalitres.

Assessment points

- Do the learners understand the value that one picture in a pictograph represents?
- Can they put categories of a pictograph in order from smallest to biggest?

Learner's Book page 97

Bar graphs and double bar graphs

In this section the learners will work with large numbers on bar graphs. You may want them to practise counting and writing in multiples of 50 000 before they do Activity 34.3.

Activity 34.3

Learner's Book page 98

1. a) Northern Cape, Free State, North West, Mpumalanga, Western Cape, Limpopo, Eastern Cape, KwaZulu-Natal, Gauteng
   b) Gauteng; 400 000
   c) Northern Cape; 25 000
   d) Gauteng: It has the most births, so maybe there are more people living there. (Note that this may not necessarily be the case, but accept any reasonable answer. The question is aimed at getting learners to think about the data more critically. Encourage class discussion of this question.)
   e) Recorded live births, 2010
   f) Statistics South Africa

MENTAL MATHS

Learner's Book page 99

The double bar graph shows infant mortality rates in different countries. Explain what 'number of deaths out of every thousand births' means.

If the learners struggle with the concept, start with smaller numbers. For example, talk about test marks out of 10, then out of 20, then out of 100, then out of 1 000. Then talk about deaths out of every 10 births, then out of every 100 births, then out of every 1 000 births.

This is a topic that may touch on painful experiences in learners' own family lives. Be sensitive to this, and support any learners who need to talk about this topic in a more personal way, or who resist talking about it at all.

1. **a)** Namibia, Zimbabwe, Botswana, South Africa, Mozambique
   b) Namibia
   c) Mozambique

Activity 34.4

Learner's Book page 99

1. **a)** Botswana, Zimbabwe, South Africa, Namibia, Mozambique
   b) Botswana
   c) Mozambique
2. **a)** Decreased
   b) Mozambique: The number of deaths per thousand was reduced by 50.
   c) Here is an example of a paragraph that the learners could write as a summary of the data:

   The graph shows the number of babies who died out of every thousand births in 2006 and in 2011. In 2006, Mozambique had the most deaths (129) and Namibia had the fewest deaths (48). In 2011, Mozambique still had the most deaths (79) but Botswana had the fewest deaths (11). The number of deaths decreased in all the countries from 2006 to 2011.

   If the learners struggle to write their paragraphs, write the above paragraph on the board, but leave out certain words. The learners can copy the paragraph and then complete it using the data.

Learner's Book page 100

Pie charts

Remind the learners what a pie chart is and how it works. Work through the example in the Learner's Book and make sure they understand how to read a pie chart. Relate the fractions in the pie charts in this section to work learners have done on fractions in this and in previous grades.

MENTAL MATHS

Learner's Book page 100

1. Make sure the learners understand that the pie chart is divided into 20 equal parts (or 20ths). Each slice of the pie chart is a certain fraction of the 20 equal parts (or a certain number of 20ths).

   a) 5; illnesses or problems at birth, HIV/AIDS, diarrhoea, injuries, other child illnesses

b) HIV/AIDS; $\frac{7}{20}$

c) $\frac{7}{20}$; $\frac{6}{20}$; $\frac{4}{20}$; $\frac{2}{20}$; $\frac{1}{20}$

d) $\frac{6}{20}$

e) $\frac{2}{20}$

f) Accept any reasonable answer here. The learners may say that HIV/AIDS is so widespread that it may still be the main cause of death in five or ten years' time. Others may say that a cure for HIV/AIDS may be found, so it may not be the main cause of death in five to ten years' time.

Activity 34.5

Learner's Book page 101

1. Note that the categories in this pie chart are made up of ranges of numbers, not single number values. Remind the learners to still follow the same way of reading the pie chart. Other graphs that use ranges (or intervals) in the data categories are explored in Term 3.

a)

Distance travelled to get to school	Fraction of children who travel this distance
Less than 1 km	$\frac{4}{10}$
1 to 5 km	$\frac{4}{10}$
6 to 10 km	$\frac{1}{10}$
More than 10 km	$\frac{1}{10}$

b)
- The fraction of children who travel 5 km or less is $\frac{8}{10}$. (The learners must add the two fractions for 'Less than 1 km' and '1 to 5 km'.)
- The fraction of children who travel more than five km is $\frac{2}{10}$. (The learners must add the two fractions for '6 to 10 km' and 'More than 10 km'.)
- More children live closer to school.

c) You can choose to do this data collection task as a whole class, with you recording the data on the board for the whole class. Or learners can create their own questionnaires modelled on the table in question 2(a), and ask each person in the class to say which category applies to him or her.

d) Let the learners compare their data to the data obtained from the Census at School data shown in the pie chart. The data in the pie chart are in fractions, not numbers of children, so the learners must estimate whether the number of learners in each category in their table is less than, more than or the same as the fraction in the pie chart. (Alternatively, you could help learners to convert the numbers in their data sets to fractions of the total number of learners in the class, so that they can do a more accurate comparison.) This question gets the learners to think about how data can be quite different, depending on when and where they were collected.

Pictograph project

You could decide to use the following activity as the Maths project for Grade 6. Read through the data and the steps of the activity with the learners to make sure they know what to do.

Activity 34.6

Learner's Book page 101

1. Remind the learners to read one sentence at a time. Suggest that they use scrap paper to record data categories and numbers as they read each sentence. This will help them to focus on what they are reading and extract relevant data.

2.

Source of drinking water	Number of households with this source of drinking water
Tap inside home	6 million
Tap on property outside home	4 million
Tap shared with the community	$2\frac{1}{2}$ million
Neighbour's tap	$\frac{1}{2}$ million
Stream or river	$\frac{1}{2}$ million
Other	1 million

3. a) The learners may choose to let one picture stand for different numbers. For example, they could let one picture stand for either $\frac{1}{2}$ million or for 1 million.

b)

Source of drinking water	Number of households with this source of drinking water
Tap inside home	
Tap on property outside home	
Tap shared with the community	
Neighbour's tap	
Stream or river	
Other	

 = 1 million households  = $\frac{1}{2}$ million households

4. **a)** 6 million

b) $\frac{1}{2}$ million

c) 13 million

d) $1\frac{1}{2}$ million (municipal tap water)

e) tap inside the home

f) fewer

g) 2010

h) Statistics South Africa

i) The data show the sources of drinking water of households in South Africa. Most households get their drinking water from a tap inside their home. The fewest households get their drinking water from a stream or river, or from a neighbour's tap.

j) Learners should say (or write about) whether they think more or fewer households will get water from taps inside their homes in the future, and why they hold this view. Accept any answers that show some logical thought behind the reasons given. (You could introduce this part of the activity by having a class discussion about why different households get their drinking water from different sources, and which sources are preferable.)

Learner's Book page 103

Mode and median

Explain that *numerical data* means data that consists of numbers only. The learners have already learned about finding the mode of a set of numbers. In this section they revise the concept and then also learn that the median is the midpoint of a set of data.

MENTAL MATHS
Learner's Book page 103

1. **a)** 20; 21; 22; 23; 24; 25; 25
   b) 25
   c) 23

Activity 34.7
Learner's Book page 104

1. **a)** 10; 10; 12; 14; 14; 16; 17; 17; 20; 21; 25; 26; 26; 27
   b) 14
   c) 27 mm
   d) 27 mm – 14 mm – 13 mm
   e) 10 mm
   f) 4 mm
   g) 17
   h) 3 mm
2. **a)** 25; 26; 29; 30; 30; 31; 32; 32; 34; 34; 35; 35; 36; 36; 36; 36; 37; 38; 39; 40; 40; 41; 41; 41; 42; 43; 45; 46; 46; 47
   b) 36 **c)** 47 **d)** 11
   e) 25 **f)** 11 **g)** 36
   h) The mode and the median are both 36
3. **a)** 0; 0; 1; 1; 1; 2; 2; 2; 2; 3; 3; 3; 3; 4; 4; 4; 4; 4; 5; 5; 6;
   b) 4 **c)** 6 **d)** 2 **e)** 0
   f) 4 **g)** 6 **h)** 3 **i)** 1

Revision
Learner's Book page 105

1. **a) and b)** Here is an example of what the questionnaire could look like.

Questionnaire		
Which relatives live with you?	Yes	No
1. Does your granny live with you?		
2. Does your grandpa live with you?		
3. Does your aunt live with you?		
4. Does your uncle live with you?		
5. Does your cousin live with you?		

   c) They can ask other learners in the school to complete the questionnaires during break times.
   d) Make sure that the learners know how to complete a tally table to help them organise the data they collected on the questionnaires.
   e–f) The learners should be able to answer these questions using their completed tally tables.
   g) The bar graph would be a normal single bar graph.
   h) Remind the learners that the summary should describe what data was collected. It should also describe the most and fewest number in each category.

2. **a)** 2001 and 2007
   b) Radio, television, telephone, cell phone
   c) Radio
   d) Radio
   e) Radio: yes Television: yes
   Telephone: no Cell phone: yes
   f) Cell phone
   g) 100 000
   h) Accept any reasonable answers. A possible answer could be:
   More people would probably have cell phones, so they would not need telephones. Therefore, fewer households would have telephones.
   i) An example of a summary:
   The data show household goods in good working order in 2001 and 2007. In 2001, most of the households had radios and the fewest had television. In 2007, this was the same. But in 2007 many more households had cell phones than in 2001. Fewer households had telephones in 2007 than in 2001.

3. **a)** 15; 16; 18; 19; 19; 20; 20; 20; 21; 21; 22; 22; 24; 24; 24; 24; 25; 26; 26; 27; 29; 29; 30
   b) 15 and 30 **c)** 15
   d) 24 **e)** 9
   f) 22 **g)** 2

Project

Learner's Book page 107

Let the learners work on their own to complete this project. As they have to work through the whole data cycle, set due dates for each part of the project to help them work through each step of the process.
You can use the following mark allocation to mark the project out of 35.

Criteria	Mark allocation
Collect data from 20 children using a questionnaire	5
Use a tally table to organise the data collected on the questionnaires	2
Tally table has suitable and clear rows of data	6
Tallies correctly added up	2
Questions are answered correctly	6
Bar graph has a title and the axes are labelled correctly	3
Bars for each category are drawn correctly	8
Summary sentences correctly describe the data	3
Total marks	**35**

Remedial activities

- Learners who struggle to read normal bar graphs should first get more practice in reading them before they move on to double bar graphs. You may want to use the same data shown by the double bar graphs in the Learner's Book, but presented as separate bar graphs first, before the learners move on to reading the same data on a double bar graph.
- Some learners are easily put off when they have to read data presented as a paragraph of text. These learners will need a lot of practice in identifying the data in the paragraph. They should look for the numerical data in each sentence and write this information down, before moving on to the next sentence. When they have read the whole paragraph they should have rough notes of all the data items that must be included in their table or graph.
- Use the same data given as tables or graphs in the Learner's Book and write these up as a paragraph. Let the learners start by matching each sentence in the paragraph to the same data shown in the graph or table in the Learner's Book. Once they can do this easily, let them work with the paragraphs only and rewrite the data from each paragraph in the form of a table.

Extension activities

- Let the learners redraw the bar graph about the number of births in South Africa. Challenge them to draw the graph using 20 000 as the number interval.
- Let the learners make up their own questionnaires to find out how learners at the school feel about certain issues. For example:
  - Do they want healthier foods to be sold at the tuck shop?
  - Do they want there to be less litter in the school?
  - Do they want improvements to the school buildings?
  - Do they think the school should start a recycling programme?
  - Do they want a vegetable garden to be started at the school?

  Remind the learners to phrase the questions so that the answers can be either *yes* or *no*. Let them collect the data using their questionnaire and then carry on with the rest of the data cycle.

Assessment 1.6 Collecting, representing, analysing and reporting data

1. Read the following paragraph, then draw a pictograph to show the data. Let one picture stand for 1 000 households.

> The households in four towns were asked if they had electricity. In Town A, about 7 000 households had electricity. There were 500 fewer households in Town B that had electricity. Town C had the most households with electricity: 8 000. Town D had 7 500 households with electricity.

2. The following table shows the Maths marks of four learners for two tests.

Learner	Test 1 mark	Test 2 mark
Gavin	45	38
Leela	39	35
Bonolo	43	39
Mthunzi	41	37

a) Draw a double bar graph to show the data above. Make sure you do the following:
- Label the vertical and horizontal axes.
- Provide a key on your graph
- Give your graph a title.

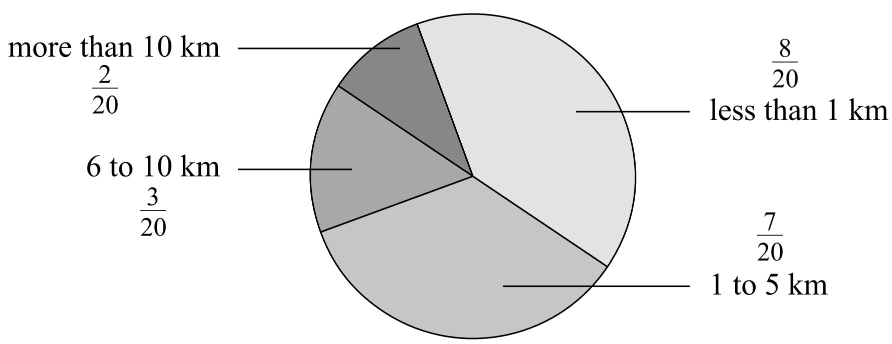
b) Look at the marks for Test 1. Who had the highest mark and who had the lowest mark?

c) Look at the marks for Test 2. Who had the highest mark and who had the lowest mark?

d) Were the learners' marks higher or lower in Test 2 than in Test 1?

e) One of the tests was a surprise test. Which test do you think it was? Explain your answer.

3. The pie chart below shows the distances travelled by children to get to school.



(Based on data from *Census at School Results 2009*, Statistics South Africa)

a) Copy and complete the following table. The first row has been completed for you.

Distance travelled to get to school	Fraction of children who travel this distance
Less than 1 km	$\frac{8}{20}$

b) What fraction of children travel less than 1 km?
c) What fraction of children travel 1 to 5 km?
d) What fraction of children travel more than 10 km?
e) What fraction of children travel 6 to 10 km?
f) Complete these sentences:
- Most of the children live ■ km from school.
- The fewest children live ■ km from school.

g) In which year were the data collected?
h) Will these data be the same for all schools? Explain your answer.

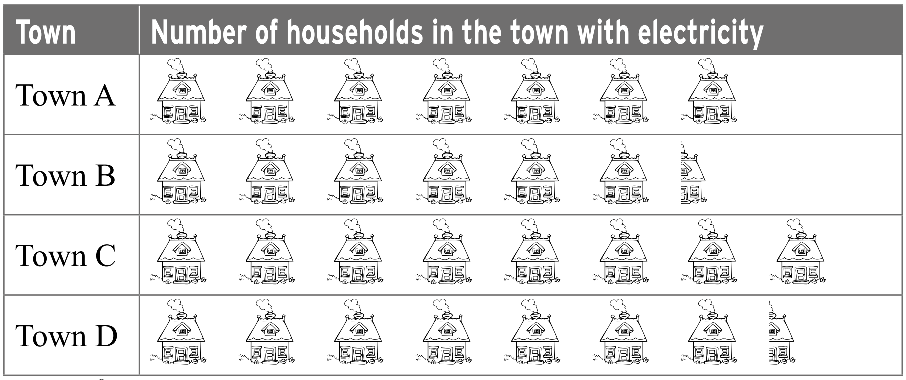
4. The data below show the daily rainfall in a town for three weeks. The numbers are in millimetres.

25, 10, 35, 10, 13, 15, 20, 15, 25, 50, 18, 20, 0, 25, 30, 25, 0, 28, 35, 0, 15, 40

a) Write the numbers in order from smallest to biggest.
b) Find the mode.
c) What is the most amount of rainfall?
d) What is the difference between the most amount of rainfall and the mode?
e) What is the least amount of rainfall?
f) What is the difference between the least amount of rainfall and the mode?
g) What is the median?
h) What is the difference between the median and the mode?

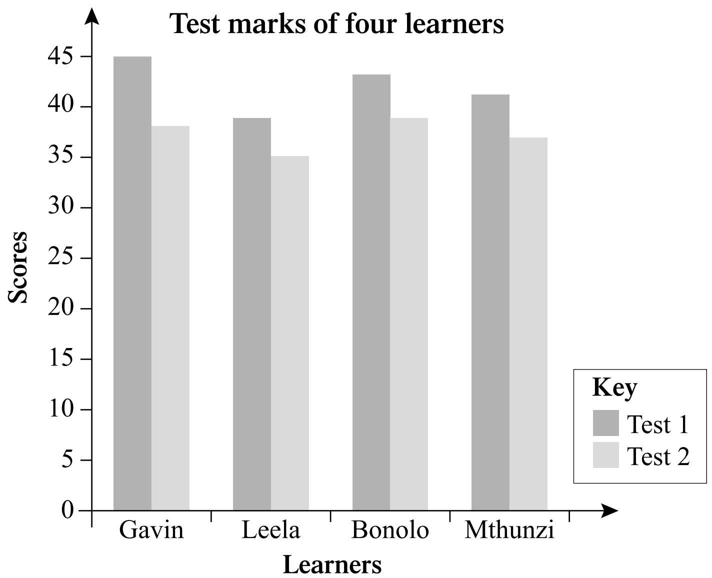
1. The learners will first have to draw up a table to show the data. This will help them to draw the pictograph more easily. Here is an example of a table and of a pictograph.

Town	Number of households in the town with electricity
Town A	7 000
Town B	6 500
Town C	8 000
Town D	7 500



Key:  = 1 000 households

2. a)



b) Gavin had the highest marks and Leela had the lowest marks.

c) Bonolo had the highest marks the highest and Leela had the highest marks.

d) Lower

e) Probably Test 2: Everyone's mark is lower, because maybe they were not prepared enough for the test.

3. a)

Distance travelled to get to school	Fraction of children who travel this distance
< 1 km	$\frac{8}{20}$
1 to 5 km	$\frac{7}{20}$
6 to 10 km	$\frac{3}{20}$
> 10 km	$\frac{2}{20}$

b) $\frac{8}{20}$

c) $\frac{7}{20}$

d) $\frac{2}{20}$

e) $\frac{3}{20}$

f) Complete these sentences:
- Most of the children live < 1 km from school.
- The fewest children live > 10 km from school.

g) 2009

h) No. Children in different areas live different distances from school.

4. a) 0, 0, 0, 10, 10, 13, 15, 15, 15, 18, 20, 20, 25, 25, 25, 25, 28, 30, 35, 35, 40, 50

b) 25

c) 50

d) 50 – 25 = 25

e) 0 mm

f) 25 – 0 = 25

g) 20

h) 25 – 20 = 5

Numeric patterns

Learner's Book page 108

Remind the learners that they often use number patterns when they work with whole numbers. During the next four units they will work with numeric or number patterns. In Grades 4 and 5 they explored, investigated, extended and created number patterns. They also worked with flow diagrams and function or number machines to determine input or output number values and describe relationships or rules. The work they do in *Numeric patterns* will help them to develop their understanding of algebra, a topic that they will deal with in the higher grades. After completing the units they will perform an assessment task to demonstrate their understanding of numeric patterns.

Unit 35 Numeric patterns in African beadwork

MENTAL MATHS

Learner's Book page 108

Ask the learners to name some number patterns (sequences) they know. They should be able to recall counting, natural, even, odd, square, triangular and rectangular numbers as well as multiples of different numbers.

Ask them to name number patterns in which they count in intervals involving non-multiples. Write these sequences on the board and ask the learners to describe them and give rules for creating the next numbers in the sequences. Learners should understand that numeric patterns involve mostly linear sequences.

In question 2 the learners investigate and describe the patterns and shapes in the African beadwork bracelet. You could ask them to do research on the Internet to find out more about the beadwork industry and culture in South Africa. They should notice that the beadwork consists of different sizes of triangles, crosses (intersecting lines), parallel lines and parallelograms.

The learners should be able to describe a pattern as a repetition of shapes, colours, objects or numbers. Allow them to use their own informal terminology to describe patterns and relationships. They have, however, dealt with various geometrical terms in Grades 4 and 5 and should therefore be able to use formal terms at this stage. If they don't, you should emphasise the use of formal terminology. Write the terms on cards and put them up on your New Maths Words board or start compiling a class Maths dictionary by binding A3 sheets of paper into book form.

In question 3 they explore the pattern in the black beads on the top and bottom edges of the bracelet.

In question 4 the learners explore the patterns in the bead arrangements in the small and large triangles. Ask them to look for relationships and to write number sentences and calculate the number of beads in the triangles. They make a drawing of the next size triangle if the beadwork is extended.

In question 5 the learners explore the number of beads in the parallelogram and parallel lines or crosses. Ask them to write number sentences to show the arrangement and to calculate the number of beads in each figure.

1. Class discussion

2. Learners should observe that there are 2 straight lines on the top and bottom of the drawing of the bracelet. There is a repetition of alternating small and big triangles on top, which are translated (slid) across. The triangles are translated diagonally and reflected (flipped) at the bottom. In the centre there are parallelograms that are reflected across. The bead arrangements inside (embedded in) the parallelograms form squares or crosses (intersecting lines) consisting of 5 beads each.

3. a) There is one group of ten beads, followed by a group of eight dark blue beads. This ten-eight pattern is then repeated: 10; 8; 10; 8; ... The rule is –2; +2.

b) The learners apply the associative and distributive properties to calculate the number of beads.

Number of beads in top edge:
$10 + 8 + 10 + 8 + 10 + 8 + 10$
$= 10 + 10 + 10 + 10 + 8 + 8 + 8$
$= (4 \times 10) + (3 \times 8)$
$= 40 + 24$
$= 64$

Number of beads on top and bottom edges:
$2 \times 64 = (2 \times 60) + (2 \times 4)$
$= 120 + 8$
$= 128$

4. a) Small triangle: 1; 2; 4; 3
Large triangle: 1; 2; 4; 3; 6; 4

b) The first 4 terms in the sequences for two triangles are the same. The big triangle is created by adding beads at the bottom. The first 3 terms in both sequences are powers of 2, i.e. $1 \times 2 = 2$; $2 \times 2 = 4$. The learners should notice that there are a number of smaller triangles and circles embedded in each triangle.

c) The learners should apply the associative property in arranging the numbers in ascending order and the commutative property to calculate the number of beads.

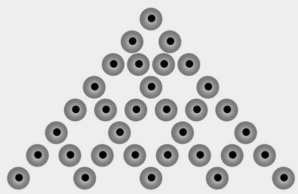
They should observe that the number of beads in the large triangle is double that of the small triangle. 10 is a triangular number and 20 a rectangular number.

Small triangle: $1 + 2 + 4 + 3 = 1 + 2 + 3 + 4$
$= (1 + 4) + (2 + 3)$
$= 10$

Large triangle: $1 + 2 + 4 + 3 + 6 + 4$
$= 1 + 2 + 3 + 4 + 4 + 6$
$= (4 + 1) + (3 + 2) + (6 + 4)$
$= 20$

d) Two rows of beads will be added at the bottom. You add a bead at each end and one between two beads. Then you add a bead at each end in the next row and two beads between two below the above. The first triangle has 4 rows of beads, the second 6 rows so the third one should have 8 rows. The learners make a drawing of the bead arrangement. Give them counters to construct the arrangement first.

The number sequence is now: 1; 2; 4; 3; 6; 4; 8; 5.
Ask the learners to look for relationships between these numbers.



5 a–b) Ask the learners to look for patterns in the diagonal lines.

Parallelogram:

7; 7; 7; 7	(move clockwise around the perimeter)
9; 9; 5; 5	(use opposite sides)

Parallel lines	(crosses):
2; 5; 2; 5; 2; 5; 2	(in rows)
9; 5; 9	(in crosses and lines below)
3; 7; 3; 7; 3	(in columns)
2; 1; 4; 2; 5; 2; 4; 1; 2	(in diagonals; the pattern is symmetrical)

c) The learners use the number sequences and write number sentences to calculate the sum of the beads in each shape. In this way they get an opportunity to check whether the sequences are correct. They apply the associative property to calculate the sums and work with addition bonds of 28 and 23.

Parallelogram:
$7 + 7 + 7 + 7 = 4 \times 7$
$= 28$

$9 + 9 + 5 + 5 = (2 \times 9) + (2 \times 5)$
$= 18 + 10$
$= 28$

Crosses: $2 + 5 + 2 + 5 + 2 + 5 + 2 = (3 \times 5) + (2 \times 4)$
$= 15 + 8$
$= 23$

$9 + 5 + 9 = (2 \times 9) + 5$
$= 18 + 5$
$= 23$

$3 + 7 + 3 + 7 + 3 = (2 \times 7) + (3 \times 3)$
$= 14 + 9$
$= 23$

$2 + 1 + 4 + 2 + 5 + 2 + 4 + 1 + 2$
$= (4 + 1) + (4 + 1) + (4 \times 2) + 5$
$= 15 + 8$
$= 23$

d) The learners apply the distributive, associative and commutative properties, building up and breaking down numbers and addition and multiplication to calculate the total number of beads in the bracelet.

Number of beads in top and bottom rows: 128

Number of beads in small triangles: $6 \times 10 = 60$

Number of beads in large triangles: $7 \times 20 = 140$

Number of beads in sides of parallelograms:
$8 \times 28 = (8 \times 20) + (8 \times 8)$
$= 160 + 64$
$= 160 + 40 + 24$
$= 224$

Number of beads in crosses: $8 \times 23 = (8 \times 20) + (8 \times 3)$
$= 160 + 24$
$= 184$

Total number of beads:
$128 + 60 + 140 + 225 + 184$
$= (140 + 60) + (225 + 5) + (120 + 180) + (4 + 3)$
$= 200 + 230 + 300 + 7$
$= 737$ beads altogether

Did you know?

Learner's Book page 109

Work through this section with the learners. They should do research to find out which other numbers in the Levi jeans range are used to label pairs of jeans.

Activity 35.1

Learner's Book page 109

The learners now complete tables to explore the relationship between the shapes and the number of beads they consist of in question 1. Give them copies of the tables or use the template with blank tables in this Teacher's Guide. Let them explain to the class what they observe.
In question 2 they complete flow diagrams with function machines that relate to the numbers involved in the beadwork bracelet. Let them write the first 10 terms for the output numbers in each flow diagram. They discuss their solutions and strategies during class feedback.
You can use the blank templates of the tables and flow diagrams in the resources section.

1. a) The learners work with multiples of 10. The common differences between the input and output numbers are multiples of 9. The rule is: triangle number × 9 + triangle number. For example:
$1 \times 9 + 1 = 10$; $2 \times 9 + 2 = 20$ and so on.

Small triangle number	1	2	3	4	5	6	7
Number of beads	10	20	30	40	50	60	70

b) They work with multiples of 20. The common differences between the input and output numbers are multiples of 19. The rule is: triangle number × 19 + triangle number. For example:
$1 \times 19 + 1 = 20$, $2 \times 19 + 2 = 40$ and so on.

Big triangle number	1	2	3	4	5	6	7
Number of beads	20	40	60	80	100	120	140

c) The learners have to count in 28s. You can show them the following strategy involving compensation and the distributive property to do this:

$$\begin{aligned} 2 \times 28 &= (2 \times 30) - (2 \times 2) \\ &= 60 - 4 \\ &= 56 \end{aligned}$$

$$\begin{aligned} 3 \times 28 &= (3 \times 30) - (3 \times 2) \\ &= 90 - 6 \\ &= 84 \text{ and so on.} \end{aligned}$$

Encourage them to perform the above procedures mentally.

Parallelogram number	1	2	3	4	5	6	7	8
Number of beads	28	56	84	112	140	168	196	224

d) The learners work with multiples of 23. You can show them the following strategy involving compensation and the distributive property to do this:

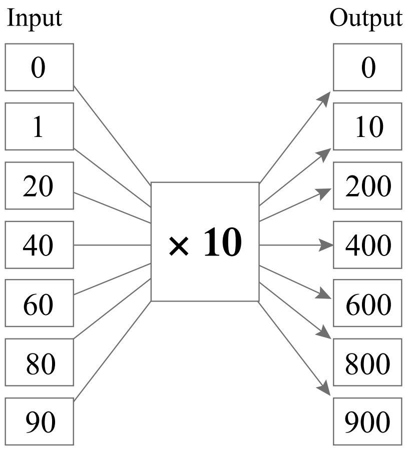
$$\begin{aligned} 2 \times 23 &= (2 \times 20) + (2 \times 3) \\ &= 40 + 6 \\ &= 46 \end{aligned}$$

$$\begin{aligned} 3 \times 23 &= (3 \times 20) + (3 \times 3) \\ &= 60 + 9 \\ &= 69 \end{aligned}$$

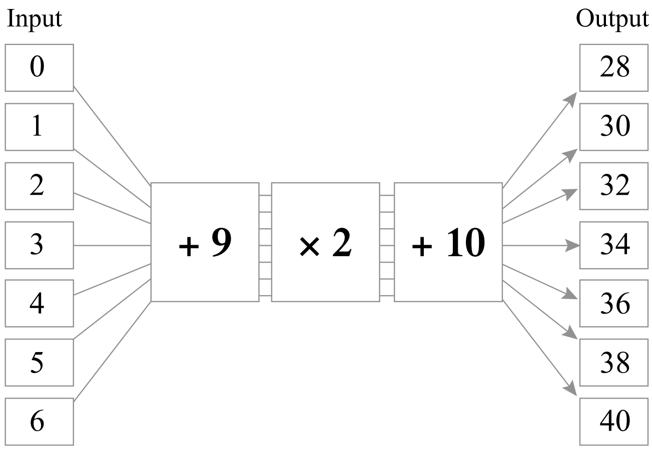
Encourage them to perform the above procedures mentally.

Crosses number	1	2	3	4	5	6	7	8
Number of beads	23	46	69	92	115	138	161	184

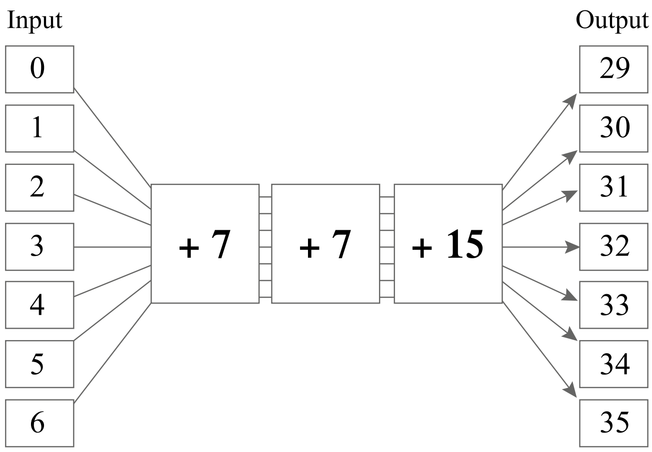
2. a)



b)



c)



3. **a)** 0; 10; 20; 30; 40; 50; 60; 70; 80; 90 (multiples of 10)
   b) 28; 30; 32; 34; 36; 38; 40; 42; 44; 46 (even numbers)
   c) 29; 30; 31; 32; 34; 35; 36; 37; 38; 39 (counting or natural numbers)

Unit 36 Multiplication strategies

MENTAL MATHS

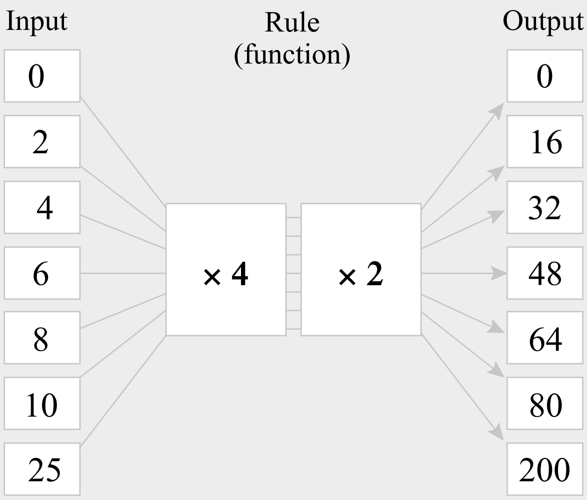
Learner's Book page 111

The learners work with flow diagrams and the sequences of the output numbers. They should realise that the functions × 4 × 2 and × 2 × 4 give the same results, i.e. applying the commutative property. They have to fill in input and output numbers, which will enhance and develop their understanding of the relationship between multiplication and division.

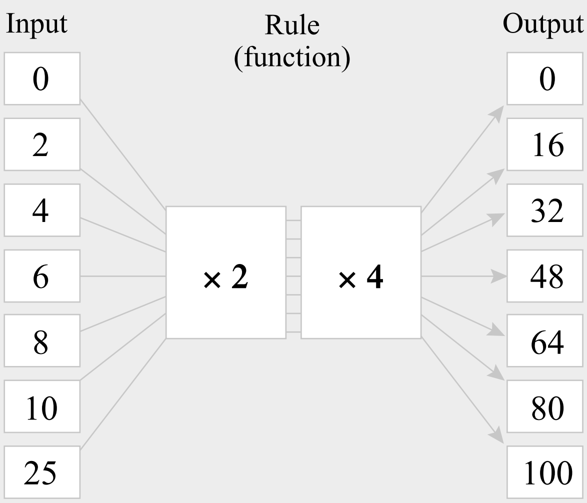
In (c) they work with inverse operations to find the input numbers, i.e. ÷ 4 ÷ 2. Let them explain their strategies and observations to the class.

In question 2 they write down the first 10 consecutive terms for the output numbers in each flow diagram.

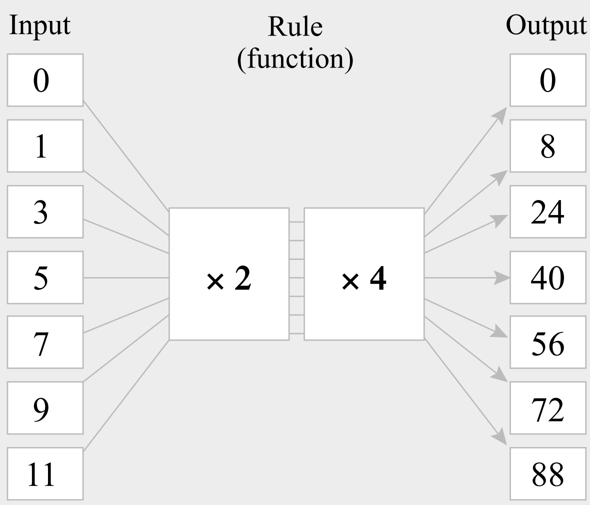
1. **a)**



b)



c)



2. **a)** $0 \times 4 \times 2 = 0$
$1 \times 4 \times 2 = 8$
$2 \times 4 \times 2 = 16$
$3 \times 4 \times 2 = 24$
. . . .
The sequence forms multiples of 8:
0; 8; 16; 24; 32; 40; 48; 56; 64; 72

b) The function $\times 2 \times 4$ is the same as $\times 4 \times 2$ in (a). The sequence will also form the multiples of 8.

3. You use the inverse operation for multiplication.

$0 \div 4 \div 2 = 0$

$8 \div 4 \div 2 = 1$

$24 \div 4 \div 2 = 3$

$40 \div 4 \div 2 = 5$

$56 \div 4 \div 2 = 7$

$72 \div 4 \div 2 = 9$

$88 \div 4 \div 2 = 11$

4. The functions have been swapped: $\times 4 \times 2$ and $\times 2 \times 4$, but they are the same because $4 \times 2 = 8$ and $2 \times 4 = 8$. You actually multiply and divide by 8 in all the flow diagrams to get the missing input and output numbers. The output numbers are therefore multiples of 8.

Activity 36.1

Learner's Book page 112

In this lesson, the learners work with flow diagrams involving functions that are equivalent. The learners should realise that they get the same output values for × 5 × 5; × 100 ÷ 4 and × 25, for example. Let them discuss their solutions.

1. a)

Number		Number × 5 × 5
0	→	0
1	→	25
2	→	50
3	→	75
4	→	100
5	→	125
6	→	150
7	→	175
8	→	200
9	→	225
10	→	250

b)

Number		Number × 100 ÷ 4
0	→	0
1	→	1 250
2	→	2 500
3	→	5 000
4	→	7 500
5	→	10 000
6	→	12 500
7	→	15 000
8	→	17 500
9	→	20 000
10	→	25 000

c)

Number		Number × 25
0	→	0
	→	50
	→	100
	→	200
	→	300
	→	400
	→	500
	→	600
	→	700
	→	800
	→	1 000

2. a)

Number		Number × 100
0	→	0
1	→	100
2	→	200
3	→	300
4	→	400
5	→	500
6	→	600
7	→	700
8	→	800
9	→	900
10	→	1 000

b)

Number		Number × 10 × 10
0	→	0
1	→	100
2	→	200
3	→	300
4	→	400
5	→	500
6	→	600
7	→	700
8	→	800
9	→	900
10	→	1 000

3. a)

Number	Number × 5 × 100
2	→ 1 000
4	→ 2 000
1	→ 500
5	→ 2 500
0	→ 0
3	→ 1 500
10	→ 5 000

b)

Number	Number × 2 × 25
5	→ 250
10	→ 500
0	→ 0
3	→ 150
1	→ 50
4	→ 200
2	→ 100

c)

Number	Number × 50
1	→ 50
4	→ 200
3	→ 150
0	→ 0
5	→ 250
2	→ 100
10	→ 500

Unit 37 Spot patterns

MENTAL MATHS

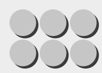
Learner's Book page 113

The learners explore arrays and the relationship between the number of dots in the rows and columns and the total number of dots. They complete function machines in which they have to find input and output values as well as functions.

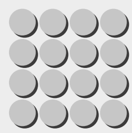
In question 1, learners should notice that the number of dots in a column × the number of dots in a row gives the sum of the dots in an array.

For question 2, you can give the learners copies of the blank function machines in the resources section if you wish.

1. a) Dots in a row: 3
   Dots in a column: 2
   Total number of dots: 2 × 3 = 6

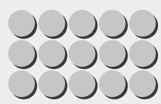


   b) Dots in a row: 4
   Dots in a column: 4
   Total number of dots: 4 × 4 = 16



   4 → × 4 → 16

   c) Dots in a row: 5
   Dots in a column: 3
   Total number of dots: 3 × 5 = 15



   5 → × 3 → 15

2. Some of the problems are open, i.e. the learners use their own input, output and functions.

a) 4 → × 4 → 16 b) 2 → × 8 → 16

c) 5 → × 5 → 25 d) 4 → × 7 → 28

e) 4 → × 5 → 20 f) 8 → × 4 → 32

Activity 37.1

Learner's Book page 114

The learners complete flow diagrams relating to the arrays they have worked with in the mental maths activity. They write the first terms for the sequence of square numbers and describe the relationship between the numbers.

In question 2 they explore the relationship between the planks and uprights in a fence. They have to develop rules for calculating the number of planks if they know the number of uprights. They complete the table by finding the number of planks for any number of uprights. They will observe that the numbers entail the sequence of multiples of 3. Ask the learners if they were able to find the rule for finding the number of planks (by not counting on in 3s).

Let them explore the two function machines in question 3. They should realise that both rules give the same output values. They use both rules to calculate the number of planks (outputs) for any number of uprights (inputs).

In question 4, the learners use one of the rules to find the number of planks for the given number of uprights. The input numbers involve multiples of 5 and 10. You should draw learners' attention to the fact that the rule for performing the correct order of operations does not apply here.

In question 5, they use the inverse operations for one of the rules to calculate the number of uprights for the given number of planks. The input numbers involve multiples of 10 and 30. They apply knowledge of addition, multiplication and division with 3-digit by 1-digit numbers to solve the calculations.

You can use copies of the blank function machines in the resources section if necessary.

1. a)

Array	Number of dots in row	Number of dots in column	Total number of dots
A	1	1	1
B	2	2	4
C	3	3	9
D	4	4	16
E	5	5	25
F	6	6	46
G	7	7	49
H	8	8	64

b) 1; 4; 9; 16; 25; 36; 49; 64; 81; 100

c) Square numbers

d) The numbers are created by multiplying the same natural numbers by itself. The answer is a square number. For example, $1 \times 1 = 1$; $2 \times 2 = 4$; $3 \times 3 = 9$ and so on. The common differences are consecutive odd numbers.

2. a) The learners have not established a rule to calculate the number of uprights for the given number of planks. They therefore use the drawing and visualise the extension of the fence to find the number of planks if there are 10 uprights. You could also ask them to draw the extension so that they could find the relationship. They make a list up to the 10th upright and count in multiples of 3:

2 uprights = 3 planks
3 uprights = 6 planks
4 uprights = 9 planks
5 uprights = 12 planks
6 uprights = 15 planks
7 uprights = 18 planks
8 uprights = 21 planks
9 uprights = 24 planks
10 uprights = 27 planks

b) Table:

Number of uprights	1	2	3	4	5	6	7	8	9	10	20	50
Number of planks	0	3	6	9	12	15	18	21	24	27	57	147

c) Multiples of 3

d) If the number of uprights = 10, the number of planks are:
$(3 \times 10) - 3$
$= 30 - 3$
$= 27$
The rule is: $3 \times$ number of uprights $- 3$

3.

	uprights			planks
a)	1	–1	× 3	0
b)	2	–1	× 3	3
c)	3	–1	× 3	6
d)	4	–1	× 3	9
e)	5	–1	× 3	12
f)	9	–1	× 3	24
g)	10	–1	× 3	27
h)	12	–1	× 3	33
i)	15	–1	× 3	42
j)	20	–1	× 3	57

4. a)	25 – 1	24 × 3	→	72	planks
b)	50 – 1	49 × 3	→	147	planks
c)	75 – 1	74 × 3	→	222	planks
d)	100 – 1	99 × 3	→	297	planks
e)	125 – 1	124 × 3	→	372	planks
f)	180 – 1	149 × 3	→	447	planks
g)	200 – 1	199 × 3	→	597	planks

5. a)	60 ÷ 3 + 1 = 21	60 + 3 ÷ 3 = 21
b)	90 ÷ 3 + 1 = 31	90 + 3 ÷ 3 = 31
c)	120 ÷ 3 + 1 = 41	120 + 3 ÷ 3 = 41
d)	150 ÷ 3 + 1 = 51	150 + 3 ÷ 3 = 51
e)	180 ÷ 3 + 1 = 61	180 + 3 ÷ 3 = 61
f)	210 ÷ 3 + 1 = 71	210 + 3 ÷ 3 = 71
g)	240 ÷ 3 + 1 = 81	240 + 3 ÷ 3 = 81

Unit 38 Using rules

MENTAL MATHS

Learner's Book page 115

Ask the learners to record the solutions in this activity on their mental maths grid. As they complete the flow diagrams they will become aware that although the order of the operations in the function changes but the output values are still counting or natural numbers.

In question 1 the inputs are non-multiples of 3 but the intervals have a difference of 3.

In question 2 the inputs are multiples of 3. Ask the learners to share their solutions and to write down the first ten sequences for the input values.

1.

number	→	(number + 2) ÷ 3
1	→	1
4	→	2
7	→	3
10	→	4
13	→	5

2.

number	→	number ÷ 3 + 2
30	→	12
27	→	11
24	→	10
21	→	9
18	→	8

Activity 38.1

Learner's Book page 116

Ask the learners to investigate and describe the arrangement and relationship between the diamonds and pearls in the necklace.
In question 2 they complete the table in question 2. Let them describe the sequence for the number of diamonds, i.e. even

numbers or multiples of 2. They have to use a rule to find the number of diamonds if there are 100 pearls, i.e. 100 × 2 – 2 = 198. The learners complete the function machine in question 3, which is number of pearls × 2 – 2 = number of diamonds. They use multiples of 5 and 10 as input numbers to calculate the number of diamonds. In question 4 they use the inverse operations to calculate the number of pearls with multiples of 10 representing the number of diamonds.

1. The learners should observe that there are 2 pearls between 2 diamonds. But they could also reason that there are 4 pearls for every 3 diamonds or 4 diamonds for every 6 pearls. They apply knowledge of ratio to describe the relationships.

number of pearls	2	3	4	5	6	7	8	9	10
number of diamonds	1	2	2	3	4	5	5	6	6

2.

Pearls	2	3	4	5	6	7	8	9	10
Diamonds	2	4	6	8	10	12	14	16	18

a) even numbers
b) Learners might try to use the smaller numbers first to investigate the rule.
2 × 2 – 2 = 2
3 × 2 – 2 = 4
Pearls → 100 × 2 – 2 → 198 diamonds

3. diamonds → × 2 → – 2 → pearls

Learners use the inverse operations to calculate the number of diamonds for the given number of pearls. Ask them to write the sequence for the output numbers and to describe the relationship between the numbers. They should observe that you count in 5s from non-multiples of 5. The 6 and 1 in the units alternate.

a) 10 + 2 ÷ 2 = 6 **b)** 20 + 2 ÷ 2 = 11
c) 30 + 2 ÷ 2 = 16 **d)** 40 + 2 ÷ 2 = 21
e) 50 + 2 ÷ 2 = 26 **f)** 60 + 2 ÷ 2 = 31
g) 70 + 2 ÷ 2 = 36 **h)** 80 + 2 ÷ 2 = 41

4. number of pearls → + 2 → ÷ 2 → number of diamonds

a) 11 **b)** 16 **c)** 21 **d)** 26
e) 31 **f)** 36 **g)** 41 **h)** 46

Did you know?

Learner's Book page 116

Go through the information in this section with the learners. They extend their general mathematical knowledge by learning about the Fibonacci series and Lucas numbers. Ask them to extend the sequence with Lucas numbers and to describe what they observe.

1; 3; 4; 7; 11; 18; 29; 47; 76

In both sequences you add the previous two numbers to get the next term.

1. Complete the flow diagrams.

a)

number		number × 10 ÷ 2
0	→	■
5	→	■
10	→	■
15	→	■
20	→	■
25	→	■
30	→	■
35	→	■

b)

number		number × 2 × 5
0	→	■
2	→	■
■	→	40
■	→	60
■	→	80
30	→	■
50	→	■
100	→	■

2. Fill in the next three terms in each sequence.
   - **a)** 1; 3; 5; 7; ■; ■; ■
   - **b)** 2; 4; 6; 8; ■; ■; ■
   - **c)** 3; 6; 9; ■; ■; ■
   - **d)** 195; 200; 205; ■; ■; ■
   - **e)** 1; 4; 9; 16; ■; ■; ■

3. What do we call the numbers in the sequences (a) to (d) above? Write the names next to each sequence.

4. Here are four function machines.

   × 4 → − 1 → ÷ 2 → + 3 →

   a) You need two of the machines to complete the table below. Choose the correct machines and complete the table.

Input		Output
2	→	7
3	→	11
10	→	39
6	→	
9	→	
7	→	
1	→	
8	→	
20	→	
100	→	

   b) Write down the rule that you used to complete the table.

5. Write down the opposite (inverse) operations for the following:
   - **a)** Divide by 4.
   - **b)** Subtract 2.
   - **c)** Add 7.
   - **d)** Multiply by 9.

6. The first term of a sequence is 2. The rule for creating the sequence is → × 4 → − 2 →
   - **a)** Write down the first 6 terms of the sequence.
   - b) What if the first term is 1? Write down the first 5 terms for the sequence.

1. a)

number		number $\times 10 \div 2$
0	→	0
5	→	25
10	→	50
15	→	75
20	→	100
25	→	125
30	→	150
35	→	175

b)

number		number $\times 2 \times 5$
0	→	0
2	→	20
4	→	40
6	→	60
8	→	80
30	→	300
50	→	500
100	→	1 000

Questions 2 and 3

a) 1; 3; 5; 7; 9; 11; 13 Uneven or odd numbers
b) 2; 4; 6; 8; 10; 12; 14 Even numbers or multiples of 2
c) 3; 6; 9; 12; 15; 18 Multiples of 3
d) 195; 200; 205; 210; 215; 220 Multiples of 5
e) 1; 4; 9; 16; 25; 36; 49 Square numbers

4. a) $\times 4$ → -1

Input		Output
2	→	7
3	→	11
10	→	39
6	→	**23**
9	→	**35**
7	→	**27**
1	→	**3**
8	→	**31**
20	→	**79**
100	→	**399**

b) Rule → $\times 4 - 2$

5. a) Divide by 4 Multiply by 4
b) Subtract 2 Add 2
c) Add 7 Subtract 7
d) Multiply by 9 Divide by 9

6. a) 2; **6; 22; 86; 342; 1 366; 5 462**
b) 1; **2; 6; 22; 86; 342**

TERM 2

Whole numbers

Learner's Book page 118

Counting, ordering, comparing, representing and place value

Remind the learners that they were introduced to 6- and 7-digit numbers in Grade 5. This term they will work with the place value of numbers up to millions, which will extend to 9-digit numbers.

To introduce the lesson, write a few 6- and 7-digit numbers on the board and let them try to read the numbers. Then ask them to give examples of where in real life really large numbers are used. Ask them why it is important to know how to use large numbers and what they think they can buy with R1 million.

Unit 1 Place value of large numbers

MENTAL MATHS

Learner's Book page 118

Remind the learners that they have worked with 7-digit cell phone numbers in Term 1. Ask them to read the 7-digit numbers. They will find that it is difficult to read the numbers without spaces between hundreds and thousands and hundred thousands and millions.

Ask them how they can use spaces to help them to read the numbers more easily. Let them read the numbers with the spaces in question 2. Use your cell phone and let some of the learners try to read a few of your contact numbers. They should know that cell phone numbers consist of 10 digits, for example 0845632145. Write the number on the board. Ask them what they think the first three numbers indicate. You can continue this discussion in the Technology lesson.

Let them write the numbers on the cell phones in question 3 on the board. They erase the first three digits and then rewrite the numbers with the necessary spaces. Let them read the numbers aloud.

In question 4 they practise writing the numbers in words

Learners with reading barriers might find writing large numbers in words difficult and will need assistance.

Activity 1.1

Learner's Book page 119

In the first term, the learners worked with the place value table up to millions. In this activity they will do some revision of place value. In question 1 they read the number in the table aloud as a class. Make sure everyone gets it right.

In question 2 they have to copy the table and fill in the 7-digit numbers in question 4 of the mental maths section of this unit. First draw the table on the board and ask them to help you to fill in one or two of the numbers as examples.

Ask them to create their own numbers and write them in the table. In question 2 they work with numbers in expanded notation. The learners should not find this difficult because it is only the millions that are added and they have worked with place values up to 100 000 before.

In question 3 they fill in the missing values of numbers in expanded notation.

In question 4 they expand money amounts and in question 5 they use knowledge of place value to find how many powers of 10 are in multiples of hundred thousands and millions.

In question 6 they write numbers for expanded notations and in 7 the learners provide the value of underlined digits. The knowledge that learners develop about the concept of place value in this lesson is needed for solving problems in some annual standardised tests.

1.

	M	Hth	Tth	Th	H	T	U
	1 000 000	**100 000**	**10 000**	**1 000**	**100**	**10**	**1**
5 464 203	5	4	6	4	2	0	3
1 437 678	1	4	3	7	6	7	8
6 221 354	6	2	2	1	3	5	4
7 145 100	7	1	4	5	1	0	0
5 006 283	5	0	0	6	2	8	3

2. **a)** 1 111 = 1 000 + 100 + 10 + 1
   b) 22 222 = 20 000 + 2 000 + 200 + 20 + 2
   c) 333 333 = 300 000 + 30 000 + 3 000 + 300 + 30 + 3
   d) 4 444 444
   = 4 000 000 + 400 000 + 40 000 + 4 000 + 400 + 40 + 4
   e) 5 555 555
   = 5 000 000 + 500 000 + 50 000 + 5 000 + 500 + 50 + 50 + 5
   f) 7 777 777
   = 7 000 000 + 700 000 + 70 000 + 7 000 + 700 + 70 + 7
   g) 3 534 263
   = 3 000 000 + 500 000 + 30 000 + 4 000 + 200 + 60 + 3
   h) 567 891 = 500 000 + 60 000 + 7 000 + 800 + 90 + 1
   i) 2 435 671
   = 2 000 000 + 400 000 + 30 000 + 5 000 + 600 + 70 + 1
   j) 3 678 542
   = 3 000 000 + 600 000 + 70 000 + 8 000 + 500 + 40 + 2

3. **a)** 942 = 2 + 40 + **900**
   b) 5 316 = 10 + 300 + **5 000 + 6**
   c) 27 529 = 500 + 9 + **20 + 7 000 + 20 000**

d) 132 587 = 30 000 + 7 + 2 000 + **100 000 + 500 + 80**

e) 6 453 178
= 100 + 70 + **8 + 3 000 + 50 000 + 400 000 + 6 000 000**

f) 702 = **700 + 2**

g) 1 090 = **1 000 + 90**

h) 20 640 = **20 000 + 600 + 40**

i) 401 101 = **400 000 + 1 000 + 100 + 1**

j) 3 280 002 = **3 000 000 + 200 000 + 80 000 + 2**

4. **a)** R948: 9 R100 notes + 4 R10 notes + 1 R5 coin + 3 R1 coin
b) R1 550: 15 R100 notes + 5 R10 notes
c) R725: 7 R100 notes + 2 R10 notes + 1 R5 coin
d) R2 679: 26 R100 notes + 7 R10 notes + 1 R5 coin + 4 R1 coin
e) R676: 6 R100 notes + 7 R10 notes + 1 R5 coin + 1 R1 coin

5. **a)** 10 **b)** 100 **c)** 10 **d)** 100
e) 100 **f)** 2 000 **g)** 100 000 **h)** 20 000
i) 2 000 **j)** 400

6. **a)** 9 + 2 000 + 800 = 2 809
b) 600 + 50 000 + 8 + 400 000 + 7 + 3 000 + 6 000 000
= 6 453 615
c) 4 000 + 100 000 + 3 000 000 + 200 + 2 + 80 000
= 3 184 202
d) 14 000 + 20 + 410 + 2 100 000 + 120 000 + 15 = 2 234 445
e) 18 + 310 + 3 700 + 35 000 = 39 028

7. Write the value of the underlined digits in each number below.
a) $\underline{5}6\underline{7}$ → 500; 7
b) $\underline{7}\ \underline{2}04$ → 7 000; 200
c) $\underline{5}1\ 9\underline{2}8$ → 50 000; 20
d) $\underline{2}3\underline{4}\ 007$ → 200 000; 4 000
e) $\underline{7}\ \underline{8}02\ 412$ → 7 000 000; 800 000

Learner's Book page 121

Multiplication

Tell the learners that they practised the multiplication tables to develop basic multiplication skills in Grades 4 and 5. They should realise that it is important to know the multiplication tables by heart, because they apply this knowledge in most topics in mathematics, for example in whole numbers, patterns and measurement. They have also multiplied numbers up to 3 digits by 2 digits. This year they will multiply numbers up to 4 digits by 3 digits. Tell them they will start practising some basic calculation facts first.

Unit 2 Multiplication with whole numbers

MENTAL MATHS

Learner's Book page 121

Let the whole class play the *I have* ... basic operations game.

In question 2 the learners have to find out which money amounts are represented by the expanded notation. They should explain their strategies to the class. They use effective calculation strategies, including brackets and multiplication by multiples of 10, for example:

(6 × R200) + (7 × R2) + (5 × R10) =

2. The learners use breaking up and building up numbers and the associative property.

a) (6 × R200) + (7 × R2) + (5 × R10)
= 1 200 + 50 + 10 + 4
= 1 264

b) (8 × R1) + (8 × R2) + (4 × R200) + (3 × R50)
= 8 + 16 + 800 + 150
= 800 + 100 + 50 + 10 + 10 + 4
= R974

c) (4 × R200) + (9 × R1) + (6 × R100) + (5 × R5)
= 800 + 9 + 600 + 25
= 800 + 200 + 400 + 25 + 5 + 4
= R1 434

d) (12 × R2) + (6 × R5) + (7 × R1)
= 24 + 30 + 7
= 30 + 20 + 7 + 3 + 1
= R61

e) (7 × R50) + (3 × R200) + (6 × R100)
= 350 + 600 + 600
= 600 + 400 + 200 + 350
= R1 550

Activity 2.1

Learner's Book page 121

The learners practise multiplication by multiples of 10 up to 100 000s. They complete flow diagrams (see resources section) in question 1 with functions involving double and single operators to find that outputs for × 2 × 10 and × 20 are the same.

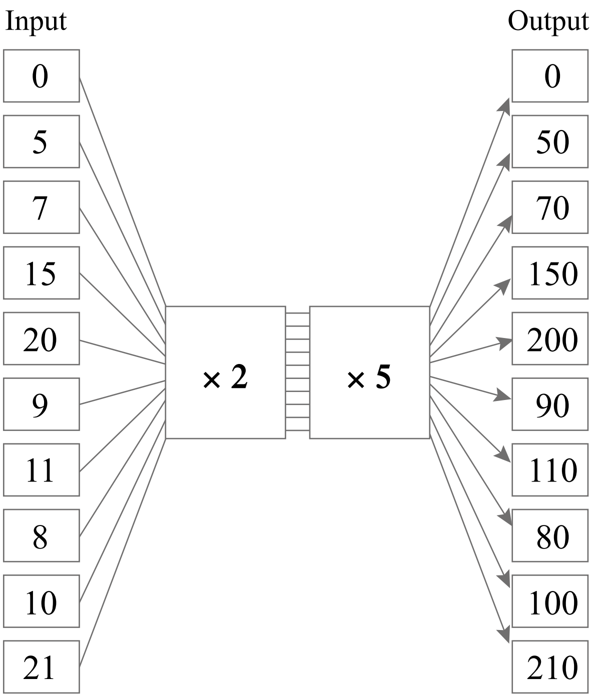
In question 2 learners apply knowledge of basic multiplication skills and the distributive property. They should recall that 40 × 80 = (4 × 10) × (8 × 10), which is equivalent to 4 × 8 × 100, for example. They also apply the inverse operation to determine the multiplicands in equations. The activity should assist learners in making sense of the general rule that you add or take away zeros when you multiply or divide by multiples and powers of 10.

In question 3 they use doubling and halving in tables and in question 4 and 5 they use the context of area to perform and determine the best estimations. Tell them to calculate the accurate solutions using a calculator and to evaluate their estimates against these to find how accurate their estimations have been.

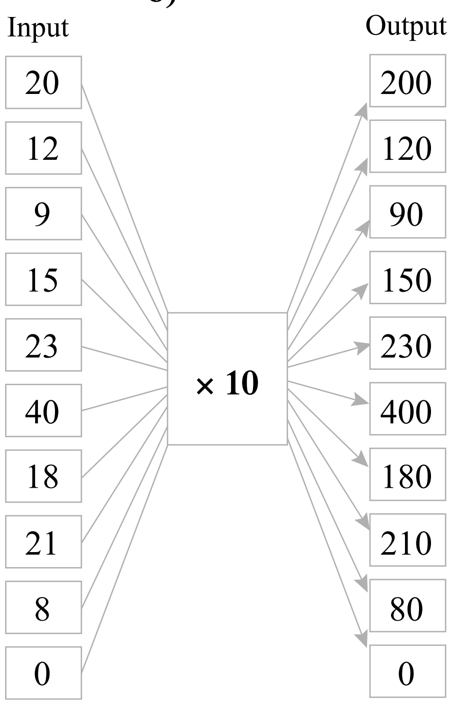
Learners should understand that estimation skills are not applied in isolation. They should use estimation skills in all activities to determine the size of numbers in solutions they expect to problems in different mathematical topics. Allow learners to share their solutions with the class.

In question 7, the learners make a table as shown in the solution below, to do their comparisons and record differences between the accurate solutions and the estimates. They do not use calculators. Ask them to decide if their estimates are good, and, if not, how they could make them more effective. They could, for example, reason that it might be better to round off 17 × 27 to the nearest 5, which is 15 × 25 = 375. The difference would then be 84 instead of 141. If you round off 2 821 × 34 to the nearest 100 and the nearest 5, you get 2 800 × 35 = 98 000. The difference is then 2 086 instead of 11 314. The learners should realise that the smaller the difference the more effective the estimate.

1. a)



b)



c)

Input		Output
17		340
25		500
21		420
9		180
0	× 2 → × 10	0
14		280
8		160
27		540
30		600
28		560

d)

Input		Output
0		0
28		560
25		500
30		600
21	× 20	420
27		540
8		160
14		280
9		280
17		340

e)

Input		Output
6		300
9		450
70		3 500
8		400
0	× 5 → × 10	0
4		200
25		1 250
31		1 550
22		1 100
7		350

f)

Input		Output
7		350
6		300
22		1 100
9		450
31	× 50	1 550
70		3 500
0		0
4		200
25		1 250
8		400

2. **a)** $40 \times 80 = 32 \times 100$
$= 3\ 200$

b) $90 \times 60 = 54 \times 100$
$= 5\ 400$

c) $70 \times 30 = 21 \times 100$
$= 2\ 100$

d) $50 \times 90 = 45 \times 100$
$= 4\ 500$

e) $60 \times 80 = 48 \times 100$
$= 4\ 800$

f) $7 \times 300 = 31 \times 100$
$= 3\ 100$

g) $9 \times 400 = 36 \times 100$
$= 3\ 600$

h) $300 \times 8 = 24 \times 100$
$= 2\ 400$

i) $\blacksquare \times 7 = 4\ 900 \rightarrow 4\ 900 \div 7 = 49 \div 7 \times 100$
$= 700$

j) ■ × 6 = 3 600 → 3 600 ÷ 6 = 36 ÷ 6 × 100
= 600

k) 8 × ■ = 320 000 → 320 000 ÷ 8 = 32 ÷ 8 × 10 000
= 40 000

l) 5 × ■ = 350 000 → 350 000 ÷ 5 = 35 ÷ 5 × 10 000
= 70 000

m) ■ × 200 = 16 000 → 16 000 ÷ 200 = 16 000 ÷ 100 ÷ 2
= 160 ÷ 2
= 80

n) ■ × 40 = 200 000 → 200 000 ÷ 40 = 200 000 ÷ 10 ÷ 4
= 20 000 ÷ 4
= 5 000

o) 400 000 × 20 = ■ → 4 × 2 × 100 000 = 8 × 100 000
= 800 000

3. a)

	25	150	75	300	750	250	125	50
double	50	300	150	600	1 500	500	250	100

b)

	700	900	80	60	1 500	800	2 500	750
halve	350	450	40	30	750	400	1 250	375

4. a) 22 × 29 = ■ D. 20 × 30 = 600
b) 17 × 27 = ■ B. 20 × 30 = 600
c) 32 × 49 = ■ A. 30 × 50 = 1 500
d) 47 × 53 = ■ B. 50 × 50 = 2 500
e) 234 × 65 = ■ D. 230 × 70 = 16 100
f) 376 × 73 = ■ A. 380 × 70 = 26 600
g) 2 821 × 34 = ■ D. 2 820 × 30 = 84 600
h) 3 201 × 91 = ■ C. 3 200 × 90 = 288 800

5. a) 638 b) 459
c) 1 568 d) 2 491
e) 15 210 f) 27 448
g) 95 914 h) 291 291

6.

	Expressions	Accurate solutions	Estimates	Differences
a)	22 × 29	638	600	38
b)	17 × 27	459	600	141
c)	32 × 49	1 568	1 500	68
d)	47 × 53	2 491	2 500	9
e)	234 × 65	15 210	16 100	890
f)	376 × 73	27 448	26 600	848
g)	2 821 × 34	95 914	84 600	11 314
h)	3 201 × 91	291 291	288 800	2 491

Did you know?

Learner's Book page 124

Tell the learners that they have worked with multiples of 10 in this lesson. Ten is a number that we work with almost intuitively because we have 10 fingers (digits) and 10 toes.

Tell them that they will learn more about decimal fractions later. They use a dictionary, books or the Internet to find out what a decagon (a 10-sided shape), a decapod (a crab with 10 legs) and a Decalogue (the biblical name for the Ten Commandments) are.

Unit 3 Multiplication facts

MENTAL MATHS

Learner's Book page 124

Tell the learners they will now start working with multiplication tables up to 12 × 12. Let them write out the 3×, 6× and 12× tables. They complete the tables and talk about the relationships they observe. They should notice that the 6 × table is double the 3× table and the 12× table is double the 6× table. They write down the 7× table up to 12 × 7 and explore the patterns in the solutions. The learners also complete number sentences requiring solutions to multiplication by zero and 1 to develop the rules that any number multiplied by zero is zero, and a number multiplied by 1 remains the same. They also apply the commutative property.

For your information, zero is the identity element for addition because $0 + a = a$; and $a + 0 = a$ for all a, so that $0 + a = a - 0$. Learners should develop the rule that, for example $0 + 10 = 10$ and $10 + 0 = 10$, so $0 + 10 = 10 - 0$. An identity element is a number that ensures validity of variables in common sets to create the equality of expressions even when the law of commutativity is applied. Zero is not an identity element for subtraction because $0 - a = -a$; and $a - 0 = a$, so that $0 - a \neq a - 0$. In multiplication, $0 \times a = 0$ and $a \times 0 = 0$ resulting in $0 \times a = a \times 0$, and for division $0 \div a = 0$ and $a \div 0 =$ undefined so that $0 \div a \neq a \div 0$. Zero is not an identity element for multiplication although it has a unique and general application in multiplication, because whenever you multiply a number by zero the result is always zero. The acceptance of the identity elements gives meaning to the idea of an inverse. The number –2 is the additive inverse of 2 because their sum is 0. Two numbers resulting in a sum of zero are additive inverses of each other, i.e. $-2 + 2 = 0$. Two numbers resulting in a product of one are multiplicative inverses of each other. Since $4 \times \frac{1}{4} = 1$, $\frac{1}{4}$ is the multiplicative inverse of 4, and vice versa. Zero is therefore the additive inverse for addition but not for subtraction.

Zero presents a problem in the operation of division. Since zero multiplied by any number is zero, i.e. $n \times 0 = 0$, zero divided by zero, i.e. $0 \div 0$, may be any number. Thus, $0 \div 0$ is called an indeterminate symbol because it may be the name for any number. In fact, $n \div 0 =$ is impossible for all numbers, including $n = 0$. The learners will learn about division by zero as a divisor at their level later during this term.

As enrichment, tell the learners that they can count from 1 to 12 on one hand, using the thumb as an indicator. They could extend this fact by using the 10 fingers to count in multiples of 3 and 6 up to 30.

1. a)

$0 \times 3 = 0$	$0 \times 6 = 0$	$0 \times 12 = 0$
$1 \times 3 = 3$	$1 \times 6 = 6$	$1 \times 12 = 12$
$2 \times 3 = 6$	$2 \times 6 = 12$	$2 \times 12 = 24$
$3 \times 3 = 9$	$3 \times 6 = 18$	$3 \times 12 = 36$
$4 \times 3 = 12$	$4 \times 6 = 24$	$4 \times 12 = 48$
$5 \times 3 = 15$	$5 \times 6 = 30$	$5 \times 12 = 60$
$6 \times 3 = 18$	$6 \times 6 = 36$	$6 \times 12 = 72$
$7 \times 3 = 21$	$7 \times 6 = 42$	$7 \times 12 = 84$
$8 \times 3 = 24$	$8 \times 6 = 48$	$8 \times 12 = 96$
$9 \times 3 = 27$	$9 \times 6 = 54$	$9 \times 12 = 108$
$10 \times 3 = 30$	$10 \times 6 = 60$	$10 \times 12 = 120$
$11 \times 3 = 33$	$11 \times 6 = 66$	$11 \times 12 = 132$
$12 \times 3 = 36$	$12 \times 6 = 96$	$12 \times 12 = 144$

2.

$0 \times 7 = 0$	$1 \times 7 = 7$	$2 \times 7 = 1\underline{4}$
$3 \times 7 = 2\underline{1}$	$4 \times 7 = 2\underline{8}$	$5 \times 7 = 3\underline{5}$
$6 \times 7 = 4\underline{2}$	$7 \times 7 = 4\underline{9}$	$8 \times 7 = 5\underline{6}$
$9 \times 7 = 6\underline{3}$	$10 \times 7 = 7\underline{0}$	$11 \times 7 = 7\underline{7}$
$12 \times 7 = 8\underline{4}$		

3. **a)** $12 \times 0 = 0$ $0 \times 12 = 0$
b) $11 \times 0 = 0$ $0 \times 11 = 0$
c) $10 \times 0 = 0$ $0 \times 10 = 0$
d) $5 \times 1 = 5$ $1 \times 5 = 5$
e) $50 \times 1 = 50$ $1 \times 50 = 50$
f) $1 \times 12 = 12 \times 1 = 12$

Activity 3.1

Learner's Book page 125

Learners have learned short cuts to multiply by 11 and 99 in Grades 4 and 5. In this lesson they will continue to use short cuts to multiply by 11. Ask them if they remember how to do 23×11 without calculating. They have to separate the 2 and 3, and insert the sum of the digits between the two digits so that $23 \times 11 = 253$ and $52 \times 11 = 572$. They find out if the rule is constant for 2-digit numbers requiring carrying and 3-digit numbers $\times$ 11. They will discover various interesting patterns in the process.

In question 1 they copy and complete the 11× table. In question 2 they multiply 2-digit numbers by 11 without carrying to get, for example, 61 × 11 = 671. Ask them what they think 78 × 11 will be – 7 158 as in the first cases? Let them check on a calculator: 78 × 11 = 858. Ask the learners to find out how the digits relate. You still add the two digits but carry the tens to the hundreds.

In question 4 they multiply 11 by 3-digit numbers. Ask them what they think 152 × 11 will be, and to look for a relationship between the digits. For example: 152 × 11 = 1 672; use the 2 as the unit, 7 is the sum of 5 and 2, then add 1 to 15 to get 16.

In question 5 they find out that × 11 is the same is × 10 × 1. They use the distributive property and the strategy to solve the problems.

In question 6 they explore the solutions to find the pattern for multiplying 11 by numbers with 3, 4, 5 and 6 in the hundreds place. You can extend the activity by asking the learners to explore patterns when they multiply 11 by, for example, 713, 823 and 912, and then go on to multiplying 4-digit numbers by 11 to explore the pattern. Ask the learners to check their solutions by multiplying by 10 and 1. The concept integrates with number patterns and develops learners' sense of pattern-seeking.

1. 0 × 11 = 0
1 × 11 = 11
2 × 11 = 22
3 × 11 = 33
4 × 11 = 44
5 × 11 = 55
6 × 11 = 66
7 × 11 = 77
8 × 11 = 88
9 × 11 = 99
10 × 11 = 110
11 × 11 = 121
12 × 11 = 132

2. **a)** **(i)** 34 × 11 = 374 3[3+4]4
(ii) 45 × 11 = 495
(iii) 27 × 11 = 297
(iv) 81 × 11 = 891
(v) 90 × 11 = 990
(vi) 22 × 11 = 242
(vii) 25 × 11 = 275
(viii) 33 × 11 = 363
(ix) 53 × 11 = 583
(x) 61 × 11 = 671

b) Class discussion

c) Class discussion

3. **a)** 88 × 11 = 968 8 + 8 = 16 [8 + 1]68
b) 57 × 11 = 627
c) 49 × 11 = 539
d) 96 × 11 = 1 056
e) 79 × 11 = 869
f) 74 × 11 = 814
g) 99 × 11 = 1 089
h) 77 × 11 = 847
i) 68 × 11 = 748
j) 59 × 11 = 649

4. **a)** **(i)** 152 × 11 = 1 672 [15 + 1][5 + 2]2
(ii) 124 × 11 = 1 364 [12 + 1][2 + 4]1
(iii) 116 × 11 = 1 276
(iv) 133 × 11 = 1 463
(v) 144 × 11 = 1 584

b) Learners explore and discuss the strategy.

c) **(i)** 152 × 11 = (152 × 10) + (152 × 1)
= 1 520 + 152
= 1 500 + 150 + 22
= 1 672

(ii) 124 × 11 = (124 × 10) + (124 × 1)
= 1 240 + 124
= 1 364

(iii) 116 × 11 = (116 × 10) + (116 × 1)
= 1 160 + 116
= 1 276

(iv) 133 × 11 = (133 × 10) + (133 × 1)
= 1 330 + 133
= 1 463

(v) 144 × 11 = (144 × 10) + (144 × 1)
= 1 440 + 144
= 1 584

5. Learners explore and discuss patterns and solutions. They should notice the following relationships:

231 × 11 = 2 541	[23 + 2][3 + 1]1
245 × 11 = 2 695	[24 + 2][4 + 5]5
314 × 11 = 3 454	[31 + 3][1 + 4]4
321 × 11 = 3 531	[32 + 3][2 + 1]1
442 × 11 = 4 862	[44 + 4][4 + 2]2
432 × 11 = 4 752	[43 + 4][3 + 2]2

When the number has 2 hundreds you add 2 to get the H's and T's digits; add the T's and U's digits to get the T's digit; the U's digit remains the same.

When the number has 3 hundreds you add 3 to get the H's and T's digits and proceed as above.

When the number has 4 hundreds you add 4 to get the H's and T's digits and proceed as above.

6. a) 242 × 11 = 2 662 b) 253 × 11 = 2 783
c) 335 × 11 = 3 685 d) 362 × 11 = 3 982
e) 423 × 11 = 4 653 f) 435 × 11 = 4 785
g) 521 × 11 = 5 731 h) 544 × 11 = 5 984
i) 623 × 11 = 6 853 j) 614 × 11 = 6 754

7. Learners check the solutions above by multiplying by 10 and 1, for example:

$242 \times 11 = 2\,662 \rightarrow (242 \times 10) + (242 \times 1) = 2\,420 + 242$
$= 2\,662$

Unit 4 Multiplication patterns

MENTAL MATHS

Learner's Book page 126

The learners continue to demonstrate their knowledge of the multiplication tables. They record solutions on their Mental Maths grid and have a discussion about the patterns they observe in solutions. They multiply, for example, 5 × 6 = 30 and 6 × 6 = 36. The learners should notice that you can add 6 to 30 to get the solution to 6 × 6. They should apply this knowledge to multiplication by 12 without calculating.

1. a) 5 × 6 = 30
b) 6 × 6 = 36 (30 + 6)
c) 7 × 8 = 56
d) 8 × 8 = 64 (56 + 8)
e) 6 × 9 = 54
f) 7 × 9 = 63 (54 + 9)
g) 5 × 7 = 35
h) 6 × 7 = 42 (35 + 7)
i) 5 × 12 = 60
j) 6 × 12 = 72 (60 + 12)

2. Learners discuss observations.

3. a) 4 × 12 = 48
5 × 12 = 60 (48 + 12)
b) 6 × 12 = 72
7 × 12 = 84 (72 + 12)
c) 8 × 12 = 96
9 × 12 = 108 (96 + 12)
d) 2 × 12 = 24
3 × 12 = 36 (24 + 12)
e) 11 × 12 = 121
12 × 12 = 132 (121 + 12)

Activity 4.1
Learner's Book page 127

Tell the learners that they will explore patterns in multiplication by 12 as they did for 11 in the previous lesson. They will look for and discuss patterns and relationships so that they can use short cuts instead of doing calculations when multiplying by 12. Ask them to look at the given strategy. They apply the strategy to solve multiplication of 2-digit numbers by 12.

In question 1, learners should realise that it is just 14 × 12 that could be solved using the strategy in the example box. The rest of the problems involve carrying. In problems (b) to (f) they should multiply by 10 to get the accurate solutions. For problems with multiplicands between 20 and 30 the rule changes completely. They multiply the units by 12 and 12 by 20 and then get the sum of the products. For multiplying 12 by multiplicands between 30 and 40 you multiply 12 by 30 in the intermediate procedure. For multiplying 12 by multiplicands between 40 and 50 you multiply 12 by 40 in the intermediate procedure. Let the learners try to discover these rules by themselves before you intervene. Ask them to present their procedures and solutions in a table as shown in the solutions below. To extend the activity, ask them to investigate rules for multiplying 12 by multiplicands in the 50s and 60s.

For question 2, allow the learners to use their own strategies to solve the problems involving 3-digit numbers multiplied by 12 before you share the strategies in the solutions below with them.

1.

	Expressions	Procedures	Solutions	
a)	14 × 12 → 4 × 2 = 8	12 + 4 = 16	168	
b)	16 × 12 → 6 × 2 = 12	12 + 6 = 18	18 × 10 = 180	180 + 12 = 192
c)	15 × 12 → 5 × 2 = 10	12 + 5 = 17	17 × 10 = 170	170 + 10 = 180
d)	18 × 12 → 8 × 2 = 16	12 + 8 = 20	20 × 10 = 200	200 + 16 = 216
e)	17 × 12 → 7 × 2 = 14	12 + 7 = 19	19 × 10 = 200	190 + 14 = 204
f)	19 × 12 → 9 × 2 = 18	12 + 9 = 21	21 × 10 = 210	210 + 18 = 228
g)	21 × 12 → 1 × 12 = 12	20 × 12 = 240	240 + 12 = 252	
h)	22 × 12 → 2 × 12 = 24	20 × 12 = 240	240 + 12 = 264	
i)	24 × 12 → 4 × 12 = 48	20 × 12 = 240	240 + 48 = 288	
j)	23 × 12 → 3 × 12 = 36	20 × 12 = 240	240 + 36 = 276	
k)	25 × 12 → 5 × 12 = 60	20 × 12 = 240	240 + 60 = 300	
l)	26 × 12 → 6 × 12 = 72	20 × 12 = 240	240 + 72 = 312	
m)	31 × 12 → 1 × 12 = 12	30 × 12 = 360	360 + 12 = 372	
n)	32 × 12 → 2 × 12 = 24	30 × 12 = 360	360 + 24 = 384	
o)	33 × 12 → 3 × 12 = 36	30 × 12 = 360	360 + 36 = 396	
p)	34 × 12 → 4 × 12 = 48	30 × 12 = 360	360 + 48 = 408	
q)	41 × 12 → 1 × 12 = 12	40 × 12 = 480	480 + 12 = 492	
r)	43 × 12 → 3 × 12 = 36	40 × 12 = 480	480 + 36 = 516	

2. a) $123 \times 12 \rightarrow 3 \times 12 = 36$ $120 \times 12 = 1\ 440$
$1\ 440 + 36 = 1\ 476$

b) $132 \times 12 \rightarrow 2 \times 12 = 24$ $130 \times 12 = 1\ 560$
$1\ 560 + 24 = 1\ 584$

c) $211 \times 12 \rightarrow 1 \times 12 = 12$ $210 \times 12 = 2\ 520$
$2\ 520 + 12 = 2\ 532$

d) $243 \times 12 \rightarrow 3 \times 12 = 36$ $240 \times 12 = 2\ 880$
$2\ 880 + 36 = 2\ 916$

e) $312 \times 12 \rightarrow 2 \times 12 = 24$ $310 \times 12 = 3\ 720$
$3\ 720 + 24 = 3\ 744$

Checks

a) $123 \times 12 \rightarrow 123 \times 10 = 1\ 230$
$123 \times 2 = 246$
$= 1\ 476$

b) $132 \times 12 \rightarrow 132 \times 10 = 1\ 320$
$132 \times 2 = 264$
$= 1\ 584$

c) $211 \times 12 \rightarrow 211 \times 10 = 2\ 110$
$211 \times 2 = 422$
$= 2\ 532$

d) $243 \times 12 \rightarrow 243 \times 10 = 2\ 430$
$243 \times 2 = 486$
$= 2\ 916$

e) $312 \times 12 \rightarrow 312 \times 10 = 3\ 120$
$312 \times 2 = 624$
$= 3\ 744$

3. The learners share their strategies and solutions with the class.

Unit 5 Multiplication short cuts

MENTAL MATHS

Learner's Book page 127

Each learner needs a calculator for this lesson, but if there is a shortage, they can work in pairs or groups. However, the ideal is for individual learners to experience the effectiveness of the calculator in developing concepts of counting, working with multiples, and so on, as well as to learn about the functions of different calculator keys. You should make it clear to learners that they will only use the calculator for concept development and practice – not for basic mental calculations, or when they are required to use intuitive and learnt strategies to demonstrate their knowledge of calculation.

Tell the learners that they will learn more about the use of some of the calculator keys. They will use the keys to explore patterns when they count on and back. Tell them that they will use the $\boxed{=}$ key to program the calculator to count on in different intervals and multiples. They enter the keys as indicated, for example 2 × = = =, etc. Ask them to put down the calculators and predict what will happen if they enter the keys as indicated in (a) to (e). Let them write the sequences they predict on the board. They enter the keys to check their predictions. They discuss the relationships between the numbers in the sequences. In 10 × = 100 = 1 000 = 10 000 = 100 000 = 1 000 000 = 10 000 000 000 they will notice that the calculator cannot display powers of 10 bigger than this. Ask them how much bigger 1 000 is than 100, for example. Use this sequence to explain to learners what it means when you talk about powers of 10. Explain to them that it is a mathematical convention that powers of 10 are written in the following way: $10^0 = 1$; $10^1 = 10$; $10^2 = 100$ ... Let the learners complete the sequence. In the sequence 5 × 2 = 10 = 50 = 250 = 1 250 ..., they should realise that the constant is × 5 each time.

In question 5 the learners explore the functions of the $\boxed{\text{CE}}$, $\boxed{\text{C}}$, $\boxed{\text{AC}}$ or $\boxed{\text{C-CE}}$ keys – these keys are different on different brands of calculators. Ask the learners what they think these keys are used for. They will find out that the $\boxed{\text{C}}$ key cancels the operation with the number entered before $\boxed{\text{C}}$, so that 5 × 2 $\boxed{\text{C}}$ 3 = 15 and not 10, for example. In question 6 they will find that in, for example, 5 + 4 $\boxed{\text{C}}$ × 4, the operation entered before $\boxed{\text{C}}$ is cancelled so that the answer is 20 and not 9.

1. **a)** 2 × = 4; 8; 16; 32; 64; 128 ... (powers of 2, i.e. multiply by 2 each time)
b) 4 + = 8; 12; 16; 20; 24; 28; ... (multiples of 4)
c) 3 + = 6; 9; 12; 15; 18; 21; ... (multiples of 3)
d) 5 + = 10; 15; 20; 25; 30; 35; ... (multiples of 5)
e) 6 + = 12; 18; 24; 36; 42; 48; ... (multiples of 6)
f) 7 + = 14; 21; 28; 35; 42; 49; ... (multiples of 7)

Questions 2 to 4

a) 8 + = 16; 24; 32; 40; 48; 56; ... (multiples of 8)
b) 11 + = 22; 33; 44; 55; 66; 77; ... (multiples of 11)
c) 12 + = 24; 36; 48; 60; 72; 84; ... (multiples of 12)
d) 10 × = 100; 1 000; 10 000; ... (powers of 10, i.e. multiply by 10 each time)
e) 5 × 2 = 10; 50; 250; 1 250; ... (multiply by 5 each time)

5. **a)** 2 × 3 C 4 = 8 **b)** 5 × 2 C 3 = 15
c) 6 × 4 C 5 = 30 **d)** 7 × 8 C 9 = 63
e) 8 × 11 C 12 = 96 **f)** 9 × 7 C 8 = 72
g) 25 × 5 C 6 = 150 **h)** 50 × 7 C 8 = 400
i) 110 × 6 C 7 = 770 **j)** 150 × 3 C 4 = 600

6. **a)** $5 + 4$ C $\times 4 = 20$ **b)** 7×7 C $+ 7 = 14$
c) $10 \div 2$ C $\times 2 = 20$ **d)** $20 - 10$ C $+ 10 = 30$
e) $20 - 2$ C $\times 2 = 40$

Activity 5.1

Learner's Book page 129

Ask the learners if they remember or know a short cut to multiply by 25 and 50. They should realise that $25 = 100 \div 4$ and $50 = 100 \div 2$. They should understand by now that it is easier to work with powers of 10. Let them use the short cut to solve the problems. They multiply 2- to 4-digit numbers using short cuts to multiply by 25 and 50. Ask them to check the solutions on a calculator by multiplying by 25 and 50. Let them explore the solutions to 28×25 and 28×50. They should notice that $28 \times 50 = 1\ 400$ is double $28 \times 25 = 700$. The answers are also multiples of 7. They look for patterns using multiples of 7, for example $14 \times 25 = 350$ and $14 \times 50 = 700$. Let them use multiples of other numbers to explore this concept.

1. **a)** $28 \times 25 \rightarrow 28 \times 100 \div 4 = 2\ 800 \div 4 = 700$
   b) $32 \times 25 \rightarrow 32 \times 100 \div 4 = 3\ 200 \div 4 = 800$
   c) $56 \times 25 \rightarrow 56 \times 100 \div 4 = 56\ 000 \div 4 = 18\ 000$
   d) $108 \times 25 \rightarrow 108 \times 100 \div 4 = 1\ 080 \div 4 = 270$
   e) $220 \times 25 \rightarrow 220 \times 100 \div 4 = 2\ 220 \div 4 = 550$
   f) $48 \times 25 \rightarrow 48 \times 100 \div 4 = 4\ 800 \div 4 = 1\ 200$
   g) $96 \times 25 \rightarrow 96 \times 100 \div 4 = 9\ 600 \div 4 = 2\ 400$
   h) $204 \times 25 \rightarrow 204 \times 100 \div 4 = 20\ 400 \div 4 = 5\ 100$
   i) $2\ 488 \times 25 \rightarrow 2\ 488 \times 100 \div 4 = 248\ 800 \div 4 = 62\ 200$
   j) $4\ 204 \times 25 \rightarrow 4\ 204 \times 100 \div 4 = 420\ 800 \div 4 = 105\ 200$

2. **a)** $28 \times 50 \rightarrow 28 \times 100 \div 2 = 2\ 800 \div 2 = 1\ 400$
   b) $36 \times 50 \rightarrow 36 \times 100 \div 2 = 3\ 600 \div 2 = 1\ 800$
   c) $76 \times 50 \rightarrow 76 \times 100 \div 2 = 7\ 600 \div 2 = 3\ 800$
   d) $102 \times 50 \rightarrow 102 \times 100 \div 2 = 10\ 200 \div 2 = 5\ 100$
   e) $224 \times 50 \rightarrow 224 \times 100 \div 2 = 22\ 400 \div 2 = 11\ 200$
   f) $4\ 250 \times 50 \rightarrow 4\ 250 \times 100 \div 2 = 425\ 000 \div 2 = 212\ 500$
   g) $6\ 866 \times 50 \rightarrow 6\ 866 \times 100 \div 2 = 686\ 600 \div 2 = 323\ 300$
   h) $8\ 428 \times 50 \rightarrow 8\ 428 \times 100 \div 2 = 842\ 800 \div 2 = 421\ 400$
   i) $4\ 004 \times 50 \rightarrow 4\ 004 \times 100 \div 2 = 400\ 400 \div 2 = 200\ 200$
   j) $8\ 800 \times 50 \rightarrow 8\ 800 \times 100 \div 2 = 880\ 000 \div 2 = 440\ 000$

3. The learners use calculators to check their solutions.

Unit 6 Multiplication strategies

MENTAL MATHS

Learner's Book page 129

The learners explore the vertical column multiplication strategy and the checking method that involves digital sums that they have worked with in Term 1. They work with the class to solve problems using the calculation and checking strategies. They apply basic addition skills and the associative property to add easily. The learners should understand that most of the calculations are performed mentally. They also check solutions on a calculator.

	Calculation	**Check**	
1.	456	$4 + 5 + 6 = 15$	
	$\times$ 37	$3 + 7 = \times$ 10	
	3 192	150	$1 + 5 + 0 = 6$
	13 680		
	16 872	$1 + 6 + 8 + 7 + 2 = 24$	$2 + 4 = 6$
2.	583	$5 + 8 + 3 = 16$	
	$\times$ 76	$7 + 6 = \times$ 13	
	3 498	208	$2 + 8 = 10$
	40 810		
	44 308	$4 + 4 + 3 + 8 = 19$	$1 + 9 = 10$
3.	632	$6 + 3 + 2 = 11$	
	$\times$ 28	$2 + 8 = \times$ 10	
	5 056	110	$11 + 0 = 11$
	12 640		
	17 696	$1 + 7 + 6 + 9 + 6 = 29$	$2 + 9 = 11$
4.	741	$7 + 4 + 1 = 12$	
	$\times$ 46	$4 + 6 = \times$ 10	
	4 446	120	$1 + 2 = 3$
	29 640		
	34 086	$3 + 4 + 8 + 6 = 21$	$2 + 1 = 3$
5.	894	$8 + 9 + 4 = 21$	
	$\times$ 63	$6 + 3 = \times$ 9	
	2 682	108	$1 + 8 = 9$
	53 640		
	56 322	$5 + 6 + 3 + 2 + 2 = 18$	$1 + 8 = 9$

Activity 6.1

Learner's Book page 130

Ask the learners to explore and discuss the multiplication strategies to solve multiplication of a 4-digit by a 3-digit number involving breaking up numbers into their place values.

In question 2 they estimate the solutions to the problems. They should estimate whether the solutions will involve numbers in powers of 10.

In question 3 the learners calculate the accurate solutions and use the digital sum strategy to check their solutions. Ask them to compare the estimates to the accurate solutions by calculating the differences between them. Let them decide whether the estimates are 'good' or 'not so good'. Ask them to construct a table as shown in the solutions below.

Ask them to use the vertical column method used in the Mental Maths activity in this unit or strategies used in this lesson to solve the contextual problems in question 4. Let them share their strategies and solutions with the class.

1. Learners explore and discuss the multiplication strategies involving the area model, breaking up numbers into place values, doubling and the vertical column method.

2.

	Expressions	Accurate solutions	Estimates	Differences
a)	134 × 135	18 090	18 200	110
b)	254 × 87	22 098	22 500	402
c)	3 426 × 9	30 834	34 300	3 466
d)	4 163 × 26	188 370	124 800	63 570
e)	7 245 × 142	1 028 790	1 015 000	13 790

3. Learners' own work

4. **a)** Total number of plants = 1 245 × 325 = 404 625 plants
(Estimated number of plants = 1 250 × 330 = 412 500)

b) Total number of eggs = 550 × 365 = 200 750 eggs
(Estimated number of eggs = 550 × 370 = 203 500)

c) Cost of cell phones = R1 698 × 575 = R976 350
(Estimated cost = R1 700 × 580 = R986 000)

d) 25 pairs of socks costs R375
$\therefore$ 1 pair of socks costs $\frac{R375}{25}$ = R15
Total costs of socks = R15 × 5 000 = R75 000

e) Total costs of counters to be produced
2 500 × 4 × 352
= 3 520 000 counters

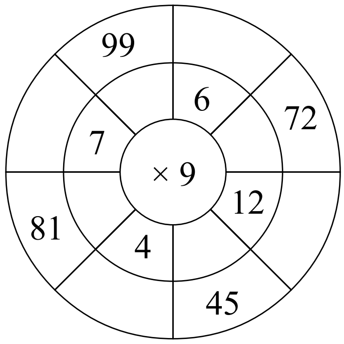
(Estimated number of counters = 2 500 × 4 × 350
= 10 000 × 350
= 3 500 000)

f) Total number of pages printed = 2 348 × 365 = 857 020
(Estimated number of pages printed = 2 350 × 370
= 869 500)

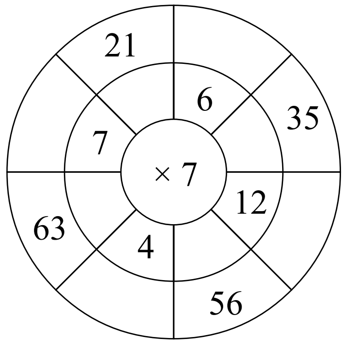
Assessment 2.1 Multiplication of whole numbers

1. Complete the multiplication diagrams.

a)



b)



2. Calculate:

a) 40 × 50 = ■

b) 70 × 80 = ■

c) 90 × 60 = ■

d) 300 × 900 = ■

e) 400 × 700 = ■

3. Which is the best estimate for each of these calculations?

a) 46 × 73 = ■
A. 40 × 70 = 2 800
B. 50 × 70 = 3 500
C. 50 × 80 = 4 000
D. 45 × 70 = 3 150

b) 238 × 62 = ■
A. 200 × 60 = 12 000
B. 230 × 60 = 13 800
C. 240 × 60 = 14 400
D. 240 × 70 = 16 800

4. Solve the following:

a) 64 × 25 = ■

b) 328 × 25 = ■

c) 1 604 × 25 = ■

d) 76 × 50 = ■

e) 246 × 50 = ■

5. Solve these problems.

a) There are 45 chairs in each row in the school hall. There are 36 rows. How many chairs are there?

b) A cupboard has 22 pigeonholes in a row and 18 pigeonholes in a column. How many pigeon holes are there?

c) Farm workers plant 126 rows with 45 cauliflower plants in each row.
They plant 234 rows with 64 cabbage plants in each row.
How many cauliflowers and cabbages do they plant altogether?

6. Use your own strategies to calculate the following.

a) 312 × 62 = ■

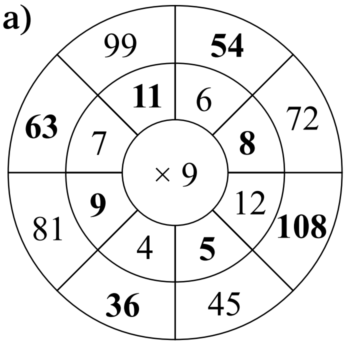
b) 576 × 825 = ■

c) 2 304 × 37 = ■

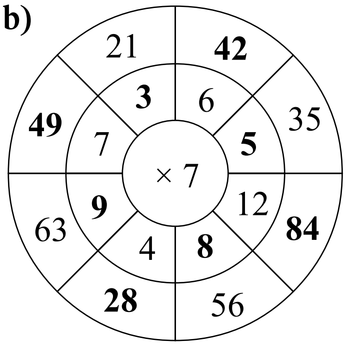
d) 1 842 × 241 = ■

e) 4 956 × 354 = ■

1. a)



b)



2. a) 40 × 50 = (4 × 5) × 100
= 2 000

b) 70 × 80 = (7 × 8) × 100
= 5 600

c) 90 × 60 = (9 × 6) × 100
= 5 400

d) 300 × 900 = (3 × 9) × 10 000
= 270 000

e) 400 × 700 = (4 × 7) × 10 000
= 280 000

3. a) 46 × 73 = 3 358

A. 40 × 70 = 2 800
B. 50 × 70 = 3 500
C. 50 × 80 = 4 000
D. 45 × 70 = 3 150

b) 238 × 62 = 14 756

A. 200 × 60 = 12 000
B. 230 × 60 = 13 800
C. 240 × 60 = 14 400
D. 240 × 70 = 16 800

B and C are the best estimates. They are closer to the accurate solutions.

4. a) 64 × 25 = (64 × 100) ÷ 4
= 6 400 ÷ 4
= 1 600

b) 328 × 25 = (328 × 100) ÷ 4
= 32 800 ÷ 4
= 8 200

c) 1 604 × 25 = (1 604 × 100) ÷ 4
= 160 400 ÷ 4
= 40 100

d) 76 × 50 = (76 × 100) ÷ 2
= 7 600 ÷ 2
= 3 800

e) 246 × 50 = (246 × 100) ÷ 2
= 24 600 ÷ 2
= 12 300

5. **a)** $45 \times 36 = (40 \times 30) + (40 \times 6) + (5 \times 30) + (5 \times 6)$
$= 1\ 200 + 240 + 150 + 30$
$= 1\ 620$ chairs in the hall

b) $22 \times 18 = (20 \times 10) + (20 \times 8) + (2 \times 10) + (2 \times 8)$
$= 200 + 160 + 20 + 16$
$= 396$ pigeon holes

c) $126 \times 45 = (120 \times 40) + (6 \times 40) + (120 \times 5) + (6 \times 5)$
$= 4\ 800 + 240 + 600 + 30$
$= 4\ 800 + 200 + 600 + 30 + 40$
$= 5\ 670$ cauliflower plants

234×64
$= (200 \times 60) + (30 \times 60) + (4 \times 60) + (200 \times 4) + (30 \times 4) + (4 \times 4)$
$= 12\ 000 + 1\ 800 + 240 + 800 + 120 + 16$
$= 13\ 000 + 800 + 200 + 800 + 100 + 40 + 20 + 16$
$= 14\ 000 + 900 + 76$
$= 14\ 976$ cabbage plants

$$
\begin{array}{rlllll}
14\ 976 + 5\ 670 = & 10\ 000 & + 4\ 000 & + 900 + 70 & + 6 \\
 & & + 5\ 000 & + 600 + 70 & \\
\hline
 & 10\ 000 & + 9\ 000 & + 1\ 500 + 140 & + 6 \\
 & = 19\ 000 & + 1\ 000 & + 600 + 46 & \\
 & = 20\ 646 & & &
\end{array}
$$

The farm workers planted 20 646 plants altogether.

6. **a)** $312 \times 62 = 19\ 344$
b) $576 \times 825 = 475\ 200$
c) $2\ 304 \times 37 = 85\ 248$
d) $1\ 842 \times 241 = 443\ 922$
e) $4\ 956 \times 354 = 1\ 754\ 424$

Properties of 3-D objects

Learner's Book page 131

In Grade 6, the focus in studying 3-D objects turns to the properties of prisms and pyramids. However, in order for the learners to understand the properties of these 3-D objects, they need a clear understanding of the types and number of surfaces of 3-D objects. The activities in Unit 7 therefore revise the key concepts that the learners have come to understand in Grades 4 and 5.

Unit 8 then focuses on the properties of pyramids. In Unit 9, the learners match nets to 3-D objects and use nets to build models of 3-D objects.

Unit 7 Surfaces and faces of 3-D objects

Revise the types of surfaces that 3-D objects have, as well as the names of 3-D objects that the learners have learned about and worked with in Grades 4 and 5.

MENTAL MATHS

Learner's Book page 132

1. **a)** 1 **b)** curved
2. **a)** 3 **b)** both flat and curved
3. Yes
4. Yes

Activity 7.1

Learner's Book page 132

1. A: cone and sphere
   B: cube
   C: cylinder
   D: cone
   E: cylinder (glass) and cubes (ice blocks)
   F: rectangular prism
   G: pyramid
   H: cube
   I: sphere
   J: sphere
   K: rectangular prism
   L: cylinder
   M: pyramid
2. Learners' own answers.

Learner's Book page 133

Faces of 3-D objects

Remind the learners that a 'face' is the flat surface of a 3-D object. Work through the Learner's Book text that describes the shapes of the faces of various 3-D objects.

Activity 7.2

Learner's Book page 133

1. **a)** Three
   b) The learners should be able to explain that there are three more faces, each opposite one of the faces that we can see.

c) The learners should be able to point to and explain that the other flat face is opposite the circular face that we see.

d) The learners should be able to point to and explain that there are two faces, each opposite the two triangular faces that we see, and there is one face that is at the bottom of the pyramid.

2. **a)** A: 6 B: 5 C: 6 D: 5

b) A: All rectangles B: 4 triangles and 1 square
C: 6 squares D: 2 triangles and 3 rectangles

c) A and C

Assessment points

- Are the learners able to name and recognise cubes, rectangular prisms and pyramids?
- How well can they describe the faces of different 3-D objects?

Unit 8 Pyramids

Learner's Book page 134

Let the learners compare the photograph of a pyramid with the mathematical drawing of the square-based pyramid. Discuss the properties of pyramids as detailed in the Learner's Book. It would help if you have models of pyramids for the learners to work with as they explore the properties of pyramids. You could use the nets of a square-based pyramid, triangular-based pyramid (tetrahedron) and pentagonal-based pyramid to create cardboard models of your own.

Tetrahedrons and other pyramids

Explain that *tetrahedron* is another name for a triangular prism. Then work through the table in the Learner's Book that explains the differences and similarities between tetrahedrons and other pyramids.

MENTAL MATHS

Learner's Book page 135

1. C, E, H

2. The faces of a tetrahedron are all triangles. All other pyramids have triangular faces on a base that is the shape of another polygon.

3.

Pyramids	Number of faces	Number of edges	Number of vertices
Triangular-based	3	3	3
Square-based	4	4	4
Pentagonal-based	5	5	5

4. Learners' own work

5. Six

Investigation
Learner's Book page 135

The statement is true. The learners will look at a number of pyramids, or at drawings of pyramids, and realise that the base of the pyramid will determine the number of faces of the pyramid. The tetrahedron has a triangular base, which is a base with the fewest number of sides (three). All other bases will have more than three sides and therefore more faces.

Unit 9 3-D models using nets

The learners have worked with nets in Grade 5. Remind them what a net is. Demonstrate how to fold a net of a rectangular prism into its 3-D model.

MENTAL MATHS
Learner's Book page 136

1. Rectangular prism: B
2. Tetrahedron: C
3. Cube: D
4. Square-based pyramid: A

Activity 9.1
Learner's Book page 137

Learners' own work.

You could give the learners copies of the net of a tetrahedron that is provided in the resources section. Remind the learners to work as accurately as possible to ensure that the faces of the model fit together neatly.

Let the learners copy and work with any other net shown in Activity 9.1. They will realise that they have to get the measurements and angles right, especially for the pyramids, otherwise the faces will not fit together properly.

Assessment points

- Are the learners able to match nets to drawings of 3-D objects?
- Can they use nets to make 3-D objects?

Revision
Learner's Book page 137

1. **a)** A: rectangular prisms
B: pyramids
C: cylinders
D: cubes
b) Any of these three: A, B, D
c) C
d) 6 faces: all rectangles
e) 5 faces: 1 square and 4 triangles

f) 6 faces: all squares
g) 6
h) A and D

2. **a)** Triangular-based pyramid
   b) 4
   c) Triangular
   d) It has a base that is a polygon and triangles that make up its faces.
   e) All the faces of a tetrahedron are triangles. The faces of other pyramids are not all triangles.

3. **a)** Pyramids – a tetrahedron and a square-based pyramid
   b) Check that the nets are folded correctly.
   c) The tetrahedron has four faces – all triangles. The square-based pyramid has five faces – four triangles and a square.

Remedial activities

It is essential for learners who struggle to have models of all the 3-D objects to handle and refer to as they work. Instead of letting them work with drawings of 3-D objects only, as they examine and describe properties, give them ample opportunities to work with the 3-D models.

Model-making is an important learning tool when working with 3-D objects. Let the learners build models of cubes, rectangular prisms, tetrahedrons and square-based pyramids from nets.
Let them make two or three models of each 3-D object.

Extension activities

- Let the learners use the net of a square-based pyramid to make a 3-D model. Once they have completed their pyramids, let them get together in groups of three and work out how to place their pyramids together to make a cube.
- Ask the learners to complete the following table.

	Number of faces	Shapes of faces
Tetrahedrons		
Square-based pyramids		
Pentagonal-based pyramids		
Hexagonal-based pyramids		
Octagonal-based pyramids		

Geometric patterns

Remind the learners that they have worked with geometric patterns in Grade 4 and 5. Tell them that they have investigated, extended and created patterns in various forms, described patterns in their own words and looked for relationships or rules to extend patterns. They will continue with this work and build on the knowledge they have already acquired. Tell them that they will first investigate patterns found in their environment, by exploring and describing patterns found in nature and in things made by people (culture).

They can describe patterns in their own words using informal vocabulary, but they should also try to use terminology they have learned in the content area Shape and space (Geometry). Ask the learners what they think a pattern is. They should know that patterns are all about shapes and objects that are repeated in a regular or irregular way. Ask them to look around in the classroom to find and describe patterns, and let them explain in which other content areas they work with patterns and designs.

Unit 10 Extending patterns

MENTAL MATHS

Learner's Book page 139

Encourage the learners to discuss their observations of the different patterns. In the natural patterns in question 1(a) they should observe the different shapes of the leaves. The oval leaves grow from small to large with regularity, and the leaf of the palm tree has a distinct line of symmetry with parts of the leaf growing diagonally from this line. Allow the learners to use informal language and comparisons to real-life objects, for example, 'It looks like a ...' but repeat their sentences using the formal terminology. Have blank cards available on which to write new words that you can pin to a *New maths words* board.

In question 1(b) the learners should identify symmetry – noticing that, if a vertical line is drawn in the centre, the shapes are reflections (flips) of the left or right side. Ask them to name the different shapes and colours they observe. They should notice rectangles, triangles, rhombi and hexagons. You could allow the learners to do research to learn more about patterns in African cultures using books or the Internet.

They will explore the pattern in the carpet in question 1(c) and the shop entrance in question 1(d) in more detail in question 2. In the brick paving they should observe tessellation (no gaps between the rectangles) and movement or transformation, i.e. rotations (turns) and translations (slides). You could ask the learners to perform these movements through dance or body movements in the performing arts lessons.

Activity 10.1

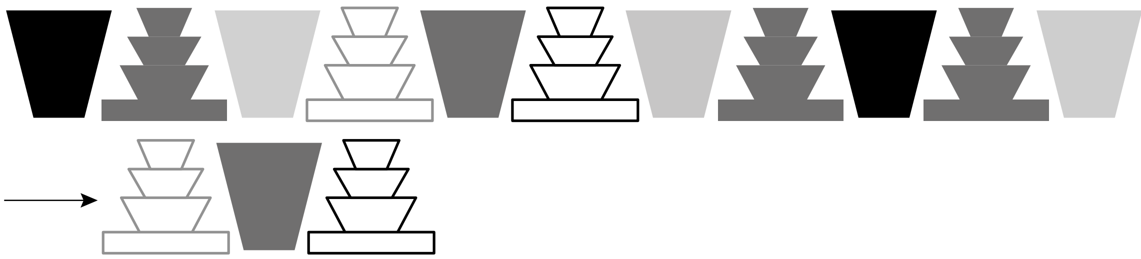
Learner's Book page 140

Pattern A

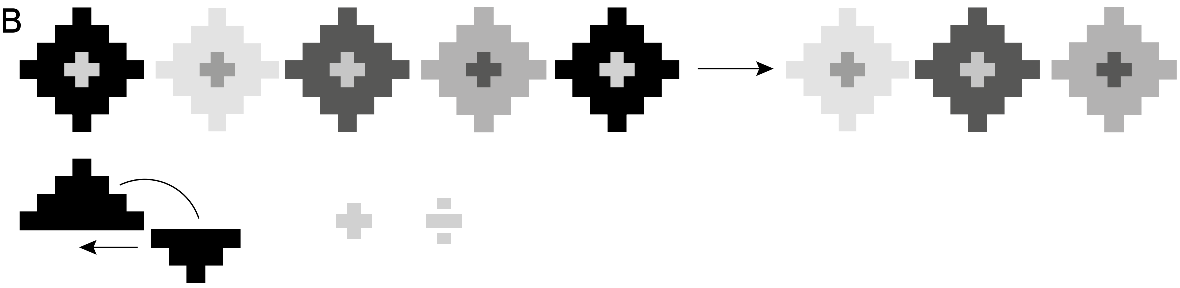
The learners get an opportunity to explore the names of shapes and their transformation in more detail, but are also allowed to see how patterns can be copied and extended. Pattern A consists of single quadrilaterals and quadrilaterals stacked on top of rectangles.

Translation along a straight line is involved. Ask the learners to describe how they think the pattern will extend. Encourage the use of formal terminology and exact descriptions. The learners might find it difficult to realise that the shapes in question 2, pattern B have been created by stacked rectangles decreasing in size because the lines are invisible. The top three rectangles have been copied, rotated and translated. The crosses are embedded in the shapes (we call this *nesting*) and consist of a rectangle and two squares, but one rectangle imposed on the other could also be used. The discussion about shapes should not be too lengthy; remember that this is not a geometry lesson. The learners should have background knowledge of transformation, shapes and objects dealt with in Shape and space. Ask the learners to describe how they think the colours and shapes will be extended (see extended patterns below).

A

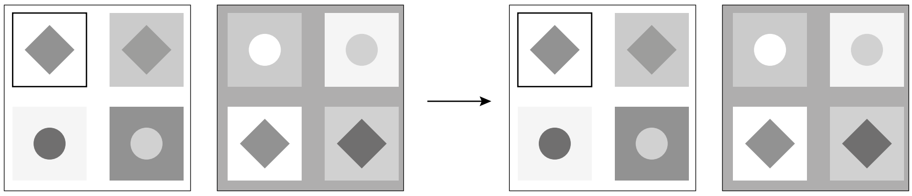


B



In question 3 the learners should notice that the pattern in C appears on the shop entrance in the picture in question 1(d) in the Mental maths section. Ask them to describe the shapes and patterns and to explain how they think the pattern will be extended. There are no right or wrong ways to extend the pattern. Ask them where they think the term *nesting* originates. The circles and rhombi (diamonds) are nested on squares which are nested on bigger squares.

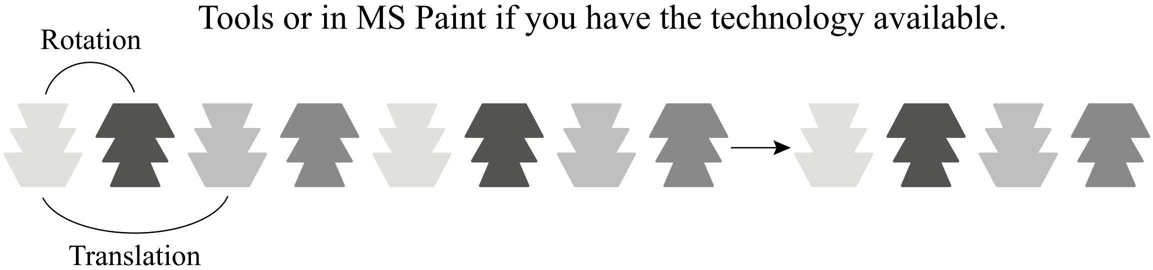
C



In question 4 the learners should identify that the pattern has been created by the stacked quadrilaterals in A above or in the picture of the carpet in the mental maths section. The shapes were then translated and rotated around the top point.

Ask the learners to copy and extend the patterns in A, B, C and D in question 5, by drawing the next four shapes in each pattern. Note that there are actually no right or wrong solutions – it depends on the learners' interpretations of the patterns. Ask them to explain their thinking. You could allow them to substitute the given colours with their own if they do not have the same colour crayons, pencils or paint. They could also create the patterns with MS Word Drawing Tools or in MS Paint if you have the technology available.

D



In question 6(a) the learners describe, copy and extend the patterns. They should notice that in pattern (i) the shading is repeated by rotation around the centre point. In (ii), the fish is also rotated around the centre point in a clockwise direction. Use this activity to enforce knowledge about transformation, i.e. rotation, reflection and translation.

In question 7 learners create their own patterns. They can use shapes and objects and different colours. They should use the knowledge they have acquired in this unit to create the patterns. Let them complete the patterns for homework or during the art lesson. They ask a partner to describe and extend their patterns. Allow them to display their work in the class. They can even create a class collage.

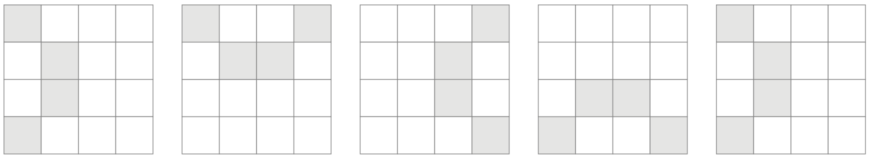
1. a) The patterns are representations or drawings of the repeating shapes in the top and bottom rows of the carpet.
b) Learners express their own interpretations of colours and shapes.

2. a) See description on above, in the Teacher's notes.
b) Learners state their own interpretations.

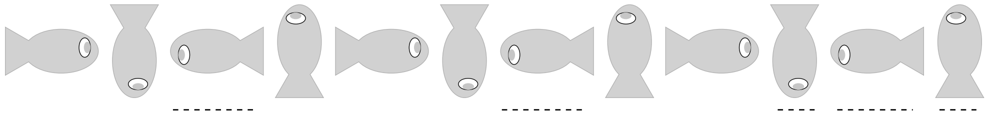
3. a) Pattern D – a shop entrance
b) Circles nested in a square and rhombi nested in a square
c) The shapes will be alternated.

4. The repeating shapes consist of trapeziums that are stacked on top of each other from large to small.
   b) The groups of trapeziums have been translated and reflected or rotated.
5. Learners copy and extend the pattern of trapeziums.
6. a)

(i)



(ii)



   b) The four shaded squares and the fish have been rotated clockwise.
7. a) Learners create their own patterns.
   b) They ask a partner to describe and extend their patterns and display their work in the classroom.

Unit 11 Star number patterns

MENTAL MATHS

Learner's Book page 141

The learners need sheets of A4 paper. Ask them to fold the paper in half each time until they have 5 folds. Let them predict the number of rectangles they will see before they unfold the paper. They unfold the paper and count the number of rectangles. They predict the number of rectangles formed when there are 6 folds. Draw the table on the board and ask them to complete it. The numbers in the solutions are powers of 2. You can introduce the learners to this but should not elaborate on the concept. They know that square numbers are written to the power of 2, i.e. $2 \times 2 = 2^2 = 4$. Explain to the learners that $8 = 2 \times 2 \times 2 = 2^3$ and $1 = 2^0$.

Number of folds	Number of rectangles	
0	1	(2^0)
1	2	(2^1)
2	4	(2^2)
3	8	(2^3)
4	16	(2^4)
5	32	(2^5)
6	64	(2^6)
7	128	(2^7)
8	256	(2^8)
9	512	(2^9)
10	1 024	(2^{10})

Did you know?

Learner's Book page 142

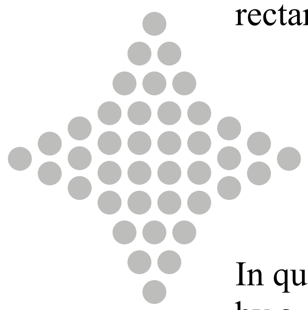
The learners extend their general knowledge about the number 32. They learn about or enhance their understanding of the number of teeth that an adult is supposed to have. They should realise that the types of teeth mentioned refer to 8 teeth on one side of one jaw, so that there are 16 on the upper and 16 on the lower jaw, with a total of 32.

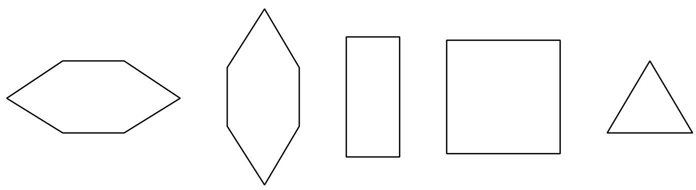
Let the learners use a soccer ball or a picture of one to investigate the number and kinds of shapes in a truncated icosahedron.

Activity 11.1

Learner's Book page 142

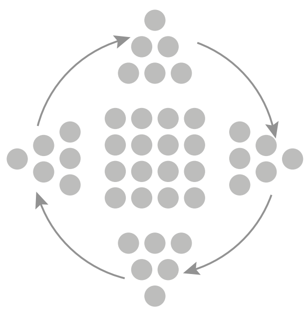
Ask the learners to study the number of dots in the 4-pointed star to find out that there are 40 stars. They name the shapes that are embedded in the star. For example, you can see two hexagons, rectangles, squares and triangles.





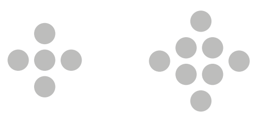
In question 1(c) the learners should discover that the star is created by a 4 × 4 square and triangles consisting of 6 dots each so that you have (4 × 4) + (4 × 6) = 16 + 24 = 40 dots.

The star is created as below. The triangles are rotated clockwise around the square.



The learners discover that 40 is the 4th star number.

In (d) they look at the 5-dot star to decide if 5 is a star number. If it fits the description for 40 stars it should be a star number. The 40-dot star is made up of square and triangular numbers, i.e. 16 dots and 6 dots repeated 4 times. 6 is a triangular number. In the 5-dot star, 1 (in the centre) is a square number and 1 is repeated 4 times on the points. 1 is a triangular number, so 5 is a star number.



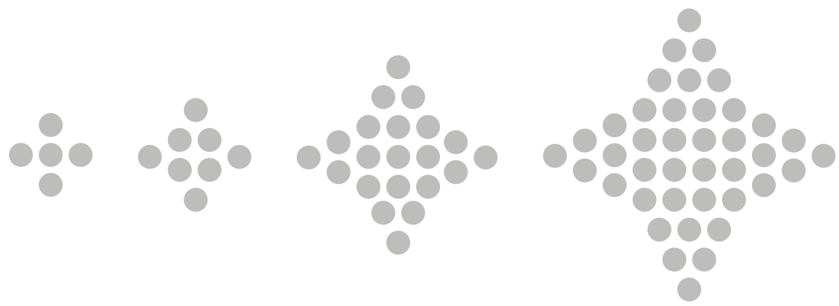
In question 2 the learners make drawings of the 1st to 7th star numbers. Give then counters to experiment with before they make the drawings.

In question 4(a) they copy (or you can give them copies) and complete the table to discover the number patterns involved in the exploration of star numbers.

In question 4(b) the learners describe the patterns they observe in the numbers in the table. Ask them to write the first 10 numbers in the sequences for the number of squares, triangles and stars. They find a way to determine the 11th and 12th star numbers. You could ask them to make drawings and use the patterns in the table.

1. **a)** 40 dots
b) a square and four triangles
c) A 4×4 square was drawn in the centre and then a triangle was drawn on each side of the square.
d) Yes.

2.



1st 2nd 3rd 4th

3. 6 dots in each triangle. 6 is a triangular number.

4. **a)**

Pattern number	Number of dots in squares	Number of dots in triangles	Star number
1	$1 \times 1 = 1$	$1 \times 4 = 4$	$4 + 1 = 5$
2	$2 \times 2 = 4$	$1 \times 4 = 4$	$4 + 4 = 8$
3	$3 \times 3 = 9$	$3 \times 4 = 12$	$12 + 9 = 21$
4	$4 \times 4 = 16$	$6 \times 4 = 24$	$24 + 16 = 40$
5	$5 \times 5 = 25$	$10 \times 4 = 40$	$50 + 25 = 75$
6	$6 \times 6 = 36$	$15 \times 4 = 60$	$60 + 36 = 96$
7	$7 \times 7 = 49$	$21 \times 4 = 84$	$84 + 49 = 133$
8	$8 \times 8 = 64$	$28 \times 4 = 112$	$112 + 64 = 176$
9	$9 \times 9 = 81$	$36 \times 4 = 144$	$144 + 81 = 225$
10	$10 \times 10 = 100$	$45 \times 4 = 180$	$180 + 100 = 280$

b) The learners should observe that the number of dots in the squares forms square numbers. In exploring the number of dots in the triangles they should notice that the numbers in the single triangles are triangular numbers. You should ask them to look for constant differences between the numbers. Ask them to write down the sequences. They should notice the following sequences and discover the differences between the terms.

1; 4; 9; 16; ... square numbers
3; 5; 7; 9; 11; ... the differences are not constant and form consecutive uneven numbers.

1; 3; 6; 10; 15; ... triangular numbers

2; 3; 4; 5; ... the differences are not constant and form consecutive counting or natural numbers.

4; 12; 24; 40; 60; ... multiples of 4 and even numbers

8; 12; 20; 20; ... the differences are not constant

5; 8; 21; 40; 75; ... star numbers

3; 13; 19; 35; ... the differences are not constant

5. **a)** 1; 4; 9; 16; 25; 36; 49; 64; 81; 100
   b) 1; 3; 6; 10; 15; 21; 28; 36; 45; 55
   c) 5; 8; 21; 40; 75; 96; 133; 176; 225; 280

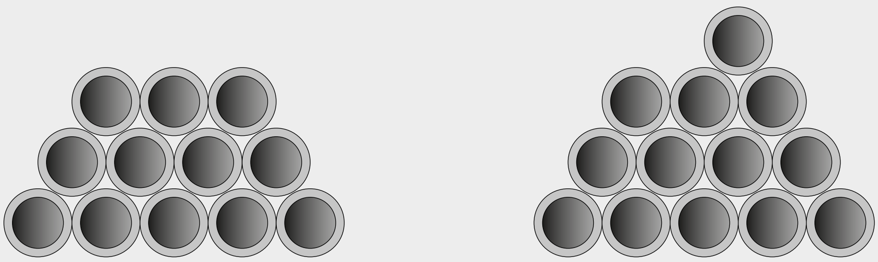
6. 11th star number:
   11 × 11 = 121 55 × 4 = 220 220 + 121 = 341
   12th star number:
   12 × 12 = 144 66 × 4 = 264 264 + 144 = 408

Unit 12 Rules for patterns

MENTAL MATHS

Learner's Book page 143

The learners have worked with triangular numbers. In question 1 they explore triangular numbers in stacks of cylinders. They should know that 1, 3, 6 and 10 are triangular numbers. Ask them to explain why these numbers are called triangular numbers. Ask them if they think 12 and 13 are triangular numbers. Let them make drawings to see that the triangles would be incomplete with 12 and 13 objects.



In question 1(c) they find out what the next 5 numbers in the sequence of triangular numbers are. They can do this by looking at the differences between the first 4 numbers:

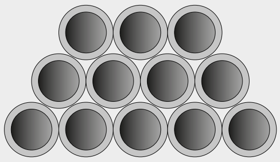
1	3	6	10	15	21	...
+ 2	+ 3	+ 4	+ 5	+ 6	...	

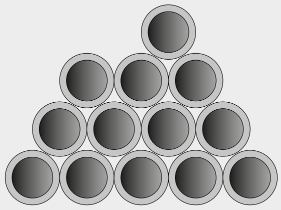
Ask them how they will determine the 50th triangular number. Let them battle with this before you tell them that they can use the Gauss method that they have used before. They should realise that we always use short cuts in mathematics and therefore search for shorter methods.

Ask them how many pairs of numbers they can make with the numbers 1 to 6 if they pair the first and last numbers; how many pairs in numbers 1 to 20, etc. and how many pairs will there be in the numbers 1 to 100. They find the sum of each pair and multiply it by 50 so that they get 101 × 50 = 5 050, which is the 100th triangular number. Tell them there is an even shorter way to determine the 100th triangular number. The rule is: add the 1st and last numbers, divide by 2 and multiply by the number you want to find. In question 2 learners apply this rule to get the answers.

1. **a)** Triangular numbers

b) The triangular number of objects can be arranged in triangles.





c) 21; 28; 36; 45; 55

d) **(i)** 50 pairs

(ii) 101 × 50 = 101 × 100 ÷ 2
= 10 100 ÷ 2
= 5 050

(iii) 5 050

2. Add the 1st and last number: 1 + 100 = 101
Divide by 2: 101 ÷ 2 = 50 remainder 1

Multiply by the number you want to find:
(50 × 100) + (50 × 1) = 5 000 + 50
= 5 050

a) 50th triangular number: 1 + 50 = 51
51 ÷ 2 = 25 rem 1
(25 × 50) + (25 × 1) = 1 250 + 25
= 1 275

b) 80th triangular number: 1 + 80 = 81
81 ÷ 2 = 40 rem 1
(40 × 80) + (40 × 1) = 3 200 + 40
= 3 240

c) 200th triangular number: 1 + 200 = 201
201 ÷ 2 = 100 rem 1
(200 × 100) + (100 × 1) = 20 000 + 100
= 20 100

d) 500th triangular number: 1 + 500 = 501
501 ÷ 2 = 250 rem 1
(500 × 250) + (250 × 1) = 125 000 + 250
= 125 250

e) 1 000th triangular number: 1 + 1 000 = 1 001
1 001 ÷ 2 = 500 rem 1
(1 000 × 500) + (500 × 1) = 500 000 + 500
= 500 500

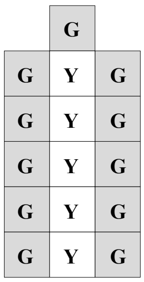
Ask the learners to notice that the 1 000th triangular number is double the 500th triangular number.

Activity 12.1

Learner's Book page 145

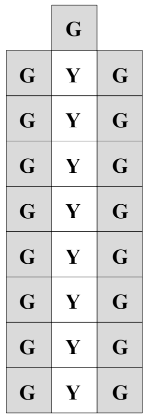
Make sure that the learners know what a mobile is. They can design their own mobiles in the art or technology lessons. Ask the learners to investigate the tile designs for creating the mobiles. They draw designs with different numbers of tiles as indicated. They work out the number of green and yellow tiles as indicated and complete the table. They use inverse operations and brackets and choose rules that describe how to calculate the number of the different colour tiles.

1. **a)** 5 green tiles
   b)



11 green tiles

c)



17 green tiles

2. Completed table

Number of yellow tiles	1	2	3	4	5	6	7	8
Number of green tiles	3	5	7	9	11	13	15	17

3. As the number of yellow tiles increase by 1, the number of green tiles increase by 2 each time.

4. **a)** 10 × 2 + 1 = 21
   b) 20 × 2 + 1 = 41
   c) 35 × 2 + 1 = 71
   d) 50 × 2 + 1 = 101
   e) 100 × 2 + 1 = 201
   f) 400 × 2 + 1 = 801

5. Number of yellow tiles = (number of green tiles – 1 ÷ 2)

6. **a)** 11 green tiles → 11 – 1 ÷ 2 = 10 ÷ 2
   = 5 yellow tiles
   b) 21 green tiles → 21 – 1 ÷ 2 = 20 ÷ 2
   = 10 yellow tiles

c) 37 green tiles → 27 – 1 ÷ 2 = 26 ÷ 2
= 13 yellow tiles

d) 59 green tiles → 59 – 1 ÷ 2 = 58 ÷ 2
= 29 yellow tiles

e) 123 green tiles → 123 – 1 ÷ 2 = 122 ÷ 2
= 61 yellow tiles

f) 151 green tiles → 151 – 1 ÷ 2 = 150 ÷ 2
= 75 yellow tiles

7. **d)** number of green tiles = (number of yellow tiles × 2) + 1

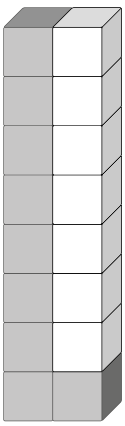
8. c) number of yellow tiles = (number of green tiles – 1) ÷ 2

Unit 13 Rules for some cube patterns

MENTAL MATHS

Learner's Book page 146

Ask the learners to explore the cube constructions and describe the patterns. Give them cubes to create the constructions. If you do not have cubes available, borrow some from the Foundation Phase teachers or use counters or bottle tops. You should expect of learners to give the rule for working out any number of cubes in words. They record the solutions in the table in question 2 on their Mental Maths grid.



1. **a)** 9 blue cubes
   b) **(i)** 8 blue cubes → 8 – 2 = 6
   (ii) 12 blue cubes → 12 – 2 = 10
   (iii) 21 blue cubes → 21 – 2 = 19
   (iv) 30 blue cubes → 30 – 2 = 28
   (v) 51 blue cubes → 51 – 2 = 49
2. Completed table

Number of red cubes	5	6	7	15	20	21	25	31	32	40
Number of blue cubes	7	8	9	17	22	23	27	33	34	42

3. Number of red cubes + 2

Activity 13.1

Learner's Book page 147

The learners investigate more cube constructions created by the learners in the context of the problem above. They use tables for each construction, use and develop rules and apply substitution to find the unknown values.

1. **a)**

Yellow cubes	1	2	3	4	5	6	7	8
Brown cubes	8	10	16	14	16	18	20	22

   b) **(i)** 4 → 4 × 2 + 6 = 14 brown cubes
   (ii) 1 → 1 × 2 + 6 = 8 brown cubes
   (iii) 6 → 6 × 2 + 6 = 18 brown cubes

(iv) $8 \rightarrow 8 \times 2 + 6 = 22$ brown cubes
(v) $10 \rightarrow 10 \times 2 + 6 = 26$ brown cubes
(vi) $50 \rightarrow 50 \times 2 + 6 = 106$ brown cubes

2. a)

Pink cubes	1	2	3	4	5	6	7	8
Green cubes	5	6	7	8	9	10	11	12

b) Fezeka's rule is: number of pink cubes plus 4
c) (i) $4 \rightarrow 4 + 4 = 8$ green cubes
(ii) $8 \rightarrow 8 + 4 = 12$ green cubes
(iii) $3 \rightarrow 3 + 4 = 7$ green cubes
(iv) $7 \rightarrow 7 + 4 = 11$ green cubes
(v) $20 \rightarrow 20 + 4 = 24$ green cubes
(vi) $80 \rightarrow 80 + 4 = 84$ green cubes

3. a)

Maroon cubes	1	2	3	4	5	6	7	8
Pink cubes	7	11	15	19	23	27	31	35

b) Anne's rule is: number of maroon cubes $\times 4 + 3$
c) (i) $1 \rightarrow 1 \times 4 + 3 = 7$ pink cubes
(ii) $5 \rightarrow 5 \times 4 + 3 = 23$ pink cubes
(iii) $8 \rightarrow 8 \times 4 + 3 = 35$ pink cubes
(iv) $6 \rightarrow 6 \times 4 + 3 = 27$ pink cubes
(v) $15 \rightarrow 15 \times 4 + 3 = 63$ pink cubes
(vi) $60 \rightarrow 60 \times 4 + 3 = 243$ pink cubes

4. a)

Green cubes	1	2	3	4	5	6	7	8
Orange cubes	4	7	10	13	16	19	22	25

b) Anwar's rule is: number of green cubes $\times 3 + 1$
c) (i) $2 \rightarrow 2 \times 3 + 1 = 7$ orange cubes
(ii) $4 \rightarrow 4 \times 3 + 1 = 13$ orange cubes
(iii) $8 \rightarrow 8 \times 3 + 1 = 25$ orange cubes
(iv) $1 \rightarrow 1 \times 3 + 1 = 4$ orange cubes
(v) $25 \rightarrow 25 \times 3 + 1 = 76$ orange cubes
(vi) $100 \rightarrow 100 \times 3 + 1 = 301$ orange cubes

Unit 14 A rule for tiles around a pond

MENTAL MATHS

Learner's Book page 148

The learners complete tables by finding rules to get the output numbers. By now they should know how to develop the rules but they could also use the difference between terms to find the missing terms.

1.

Input	1	2	3	4	5	6	10	20	50	100
Output	4	6	8	10	12	14	22	42	102	202

Rule: Input number $\times 2 + 2$

2.

Input	1	2	3	4	5	6	10	20	50	100
Output	5	8	11	14	17	20	32	62	152	302

Rule: Input number × 3 + 2

3.

Input	1	2	3	4	5	6	10	20	50	100
Output	4	8	16	22	28	34	58	118	298	598

Rule: Input number × 6 – 2

4.

Input	4	8	12	16	20	24
Output	4	6	8	10	12	14

Rule: Input number ÷ 2 + 2

5.

Input	1	2	3	4	5	6	10	20	50	100
Output	7	9	11	13	15	17	25	45	105	205

Rule: Input × 2 + 5

Activity 14.1

Learner's Book page 149

The learners engage with real-life problem situations again to see how the work on patterns is related to everyday situations. They investigate the numbers of tiles that are used to tile areas around three fish ponds of different sizes by calculating and doing drawings. They complete a table and find the number of tiles if the area of the pond increases. They select a rule that fits the problem from a list of rules.

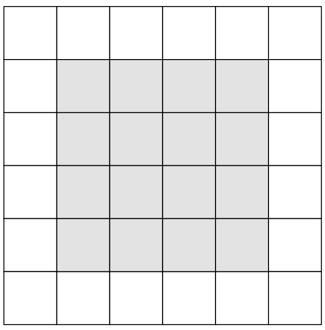
1. Allow the learners to use their own strategies to calculate the number of tiles. Share the following strategy involving the area model with them if they do not apply it. They should recognise that they work with square numbers.

Pond 1: (3 × 3) – (1 × 1) = 9 – 1
= 8 tiles

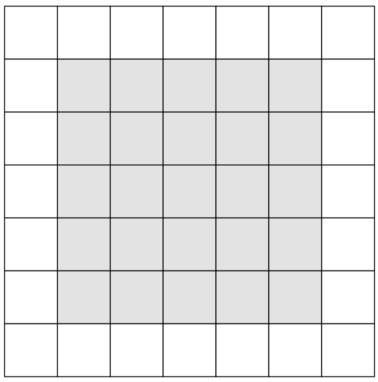
Pond 2: (4 × 4) – (2 × 2) = 16 – 4
= 12 tiles

Pond 3: (5 × 5) – (3 × 3) = 25 – 9
= 16 tiles

2. **a)** 4 m × 4 m



b) 5 m × 5 m



3. **a)** (6 × 6) – (4 × 4) = 36 – 16 = 20 tiles
b) (7 × 7) – (5 × 5) = 49 – 25 = 24 tiles

4.

Side length of pond (m)	1	2	3	4	5	6
Number of tiles	8	12	16	20	24	28

5. $7 \times 4 + 4 = 32$ tiles. Ask the learners to make a drawing to check the solution.
6. $10 \times 4 + 4 = 44$ tiles
7. $48 \div 4 - 4 = 8$
   An 8 m × 8 m size pond
8. Rule: side length of pond × 4 + 4
9. $68 \times 4 + 4 = (60 \times 4) + (8 \times 4) + 4$
   $= 240 + 32 + 4$
   $= 276$ tiles
   Learners should notice that a 68 m × 68 m pond needs 4 more tiles than a 67 m × 67 m pond. Ask them how many tiles a 69 m × 69 m would have.
10. (number × 4) + 4

Unit 15 Rules for groups of tables

MENTAL MATHS

Learner's Book page 150

The learners investigate the relationship between the number of dots, lines, intersections and regions in circles. Ask them to look at circle C. Help them to understand what the regions and intersections are. They should note how the lines are connected to the dots. Each dot is connected to every other one. They do the same for circles A, B, D and E.

In question 2 they copy and complete the table by counting the number of lines, regions and intersections.

In question 3 they find rules for calculating the number of lines, regions and intersections for circles with increased numbers of dots.

1. The learners should notice the pattern when they draw lines to connect the circles. Connecting 2 dots gives a line; 3 dots a triangle, 4 dots a quadrilateral; 5 dots a pentagon and 6 dots make a hexagon.
2.

	Number of dots	Number of lines	Number of regions	Number of intersections
A	2	1	2	0
B	3	3	4	0
C	4	6	8	1
D	5	10	16	5
E	6	15	30	13

3.

	Dots	Lines	Regions	Intersections
a)	7	21	50	28
b)	8	28	86	34

Activity 15.1

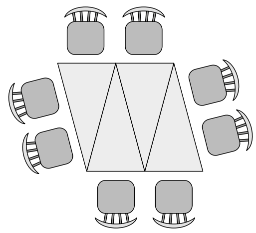
Learner's Book page 151

The learners continue to work with real-life simulations involving geometric patterns that they have to investigate to find relationships and rules. Ask them to record their strategies, drawings and solutions on large sheets of paper. Allow them to present their work to the class. You should let them display their work in the classroom. They investigate the number of chairs to be placed at triangular- and pentagonal-shaped tables. They first calculate the number of chairs as in the pictures, do drawings and find rules for calculating the number of chairs when the number of tables is increased. Encourage them to use short forms to write rules. When they are given the number of chairs and are required to work out the numbers of tables, they have to apply the inverse operations.

1. a) 4 + 2 = 6 people

b) 4 + 5 = 9 people

c)

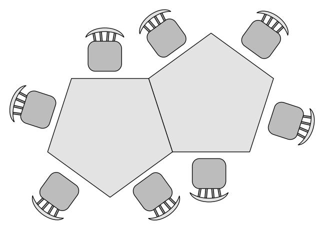


d) 4 + 4 = 8 people can be seated.

e) Number of tables + 4
= number of chairs

2. a) 3 tables:
4 + 3 + 4 = 11 people

b)



c) 4 + 4 = 8 people can be seated.

d)

Tables	People
2	8
3	11
4	14
5	17
6	20
10	32

The rule for calculating the number of people:
number of tables × 3 + 2

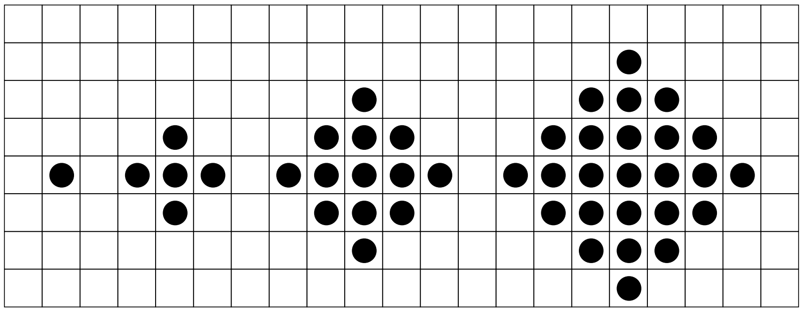
3. a) The rule to get the number of people: number of tables + 4
The learners use the inverse operation to get the number of tables, i.e. 38 – 4 = 34 tables

b) The rule to get the number of people:
number of tables × 3 + 2

The rule to get the number of tables:
number of people – 2 ÷ 3
38 – 2 ÷ 3 = 36 ÷ 3
= 12 tables

Assessment 2.2 Geometric patterns

1. Study the patterns on this grid.



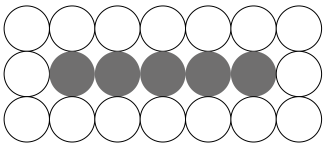
a) How many dots are there in the 4th pattern?

b) Draw the 5th pattern. There must be an odd number of dots in each row.

c) Complete the table.

Pattern number	1	2	3	4	5	6
Number of dots						

2 Study the pattern with white and black dots.



a) How many white dots are there if there are 3 black dots?

b) How many white dots are there if there are 6 black dots?

c) How many black dots are there if there are 14 white dots?

d) How many black dots are there if there are 22 white dots?

e) Complete the table.

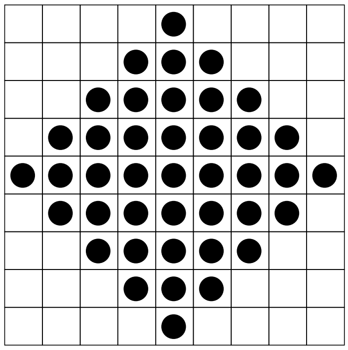
Black dots	1	2	3	4	5	6	7	8	10	20	100
White dots											

f) Write the rule to get the number of white dots if you know the number of black dots.

1. The learners explore the patterns in the grid.

a) The 4th pattern has 25 dots.

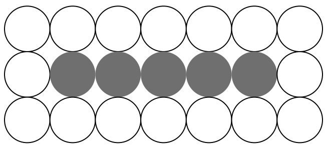
b) They draw the 5th pattern making sure that there is an odd number of dots in each row.



c)

Pattern number	1	2	3	4	5	6
Number of dots	**1**	**5**	**13**	**25**	**41**	**59**

2.



a) Number of white dots: $3 \times 2 + 6 = 12$

b) Number of white dots: $6 \times 2 + 6 = 18$

c) Number of black dots: $(14 - 6) \div 2 = 8 \div 2$
$= 4$

d) Number of white dots: $22 \times 2 + 6 = 50$

e) Completed table

Black dots	1	2	3	4	5	6	7	8	10	20	100
White dots	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**26**	**46**	**206**

f) Multiply the number of black dots by 2 and add 6 to get the number of white dots.

Symmetry

Learner's Book page 152

The learners should have a good basic understanding of symmetry from work done in Grades 4 and 5. In Grade 6, the focus is on identifying lines of symmetry in 2-D shapes. This extends the work on 2-D shapes done in Term 1, as symmetry is another property of 2-D shapes that the learners explore.

Unit 16 Symmetrical shapes

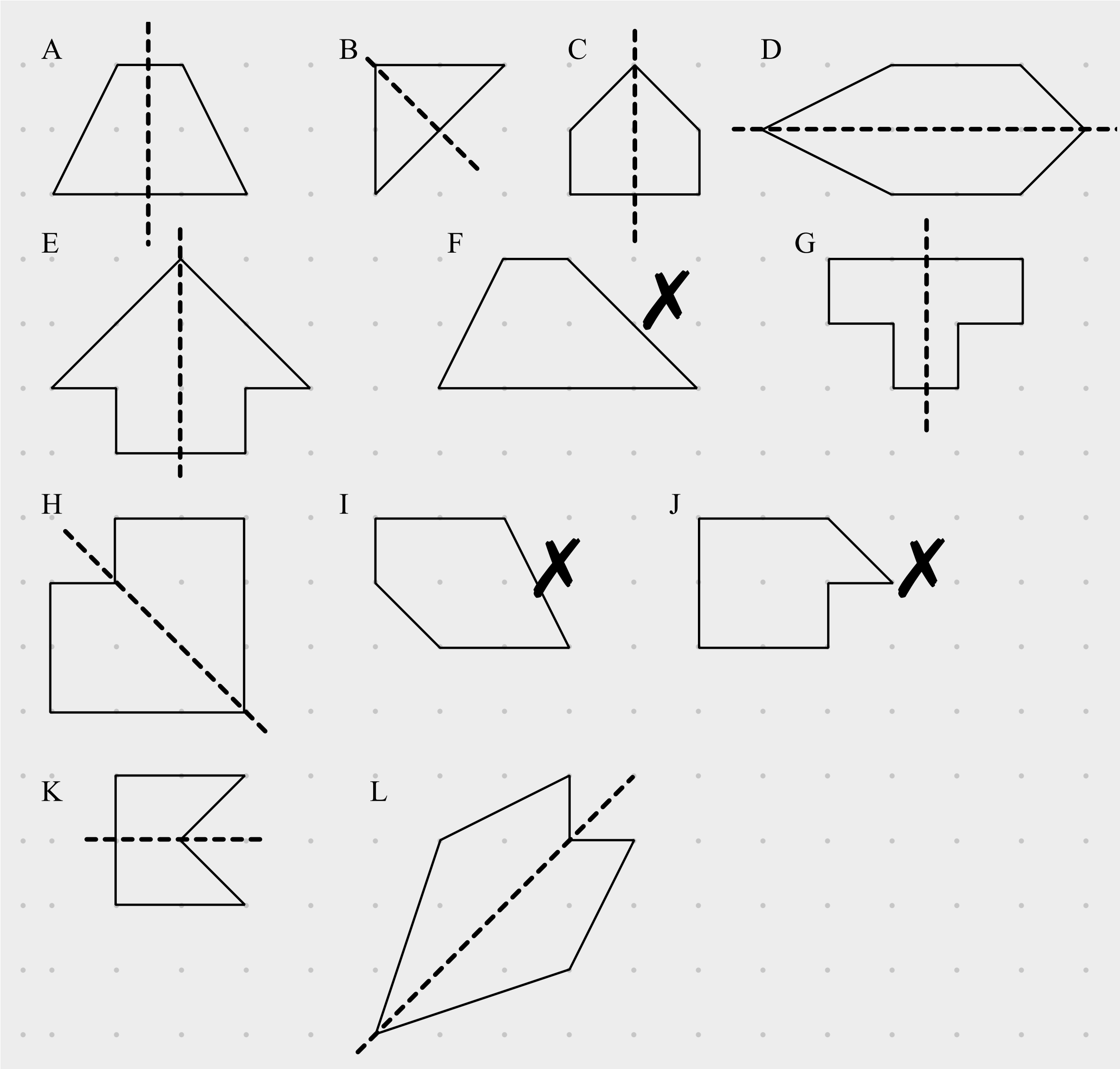
Remind the learners what a line of symmetry is and help them to recognise shapes that are symmetrical and shapes that are not symmetrical. Mention that lines of symmetry can be positioned in any direction – they do not always have to be vertical or horizontal.

It would be good practice for the learners to copy the shapes in all the activities in this unit onto dotted paper themselves.

MENTAL MATHS

Learner's Book page 152

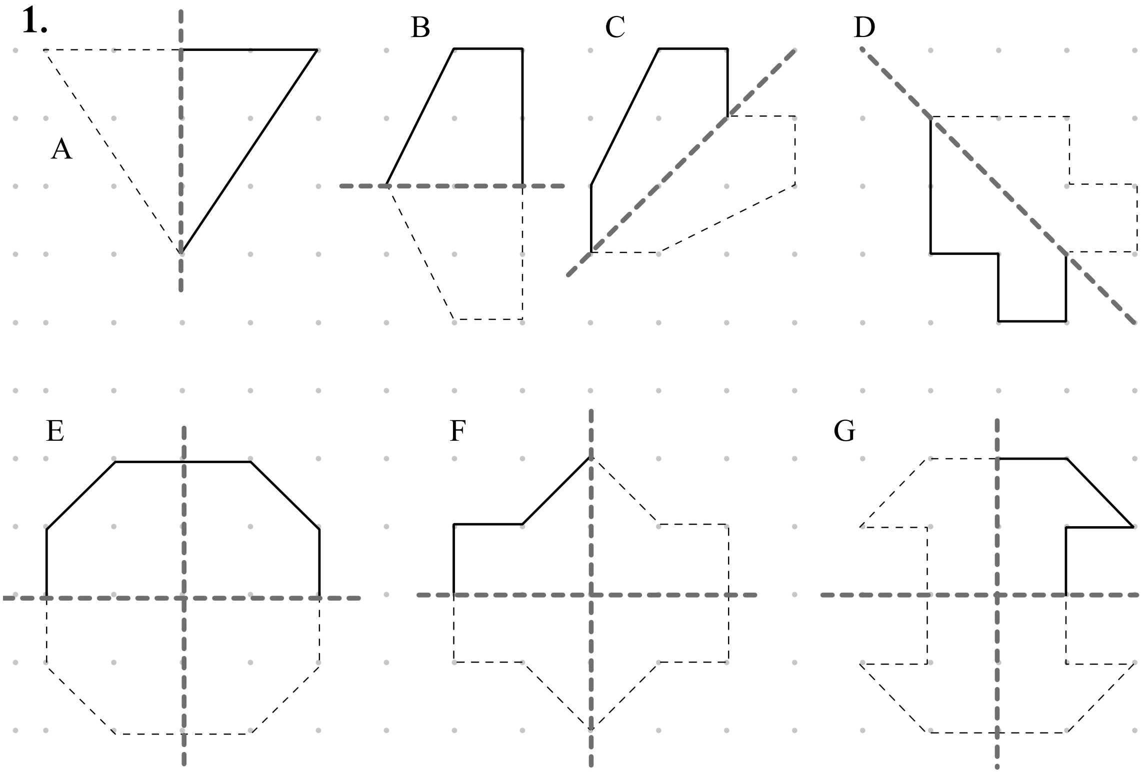
For the Mental Maths activity, let the learners copy the shapes onto dotted paper (unless you have given them copies of the shapes). Ask them to visualise (imagine) where the line of symmetry is in each shape. Let them explain their thinking and reasoning to the class. They draw the lines of symmetry in the shapes to check their thinking. Ask them to put a cross next to the shapes that are not symmetrical. Ask them to explain how they should adapt the drawings to make these shapes symmetrical. Let them change the shapes on the dotted paper to make them symmetrical. 'Visualization is an important part of geometrical thinking. It's the skill you use when you pretend to be somewhere else and imagine how that place looks, or when you fancy how a situation would look if things were just a little bit different' (http://www.learner.org/teacherslab/math/geometry/space/). Keep in mind that the development of visual skills in Space and shape will assist learners in developing effective mental calculation skills. According to A Hoffer (1981), learners who did not develop effective visualisation skills often perform poorly in work with numbers.



Activity 16.1

Learner's Book page 153

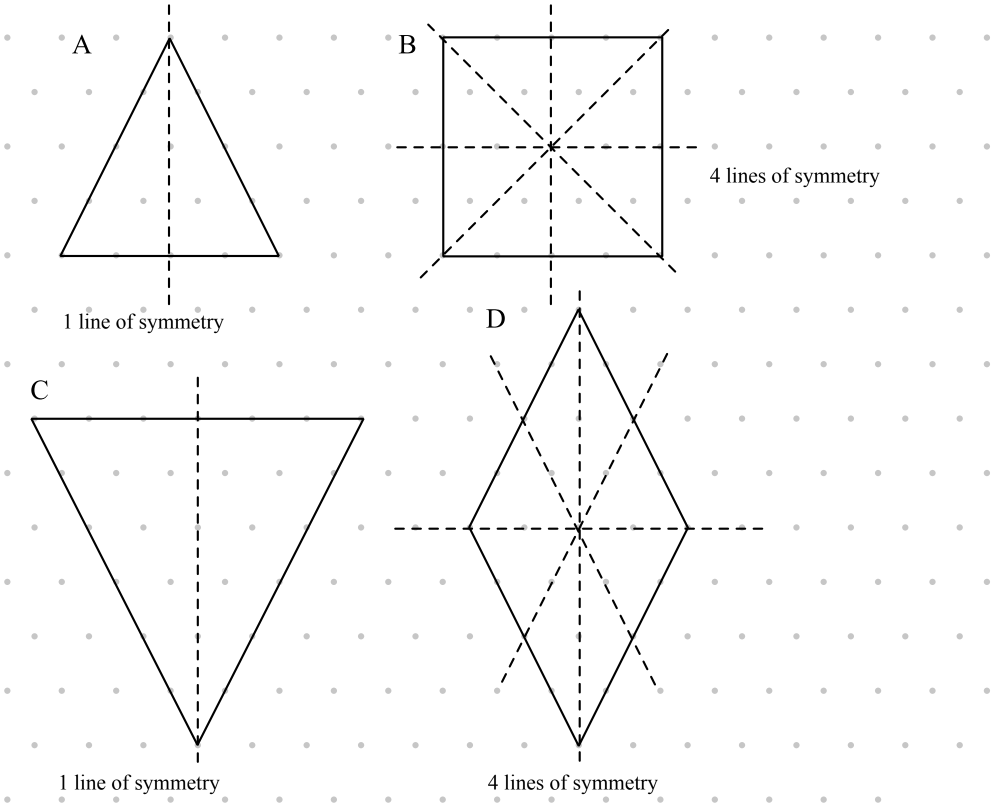
1.



2. A: incorrect
B: correct
C: incorrect
D: correct
E: correct
F: incorrect
G: correct
H: correct

Activity 16.2
Learner's Book page 155

1.



Activity 16.3
Learner's Book page 155

Many learners find it difficult to visualise symmetrical shapes when there is more than one line of symmetry. This activity helps them to learn about lines of symmetry in a concrete way. Allow them sufficient time to explore symmetry in this activity. You could also combine this activity with a Visual Arts activity and encourage the learners to create attractive and interesting symmetrical shapes, which you could display and discuss with the whole class.

Learners' own work.

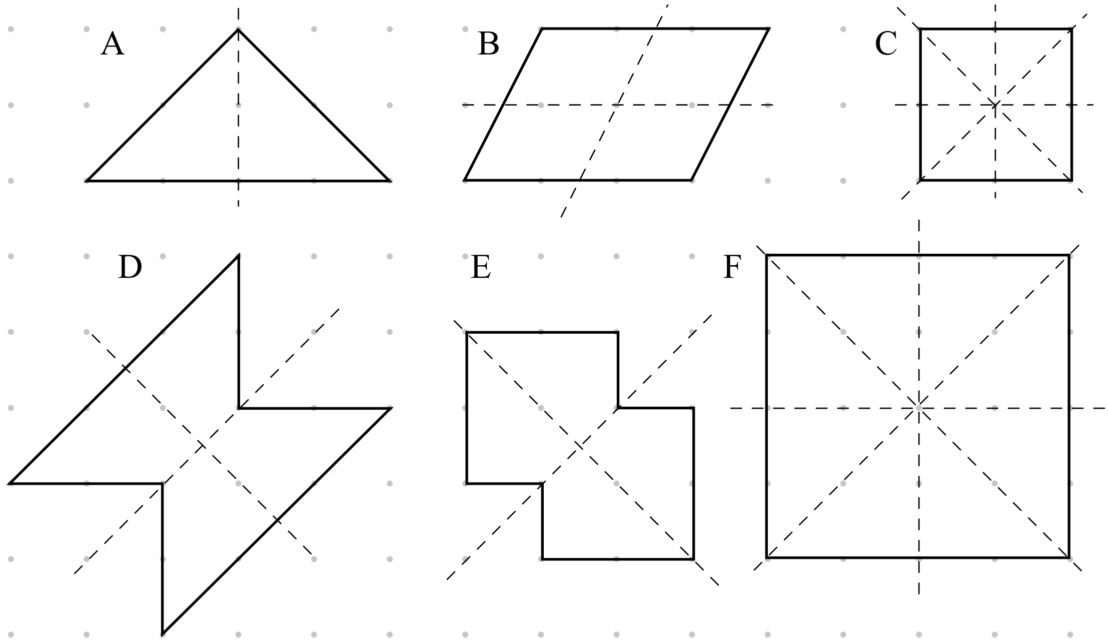
Assessment points

- Can they draw one line of symmetry in symmetrical shapes?
- Can they draw more than one line of symmetry in symmetrical shapes?

Revision

Learner's Book page 156

Let the learners copy the shapes onto dotted paper.



Investigation

Learner's Book page 157

In previous activities, the learners folded paper squares to make 2 and 4 lines of symmetry. Remind them how to do this, then they should be able to figure out that they can make shapes with 8 lines of symmetry if they fold the page in half again after they have folded it to make 4 lines of symmetry. They will need to work out where they should make the fold, i.e. only one edge of the folded paper should have all the loose parts of the paper. The other three edges must all have folds.

Project

Learner's Book page 157

Let the learners work with dotted paper 1 cm × 1 cm apart. It will help them to measure the distances accurately.

Use the following grid to allocate marks for the project.

Criteria	Maximum mark
The pattern of the net is correct for a cube.	2
The measurements of the net are accurate.	4
The cube made from the net is neat and clear and glued in place.	5
All the 2-D shapes have been drawn correctly.	6
All the 2-D shapes have been pasted correctly onto the cube.	3
Total marks	**20**

Remedial activities

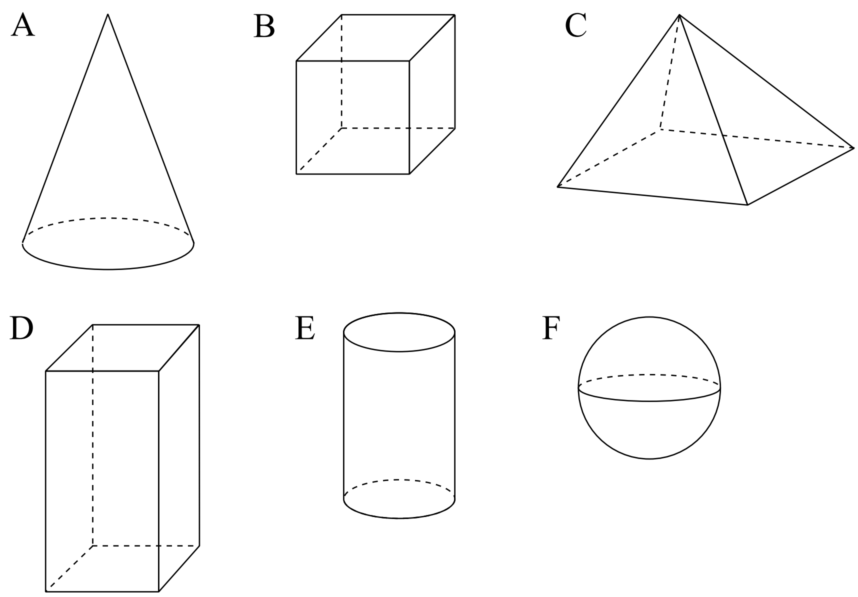
- Give the learners shapes with only one line of symmetry. Draw these shapes on dotted paper as this will help the learners to copy the shapes later. Let them draw in the line of symmetry on each shape. Then let them turn the page sideways (i.e. with the long sides horizontal) so that the line of symmetry falls in another direction. Let them copy this turned shape with its line of symmetry on their own sheet of dotted paper. Once they are able to do this comfortably, let them do the same with shapes that have two lines of symmetry.
- If the learners struggle to identify lines of symmetry, give them symmetrical shapes with one, two, three and four lines of symmetry. Let them cut out each shape and fold it in half. When they unfold the shape, they can draw in the line of symmetry on the fold in the shape. Then let them find other ways to fold the shape in half. Each time, let them unfold the paper and draw in the line of symmetry on the fold.

Extension activity

Give the learners copies of the following regular shapes, i.e. shapes with sides equal and with angles equal: triangle, square, pentagon, hexagon and octagon. Let them draw in all the lines of symmetry on each shape. Ask them if they notice a pattern in the number of lines of symmetry and the number of sides of the shape. (The pattern is that the number of lines of symmetry of each shape equals the number of sides of the shape. This is true for regular shapes.)

Assessment 2.3 Properties of 3-D objects and symmetry

1. Look at the 3-D objects below.



a) Name each of the 3-D objects.

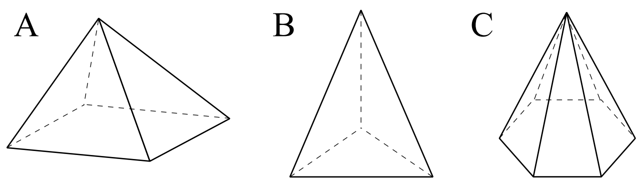
b) Which three objects have at least one curved surface?

c) Which three objects have only flat surfaces?

d) Which two objects have both curved and flat surfaces?

e) Which two objects have faces with right angles?

2. Look at pyramids A, B and C below.



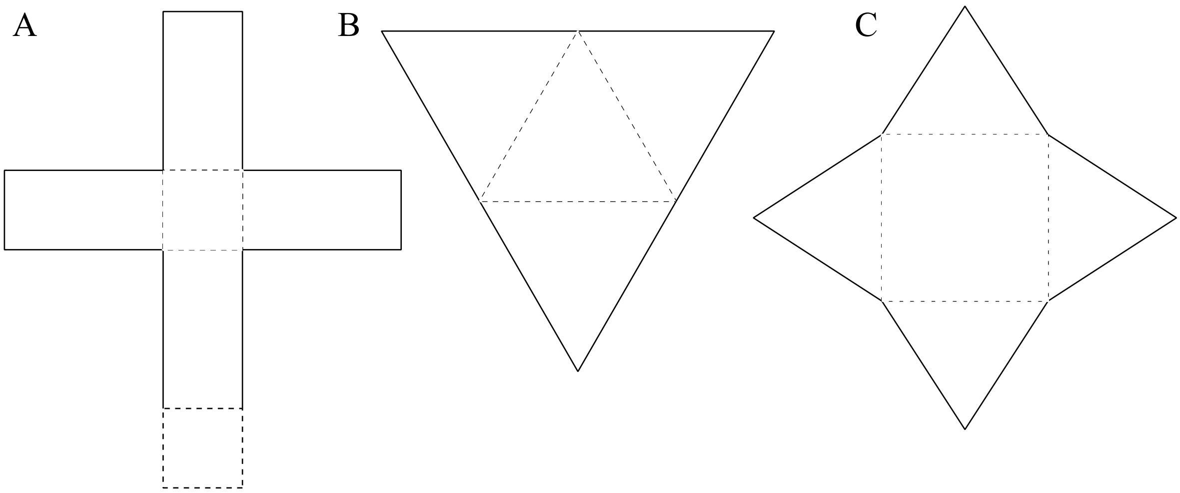
a) What is the name of shape B?

b) Copy and complete the table below for the shapes above.

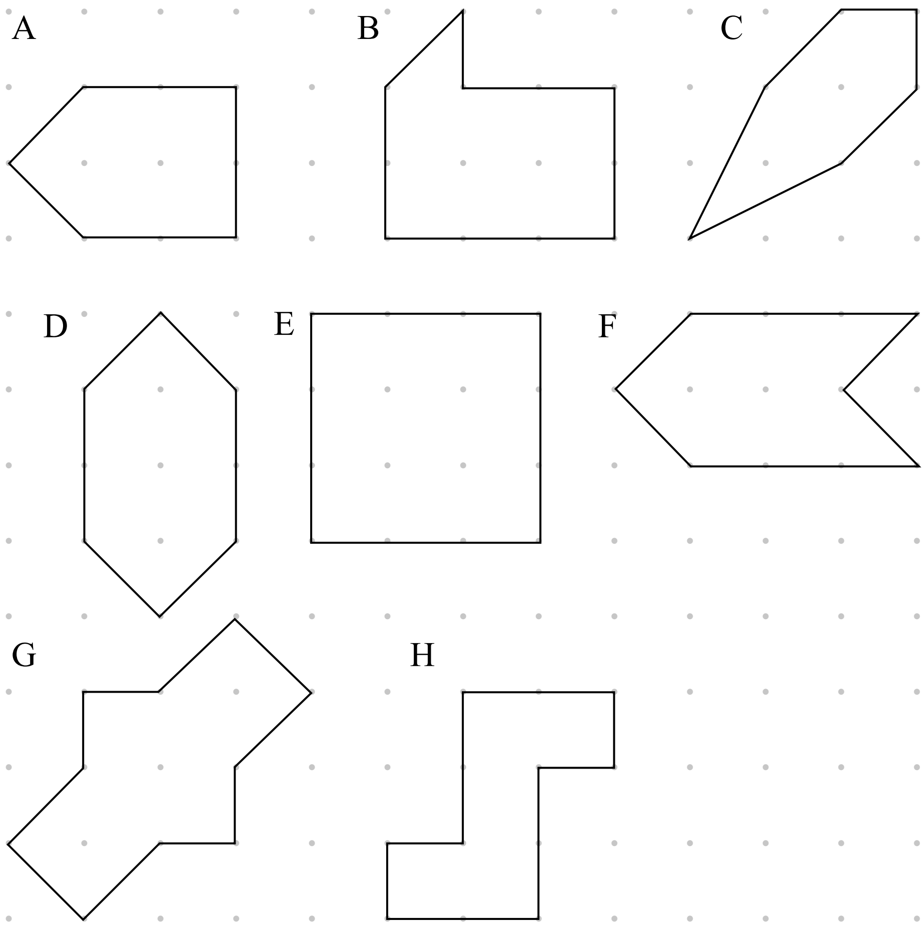
	Shape A	Shape B	Shape C
Shape of the base			
Number of sides of the base			
Number of triangular faces			
Total number of faces			

3. Match each net below with the name of its 3-D object.

tetrahedron | square-based pyramid | rectangular prism



4. a) Which of the shapes below are symmetrical?
   b) Copy the symmetrical shapes. Draw all the lines of symmetry for each shape.



Assessment 2.3 Properties of 3-D objects and symmetry
Solutions

1. a) A → cone B → cube
C → square-based pyramid D → rectangular prism
E → cylinder F → sphere

b) A, E, F
c) B, C, D
d) A, E
e) B and D

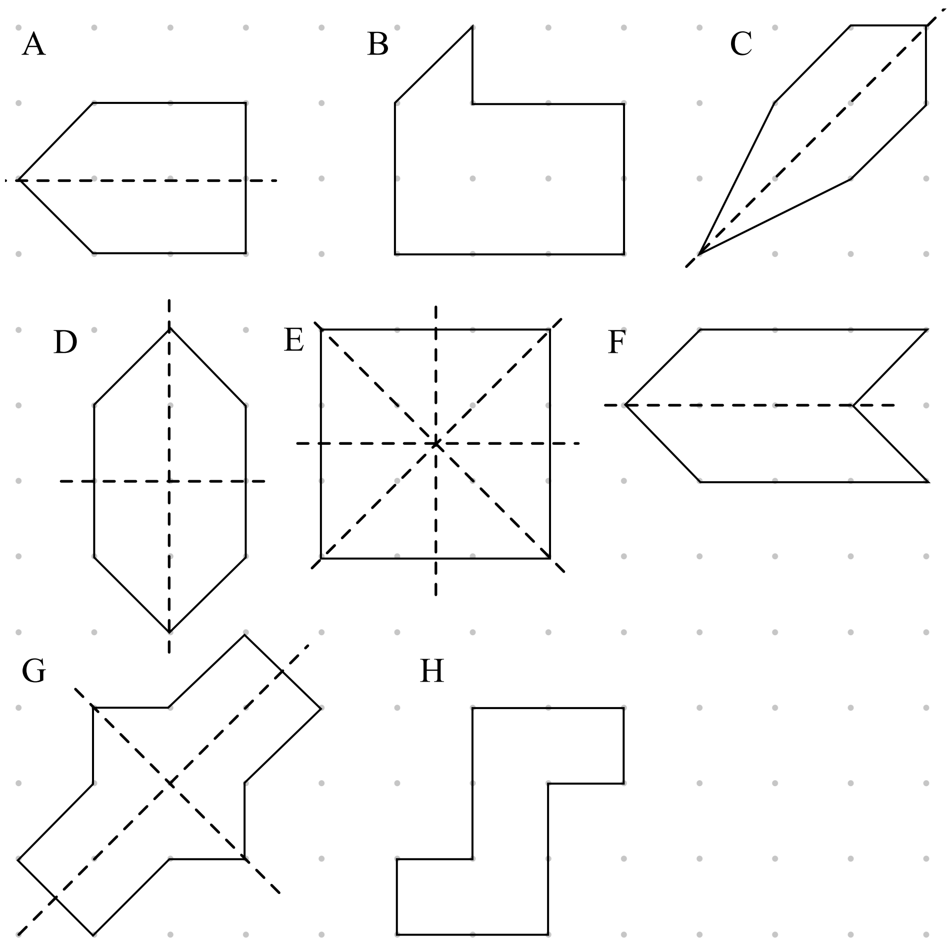
2. a) Tetrahedron or triangular-based pyramid

b)

	Shape A	Shape B	Shape C
Shape of the base	Square	Triangle	Hexagon
Number of sides of the base	4	3	6
Number of triangular faces	4	3	6
Total number of faces	5	4	7

3. A → rectangular prism B → tetrahedron
C → square-based pyramid

4. a) All except for B and H
b) You could give the learners copies of the shapes below, which are provided in the Photocopiable Resources section at the back of this Teacher's Guide.



Whole numbers

Learner's Book page 158

Division

Tell the learners that they have learned and developed knowledge of basic division facts in Grades 4 and 5. They should know basic division facts off by heart – if they know the basic multiplication facts, they should know the division facts because they are related. They need to apply the basic facts to calculations with larger numbers. Remind them that they have worked with division tables up to 100 ÷ 10. This knowledge will be extended to involve division by 11 and 12. They have divided up to 3-digit by 2- digit numbers so far. This year they will divide up to 4-digit by 2-digit numbers. They will start with practising basic division facts.

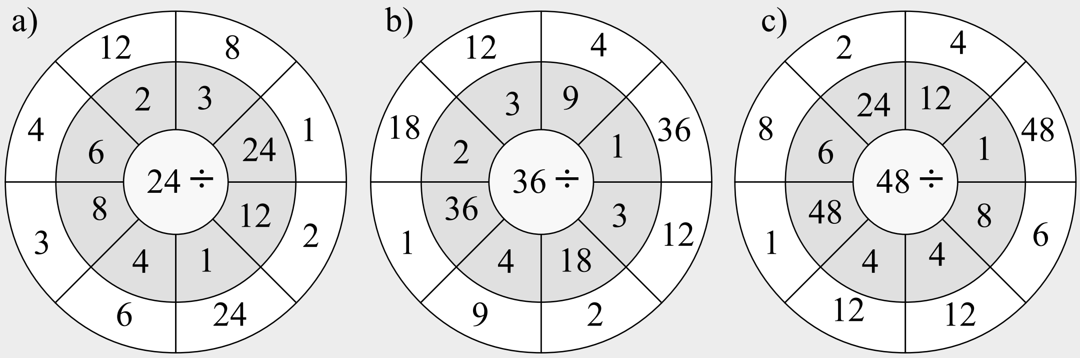
Unit 17 Basic division

MENTAL MATHS

Learner's Book page 158

Draw the division circles on the board. Ask individual learners for the answers. Give the learners copies of the circles in the resources section to complete on their own. Learners who struggle should write out the division tables in full.

1.



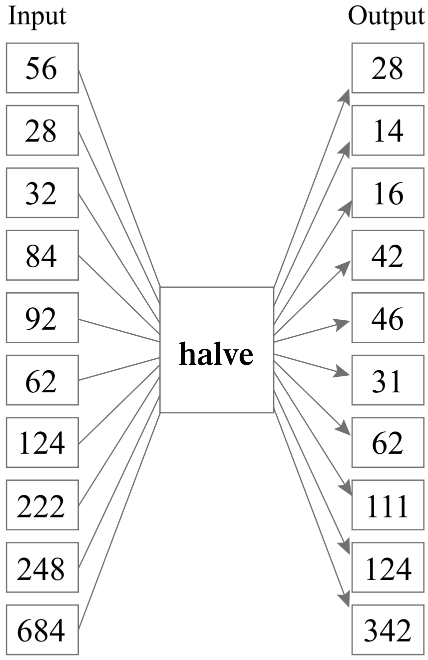
Activity 17.1

Learner's Book page 158

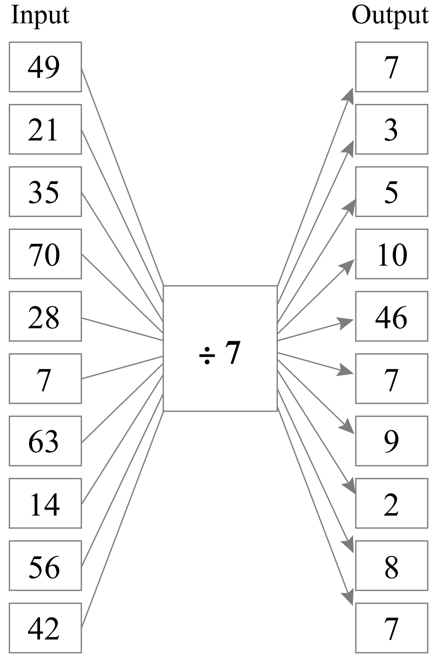
The learners practise basic division facts by completing flow diagrams and number sentences. They halve numbers, divide by 3, 6 and 12 and look for relationships in the solutions, for example 24 ÷ 3 = 8; 24 ÷ 6 = 4 and 24 ÷ 12 = 2.

They write addition, subtraction, multiplication and division facts for arrays of counters to demonstrate understanding of the relationship between the four basic operations. Working with arrays allows the learners to illustrate multiplication as a short form for repeated addition and division as a short form for subtraction. They show inverse operations for multiplication and addition and the commutative property for multiplication. Let the learners discuss their observations with the class.

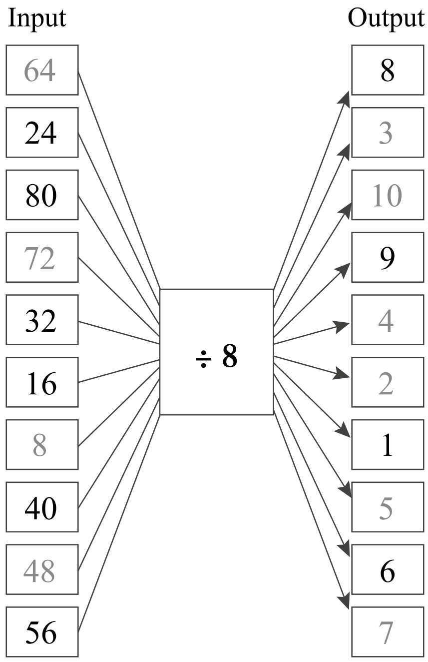
1. a)



b)



c)



2. **a)** 10; 5; 5 **b)** 1; 1; 1 **c)** 8; 4; 2
d) 7; 7; 7 **e)** 6; 3; 3 **f)** 4; 2; 1
g) 16; 8; 4 **h)** 20; 10; 5 **i)** 12; 6; 3
j) 9; 9; 9

3. **a)** $7 + 7 + 7 + 7 + 7 = 35$

$5 \times 7 = 35$

$35 - 7 - 7 - 7 - 7 - 7 = 0$

$35 \div 5 = 7$

$5 + 5 + 5 + 5 + 5 + 5 + 5 = 35$

$7 \times 5 = 35$

$35 - 5 - 5 - 5 - 5 - 5 - 5 - 5 = 0$

$35 \div 7 = 5$

b) $3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 = 24$

$8 \times 3 = 24$

$24 - 3 - 3 - 3 - 3 - 3 - 3 - 3 - 3 = 0$

$24 \div 8 = 3$

$8 + 8 + 8 = 24$

$3 \times 8 = 24$

$24 - 8 - 8 - 8 = 0$

$24 \div 3 = 8$

c) $3 + 3 + 3 + 3 + 3 + 3 = 18$

$6 \times 3 = 18$

$18 - 3 - 3 - 3 - 3 - 3 - 3 = 0$

$18 \div 6 = 3$

$6 + 6 + 6 = 18$

$3 \times 6 = 18$

$18 - 6 - 6 - 6 = 0$

$18 \div 3 = 6$

Unit 18 Division rules

MENTAL MATHS

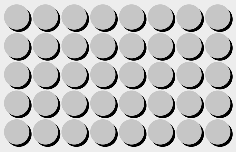
Learner's Book page 160

The learners break up counters into different groups and use the distributive property to demonstrate that a number divided by different factors can give the same result. They explore and discuss the illustrated example and use the method to show division by different factors for 40, 27 and 18. Give them counters to explore different combinations.

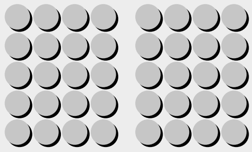
Ask them to use the commutative property (swapping numbers) and inverse operations (opposite operations) to show the relationship between multiplication and division for each number. They use the distributive property to group the numbers to show division by the same factors that give different quotients.

1. Discussion

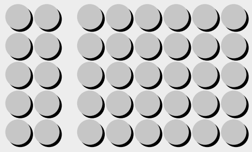
2. You should expect different solutions. Below are some of the combinations the learners could create.



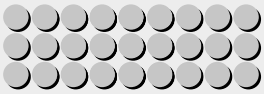
$40 \div 5 = 8$
$= 4 + 4$
$= 8$



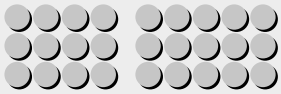
$(20 \div 5) + (20 \div 5)$
$= 2 + 6$
$= 8$



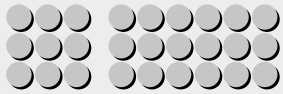
$10 \div 5) + (30 \div 5)$



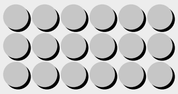
$27 \div 3 = 9$
$= 4 + 5$
$= 9$



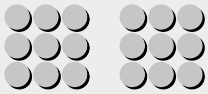
$(12 \div 3) + (15 \div 3)$
$= 3 + 6$
$= 9$



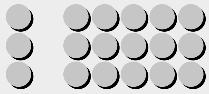
$(9 \div 3) + (18 \div 3)$



$18 \div 3 = 6$
$= 3 + 3$
$= 6$



$(9 \div 3) + (9 \div 3)$
$= 1 + 5$
$= 6$



$(3 \div 3) + (15 \div 3)$

Activity 18.1

Learner's Book page 160

The learners use grouping (the distributive property) to solve the division problems. They should realise that they have to break up the dividend and divide both numbers by the same factor to get the solutions. They check that the sum of the dividends add up to the original dividend.

You should expect different solutions. Below are some of the solutions learners might offer. They would probably use numbers that combine easily. In questions 6 to 10 the learners should realise that the dividend is the sum of the two dividends in brackets.

1. $99 \div 11$
$= (\mathbf{44} \div 11) + (\mathbf{55} \div 11)$
$= 4 + 5$
$= 9$

2. $108 \div 12$
$= (\mathbf{60} \div 12) + (\mathbf{48} \div 12)$
$= 5 + 4$
$= 9$

3. $72 \div 9$
$= (\mathbf{36} \div 9) + (\mathbf{36} \div 9)$
$= 4 + 4$
$= 8$

4. $48 \div 8$
$= (\mathbf{40} \div 8) + (\mathbf{8} \div 8)$
$= 5 + 1$
$= 6$

5. $32 \div 4$
$= (\mathbf{20} \div 4) + (\mathbf{12} \div 4)$
$= 5 + 3$
$= 8$

6. $(16 \div 4) + (8 \div 4)$
$= \mathbf{24} \div 4$
$= 6$

7. $(12 \div 2) + (4 \div 2)$
$= 16 \div \mathbf{2}$
$= 8$

8. $(42 \div 7) + (14 \div 2)$
$= \mathbf{6} + 7$
$= 13$

9. $(36 \div 6) + (\mathbf{9} \div 3)$
$= 6 + \mathbf{3}$
$= 9$

10. $(14 \div 7) + (28 \div 7)$
$= 42 \div \mathbf{7}$
$= 6$

Unit 19 Division by zero

MENTAL MATHS

Learner's Book page 161

Give the learners each a copy of the *One-minute calculations* table. Ask them to complete the table to show how quickly they are able to recall division facts. Keep time and let the learners find out how many (correct) solutions they can provide in one minute. They solve division problems involving multiples of 10 by following a pattern, and solve problems using short cuts and rules for dividing by 10 and its multiples that do not require calculations.

1.

One-minute calculations			
Division			
1.	20 ÷ 1 = 20	**11.**	30 ÷ 5 = 6
2.	20 ÷ 20 = 1	**12.**	35 ÷ 7 = 5
3.	45 ÷ 5 = 9	**13.**	16 ÷ 4 = 4
4.	60 ÷ 12 = 5	**14.**	42 ÷ 6 = 7
5.	44 ÷ 11= 4	**15.**	60 ÷ 5 = 12
6.	49 ÷ 7 = 7	**16.**	72 ÷ 9 = 8
7.	27 ÷ 3 = 9	**17.**	98 ÷ 7 = 14
8.	0 ÷ 8 = 0	**18.**	99 ÷ 11 = 9
9.	0 ÷ 10 = 0	**19.**	15 ÷ 3 = 5
10.	144 ÷ 12 = 12	**20.**	56 ÷ 8 = 7

2. **a)** 30 ÷ 10 = **3**
300 ÷ 10 = **30**
3 000 ÷ 10 = **300**
30 000 ÷ 10 = **3 000**
300 000 ÷ 10 = **30 000**
3 000 000 ÷ 10 = **300 000**

b) 400 ÷ 100 = **4**
4 000 ÷ 100 = **40**
40 000 ÷ 100 = **400**
400 000 ÷ 100 = **4 000**
4 000 000 ÷ 100 = **40 000**

c) 6 000 ÷ 1 000 = **6**
60 000 ÷ 1 000 = **60**
600 000 ÷ 1 000 = **600**
6 000 000 ÷ 1 000 = **6 000**

d) 70 000 ÷ 10 000 = **7**
700 000 ÷ 1 000 = **700**
7 000 000 ÷ 1 000 = **7 000**

e) 500 000 ÷ 100 000 = **5**
5 000 000 ÷ 1 000 = **5 000**

3. a)	400 ÷ 4 = **100**	400 ÷ 40 = **10**
b)	220 ÷ 2 = **110**	220 ÷ 20 = **11**
c)	480 ÷ 8 = **60**	480 ÷ 80 = **6**
d)	550 ÷ 5 = **110**	550 ÷ 50 = **11**
e)	2 400 ÷ 4 = **600**	2 400 ÷ 40 = **60**
f)	9 900 ÷ 9 = **1 100**	9 900 ÷ 90 = **110**
g)	3 600 ÷ 12 = **300**	3 600 ÷ 120 = **30**
h)	32 000 ÷ 800 = **40**	32 000 ÷ 8 000 = **4**
i)	420 000 ÷ 700 = **600**	420 000 ÷ 7 000 = **60**
j)	54 000 ÷ 60 = **900**	54 000 ÷ 600 = **9**

Activity 19.1

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Division by zero as a divisor is normally ignored or neglected in primary school although the concept is very significant in higher grades. High school learners often know that division by zero is not possible, not allowed or undefined, but they are not able to explain why this is so – even some teachers are not able to conceptualise division by zero effectively.

Grade 6 learners will explore division by zero in this lesson to realise that, for example, 4 ÷ 0 ≠ 0; it is impossible to divide by zero and learners should be able to explain why once they have developed an understanding of the concept. Learners normally know that, for example, 0 ÷ 4 = 0, but they cannot justify a concept such as 8 ÷ 4 = 2, where for example you have 8 sweets divided by 4 children and each one gets 2 sweets. They need to construct meaning of the concept in a systematic, meaningful and practical way. If you have 4 ÷ 4 = 1, it means you have 4 sweets and 4 children so that each child gets 1 sweet. If you have 0 ÷ 4 = 0 it means there are zero sweets and 4 children so that each child gets zero sweets.

Learners should refrain from referring to zero as nothing. The concept of division by zero as a divisor is more abstract. Learners and adults often think that, for example, 4 ÷ 0 = 0, which is untrue. The activities in this lesson should help learners to understand that 4 ÷ 0 is impossible or senseless.

Let the learners work together as a class. They use the counters to answer question in 1.

In question 2, the learners use the grouping model to make sense of division by zero.

Ask the learners to use drawings in question 3 and 4 to demonstrate their understanding and to write number sentences. In question 3 they use the equal sharing model to make sense of division by zero, and in question 4 they use the measurement model. Let them write multiplication number sentences to indicate the number of pieces cut.

In question 5 the learners solve the problems using inverse operations to realise that 12 ÷ 0 = 0 and 0 × 0 = 12 do not make sense.

In question 6, the learners explore the number lines and division number sentences. They should discover that it is not possible to illustrate 12 ÷ 0 on the number line. Let them describe the pattern they observe in the solutions to realise that 0 does not fit into the pattern as the next term.

1. **a)** 3 groups of 4 in 12 **b)** 12 ÷ 4 = 3

2. **a)** 4 groups of 3 in 12 12 ÷ 3 = 4
b) 6 groups of 2 in 12 12 ÷ 2 = 6
c) 12 groups of 1 in 12 12 ÷ 1 = 12
d) Cannot get zero groups in 12. 12 ÷ 0 is impossible.

3. **a)** 12 ÷ 12 = 1 Each child gets 1
b) 12 ÷ 6 = 2 Each child gets 2
c) 12 ÷ 4 = 3 Each child gets 3
d) 12 ÷ 3 = 4 Each child gets 4
e) 12 ÷ 2 = 6 Each child gets 6
f) 12 ÷ 1 = 12 One child gets 12
g) 12 ÷ 0 is meaningless

4. **a)** 24 ÷ 12 = 2 2 × 12 m
b) 24 ÷ 8 = 3 3 × 8 m
c) 24 ÷ 6 = 4 4 × 6 m
d) 24 ÷ 4 = 6 6 × 4 m
e) 24 ÷ 3 = 8 8 × 3 m
f) 24 ÷ 2 = 12 12 × 2 m
g) 24 ÷ 1 = 12 12 × 1 m
h) You cannot cut 0 m pieces of rope.

5. **a)** 12 ÷ 12 = 1 12 × 1 = 12
b) 12 ÷ 6 = 2 6 × 2 = 12
c) 12 ÷ 4 = 3 4 × 3 = 12
d) 12 ÷ 3 = 4 3 × 4 = 12
e) 12 ÷ 2 = 6 2 × 6 = 12
f) 12 ÷ 1 = 12 1 × 12 = 12
g) 12 ÷ 0 = 0 and 0 × 0 = 12 are untrue – it is senseless.

6. **a)** 12 ÷ 2 = 6 **b)** 12 ÷ 3 = 4
c) 12 ÷ 4 = 3 **d)** 12 ÷ 6 = 2
e) 12 ÷ 1 = 12
f) It is impossible to illustrate 12 ÷ 0 on the number line.

7. Learners' own work.

Note: Read the information to the learners to emphasise that division by zero is not allowed in mathematics. Let them use calculators to check division by zero as a dividend and divisor. Ask the learners to reflect on their learning experience by writing a letter to a teacher in the school to explain what they have learned about division by zero.

Let them read and discuss the information about infinity in the *Did you know?* box on page 164.

Unit 20 Using a calculator to check

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The learners investigate outputs when a calculator is programmed to divide repeatedly. They use sequential calculators in question 1 to find out what happens if they divide by 2, 5, 10, 12 and 20. Let them write the natural or counting numbers in each sequence on the board. Ask them to discuss the relationships they observe.

In question 2 the learners use sequential and scientific calculators to perform operations. The objective is to discover that the scientific calculator is a four-operation device – it performs the calculations in the correct order and provides the correct solutions. You could let one half of the class use scientific calculators and the other half sequential ones. They should find out, for example, that 560 – 60 ÷ 5 = 100 on the sequential calculator, whereas 560 – 60 ÷ 5 = 548 on the scientific calculator. They discuss their solutions and decide which calculator gives the most accurate solutions. They write the problems on the board and use brackets to show the correct order of operations.

1. **a)** 512 ÷ 2 =256; 128; 64; 32; 16; 8; 4; 2; 1
b) 100 000 ÷ 10 = 10 000; 1 000; 100; 10; 1
c) 2 000 000 ÷ 20 = 100 000; 5 000; 250
d) 500 000 ÷ 5 = 100 000; 20 000; 4 000; 800; 160; 32
e) 2 985 984 ÷ 12 = 248 832; 20 736; 1 728; 144; 12; 1

The learners should notice that the calculator divides by the divisor repeatedly if you use the constant key (=) repeatedly. The products in the sequences are all factors of the dividends.

2.

		Answer on sequential calculator	Answers on scientific calculator
a)	236 ÷ 4 × 15	885	885
b)	427 ÷ 7 × 20	1 220	1 220
c)	25 × 8 ÷ 50	4	4
d)	75 × 8 ÷ 25	24	24
e)	560 – 60 ÷ 5	100	548
f)	108 – 12 ÷ 4	24	105
g)	450 + 450 ÷ 90	10	500
h)	475 + 25 ÷ 25	20	476

3. **a)** 236 ÷ 4 × 15 = 885 Perform (÷) and (×) as they appear
b) 427 ÷ 7 × 20 = 1 220
c) 25 × 8 ÷ 50 = 4 Perform (×) and (÷) as they appear
d) 75 × 8 ÷ 25 = 24
e) 560 – 60 ÷ 5 = 548 First do (÷) then (–)
f) 108 – 12 ÷ 4 = 105
g) 450 + 450 ÷ 90 = 500 First do (–) then (+)
h) 475 + 25 ÷ 25 = 476

Activity 20.1

Learner's Book page 165

Ask the learners to look at the problem and the solution. Ask them how they can check that the answer is true. Let them use a calculator to check the solution. They would probably use the inverse relationship between multiplication and division. Let them explore the checking strategy suggested in the examples by just looking at the product of the units in the dividend, divisor and quotient. They use this strategy to check the solutions in question 1.They then use calculators to find the accurate solutions.

In question 3 the learners use the 'unit' strategy to check the solutions and then find the accurate solutions on a calculator.

In question 4 they use their own strategies to solve 3- by 2-digit division problems. Make sure that they do not use calculators. Let them ask a partner to check their solutions using checking strategies of their choice. This will give you an opportunity to assess their ability to solve division problems.

1. **a)** 952 ÷ 56 = 18
False: 8 × 6 = 48: The unit in 952 should be 8.
b) 989 ÷ 23 = 44
False: 4 × 3 = 12: The unit in 989 should be 2.
c) 896 ÷ 32 = 27
False: 7 × 2 = 14: The unit in 896 should be 4.
d) 1 134 ÷ 42 = 27
True: 7 × 2 = 14: The unit in 1 134 is 4.
e) 1 624 ÷ 29 = 52
False: 2 × 9 = 18: The unit in 1 624 should be 8.
f) 2 736 ÷ 57 = 49
False: 9 × 7 = 63: The unit in 2 736 should be 3.

2. The learners use calculators to check the accurate solutions. Let them use the units to justify the solutions.

a)	95**2** ÷ 56 = 17	True	7 × 6 = 4**2**
b)	98**9** ÷ 23 = 43	True	3 × 3 = **9**
c)	89**6** ÷ 32 = 28	True	8 × 2 = 1**6**
d)	1 13**4** ÷ 42 = 27	True	7 × 2 = 1**4**
e)	1 62**4** ÷ 29 = 56	True	6 × 9 = 5**4**
f)	2 73**6** ÷ 57 = 48	True	8 × 7 = 5**6**

3. **a)** 204 ÷ 4 = 51 1 × 4 = 4
The unit is correct: 204 ÷ 4 = 51
b) 437 ÷ 19 = 32 2 × 9 = 18
The unit is incorrect: 437 ÷ 19 = 23
c) 20 433 ÷ 973 = 57
7 × 3 = 21: The unit is incorrect: 20 433 ÷ 973 = 21
d) 2 176 ÷ 68 = 34
4 × 8 = 32: The unit is incorrect: 2 176 ÷ 68 = 32
e) 3 648 ÷ 48 = 76
6 × 8 = 48: The unit is correct: 3 648 ÷ 48 = 76

f) 880 ÷ 40 = 24
0 × 4 = 0: The unit is correct: 880 ÷ 40 = 22

In the last problem the learners should notice that although the unit is correct, the solution to 880 ÷ 40 ≠ 24 because 880 ÷ 40 = 22. They should therefore realise that the 'unit strategy' might work effectively but it is not always reliable – they always have to check solutions effectively.

4. **a)** 391 ÷ 17 = 23 **b)** 686 ÷ 49 = 14
c) 903 ÷ 21 = 43 **d)** 992 ÷ 31 = 32
e) 432 ÷ 18 = 24

Unit 21 Division short cuts

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The learners use short cuts to multiply by 5 and 50. Ask them which double but simpler operators they can use for × 5 and × 50. Ask them to explore and discuss the strategies. They use the short cuts to solve the problems. Let them check their solutions on a calculator.

1. **a)** 235 **b)** 295 **c)** 1 340
d) 3 370 **e)** 6 785 **f)** 12 490

2. **a)** 1 400 **b)** 3 450 **c)** 22 850
d) 17 300 **e)** 128 600 **f)** 316 05

Activity 21.1

Learner's Book page 166

Tell the learners that they have to use short cuts to solve the problems. They have to find that × 500 is equivalent to × 1 000 ÷ 2 so that 68 × 500 = (68 × 1 000) ÷ 2 = 68 000 ÷ 2 = 34 000.

In question 2 they should realise that, for example, 240 ÷ 12 = 20 and 480 ÷ 24 = 20. They should notice the doubling. Ask them to investigate and explain why the solutions are the same. Some of your learners might still be at the level of breaking up numbers to divide while others might solve the problems below mechanically using existing knowledge of division tables. Allow them to share their strategies to encourage learners at different levels of development to use shortcuts. Remind the learners about the rule for taking away zeros in division with multiples of 10. They in fact do not take away zeros, but rather divide by 10. They apply the distributive property and compensation to show this process. They should use the 'unit strategy' to divide by bigger numbers during the 2nd steps of the calculating procedures. For example, 104 ÷ 26 = ■. Because the unit in the dividend is 4, 6 must be multiplied by a number that gives a product with 4 as a unit, i.e. 4. The learners should observe the doubling and halving in the calculations.

In question 3 and 4 they complete the function machines with double and single operators and discuss which they find easier to solve. Give them blank copies of the function machines in the resources section to work on.

In question 5 they use short cuts to divide by 5, 50 and 500. The learners find out more about the number 5 and develop their general knowledge. They find out what a pentagon is, how many arms a starfish has and how many rings there are in the Olympic symbol.

1. a) $68 \times 500 = 68 \times 1\,000 \div 2 = 34\,000$

b) 48 500 **c)** 158 000 **d)** 294 500

e) 488 000 **f)** 1 329 000 **g)** 1 939 500

h) 2 163 500

2. a) $240 \div 12 = (240 \div 10) \div 12$
$= 24 \div 12 \times 10$
$= 2 \times 10$
$= 20$

$480 \div 24 = (480 \div 10) \div 24$
$= 48 \div 24 \times 10$
$= 2 \times 10$
$= 20$

b) $520 \div 13 = (520 \div 10) \div 13$
$= 52 \div 13 \times 10$
$= 4 \times 10$
$= 40$

$1\,040 \div 26 = (1\,040 \div 10) \div 26$
$= 104 \div 26 \times 10$
$= 2 \times 10$
$= 20$

c) $615 \div 15 = (600 \div 15) + (15 \div 15)$
$= 40 + 1$
$= 41$

$1\,230 \div 30 = (1\,230 \div 10) \div 3$
$= 123 \div 3$
$= 41$

d) $360 \div 18 = (360 \div 10) \div 18$
$= 36 \div 18 \times 10$
$= 2 \times 10$
$= 20$

$180 \div 9 = (180 \div 10) \div 9$
$= 18 \div 9 \times 10$
$= 2 \times 10$
$= 20$

e) $640 \div 16 = (640 \div 10) \div 16$
$= 64 \div 16 \times 10$
$= 4 \times 10$
$= 40$

$$\begin{aligned} 640 \div 32 &= (640 \div 10) \div 32 \\ &= 64 \div 32 \times 10 \\ &= 2 \times 10 \\ &= 20 \end{aligned}$$

f) $$\begin{aligned} 1\,020 \div 17 &= (1\,020 \div 10) \div 17 \\ &= 102 \div 17 \times 10 \\ &= 6 \times 10 \\ &= 60 \end{aligned}$$

$$\begin{aligned} 1\,020 \div 34 &= (1\,020 \div 10) \div 34 \\ &= 102 \div 34 \times 10 \\ &= 3 \times 10 \\ &= 30 \end{aligned}$$

3.

a)	160	÷ 2	80	÷ 4	20	160	÷ 8	20
b)	480	÷ 4	120	÷ 4	30	480	÷ 16	30
c)	150	÷ 3	50	÷ 5	10	150	÷ 15	10
d)	108	÷ 3	36	÷ 3	12	108	÷ 9	12
e)	288	÷ 2	144	÷ 6	24	288	÷ 12	24

4.

a)	850	÷ 25	34	÷ 2	17	850	÷ 50	17
b)	900	÷ 3	300	÷ 25	12	900	÷ 75	12
c)	800	÷ 2	400	÷ 10	40	800	÷ 20	40
d)	960	÷ 3	320	÷ 10	32	960	÷ 60	32
e)	720	÷ 6	120	÷ 4	30	720	÷ 24	30

5. Tell the learners to try to do the division by 2 in their heads.

a) $$\begin{aligned} 6\,789 \times 5 &= (6\,789 \times 10) \div 2 \\ &= 67\,890 \div 2 \\ &= 23\,945 \end{aligned}$$

b) $$\begin{aligned} 7\,365 \times 5 &= (7\,365 \times 10) \div 2 \\ &= 73\,650 \div 2 \\ &= 36\,825 \end{aligned}$$

c) $$\begin{aligned} 4\,567 \times 50 &= (4\,567 \times 100) \div 2 \\ &= 456\,700 \div 2 \\ &= 228\,350 \end{aligned}$$

d) $$\begin{aligned} 6\,489 \times 50 &= (6\,489 \times 100) \div 2 \\ &= 648\,900 \div 2 \\ &= 324\,450 \end{aligned}$$

e) $$\begin{aligned} 3\,843 \times 500 &= (3\,843 \times 1\,000) \div 2 \\ &= 3\,843\,000 \div 2 \\ &= 1\,921\,500 \end{aligned}$$

f) $$\begin{aligned} 5\,296 \times 500 &= (5\,296 \times 1\,000) \div 2 \\ &= 5\,296\,000 \div 2 \\ &= 2\,648\,000 \end{aligned}$$

Unit 22 Division with remainders

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The learners solve basic problems involving division with remainders together as a class. Ask them to show how they will check the solutions, for example for 10 ÷ 3 = 3 rem 1, by applying the inverse operation and use brackets showing that they add the remainder: (3 × 3) + 1 = 10. They record the solutions in question 2 on their Mental Maths grids. They divide the number of sweets by different numbers according to the number of faces.

1. **a)** 3 rem 1 **b)** 2 rem 4 **c)** 2 rem 3
d) 1 rem 7 **e)** 2 rem 2 **f)** 0 rem 9
g) 3 rem 3 **h)** 7 rem 1 **i)** 12 rem 2
j) 7 rem 1

2. **a)** 49 ÷ 4 = 12 rem 1
b) 49 ÷ 8 = 6 rem 1
c) 49 ÷ 6 = 8 rem 1
d) 49 ÷ 7 = 7 rem 0
e) 49 ÷ 12 = 4 rem 1
f) 38 apples ÷ 11 children = 3 rem 5
g) 38 apples ÷ 5 children = 7 rem 3
h) 38 apples ÷ 9 children = 4 rem 2
i) 38 apples ÷ 6 children = 6 rem 2
j) 38 apples ÷ 3 children = 12 rem 2

Activity 22.1

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The learners use bigger numbers in division with remainders. They start with division by multiples of 10.

In question 2 the learners use the strategy in the example to solve the problems and to check the solutions. They apply the distributive property and break up numbers by using multiples. Make sure that the learners understand that 3 ÷ 7 = 0 remainder 3, for example. Ask them to check this by doing the inverse operations.

In question 3 they explore the short division method and use it to solve the problems involving 3-digit by 2-digit division.

1. **a)** 1 rem 25 **b)** 2 rem 23 **c)** 3 rem 250
d) 3 rem 1 **e)** 3 rem 8 **f)** 34 rem 5
g) 421 rem 5 **h)** 564 rem 56 **i)** 42 rem 678
j) 22 rem 859

2. 813 ÷ 9 = (810 ÷ 9) + (3 ÷ 9)
= 90 + 0 rem 3
= 90 rem 3

Check: 90 × 9 + 3 = 810 + 3
= 813

a) 429 ÷ 7 = (420 ÷ 7) + (9 ÷ 7)
= 60 + 1 rem 2
= 61 rem 2

b) 813 ÷ 9 = (810 ÷ 9) + (3 ÷ 9)
= 90 + 0 rem 3
= 90 rem 0

c) 729 ÷ 8 = (720 ÷ 8) + (9 ÷ 8)
= 90 + 1 rem 1
= 91 rem 1

d) 609 ÷ 6 = (600 ÷ 6) + (9 ÷ 6)
= 100 + 1 rem 3
= 101 rem 3

e) 146 ÷ 12 = (144 ÷ 12) + (2 ÷ 12)
= 12 + 0 rem 2
= 12 rem 2

f) 105 ÷ 11 = (99 ÷ 11) + (6 ÷ 11)
= 9 + 0 rem 6
= 9 rem 6

g) 499 ÷ 4 = (496 ÷ 4) + (3 ÷ 4)
= 124 + 0 rem 3
= 124 rem 3

h) 728 ÷ 3 = (720 ÷ 3) + (8 ÷ 3)
= 240 + 2 rem 2
= 242 rem 2

i) 918 ÷ 10 = (910 ÷ 10) + (8 ÷ 10)
= 91 + 0 rem 8
= 91 rem 8

3. a) 416 ÷ 26 = ■

$26\overline{)\overset{15}{416}}$	26 × 1 = 26	41 – 26 = 15
16	26 × 10 = 260	
	26 × 5 = 130	
	26 × 6 = 156	

416 ÷ 26 = 16

b) 368 ÷ 21 = ■

$21\overline{)\overset{15}{368}}$	21 × 1 = 21	36 – 21 = 15
17	21 × 10 = 210	
	21 × 5 = 105	
	21 × 6 = 126	
	21 × 7 = 147	158 – 147 = 11

368 ÷ 21 = 17 rem 11

c) 323 ÷ 17 = ■

$17\overline{)\overset{15}{323}}$	17 × 1 = 17	32 – 17 = 15
19	17 × 2 = 34	
	17 × 10 = 170	
	17 × 9 = 153	

323 ÷ 17 = 19

d) 475 ÷ 19 = ■

9		
19 | 475	19 × 2 = 38	47 – 38 = 9
25	19 × 5 = 95	

475 ÷ 19 = 25

e) 427 ÷ 18 = ■

6		
18 | 427	18 × 2 = 36	42 – 36 = 6
23	18 × 3 = 54	67 – 54 = 13

427 ÷ 18 = 23 rem 13

f) 390 ÷ 15 = ■

9		
15 | 390	15 × 2 = 30	39 – 30 = 9
25	15 × 4 = 60	67 – 54 = 13
	15 × 5 = 90	

390 ÷ 15 = 25

Unit 23 Real-life problems

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Tell the learners that they will apply their knowledge of division to solve real-life problems. They work together to solve the problems. Allow them to use the strategies they prefer. They use and discuss different strategies. Let them check their solutions using the strategies they have applied during the past lessons.

1. 48 ÷ 4 = 12 pages

2. 28 ÷ 7 = 4 m long

3. 2 000 ÷ 500 = 4 bottles

4. 1 456 ÷ 100 = 14 rem 56. There are 14 R100-notes

5. 4 × 250 = 1 litre
80 × 250 = (25 × 8) × 10 × 10
= 200 × 100
= 20 000 ml
= 20 litres

6. 34 ÷ 6 = 5 remainder 4. Each one gets 5 sweets

7. 1 075 ÷ 5 = R215 per day

8. 256 ÷ 2 = 128 stamps

9. 348 ÷ 58 = 6 chairs per row

10. 180 × 12 = R15

Activity 23.1

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The learners apply the long division strategy to solve 3-digit by 2-digit numbers. Tell them that the example involves a problem that they have already solved in Activity 22.1. They therefore know that 323 ÷ 17 = 19 and can check the solution in the long division method. Explain to them that we often are not able to solve division with big numbers mentally because we do not know the multiples of big numbers. It is therefore good to create a clue card and use doubling and combining to find products for big numbers. They start with multiplying the divisor by 1, then double, combine products when multiplying by odd numbers, multiply by 5 and 10 and double to multiply by 20. Make sure that all the learners understand the processes involved in the calculation. Ask them to use the long division strategy to solve the problems. Divide the class into two groups, with one group checking the solutions on calculators and the other group ding the inverse operations.

1. **a)** 276 ÷ 23 = 12 **b)** 586 ÷ 25 = 23 remainder 11
c) 396 ÷ 18 = 22 **d)** 550 ÷ 14 = 39 remainder 4

Activity 23.2

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Allow the learners to work in their groups to solve the real-life problems. Give them large sheets of paper to record strategies and solutions. Let them present their work to the class. They use strategies that they are comfortable with and use checking methods they have learned to assess their solutions.

1. 1 248 ÷ 104 = 12 photos per page

2. 2 550 ÷ 15 = 170 m

3. 6 vouchers → R660
1 voucher → 660 ÷ 6 = 110
8 vouchers → 110 × 8 = R880

4. 36 ÷ 3 = 12
2 × 12 = 24
1 × 12 = 12
12 + 24 = 36
24 learners walk to school

Assessment 2.4: Division of whole numbers

The learners work on their own to show what they have learnt about division during the last lessons and what they remember from previous lessons. They solve 2-digit and 3-digit by 1-digit division problems with and without remainders, division with 10 and 100 as divisors and dividends that are not multiples of 10 and 100, do inverse operations and solve word problems involving grouping.

Assessment 2.4 Division of whole numbers

1. Complete these number chains.

a)

200 → ÷ 1 → ☐ → ÷ 2 → ☐ → ÷ 4 → ☐ → ÷ 5 → ☐

b)

240 → ÷ 1 → ☐ → ÷ 2 → ☐ → ÷ 3 → ☐ → ÷ 5 → ☐

c)

4 800 → ÷ 10 → ☐ → ÷ 6 → ☐ → ÷ 4 → ☐ → ÷ 5 → ☐ → ÷ 2 → ☐

d)

2 700 → ÷ 9 → ☐ → ÷ 2 → ☐ → ÷ 3 → ☐ → ÷ 2 → ☐ → ÷ 5 → ☐

e)

63 000 → ÷ 100 → ☐ → ÷ 7 → ☐ → ÷ 2 → ☐ → ÷ 5 → ☐ → ÷ 3 → ☐

2. Fill in the missing numbers.

a)	24 ÷ 3 = ■	24 ÷ 6 = ■	24 ÷ 12 = ■	
b)	36 ÷ 3 = ■	36 ÷ 6 = ■	36 ÷ 12 = ■	
c)	48 ÷ 2 = ■	48 ÷ 4 = ■	48 ÷ 8 = ■	48 ÷ 16 = ■
d)	64 ÷ 2 = ■	64 ÷ 4 = ■	64 ÷ 8 = ■	64 ÷ 16 = ■
e)	72 ÷ 3 = ■	72 ÷ 6 = ■	72 ÷ 9 = ■	72 ÷ 12 = ■

3. Solve the following:

a) 45 ÷ 15 = (■ ÷ 15) + (■ ÷ 15)
= ■ + ■
= ■

b) 64 ÷ 8 = (■ ÷ 8) + (■ ÷ 8)
= ■ + ■
= ■

4. Complete the number sentences.

a) 20 ÷ 4 = ■	200 ÷ 4 = ■	2 000 ÷ 40 = ■
b) 400 ÷ 8 = ■	400 ÷ 80 = ■	4 000 ÷ 800 = ■
c) 28 ÷ 7 = ■	280 ÷ 7 = ■	2 800 ÷ 70 = ■
d) 42 000 ÷ 6 000 = ■	4 200 ÷ 60 = ■	420 ÷ 6 = ■
e) 60 ÷ 12 = ■	600 ÷ 12 = ■	6 000 ÷ 12= ■

5. Calculate:

a) 36 ÷ 12 = ■	b) 36 ÷ 9 = ■	c) 36 ÷ 6 = ■
d) 36 ÷ 4 = ■	e) 36 ÷ 3 = ■	f) 36 ÷ 2 = ■
g) 36 ÷ 1 = ■	h) 36 ÷ 0 = ■	

6. Use the calculations in the boxes to solve the ones below each box. Do not calculate. Look for relationships.

a) $\boxed{144 \div 12 = 12}$
12 × 12 = ■
13 × 12 = ■

b) $\boxed{11 \times 11 = 121}$
11 × 12 = ■
11 × 10 = ■

c) $\boxed{4 \times 4 = 16}$
40 × 40 = ■
400 × 40 = ■

d) $\boxed{64 \div 8 = 8}$
640 ÷ 8 = ■
640 ÷ 80 = ■

7. Use short cuts to calculate:
a) 56 × 5 = ■
b) 67 × 25 = ■
c) 78 × 50 = ■
d) 96 × 500 = ■

8. Use the example below to solve the calculations.
729 ÷ 9 = ■
= (720 ÷ 9) + (9 ÷ 9)
= 80 + 1
= 81
a) 847 ÷ 7 = ■
b) 1 648 ÷ 8 = ■
c) 1 260 ÷ 12 = ■
d) 9 911 ÷ 11 = ■
e) 3 015 ÷ 15 = ■

9. Calculate
a) $14\overline{)223}$ b) $16\overline{)416}$ c) $19\overline{)473}$ d) $23\overline{)621}$

10. Use your own methods to solve the following.
a) How many 8 m pieces of ribbon can you cut from 329 m of ribbon?
b) A deck consists of 52 cards. If there are 676 cards, how many decks are there?
c) Zodwa pays R10 for 4 apples. How much does she pay for 12 apples?
d) Laura works 5 days a week. She earns R600 per week. Mzwai works 7 days per week. He earns R805 per week. Who earns more, Laura or Mzwai?

1. a)

200 → ÷ 1 → **200** → ÷ 2 → **100** → ÷ 4 → **25** → ÷ 5 → **1**

b)

240 → ÷ 1 → **120** → ÷ 2 → **60** → ÷ 3 → **5** → ÷ 5 → **1**

c)

4 800 → ÷ 10 → **480** → ÷ 6 → **80** → ÷ 4 → **20** → ÷ 5 → **4** → ÷ 2 → **2**

d)

2 700 → ÷ 9 → **300** → ÷ 2 → **150** → ÷ 3 → **50** → ÷ 2 → **25** → ÷ 5 → **5**

e)

63 000 → ÷ 100 → **630** → ÷ 7 → **90** → ÷ 2 → **45** → ÷ 5 → **9** → ÷ 3 → **3**

2. a) 24 ÷ 3 = 8 24 ÷ 6 = 4 24 ÷ 12 = 2

b) 36 ÷ 3 = 12 36 ÷ 6 = 6 36 ÷ 12 = 3

c) 48 ÷ 2 = 24 48 ÷ 4 = 12 48 ÷ 8 = 6 48 ÷ 16 = 4

d) 64 ÷ 2 = 32 64 ÷ 4 = 16 64 ÷ 8 = 8 64 ÷ 16 = 4

e) 72 ÷ 3 = 24 72 ÷ 6 = 12 72 ÷ 9 = 8 72 ÷ 12 = 6

3. a) 45 ÷ 15 = (30 ÷ 15) + (15 ÷ 15)
= 2 + 1
= 3

b) 64 ÷ 8 = (40 ÷ 8) + (24 ÷ 8) or (56 ÷ 8) + (8 ÷ 8)
= 5 + 3 = 7 + 1
= 8 = 8

4. a) 20 ÷ 4 = 5 200 ÷ 4 = 50 2 000 ÷ 40 = 50

b) 400 ÷ 8 = 50 400 ÷ 80 = 5 4 000 ÷ 800 = 5

c) 28 ÷ 7 = 4 280 ÷ 7 = 40 2 800 ÷ 70 = 40

d) 42 000 ÷ 6 000 = 7 4 200 ÷ 60 = 70 420 ÷ 6 = 70

e) 60 ÷ 12 = 5 600 ÷ 12 = 50 6 000 ÷ 12 = 500

5. a) 36 ÷ 12 = 3 **b)** 36 ÷ 9 = 4

c) 36 ÷ 6 = 6 **d)** 36 ÷ 4 = 9

e) 36 ÷ 3 = 12 **f)** 36 ÷ 2 = 18

g) 36 ÷ 1 = 36 **h)** 36 ÷ 0 = not allowed

6. **a)** $144 \div 12 = 12$
$12 \times 12 = 144$
$13 \times 12 = 156$

b) $11 \times 11 = 121$
$11 \times 12 = 132$
$11 \times 10 = 110$

c) $4 \times 4 = 16$
$40 \times 40 = 1\ 600$
$400 \times 40 = 16\ 000$

d) $64 \div 8 = 8$
$640 \div 8 = 80$
$640 \div 80 = 8$

7. **a)** $56 \times 5 = 56 \times 10 \div 2$
$= 560 \div 2$
$= 280$

b) $67 \times 25 = 67 \times 100 \div 4$
$= 6\ 700 \div 4$
$= 1\ 675$

c) $78 \times 50 = 78 \times 100 \div 2$
$= 7\ 800 \div 2$
$= 3\ 900$

d) $96 \times 500 = 96 \times 1\ 000 \div 2$
$= 96\ 000 \div 2$
$= 48\ 000$

8. **a)** $847 \div 7 = (840 \div 7) + (7 \div 7)$
$= 120 + 1$
$= 121$

b) $1\ 648 \div 8 = (1\ 600 \div 8) + (48 \div 8)$
$= 200 + 6$
$= 206$

c) $1\ 260 \div 12 = (1\ 200 \div 12) + (60 \div 12)$
$= 100 + 5$
$= 105$

d) $9\ 911 \div 11 = (9\ 900 \div 11) + (11 \div 11)$
$= 900 + 1$
$= 901$

e) $3\ 015 \div 15 = (3\ 000 \div 15) + (15 \div 15)$
$= 200 + 1$
$= 201$

9. **a)** $14 \overline{)223}$
15 rem 13

b) $16 \overline{)416}$
26

c) $19 \overline{)473}$
24 rem 17

d) $23 \overline{)621}$
27

10. **a)** $329 \div 8 = 41$ rem 1
You can cut 41×8 m pieces and 1 m remains.

b) $676 \div 52 = 13$ decks of cards

c) 4 apples = R10
8 apples = R20
$8 + 4 = 12$
R10 + R20 = R30
Zodwa pays R30 for 12 apples.
or
$4 \times 3 = 12$
$10 \times 3 =$ R30

d) Laura earns: $600 \div 5 =$ R120 per day
Mzwai earns: $805 \div 7 =$ R115 per day
Laura earns more than Mzwai.

Decimal fractions

Learner's Book page 171

Tell the learners that they will work with decimal fractions during the next nine units. Although this is a new topic that they only start dealing with in Grade 6, they have worked with decimal fractions in other topics. In Whole numbers they deal with money amounts and in Measurement they work with masses and volumes that include decimal numbers. We often work with decimals in real-life situations, for example products that we buy are measured in decimals. During this term the learners will count, compare and order decimals and work with decimal place values. They will learn how decimal and common fractions are related, do calculations and solve problems involving decimal fractions. Ask the learners to name some examples of decimals that they have worked with before. You could have some products available as examples.

Unit 24 Decimals and measuring length

MENTAL MATHS

Learner's Book page 171

The learners will work together as a class, do mental calculations and have discussions for the duration of the lesson. They should know that products are measured in decimal numbers. Ask them to read the volume and mass measurements on the products. Ask them how the numbers are different from whole numbers. Tell them that it is only in South Africa that we use a comma in decimals; other countries use a decimal point. In devices such as computers and calculators, decimal points are used. The learners compare the capacity of the containers to find which holds the most and the least. (They will expand on this in the Measurement section of the course that follows this section.) They write the measurements in ascending order. Draw the table on the board and ask the learners to record the number of 250 ml and 500 ml containers that will fill containers with larger capacities.

Then ask them to look at the mass of the chickens on the scales in question 2. Let them read the mass of each chicken and note the connection between the decimals and whole numbers. They find out how many of the smaller chickens will have a mass equal to that of the bigger chickens. Ask the learners what other products or units involve decimal fractions, for example measures of length. Learners in some parts of the country will know that some cool drinks are sold in 1,25 litre bottles. Assist learners in reading decimals correctly, i.e. 'one comma two five' and not 'one comma twenty-five'.

Write the common fractions, decimals and money amounts on the board. Ask the learners to name some differences and similarities between the numbers. They might know, for example, that $\frac{1}{2}$ = 0,5 = R0,50.

In question 3 they find fractions of money amounts to observe the relationship between fractions and decimals using their existing knowledge, i.e. $\frac{1}{2}$ of R100 = R50 and $\frac{1}{2}$ of R1 = 50c or R0,50. Ask them to explore ways of displaying common fractions on a calculator. Some of them might know that a fraction is another way of writing a division expression.

In question 4 they enter the expressions in the calculator to find the equivalent decimals for the fractions. Let them discuss their observations. They should be able to relate the numbers to the money amounts they have worked with earlier. Let them explore the numbers, for example $\frac{1}{2}$ = 0,5; $\frac{1}{4}$ = 0,25 and $\frac{3}{4}$ = 0,75 and describe the patterns they observe. Explain to the learners that 0,5 is the same as 0,50 – the calculator does not show the zero at the end. Ask the learners what they think will appear on the screen if they enter $\frac{1}{5}$ and $\frac{1}{10}$.

In question 5 and 6 they find decimals for the common fractions. You can show them how to use the memory plus ($\boxed{\text{M+}}$) and memory recall ($\boxed{\text{MR}}$ or $\boxed{\text{MRC}}$) functions to do this:

1 $\boxed{\text{M+}}$ ÷ 5 = 0,2 $\boxed{\text{MR}}$ 2 $\boxed{\text{M+}}$ = 0,4 $\boxed{\text{MRC}}$ 3 $\boxed{\text{M+}}$ 0,6 $\boxed{\text{MRC}}$ 4 $\boxed{\text{M+}}$ 0,8 $\boxed{\text{MRC}}$ 5 $\boxed{\text{M+}}$ 1. Let them write down the sequences on the board and describe the patterns.

Read through the *Did you know?* information with them as enrichment. Tell them that they will learn about percentages in Term 3. Ask the learners to reflect on their learning experiences by writing a short letter to a friend. You should allow learners to share their reflections with the class.

1. a) 250 ml container
b) 5 litre container
c) 250 ml; 500 ml; 1 ℓ; 1,5 ℓ; 2 ℓ; 2,5 ℓ; 3 ℓ; 5 ℓ
d) Completed table

	500 ml	1 litre	1,5 litre	2 litre	2,5 litre	3 litre	5 litre
250 ml	2	4	6	8	10	6	10
500 ml	1	2	3	4	5	6	10

2. a) Three 0,5 kg chickens have the same mass as a 1,5 kg chicken.
Five 0,5 kg chickens have the same mass as a 2,5 kg chicken.
b) Learners' own work.

3. a) $\frac{1}{2}$ of R100 = R50 $\frac{1}{2}$ of R1,00 = R0,50 = 50c

b) $\frac{1}{4}$ of R100 = R25 $\frac{1}{4}$ of R1,00 = R0,25 = 25c

c) $\frac{3}{4}$ of R100 = R75 $\frac{3}{4}$ of R1,00 = R0,75 = 75c

4. a) $1 \div 2 = 0,5$ $1 \div 4 = 0,25$ $3 \div 4 = 0,75$

   b) The learners should notice that:
   $\frac{1}{2} = 0,5$ $\frac{1}{4} = 0,25$ $\frac{3}{4} = 0,75$

5. a) $\frac{1}{5} = 0,2$ b) $\frac{2}{5} = 0,4$ c) $\frac{3}{5} = 0,6$

   d) $\frac{4}{5} = 0,8$ e) $\frac{5}{5} = 1$

   Learners predict what the calculator will display for $\frac{1}{10}$ or $1 \div 10$, i.e. 0,1.

6. a) $\frac{1}{10} = 0,1$ b) $\frac{2}{10} = 0,2$ c) $\frac{3}{10} = 0,3$

   d) $\frac{4}{10} = 0,4$ e) $\frac{5}{10} = 0,5$ f) $\frac{6}{10} = 0,6$

   g) $\frac{7}{10} = 0,7$ h) $\frac{8}{10} = 0,8$ i) $\frac{9}{10} = 0,9$

   j) $\frac{10}{10} = 1$

7. Ask the learners to write the sequences for the outputs in questions 5 and 6 on the board. Rewrite the sequences as below.
   0,2 0,4 0,6 0,8 1
   0,1 0,2 0,3 0,4 0,5 0,6 0,7 0,8 0,9 1
   The learners should observe that $\frac{1}{5}$ and $\frac{2}{10}$ are both equal to 0,2 and so on. Display the equivalent fraction wall on the board. Ask the learners to describe the relationships they observe between the decimals and the fractions. They should now notice that $\frac{1}{5} = \frac{2}{10} = 0,5$ and so on.

Activity 24.1

Learner's Book page 173

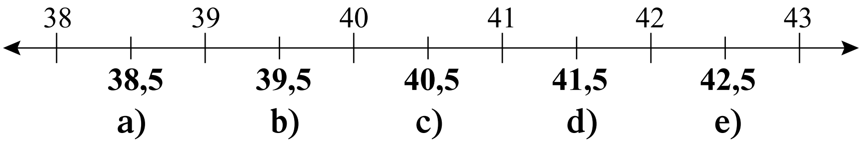
Tell the learners that they will work with measurement as a context to learn more about decimal fractions. Ask them to look at the picture of the earthworm and study the measurements. They should understand that the millimetres are converted to show centimetres as a decimal and a common fraction. They study the length of the earth worm at one, two and three months and write the lengths as mm, cm and fractions of a cm to develop or enhance their understanding of the relationship between decimals and common fractions.

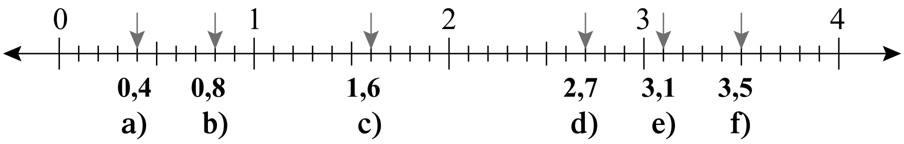
In question 2 and 3 they write down the decimal fractions on the number lines.

In question 4 the learners study the calibrations on the ruler and explore the relationship between mm and cm, and decimals and fractions. They write mm as cm.

The learners read and record the lengths of the caterpillars in question 5.

1. **a)** 1 month old:
   (i) 41 mm **(ii)** 4,1 cm **(iii)** $4\frac{1}{10}$ cm
   b) 2 months old:
   (i) 63 mm **(ii)** 6,3 cm **(iii)** $6\frac{3}{10}$ cm
   c) 3 months old:
   (i) 78 mm **(ii)** 7,8 cm **(iii)** $7\frac{7}{10}$ cm

2. 

3. 

g) 18,6	**h)** 19,3	**i)** 19,9	**j)** 20,2
k) 20,9	**l)** 21,6	**m)** 28,3	**n)** 29,1
o) 29,7	**p)** 30,5	**q)** 31,2	**r)** 31,7

4. **a)** 5 mm = 0,5 cm **b)** 9 mm = 0,9 cm
   c) 12 mm = 1,2 cm **d)** 25 mm = 2,5 cm
   e) 75 mm = 7,5 cm **f)** 83 mm = 8,3 cm
   g) 56 mm = 5,6 cm **h)** 99 mm = 9,9 cm

5. **a)** 0,9 cm **b)** 0,5 cm
   c) 0,7 cm **d)** 1,2 cm
   e) 0,8 cm **f)** 0,1 cm

Unit 25 Decimal fractions

MENTAL MATHS

Learner's Book page 174

Tell the learners that they will count, order and compare decimals in this lesson. Let them explore the masses of the puppies. They find out which of the puppiesy is the heaviest and the lightest and write the masses in descending order.

Let them write the decimals in question 2 in ascending order on the board and use the relationship signs to compare the decimals and common fractions in question 3. When they check the solutions on the calculator, they should find that $\frac{1}{4} < 0{,}75$ because $\frac{1}{4} = 0{,}25$, which is smaller than 0,75.

1. **a)** Happy: 1,75 kg
   b) Doc: 0,5 kg
   c) 1,75 kg; 1,5 kg; 1,01 kg; 0,9 kg; 0,65 kg; 0,61 kg; 0,5 kg
2. **a)** 0; 0,5; 1; 1,25; 1.5; 2; 2,5
   b) 0,2; 1; 2,0; 3,5; 4,25; 4,5; 5
   c) 0; 0,3; 0,4; 0,8; 0,9; 1,5; 1,6

3. a) $1 > 0{,}5$	**b)** $0{,}5 < 5$	**c)** $12 > 1{,}2$	**d)** $0{,}1 = \frac{1}{10}$
e) $\frac{1}{4} < 0{,}75$	**f)** $\frac{1}{2} = 0{,}50$	**g)** $0{,}4 > 0{,}1$	**h)** $\frac{3}{4} > 0{,}5$
i) $0{,}3 < 3{,}0$	**j)** $2\frac{1}{2} = 2{,}5$		

Activity 25.1

Learner's Book page 175

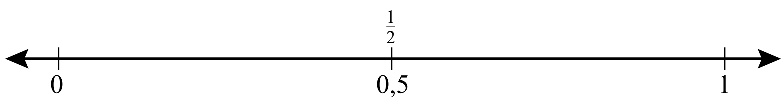
Ask the learners to look at the number lines in the example. They should notice that $2\frac{1}{2}$ and 2,5 are exactly between 2 and 3. They should indicate the common and decimal fractions that are exactly halfway between the two whole numbers on each number line.

In question 2 they count decimals to determine the numbers that are indicated by the arrows. Ask them what they notice about the numbers in the sequences. Some of them might notice that you can count as with whole numbers but the values of the decimals are smaller than whole number values.

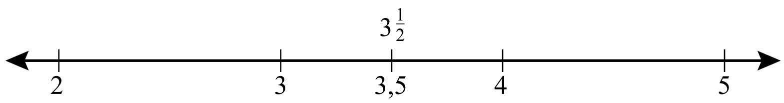
In question 3 they copy and complete the sequences by filling in the next three terms.

In question 4, ask the learners what they think will happen if they enter the keys $\boxed{0}\ \boxed{.}\ \boxed{1}\ \boxed{+}\ \boxed{=}\ \boxed{=}\ \boxed{=}$, and so on, on the calculator. They use the constant keys on their calculators to find sequences as indicated. They write down the first five numbers as they appear on the screen. Ask the learners to put down the calculators and fill in the next five terms without using a calculator.

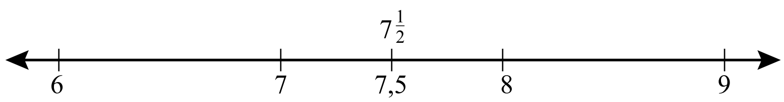
1. a)



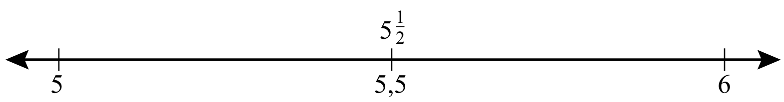
b)



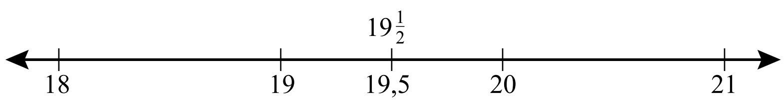
c)



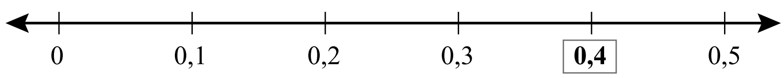
d)



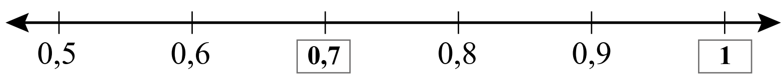
e)



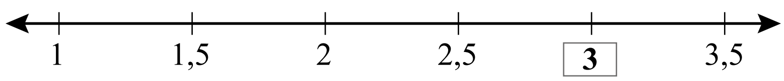
2. a)



b)



c)



d) 2 — 2,25 — 2,5 — $\boxed{\mathbf{2{,}75}}$ — 3 — 3,25

e) 0 — 0,2 — 0,4 — 0,6 — 0,8 — $\boxed{\mathbf{1}}$

f) 4,1 — 4,3 — 4,5 — 4,7 — $\boxed{\mathbf{4{,}9}}$ — 5,1

3. **a)** 5; 4; 3; 2; 1; 0; 0,1; 0,2; **0,3; 0,4; 0,5**
b) 0; 0,5; 1; 1,5; 2; **2,5; 3; 3,5; 4**
c) 0; 0,2; 0,4; 0,6; **0,8; 1; 1,2**
d) 3; 2,9; 2,8; 2,7; 2,6; **2,5; 2,4; 2,3**

4. Ask the learners to replace the decimal point by a comma in each number.
a) 0.1 + = 0,2; 0,3; 0,4; 0,5; 0,6; 0,7; 0,8; 0,9; 1; 1,1
b) 0.2 + = 0,4; 0,6; 0,8; 1; 1,2; 1,4; 1,6; 1,8; 2; 2,2
c) 10 – 0.1 = 9,9; 9,8; 9,7; 9,6; 9,5; 9,4; 9,3; 9,2; 9,1; 9
d) 1 + 0.1 = 1,1; 1,2; 1,3; 1,4; 1,5; 1,6; 1,7; 1,8; 1,9; 2
e) 1.1 + = 2,2; 3,3; 4,4; 5,5; 6,6; 7,7; 8,8; 9,9; 11; 12,1
f) 2 – 0.2 = 1,8; 1,6; 1,4; 1,2; 1; 0,8; 0,6; 0,4; 0,2; 0
g) 1.2 + = 2,4; 3,6; 4,8; 6; 7,2; 8,4; 9,6; 10,8; 12; 13,2
h) 0.3 + = 0,6; 0,9; 1,2; 1,5; 1,8; 2,1; 2,4; 2,7; 3; 3,3

Unit 26 More decimal fractions

MENTAL MATHS

Learner's Book page 176

Tell the learners that they will represent decimal fractions as they have done with common fractions in previous lessons. They will work with tenths. They name the common and decimal fractions shaded in the shapes.

In question 3 and 4 they estimate the width of a car and a bicycle by choosing measures from a list. Ask them to estimate the width or height of other real-life objects such as the classroom door, table, duster, books, etc. and then measure the lengths to evaluate their estimates.

Questions 1 and 2	**Common fraction**	**Decimal fraction**
a)	$\frac{1}{10}$	0,1
b)	$\frac{7}{10}$	0,7
c)	$\frac{5}{10}$ or $\frac{1}{2}$	0,5
d)	$\frac{4}{10}$ or $\frac{2}{5}$	0,4
e)	$\frac{4}{10}$ or $\frac{2}{5}$	0,4

Questions 1 and 2	Common fraction	Decimal fraction
f)	$\frac{4}{10}$ or $\frac{2}{5}$	0,4
g)	$\frac{2}{10}$ or $\frac{1}{5}$	0,2
h)	$\frac{3}{10}$	0,3
i)	$\frac{5}{10}$ or $\frac{1}{2}$	0,5
j)	$\frac{6}{10}$ or $\frac{3}{5}$	0,6

Some learners might want to debate the estimates for a car and a bicycle. There are no wrong solutions. Learners might reason that you get a toy car with a length of 1 m or a child's bike with a length of 0,4 m.

3. The length of a standard car is about 2,5 m.
4. The length of a standard bicycle is about 1,1 m.

Activity 26.1

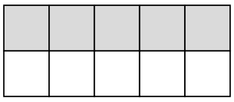
Learner's Book page 177

Give the learners squared paper so they can copy the shapes accurately. They work with multiples of ten to shade the decimals/ common fractions as indicated.

In questions 2 and 3 they should perform accurate scale readings to determine the masses of the animals.

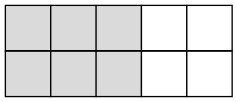
They determine the height and length of the animals in question 4, and in 5 they measure different body parts of the animals. Ask the learners to share their solutions and observations with the class.

1. **a)**



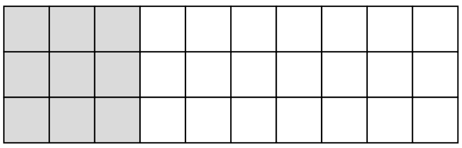
0,5 or $\frac{5}{10}$

b)



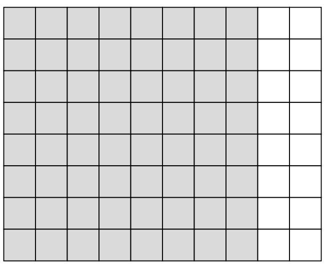
0,6 or $\frac{6}{10}$

c)



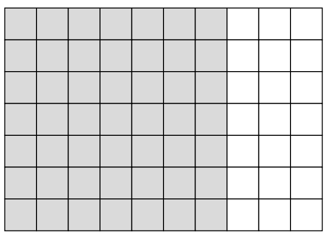
0,3 or $\frac{3}{10}$

d)

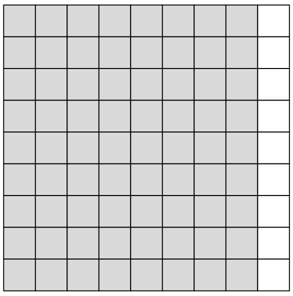


0,8 or $\frac{8}{10}$

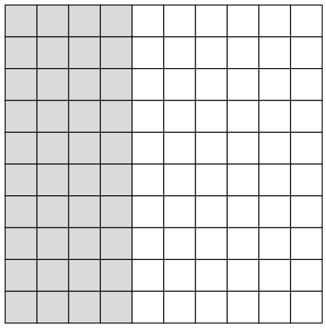
e)



0,7 or $\frac{7}{10}$

f) 

0,9 or $\frac{9}{10}$

g) 

0,4 or $\frac{4}{10}$

2. **a)** Kitten: 0,4 kg
b) Tortoise: 1,8 kg
c) Monkey: 1,7 kg
d) Baby crocodile: 3,8 kg

3. A → 1,3 B → 2,2
C → 3,8 D → 1,7

4. **a)** Kangaroo: 1,8 m
b) Great Indian Rhinoceros: 1,5 m
c) Arabian camel: 1,8 m
d) Eland:1,5 m
e) Komodo dragon: 0,9 m

5. Remind the learners that they have worked with 'tricky' measurements before. They have to read measurements from numbers other than zero.
a) Tusk of narwhal whale: 2,2 m
b) Jaws of gavial crocodile: 1 m
c) Crocodile's ...
(i) head: 0,9 m
(ii) body: 1,8 m
(iii) tail: 2 m

Unit 27 Decimal place value

MENTAL MATHS

Learner's Book page 181

Tell the learners that they will work with place value to find the value of digits in decimal numbers.

Let them give the length of the lizard. Help them to understand that 12 cm 4 mm = 12 cm and $\frac{4}{10}$ of a cm, so that 12,4 = 1 ten (T) + 2 units (U) + 4 tenths (t) or 1 + 2 + $\frac{1}{10}$. Draw the place value table on the board and ask the learner's to write the number in the table.

Emphasise the position and significance of the comma. They read the lengths of the lizards' tails and write the measures in the place value table on the board.

1.

	Length	Tens	Units	,	Tenths
a)	12,1 cm	1	2	,	4
b)	14,3 cm	1	4	,	3
c)	10,6 cm	1	0	,	6
d)	23,5 cm	2	3	,	5
e)	11 cm	1	1	,	0
f)	16,9 cm	1	6	,	9

Activity 27.1

Learner's Book page 181

Tell the learners that they will continue to learn about the place value of decimals. They will use the measurements of the lizards above. Show them how the first length is written in expanded notation.

They complete the expanded notation for the rest of the lengths of the lizards.

Ask the learners to study the counters, place values and expanded notation given for the counters on the abaci (one abacus, many abaci or abacuses). They can find out more about the Chinese abaci in books or on the Internet. They should realise that t (tenth) is the same as $\frac{1}{10}$. Ask the learners to write the numbers and their expanded notation indicated on each abacus.

In question 3 they write the numbers indicated by the whole numbers and common fractions in expanded notation. In question 4 they write the decimal numbers in expanded notation.

1. **Example: a)** 12,1 = 1 ten + 2 units + 1 tenth
   - **b)** 14,3 = 1 ten + 4 units + 3 tenths
   - **c)** 10,6 = 1 ten + 0 units + 6 tenths
   - **d)** 23,5 = 2 tens + 3 units + 5 tenths
   - **e)** 11 = 1 ten + 1 units
   - **f)** 16,9 = 1 ten + 6 units + 9 tenths
2. **a)** 10,1 = 1 ten + 0 units + 1 tenths
   - **b)** 15,3 = 1 ten + 5 units + 3 tenths
   - **c)** 2,9 = 2 units + 9 tenths
   - **d)** 4,7 = 4 units + 7 tenths
   - **e)** 48,9 = 4 tens + 8 units + 9 tenths
   - **f)** 12,0 = 1 ten + 2 units + 0 tenths
3. **a)** $40 + 3 + \frac{1}{10} = 43{,}1$ **b)** $5 + \frac{6}{10} = 5{,}6$
   - **c)** $\frac{15}{10} = 1\frac{5}{10} = 1{,}5$ **d)** $\frac{6}{10} + \frac{11}{10} = \frac{17}{10} = 1{,}7$
   - **e)** $10 + 1 + \frac{1}{10} = 11{,}1$ **f)** $\frac{10}{10} + \frac{10}{10} = \frac{20}{10} = 2{,}0$
   - **g)** $200 + 20 + 2 + \frac{2}{10} = 222{,}2$
   - **h)** $100 + 70 + 3 + \frac{14}{10} = 173 + 1 + \frac{4}{10} = 174{,}4$
   - **i)** $60 + 2 + \frac{2}{10} = 62{,}2$ **j)** $7 + \frac{10}{10} = 7 + 1 = 8{,}0$

4. a) $1,1 = 1 + \frac{1}{10}$ b) $3,6 = 3 + \frac{6}{10}$
c) $5,5 = 5 + \frac{5}{10}$ d) $23,7 = 20 + 3 + \frac{7}{10}$
e) $12,0 = 10 + 2$ f) $48,9 = 40 + 8 + \frac{9}{10}$

Unit 28 Decimal tenths and hundredths

MENTAL MATHS

Learner's Book page 183

Remind the learners that they worked with Dienes blocks in Grades 4 and 5 to develop their understanding of place value. They will now work with the 100s, 10s and 1s blocks to learn more about decimal place value. Ask them how many blocks there are in each group of blocks, what fraction of the 100-block the 10-block is and what fraction of the 100-block the small square is. They find out that the small square is $\frac{1}{10}$ of the 10-block and that the 10-block is $\frac{1}{10}$ of the 100-block.

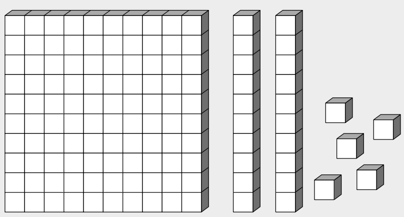
They use the blocks to assist with the calculation of the equivalent fractions in $\frac{1}{10}$s and $\frac{1}{100}$s in question 2. The learners need to understand that the digits can extend to the left and right of the comma – just as the whole numbers they have worked with extended to the millions, decimals can be extended to millionths. This year they will work with decimals up to hundredths. You could write the words on cards or draw a place value board on a chart to indicate the following:

Thousands Hundreds Tens Units , tenths hundredths thousandths

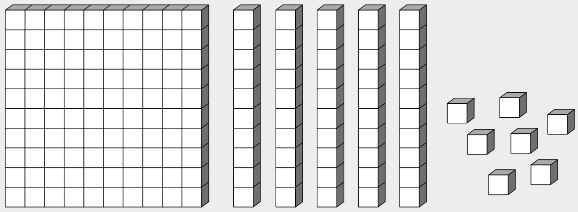
In question 3 the learners study the numbers represented by the Dienes blocks. Copy the Dienes blocks template in the resources section on stiff card and laminate it for repeated use to help with concept development of place value. They use the cards to show the expanded notation for the numbers indicated, and in question 4 they write the numbers in words.

In question 5 the learners write the numbers represented on the abaci. Ask them to write the numbers in words, too. They should understand that we refer to decimals as written to one or two decimal places after the comma.

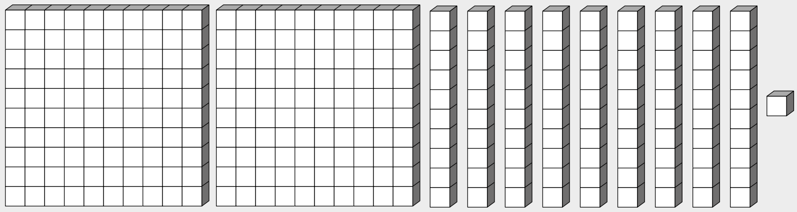
1. a) 100 b) $\frac{1}{10}$ c) $\frac{1}{100}$ d) $\frac{1}{10}$
2. a) $\frac{1}{10} = \frac{10}{100}$ b) $\frac{4}{10} = \frac{40}{100}$ c) $\frac{5}{10} = \frac{50}{100}$
d) $\frac{7}{10} = \frac{70}{100}$ e) $\frac{100}{100} = \frac{10}{10}$
3. a) 1,25



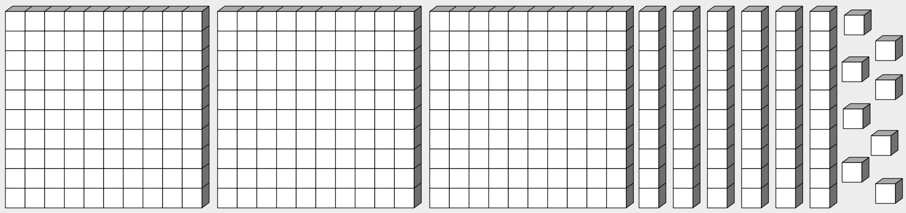
b) 1,57



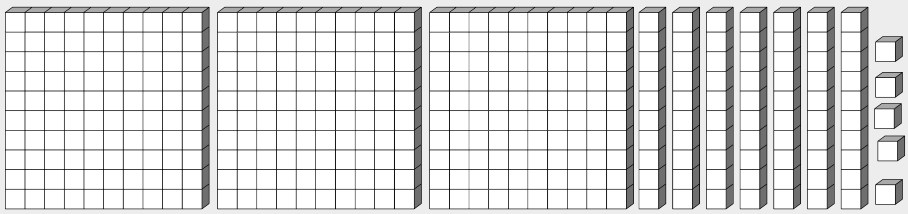
c) 2,15



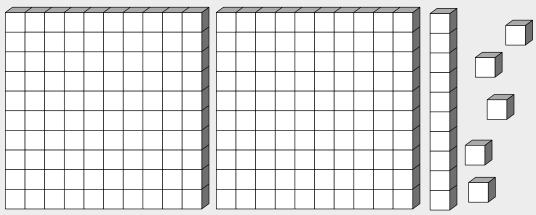
d) 2,91



e) 3,68



f) 3,75



4. **a)** $1 + \frac{2}{10} + \frac{5}{100}$ = one comma two five

b) $1 + \frac{5}{10} + \frac{7}{100}$ = one comma five seven

c) $2 + \frac{1}{10} + \frac{5}{100}$ = two comma one five

d) $2 + \frac{9}{10} + \frac{1}{100}$ = two comma nine one

e) $3 + \frac{6}{10} + \frac{8}{100}$ = three comma six eight

f) $3 + \frac{7}{10} + \frac{5}{100}$ = three comma seven five

5. a) $30 + \frac{2}{10} + \frac{2}{100} = 30{,}22$ b) $50 + 1 + \frac{4}{10} + \frac{6}{100} = 51{,}46$
   c) $10 + 2 + \frac{7}{100} = 12{,}07$ d) $20 + \frac{4}{10} = 20{,}4$
   e) $8 + \frac{5}{10} + \frac{6}{100} = 8{,}56$ f) $10 + 1 + \frac{1}{10} + \frac{1}{100} = 11{,}11$

Activity 28.1

Learner's Book page 184

The learners continue to develop their understanding of decimal place value. In this lesson they use decimal flard cards to find the decimals represented. Copy the flard card template in the resources section and laminate the cards for repeated use.

In question 1 the learners write the decimals represented by the flard cards.

In question 2 they read the numbers indicated by the stacked cards and write the numbers in expanded notation.

Ask them to write the numbers in question 3 in ascending order.

1. a) 1,1   b) 3,01   c) 4,35
   d) 1,11   e) 0,24   f) 9,99
   g) 9,76
2. a) 4 + ,2 + ,01   b) 0 + ,7 + ,05   c) 8 + ,9 + ,01
   d) 1 + ,5 + ,06   e) 2 + ,06   f) 9 + ,04
3. a) 0,01   0,1   0,11   0   1,0   1,1
   b) 0,14   0,41   1,14   1,4   1,41   4   4,01   4,1

Unit 29 Calculations with decimal fractions

MENTAL MATHS

Learner's Book page 185

Ask the learners to give the decimal fractions that are shaded in each 100-square. They use effective counting strategies to do this. The blue squares in (f) and (g) indicate wholes.

In question 2 they write the fractions as decimals.

1. a) $\frac{18}{100} = 0{,}18$ b) $\frac{25}{100} = 0{,}25$
   c) $\frac{50}{100} = 0{,}5$ d) $\frac{70}{100} = 0{,}7$
   e) $\frac{42}{100} = 0{,}42$ f) $\frac{100}{100} + \frac{94}{100} = \frac{194}{100} = 1{,}94$
   g) $\frac{100}{100} + \frac{100}{100} + \frac{36}{100} = \frac{236}{100} = 2{,}36$
2. a) $\frac{2}{10} = 0{,}2$ b) $\frac{17}{10} = 0{,}17$ c) $\frac{45}{10} = 0{,}45$
   d) $\frac{1}{10} = 0{,}1$ e) $\frac{11}{10} = 1{,}1$ f) $\frac{8}{100} = 0{,}08$
   g) $\frac{15}{100} = 0{,}15$ h) $\frac{20}{100} = 0{,}20$ or $0{,}2$ i) $\frac{99}{100} = 0{,}99$
   j) $\frac{3}{100} = 0{,}03$

Activity 29.1

Learner's Book page 186

Remind the learners that they worked with numbers up to millions in the Whole numbers units. Ask them to read the numbers 5 123 405 and 12 600 500 aloud to the class. Tell them that we normally write large numbers as decimals so we can read the numbers easier. They explore the numbers on the number line to find out that 6 500 000 (6 million five hundred thousand) is halfway between 6 million and 7 million. 6 500 000 = 6,5 million (written to one decimal place after the comma). If the population of a country is 8 750 000, you write it as 8,75 million, written to two decimal places after the comma.

Work through the data in the table in question 1 with the learners. Ask them to read the numbers aloud. They write the numbers as decimals with two places after the comma.

Ask them to study the boy's reasoning about multiplication by 10 and the problem he has with the decimal number. They decide whether Tumi is correct or not. They should realise that 10 pairs of socks cannot cost R7 500. Let them calculate the accurate cost, which is R7,50 x 10 = R75,00.

They solve the problems in question 3 to show their understanding of money amounts or decimals multiplied by 10 and 100.

Ask the learners to explore the numbers in the place value tables in question 4. They describe how the numbers and the place values change when multiplied by 10 and 100. Let them copy the tables and complete them for the calculations from (d) to (o) in question 3. Let the learners share their solutions and observations.

1.

Cultural groups	Numbers
Black	32 340 000 → 32,34 million
White	4 494 000 → 4,49 million
Asian	1 050 000 → 1,05 million
Coloured	3 696 000 → 3,69 million

2. **a)** Tumi is wrong. He works with the decimal number the same way he works with whole numbers.

b) R7,50 × 10 = R75,00

3. **a)** R35,00 **b)** R88,90
c) R1 105,00 **d)** R72,50
e) R188,90 **f)** R350,00
g) R550,00 **h)** R120,00
i) R725,00 **j)** R1 789,00
k) R559,90 **l)** R7 555,00
m) R999,90 **n)** R999,00
o) R1 255,00

4.	Number	Tth	Th	H	T	U	,	t	h
d)	R7,25 × 10			7	7	2	,	5	0
	R7,25 × 100				2	5	,	0	0
e)	R18,89 × 10		1	1	8	8	,	9	0
	R18,89 × 100			8	8	9	,	0	0
f)	R3,50 × 10			3	3	5	,	0	0
	R3,50 × 100				5	0	,	0	0
g)	R5,50 × 10			5	5	5	,	0	0
	R5,50 × 100				5	0	,	0	0
h)	R1,20 × 10			1	1	2	,	0	0
	R1,20 × 100				2	0	,	0	0
i)	R7,25 × 10			7	7	2	,	0	0
	R7,25 × 100				2	5	,	0	0
j)	R17,89 × 10		1	1	7	8	,	9	0
	R17,89 × 100			7	8	9	,	0	0
k)	R55,99 × 10		5	5	5	9	,	9	0
	R55,99 × 100			5	9	9	,	0	0
l)	R75,55 × 10		7	7	5	5	,	5	0
	R75,55 × 100			5	5	5	,	0	0
m)	R99,99 × 10		9	9	9	9	,	9	0
	R99,99 × 100			9	9	9	,	0	0
n)	R9,99 × 10			9	9	9	,	9	0
	R9,99 × 100				9	9	,	0	0
o)	R125,50 × 10	1	1	2	5	5	,	0	0
	R125,50 × 100		2	5	5	0	,	0	0

Unit 30 Decimal addition with carrying

MENTAL MATHS

Learner's Book page 188

Tell the learners that they will now learn to do calculations with decimals. In the next lessons they will add, subtract and multiply with decimal numbers. In question 1 they add and count in different decimal intervals. Let them count the decimals aloud. Ask them to create their own operators and ask their partners to complete their decimal number chains. Write basic problems like 0,1 + 0,1 + 0,1 = 0,3; 1,5 + 1,5 = 3, etc. on the board and ask the learners to solve them.

Write the following calculations on the board and ask the learners to solve them:

0,1	0,2	0,4	1,04	2,3
+ 0,1	+ 0,2	+ 0,4	+ 1,04	+ 2,3

Ask the learners to write their own decimal addition calculations like these. They ask their partners to solve them.

Remind the learners that they have worked with hundredths shaded in 100-squares in the mental maths section in Unit 29. They will now use the 100-squares to learn more about adding decimal fractions. Ask them to look at the example.

In question 2 they write addition calculations to find the decimals represented by the shaded parts. They work with hundredths and also hundredths and whole numbers.

In question 3 they work with wholes, tenths and hundredths. Ask the learners to use effective counting and calculating strategies and mental multiplication.

In question 4 the learners solve the decimal addition problems without carrying.

1. Ask the learners to look for similarities and differences in counting in whole numbers and decimal fractions.

a)

0 → + 0,1 → **0,1** → + 0,1 → **0,2** → + 0,1 → **0,3** ↓

+ 0,1 ← **0,6** ← + 0,1 ← **0,5** ← + 0,1 ← **0,4** ← + 0,1

↓ **0,7** → + 0,1 → **0,8** → + 0,1 → **0,9** → + 0,1 → **1**

b)

0 → + 0,2 → **0,02** → + 0,2 → **0,04** → + 0,2 → **0,06** ↓

+ 0,1 ← **0,12** ← + 0,2 ← **0,10** ← + 0,2 ← **0,08** ← + 0,2

↓ **0,14** → + 0,2 → **0,16** → + 0,2 → **0,18** → + 0,2 → **0,20**

c)

0 → + 0,5 → **0,5** → + 0,5 → **1,0** → + 0,5 → **1,5** ↓

+ 0,1 ← **3,0** ← + 0,5 ← **2,5** ← + 0,5 ← **2,0** ← + 0,5

↓ **3,5** → + 0,5 → **4,0** → + 0,5 → **4,5** → + 0,5 → **5,0**

d)

0 → + 1,04 → **1,04** → + 1,04 → **2,08** → + 1,04 → **2,12** ↓

+ 1,04 ← **5,24** ← + 1,04 ← **4,20** ← + 1,04 ← **3,16** ← + 1,04

↓ **6,28** → + 1,04 → **7,32** → + 1,04 → **8,36** → + 1,04 → **9,40**

2. Ask the learners to use brackets to group numbers they associate with each other (apply the associative property).

a) $\left(\frac{20}{100} + \frac{20}{100}\right) + \left(\frac{15}{100} + \frac{15}{100}\right)$
$= \frac{40}{100} + \frac{30}{100}$
$= \frac{70}{100}$
$= 0{,}70$

b) $\frac{20}{100} + \left(\frac{5}{100} + \frac{5}{100}\right) + \left(\frac{4}{100} + \frac{4}{100} + \frac{4}{100}\right)$
$= \frac{20}{100} + \frac{10}{100} + \frac{12}{100}$
$= \frac{42}{100}$
$= 0{,}42$

c) $\left(\frac{100}{100} + \frac{100}{100}\right) + \frac{20}{100} + \left(\frac{5}{100} + \frac{5}{100}\right) + \left(\frac{3}{100} + \frac{3}{100}\right)$
$= \frac{200}{100} + \frac{20}{100} + \frac{10}{100} + \frac{6}{100}$
$= \frac{236}{100}$
$= 2{,}36$

You could ask the learners if they think they can apply multiplication to represent the addition of hundredths in the calculations above. You could demonstrate this skill although the learners have not worked with decimal multiplication. They use existing knowledge of whole numbers and common fractions.

a) $\left(2 \times \frac{20}{100}\right) + 2 \times \frac{15}{100}$
$= \frac{40}{100} + \frac{30}{100}$
$= \frac{70}{100}$
$= 0{,}70$

b) $\frac{20}{100} + \left(2 \times \frac{5}{100}\right) + \left(3 \times \frac{4}{100}\right)$
$= \frac{20}{100} + \frac{10}{100} + \frac{12}{100}$
$= \frac{42}{100}$
$= 0{,}42$

c) $\left(2 \times \frac{100}{100}\right) + \frac{20}{100} + \left(2 \times \frac{5}{100}\right) + \left(2 \times \frac{3}{100}\right)$
$= \frac{200}{100} + \frac{20}{100} + \frac{10}{100} + \frac{6}{100}$
$= \frac{236}{100}$
$= 2{,}36$

3. Ask the learners to apply multiplication and the associative property after they have performed the repeated addition. Emphasise that they have to write tenths as hundredths.

a) $\left(\frac{20}{100} + \frac{10}{100}\right) + \left(\frac{5}{100} + \frac{5}{100} + \frac{5}{100} + \frac{5}{100} + \frac{5}{100}\right) + \frac{4}{10}$
$= \frac{30}{100} + \frac{25}{100} + \frac{4}{10}$
$= \frac{55}{100} + \frac{4}{10}$ $\quad\left(\frac{4}{10} = \frac{40}{100}\right)$
$= \frac{95}{100}$
$= 0{,}95$

b) $\frac{20}{100} + \frac{5}{100} + \left(\frac{7}{100} + \frac{7}{100}\right) + \frac{1}{10}$
$= \frac{25}{100} + \frac{14}{100} + \frac{10}{100}$
$= \frac{49}{100}$
$= 0{,}49$

c) $\frac{100}{100} + \left(\frac{30}{100} + \frac{30}{100}\right) + \left(\frac{5}{100} + \frac{5}{100}\right) + \frac{7}{10}$
$= \frac{100}{100} + \frac{60}{100} + \frac{10}{100} + \frac{70}{100}$
$= 1 + \frac{140}{100}$
$= 2\frac{40}{100}$
$= 2{,}40$

---

a) $\frac{30}{100} + \left(5 \times \frac{5}{100}\right) + \frac{40}{100}$ $\left[\frac{4}{10} = \frac{40}{100}\right]$
$= \frac{30}{100} + \frac{25}{100} + \frac{40}{100}$
$= \frac{95}{100}$
$= 0{,}95$

b) $\frac{20}{100} + \frac{5}{100} + \left(2 \times \frac{7}{100}\right) + \frac{1}{10}$
$= \frac{25}{100} + \frac{14}{100} + \frac{10}{100}$
$= \frac{49}{100}$
$= 0{,}49$

c) $\frac{100}{100} + \left(2 \times \frac{30}{100}\right) + \left(2 \times \frac{5}{100}\right) + \frac{7}{10}$
$= 1 + \frac{60}{100} + \frac{10}{100} + \frac{70}{100}$
$= 1 + \frac{140}{100}$
$= 2\frac{40}{100}$
$= 2{,}40$

4. You could ask the learners to look for relationships between whole numbers and decimal fractions regarding multiplication and repeated addition.

a) $0{,}3 + 0{,}3 + 0{,}3 = 0{,}9 = \frac{9}{10}$ $3 \times 3 = 9$ $3 \times 0{,}3 = 0{,}9$
b) $0{,}2 + 0{,}2 + 0{,}2 + 0{,}2 = 0{,}8 = \frac{8}{10}$ $4 \times 2 = 8$ $4 \times 0{,}2 = 0{,}8$
c) $0{,}5 + 0{,}5 + 0{,}5 = 1{,}5 = \frac{15}{10}$ or $1\frac{5}{10}$ $3 \times 5 = 15$ $3 \times 0{,}5 = 1{,}5$
d) $1{,}4 + 1{,}4 = 2{,}8 = \frac{28}{10} = 2\frac{8}{10}$ $2 \times 14 = 28$ $2 \times 1{,}4 = 2{,}8$ and so on
e) $1{,}2 + 1{,}2 + 1{,}3 = 2{,}4 + 1{,}3 = 3{,}7 = \frac{37}{10} = 3\frac{7}{10}$
f) $2{,}3 + 2{,}3 + 1{,}1 = 4{,}6 + 1{,}1 = 5{,}7 = \frac{57}{10} = 5\frac{7}{10}$

Activity 30.1

Learner's Book page 190

The learners start working with decimal addition with carrying. To develop their understanding of this concept, they explore the pictures to find out how tenths are carried to add to whole numbers. One-litre jugs and 0,1 litre beakers are used to demonstrate carrying. Ask the learners to discuss the strategies.

In questions 1 and 2 they find out how much water the containers hold. They should realise that a full group of $\frac{10}{10}$ is carried to the units. They explore the vertical column method and the expanded notation strategy that the learners use in the pictures. They use the strategy they prefer to solve the problems. Let them estimate the solutions before calculating the accurate solutions. They check their solutions on a calculator.

In question 3, tell the learners that adding the tens and units in the decimal fractions will give them the rough answers to the addition calculations. They can do this mentally. They should remember that estimating solutions gives them an idea of the magnitude of the solutions they expect. They are then able to judge the reasonableness of their solutions. Always allow the learners to justify estimations before doing calculations and to compare estimates to accurate solutions. Tell them that they could use zero as a place holder to fill empty places to prevent confusion. They should make sure that digits in the decimal numbers should be correctly aligned according to their place values.

1. 1 litre + $\frac{10}{10}$ = 1 + 1 = 2 litres or 1 + (10 × 0,1) = 1 + 1,0 = 2 litres
2 litres + $\frac{10}{10}$ + $\frac{4}{10}$ = 3,4 litres

2. **a)** 2 litres + 1 litre $\left(\frac{10}{10}\right)$ + $\frac{3}{10}$ = 3,3 litres

b) 1 litre + $\frac{15}{10}$ = 2 litres + $\frac{5}{10}$ = 2,5 litres

c) 1 litre + $\frac{11}{10}$ = 2 litres + $\frac{1}{10}$ = 2,1 litres

d) 1 litre + $\frac{12}{10}$ = 2 litres + $\frac{2}{10}$ = 2,2 litres

3. **a)** ± 6 **b)** ± 20 **c)** ± 10
d) ± 4 **e)** ± 21 **f)** ± 10

a)
$$\begin{array}{r} 3{,}70 \\ 2{,}50 \\ +\ 0{,}57 \\ \hline 6{,}77 \end{array}$$

b)
$$\begin{array}{r} 14{,}90 \\ 2{,}68 \\ +\ 3{,}04 \\ \hline 20{,}62 \end{array}$$

c)
$$\begin{array}{r} 5{,}60 \\ 3{,}80 \\ +\ 1{,}75 \\ \hline 11{,}15 \end{array}$$

d)
$$\begin{array}{r} 0{,}80 \\ 1{,}56 \\ +\ 3{,}90 \\ \hline 6{,}26 \end{array}$$

e)
$$\begin{array}{r} 12{,}70 \\ 6{,}45 \\ +\ 5{,}25 \\ \hline 24{,}40 \end{array}$$

f)
$$\begin{array}{r} 9{,}30 \\ 0{,}07 \\ +\ 0{,}86 \\ \hline 10{,}23 \end{array}$$

Unit 31 Solving problems with decimals

MENTAL MATHS

Learner's Book page 192

Ask the learners to use calculators. They program the calculators to subtract or count back. Ask them to enter the keys as indicated. They write the first 10 terms in each sequence on the board and discuss and describe the patterns they observe.

In question 2 they write the solutions to the subtraction calculations on their Mental Maths grids. They subtract tenths and hundredths. They also work with units without decomposition.

1. Remind the learners to substitute the decimal points by commas. They should notice that if they ignore the commas in the numbers in the sequences, they count backwards in 1s, 5s, 12s, 25s and 3s.

   a) 3 – 0.1 = **2,9; 2,8; 2,7; 2,6; 2,5; 2,4; 2,3; 2,2; 2,1; 2**
   b) 10 – 0.5 = **9,5; 9; 8,5; 8; 7,5; 7; 6,5; 6; 5,5; 5**
   c) 12 – 1.2 = **10,8; 9,6; 8,4; 7,2; 6; 4,8; 3,6; 2,4; 1,2; 0**
   d) 5 – 0.25 = **4,75; 4,5; 4,25; 4; 3,75; 3,5; 3,25; 3; 2,75; 2,5**
   e) 6 – 0.3 = **5,7; 5,4; 5,1; 4,8; 4,5; 4,2; 3,9; 3,6; 3,3; 3**

2. **a)** $\frac{7}{10} - \frac{3}{10} = \frac{4}{10}$ **b)** $\frac{9}{10} - \frac{4}{10} = \frac{5}{10}$

   c) $1\frac{8}{10} - \frac{2}{10} = 1\frac{6}{10}$ **d)** $3\frac{6}{10} - 2\frac{1}{10} = 1\frac{5}{10}$

   e) $1\frac{5}{10} - \frac{1}{10} = 1\frac{4}{10}$ **f)** $\frac{50}{100} - \frac{2}{100} = \frac{48}{100}$

   g) $\frac{90}{100} - \frac{15}{100} = \frac{75}{100}$ **h)** $\frac{75}{100} - \frac{25}{100} = \frac{50}{100}$

   i) $\frac{25}{100} - \frac{10}{100} = \frac{15}{100}$ **j)** $2\frac{70}{100} - 1\frac{13}{100} = 1\frac{57}{100}$

Activity 31.1

Learner's Book page 192

Tell the learners that they will solve decimal subtraction problems. They work in their groups and discuss the strategy used to demonstrate subtraction involving decomposition. Make sure that they understand both strategies. Ask the learners to estimate the solutions in question 4 before solving the problems. They use calculators to check their solutions by doing the inverse operation.

2,3 litres – 0,6 litre = 1,7 litres (by exploring the capacities in the pictures)

Encourage the learners to make drawings to illustrate their understanding if necessary. You could also ask them to manipulate the numbers as they do with money amounts. They should however insert the commas correctly in their final solutions.

1. **a)** 4,2 – 0,7 = ■ 42 – 7 = 35 4,2 – 0,7 = 3,5 litre
   b) 4,5 – 1,6 = ■ 45 – 16 = 19 4,5 – 1,6 = 1,9 litre

2. Go through the strategy with the learners to help them develop understanding of the vertical column method for subtracting decimal numbers with decomposition.

3. **a)** 13,1 – 10,56 = 2,54 **b)** 1,2 – 0,7 = 0,5
   c) 5,4 – 2,87 = 2,53 **d)** 20, 45 – 5,63 = 14,82
   e) 14,5 – 10,75 = 3,75 **f)** 8,31 – 2,7 = 5,61
   g) 21,35 – 18,76 = 2,59 **h)** 10,1 – 6,25 = 3,85
   i) 15,76 – 14,87 = 0,89 **j)** 27 – 4,12 = 22,88

Unit 32 Multiply with decimals

MENTAL MATHS

Learner's Book page 194

Tell the learners that they will do multiplication with decimal numbers. They work with the class to discuss how they could calculate the total mass of the boxes on the scale in a quicker way than adding them. They explore and discuss the two strategies involving the application of the distributive property and the vertical column method for multiplication. Ask the learners how the vertical column method for multiplying decimals differs from multiplying with whole numbers. Let them do the calculation without the comma to enforce their understanding that the comma makes a significant difference in the value of the digits. They check the solution to 3,6 × 4 on the calculator.

In question 3 the learners estimate the solutions before calculating the accurate solutions. Ask them to use both strategies as in the examples. They use calculators to check the solutions.

1. Multiplication is a shorter method than repeated addition. You can also use doubling.

   36 × 4 = (30 × 4) + (6 × 4) 3,6 + 3,6 = 7,2
   = 120 + 24 7,2 + 7,2 = 14,4
   = 144
   3,6 × 4 = 14,4

2. 3,6 × 4 = 14,4

3.

a)	Bigger than 1:	3 × 5 = 15	0,3 × 5 = 1,5
b)	Smaller than 1:	2 × 1 = 2	0,2 × 1 = 0,2
c)	Bigger than 1:	5 × 5 = 25	0,5 × 5 = 2,5
d)	Bigger than 1:	7 × 8 = 56	0,7 × 8 = 5,6
e)	Bigger than 1:	9 × 5 = 45	0,9 × 5 = 4,5
f)	Bigger than 1:	12 × 1 = 12	1,2 × 1 = 1,2
g)	Smaller than 1:	8 × 0 = 0	0,8 × 0 = 0
h)	Bigger than 1:	12 × 12 = 144	1,2 × 1,2 = 1,44
i)	Bigger than 1:	11 × 3 = 33	1,1 × 3 = 3,3
j)	Bigger than 1:	12 × 5 = 60	1,2 × 5 = 6,0

4. Learners use calculators to check their solutions.

Activity 32.1
Learner's Book page 195

Ask the learners to use both strategies demonstrated in the mental maths activity in this unit to solve the problems in question 1.

In question 2 they assess the mass of the boxes on the scale and calculate the accurate mass.

In question 3 they calculate the total mass of the boxes.

1. Ask the learners to first estimate the solutions to these problems. They should use the distributive property and the vertical column method to solve the problems as in the first problem below. Let them check solutions on a calculator.

   a) $2,8 \times 4 = \blacksquare$

   $(2 \times 4) + \left(\frac{8}{10} \times 4\right)$
   $= 8 + \frac{32}{10}$
   $= 8 + 3 + \frac{2}{10}$
   $= 11\frac{2}{10}$

   $$\begin{array}{r} 2,8 \\ \times\ \underline{\ \ 4} \\ 3,2 \\ \underline{8,0} \\ 11,2 \end{array}$$

   b) $1,5 \times 5 = 7,5$
   c) $2,5 \times 5 = 12,5$
   d) $3,7 \times 7 = 25,9$
   e) $4,6 \times 3 = 13,8$
   f) $3,2 \times 8 = 25,6$
   g) $5,3 \times 7 = 12,3$
   h) $9,1 \times 6 = 54,6$
   i) $7,3 \times 9 = 65,7$
   j) $1,2 \times 8 = 9,6$

2. Yes.

   $$\begin{array}{rl} 4,5 & \\ \times\ \underline{\ \ 3} & \\ 1,5 & (0,5 \times 3) \\ \underline{12,0} & (4 \times 3) \\ \underline{13,5} & \end{array}$$

3. $2,4 \times 5 = 12$ kg

Unit 33 Problem-solving: Add, subtract and multiply decimal fractions

The learners work in their groups to solve the contextual problems. Ask them to record their strategies on a large sheet of paper so that they can do a class presentation during feedback. The problems involve addition, subtraction and multiplication of decimals. Tell them to use strategies with which they are comfortable and remind them to check their solutions on calculators.

MENTAL MATHS
Learner's Book page 195

1. $4,6 \times 6 = 27,6$ m. The total length of 6 pipes is 26,6 m.
2. **a)** $R12,55 \times 10 = R125,50$
   b) $R12,55 \times 100 = R1\ 255,00$

Activity 33.1

Learner's Book page 196

In question 1, the learners explain what Lawrence did wrong. They should notice that the digits in some numbers are aligned incorrectly and in some problems he subtracted the top number from the number below. They use the strategies they prefer to rectify the mistakes or misconceptions.

1. **a)** 6,7 + 2,5 = 9,2 **b)** 48 – 17,6 = 30,4
c) 28,9 – 4 = 24,9 **d)** 38,3 – 17,9 = 20,4

2.

Metres	Cost
1 m	R16,95
2 m	R33,90
3 m	R50,85
4 m	R67,80
6 m	R101,70
8 m	R135,60

3. Mass of kitten = 8,3 kg – 7,8 kg = 0,5 kg

4. **a)** Height of stacked containers:
1,3 m + 0,9 m + 2,6 m + 2 m = 6,8 m

b) Total mass of containers:
12,6 kg + 8,1 kg + 18,3 kg + 13,9 kg = 52,9 kg

5. **a)** Rashieda makes 5 trips per day between home and work.
Total distance travelled per day: 5 × 3,7 km = 18,5 km

b) Distance travelled in 5 days: 5 × 18,5 kg = 92,5 km

Assessment 2.5 Decimal fractions

The learners will apply knowledge gained during the last nine units to solve the problems involving decimal fractions. They will compare and recognise decimal fractions in diagrammatic representation, show knowledge of decimal place value and solve addition, subtraction and multiplication with decimal numbers in and out of context.

Assessment 2.5 Decimal fractions

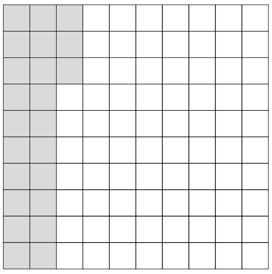
1. Put these decimals in order from the smallest to the largest.

a) 0,7 7,0 7,01 7,1 0,17 0,71

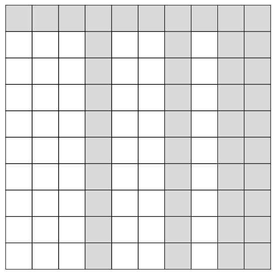
b) 0,2 2,1 2,0 0,12 0,21 2,01

2. Which fractions are shaded in these shapes? Write the common fraction and the decimal fraction for each shape.

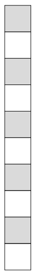
a)



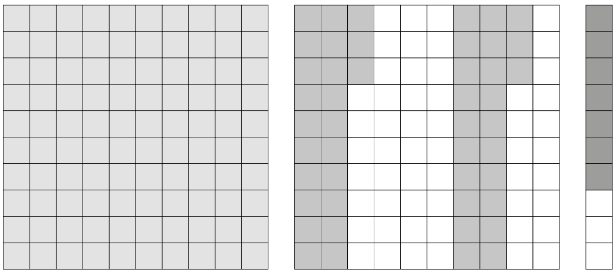
b)



c)

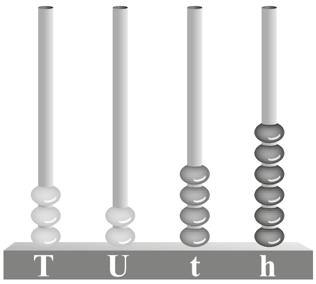


d)

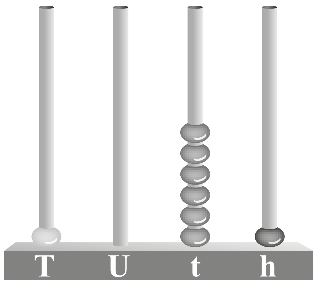


3. Which decimal numbers are represented on the abacuses?

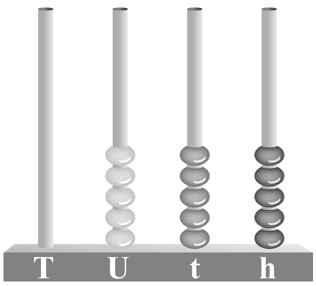
a)



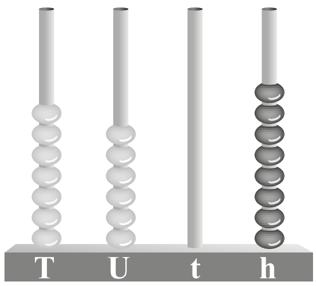
b)



c)



d)



4. Write these numbers in expanded notation.

a) 5,16 = ■ + ■ + ■
b) 2, 09 = ■ + ■
c) 34, 23 = ■ + ■ + ■
d) 52, 76 ■ + ■ + ■

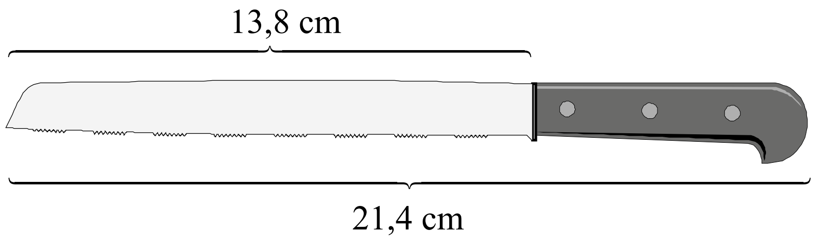
5. Calculate the following.

a) $4 + \frac{4}{10} + \frac{5}{100} =$ ■
b) $20 + \frac{17}{100} =$ ■
c) $7 + \frac{55}{10} =$ ■
d) $12 + \frac{8}{10} + \frac{16}{100} =$ ■

6. Solve the following.

a) 25,36 – 15,47 = ■
b) 17 – 3,28 = ■
c) 4,6 + 1,5 + 0,89 = ■
d) 24,9 + 4,67 + 3,08 = ■
e) 0,8 × 6 = ■
f) 4,7 × 4 = ■

7. A knife is 21,4 cm long. The blade is 13,8 cm long. How long is the handle?



8. Racing cars drive different laps around a track.
How far did each of these cars travel?

a) 7 laps of 12,7 km
b) 4 laps of 26,6 km
c) 5 laps of 15,9 km
d) 6 laps of 22,8 km

9. A dog has a mass of 8,79 kg. Its puppy's mass is 1,85 kg.

a) How much is the total mass of the dog and the puppy?
b) How much heavier is the dog than the puppy?

1. **a)** 0,17; 0,7; 0,71; 7,0; 7,1; 7,01
b) 0,12; 0,21; 1,2; 2,0; 2,01; 2,1

2. **a)** $\frac{13}{100} = 0{,}13$
b) $\frac{46}{100} = 0{,}46$
c) $\frac{5}{10} = 0{,}5$
d) $1 + \frac{46}{100} + \frac{7}{10} = 1 + \frac{46}{100} + \frac{70}{100} = 1$ and $\frac{116}{100} = 2$ and $\frac{16}{100} = 2{,}16$

3. **a)** 3 246 **b)** 1 061
c) 555 **d)** 7 608

4. **a)** $5{,}16 = 5 + \frac{1}{10} + \frac{6}{100}$
b) $2{,}09 = 2 + \frac{9}{100}$
c) $34{,}\ 23 = 30 + 4 + \frac{2}{10} + \frac{3}{100}$
d) $52{,}\ 76 = 50 + 2 + \frac{7}{10} + \frac{6}{100}$

5. **a)** $4 + \frac{4}{10} + \frac{5}{100} = 4 + \frac{40}{100} + \frac{5}{100}$
$= 4$ and $\frac{45}{100}$
b) $20 + \frac{17}{100} = 20$ and $\frac{17}{100}$
c) $7 + \frac{55}{10} = 7 + 5 + \frac{5}{10}$
$= 12$ and $\frac{5}{10}$
d) $12 + \frac{8}{10} + \frac{16}{100} = 12 + \frac{80}{100} + \frac{16}{100}$
$= 12$ and $\frac{96}{100}$

6. **a)** 25,36 – 15,47 = 40,83
b) 17 – 3,28 = 13,72
c) 4,6 + 1,5 + 0,89 = 6,99
d) 24,9 + 4,67 + 3,08 = 32,65
e) 0,8 × 6 = 4,8
f) 4,7 × 4 = 18,8

7. 21,4 – 13,8 = 7,6
The handle is 7,6 cm long.

8. **a)** 7 laps of 12,7 km → 12,7 × 7 = 88,9 km
b) 4 laps of 26,6 km → 26,6 × 4 = 106,4 km
c) 5 laps of 15,9 km → 15,9 × 5 = 79,5 km
d) 6 laps of 22,8 km → 22,8 × 6 = 136,8 km

9. a) Combined mass of dog and puppy: 8,79 + 1,85 = 10,64 kg
b) 8,79 – 1,85 = 6,94
The dog weighs 6,94 kg more than the puppy.

Capacity/volume

Learner's Book page 198

In Grades 4 and 5 learners were introduced to methods for measuring the capacity and volume of a container and the volume of material inside the container. This term they continue to develop their understanding of capacity and volume. They use ml and ℓ as before, and also a new measuring unit, kilolitres (kl). They do conversions between measuring units and choose the most suitable measuring units for different quantities and contexts. They also begin to work with decimals in their calculations and measurements. So far in Grade 6 they will have learned how to count, add and subtract with simple decimal fractions, and calculations of volume and capacity with decimal quantities are limited to these operations.

Unit 34 Estimating, measuring, recording and comparing volume and capacity

In this unit learners practise their estimation skills and their ability to measure volumes accurately. Encourage them to refine their estimations – these should not be wild guesses. Learners should look at the clues in a given situation as to what a reasonable estimate would be. For example, if a liquid is in a small measuring jug, it would not be a quantity bigger than about 1 or 2 litres. Learners should also consolidate their understanding of how much a ml, a ℓ and a kl is, so they can make sensible estimates in different contexts, and check whether the measuring units they use in different calculations are appropriate or correct.

They do a mental maths activity to revise number skills such as ordering volumes, counting forwards and backwards, and identifying and counting in multiples of 5, 10, 100, 250. They do conversions between ml, ℓ and kl, and choose measuring units that are suited to different contexts and quantities of material to be measured. Help learners to acquire the habit of using the conversion table provided in the Learner's Book to check the method for converting between measuring units. They will use other conversion tables when they work with mass and length later in this grade. They need to understand the relationship between ml, ℓ and kl, and multiply or divide as appropriate to convert these units. (To convert from a small unit to a bigger unit you divide; to convert from a big unit to a smaller unit you multiply.)

Learners use apparatus such as spoons, cups and buckets to compare volumes and capacities. Have as many different-sized containers in the classroom as possible for Activity 34.3, and let groups take turns to use different containers to repeat the comparison activities.

MENTAL MATHS
Learner's Book page 198

1. a) 100 ml, 250 ml, 340 ml, 375 ml, 500 ml, 750 ml, 1 000 ml
   b) 55 ℓ, 75 ℓ, 98 ℓ, 335 ℓ, 708 ℓ, 1 065 ℓ
2. a) 100, 250, 340, 500, 750, 1 000
   b) 55, 75, 335, 1 065
3. 20
4. 8

Activity 34.1
Learner's Book page 199

1. a) 0,375 ℓ   b) 7 500 ml
   c) 2 500 ℓ   d) 1,5 ℓ
   e) 25 kl   f) 3 500
   g) 0,5 ℓ   h) 0,75
   i) $\frac{5}{100}$ ℓ = $\frac{50}{1\,000}$ ℓ = 50 ml   j) 100 kl

Activity 34.2
Learner's Book page 200

1. a) 100 ml   b) 50 ml   c) 75 ml   d) 10 ml
2. a) ℓ   b) ml   c) ml   d) ℓ
   e) kl   f) ml   g) kl   h) ℓ
3. a) B   b) A   c) C   d) C
4. a) $84\frac{4}{10}$ ml = $95\frac{2}{5}$ ml   b) $23\frac{75}{100}$ ml = $23\frac{3}{4}$ ml
   c) $41\frac{9}{10}$ ℓ   d) $5\frac{15}{100}$ ℓ = $5\frac{3}{20}$ ℓ
   e) $9\frac{95}{100}$ ml = $9\frac{19}{20}$ ml   f) $12\frac{1}{10}$ ℓ
5. b) 1,5 ℓ vase   b) 400 ml jug   c) 2,5 ℓ box

Activity 34.3
Learner's Book page 201

Learners' own work

Activity 34.4
Learner's Book page 202

Learners' own work

Activity 34.5
Learner's Book page 204

Learners' own work

Unit 35 Reading capacity and volume levels

Learner's Book page 204

In this unit the learners practise the correct method for reading the measurement of liquid in a container – at eye level – and also practise reading the calibrations on measuring jugs and other instruments. They do activities to work out the calibrations at un-numbered intervals on measuring instruments where there are 2, 4, 5 and 10 un-numbered intervals. They use addition and subtraction skills to do calculations with given volumes, including volumes with decimal fractions. They solve problems in context that involve calculating volumes of substances, increasing volumes in a given ratio, and dividing volumes into given quantities.

MENTAL MATHS

Learner's Book page 205

1. **a)** 250 ml; 500 ml
   b) 4 ml; 8 ml; 16 ml; 18 ml
   c) 1 ml; 2 ml; 3 ml; 4 ml; 6 ml; 7 ml; 8 ml; 9 ml; 10 ml; 12 ml; 13 ml; 14 ml; 15 ml; 16 ml; 17 ml; 19 ml, 20 ml
   d) 2 ml; 3 ml; 5 ml; 7 ml; 8 ml; 9 ml; 10 ml; 12 ml; 13 ml; 15 ml
   e) $\frac{1}{8}$ ml; $\frac{2}{8}\left(\frac{1}{4}\right)$ ml; $\frac{3}{8}$ ml; $\frac{4}{8}\left(\frac{1}{2}\right)$ ml; $\frac{5}{8}$ ml; $\frac{6}{8}\left(\frac{3}{4}\right)$ ml; $\frac{8}{8}$ (1) ml
   f) 0,2 ml; 0,3 ml; 0,4 ml; 0,6 ml; 0,7 ml; 0,7 ml; 0,9 ml; 1 ml
2. **a)** 50 ml **b)** 200 ml
   c) 400 ml **d)** 50 ml
   e) 140 ml **f)** 180 ml

Activity 35.1

Learner's Book page 206

Learners' own work

Activity 35.2

Learner's Book page 206

1. **a)** 13,6 ℓ **b)** $7\frac{3}{4}$ ℓ
   c) 131,5 ℓ **d)** $31\frac{1}{3}$ ℓ
2. **a)** 2,5 ℓ or $2\frac{1}{2}$ ℓ **b)** 1,05 ℓ or $1\frac{1}{20}$ ℓ
   c) 5,0 ℓ **d)** 2,25 ℓ or $2\frac{1}{4}$ ℓ
   e) 90,5 ℓ or $90\frac{1}{2}$ ℓ **f)** 22,25 ℓ or $22\frac{1}{4}$ ℓ
3. **a)** 32,5 ℓ **b)** No
   c) 22,5 ℓ **d)** R541,75
4. Number of cups = 4 000 ml ÷ 175 ml
   Approximately 22 cups
5.

	Number	Round off to the nearest:			
		10 ml	50 ml	100 ml	1 000 ml
a)	798 ml	800 ml	800 ml	800 ml	1 000 ml
b)	1 421 ml	1 420 ml	1400 ml	1 400 ml	1 000 ml
c)	529 ml	530 ml	550 ml	500 ml	1 000 ml
d)	1 972 ml	1 970 ml	1 950 ml	2 000 ml	2 000 ml
e)	107 ml	110 ml	100 ml	100 ml	0
f)	117 ml	120 ml	100 ml	100 ml	0

6.

Capacity of drink can	Number of cans sold	a) Total volume
340 ml	4 515	1 535 100
250 ml	730	182 500
500 ml	3 544	1 772 000
1,5 ℓ	1 874	2 811 000
Total	**10 663**	**6 300 600**

b) 6 300 600 ml or 6 300,6 ℓ
c) 10 663 cans

7. **a)** 20 containers
b) 3 containers
c) 180 containers
d) 6 containers

8. 1,6 kl = 1 600 ℓ

9. Fruit juice concentrate to water = 1 to 4
$3\frac{3}{4} \times 5 = \frac{15}{4} \times \frac{5}{1} = \frac{75}{4} = 18\frac{3}{4}$ ℓ of juice

10. 2 bananas × 11 = 33 bananas
45 ml peanut butter × 11= 495 ml peanut butter
60 ml plain yoghurt × 44 = 6 600 ml yoghurt
30 ml honey × 11 = 330 ml honey

11. (100 ml × 3) + (150 ml × 5) + (180 ml × 2)
= 300 ml + 450 ml + 360 ml = 1 110 ml

12. **a)** (3 × 1 ℓ) + (5 × 500 ml) = 3 ℓ + 2 500 ml
3 ℓ + 2 ℓ + 500 ml
= 5,5 ℓ

b) 3 × 750 ml = 2 250 ml
= 2,25 ℓ

c) 2,25 ℓ + 6 × 250 ml
= 2,25 ℓ + 1 500 ml
= 2,25 ℓ + 1,5 ℓ
= 3,75 ℓ

d) 5,5 ℓ + 3,75 ℓ = 9,25 ℓ

13. **a)** 2 glasses
b) 1 glass
c) 6 glasses
d) 8 glasses
e) 4 glasses
f) 3 glasses

14. Learners' own work

1. Which is the best unit to use to measure each volume below: millilitres (ml), litres (ℓ) or kilolitres (kl)?
   a) cool drink in a glass
   b) water in a big swimming pool
   c) petrol in a car's petrol tank
   d) petrol in a tanker that delivers petrol to garages around the country
   e) medicine in a syringe
   f) total volume of water used by Johannesburg in one day

2. Give the capacity of each jug below.

a)

b)

c)

d)

3. What is the volume of liquid in each jug in question 2?

4. Round off each volume to the nearest 100 ml.
   a) 825 ml **b)** 92 ml **c)** 1 573 ml

5. Complete each conversion.
   a) 1 ℓ = ■ ml **b)** $1\frac{1}{2}$ ℓ = ■ ml
   c) 1 750 ml = ■ ℓ **d)** 1,5 kl = ■ ℓ
   e) 5 000 ℓ = ■ kl **f)** 2 500 ml = ■ ℓ
   g) 1,2 kl = ■ ℓ

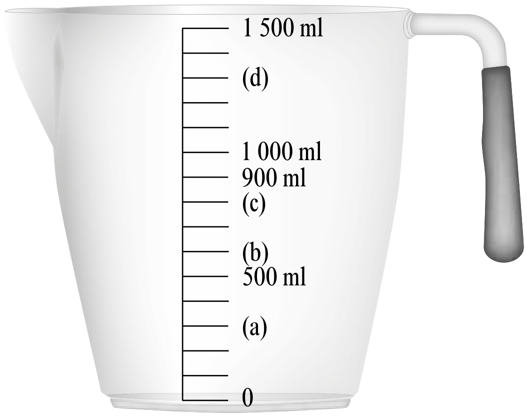
6. Arrange the volumes from smallest to largest.
   (*Hint:* First convert all volumes to litres.)
   1 250 ml; 1 kl; 1 500 ℓ; 175 ℓ; 500 ml

7. Arrange the volumes from largest to smallest.
   (*Hint:* First convert all volumes to millilitres.)
   12 ml; 0,5 ℓ; 138 ml; 0,01 kl; 1 ℓ

8. How many spoonfuls will you need to fill a 250 ml cup?

9. How many glasses with a capacity of 250 ml each can you fill if you have $1\frac{1}{2}$ ℓ of cool drink?

10. Give the missing ml values at (a), (b), (c) and (d) on this jug.



11. Water is stored in four small bottles in the fridge, with volumes of 250 ml, 100 ml, 125 ml and 500 ml. What is the total volume of water in the fridge?

12. The volume of oil in a bottle is 750 ml. How much oil will be left if you pour 125 ml out of the bottle?

13. Mosega has a water bottle with a capacity of 5 ℓ. She pours some of the water into smaller bottles for three of her friends. Each of their bottles has a volume of 1,5 ℓ.

a) How much water is left in her bottle? Show your calculations.

b) Mosega uses 1 ℓ from the water left in her own bottle. hen two of her friends pour their 1,5 ℓ back into her bottle. What is the volume of water in her bottle now?

14. Joshua drinks an energy drink when he goes cycling. He has a 2,5 ℓ flask of energy drink with him. Every two hours he drinks 250 ml of the energy drink. How many times can he drink from the flask before it is empty?

1. **a)** cool drink in a glass → millilitres
b) water in a swimming pool → litres
c) petrol in a car's petrol tank → litres
d) petrol in a delivering tanker → kilolitre
e) medicine in a syringe → millilitres
f) total volume of water per day by Johannesburg → kilolitres

2. **a)** 1 litre **b)** 250 ml **c)** 750 ml **d)** 100 ml

3. **a)** 750 ml **b)** 125 ml **c)** 750 ml **d)** 90 ml

4. **a)** 825 ml → 800 ml **b)** 92 ml → 100 ml
c) 1 573 ml → 1 600 ml

5. **a)** 1 ℓ = 1 000 ml **b)** $1\frac{1}{2}$ ℓ = 1 500 ml
c) 1 750 ml = $1\frac{3}{4}$ ℓ **d)** 1,5 kl = 1 500 ℓ
e) 5 000 ℓ = 5 kl **f)** 2 500 ml = $2\frac{1}{2}$ ℓ
g) 1,2 kl = 1 200 ℓ

6. 1 250 ml; 1 kl; 1 500 ℓ; 175 ℓ; 500 ml
$1\frac{1}{4}$ ℓ; 1 000 ℓ; 1 500 ℓ; 175 ℓ; $\frac{1}{2}$ ℓ
$\frac{1}{2}$ ℓ; $1\frac{1}{4}$ ℓ; 175 ℓ; 1 000 ℓ; 1 500 ℓ;

7. 12 ml; 0,5 ℓ; 138 ml; 0,01 kl; 1 ℓ
12 ml; 500 ml; 138 ml; 10 000 ml (0,01 kl = 10 ℓ); 1 000 ml
10 000 ml; 1 000 ml; 500 ml; 138 ml; 12 ml

8. The cup is 250 ml and the spoon 5 ml:
250 ml ÷ 5 ml = 50 spoonfuls

9. $1\frac{1}{2}$ ℓ = 1 500 ml
1 500 ml ÷ 250 ml: 1 000 ÷ 250 = 4
500 ÷ 250 = 2
6 glasses can be filled from $1\frac{1}{2}$ ℓ cool drink

10. **a)** 300 ml **b)** 600 ml **c)** 800 ml **d)** 1 300 ml

11. 250 ml + 100 ml + 125 ml + 500 ml
= (500 + 100 + 200 + 75)
= 875 ml

12. 750 ml – 125 ml = (700 – 100) + (50 – 25)
= 625 ml oil left

13. **a)** 5 ℓ – (1,5 ℓ × 3) = 5 – 4,5
= 0,5 ℓ left in Mosega's bottle
b) Volume of water now in her bottle: 1,5 ℓ + 1,5 ℓ = 3 litre

14. 2,5 ℓ = 2 500 ml
1 000 ÷ 250 = 4
1 000 ÷ 250 = 4
500 ÷ 250 = 2
Joshua will be able to drink 10 times before the bottle is empty.

TERM 3

Mass

Learner's Book page 212

Learners have done measurements and calculations with grams and kilograms in Grades 4 and 5. In Grade 6 they practise and extend these skills. They consolidate their understanding of how much 1 kg and 1 g are, and of the relationship between grams and kilograms. They use decimal fractions to two decimal places as well as common fractions in mass measurements and simple calculations, and in solving problems in context. They practise reading masses on different measuring instruments such as balances, analogue scales and digital mass meters that show mass to at least two decimal places.

Try to have a wide variety of scales available in the classroom during these activities. Bring different types of packaging to class and let learners identify the mass stated on each packaging. Let them talk about whether the packaging states the masses in grams or kilograms, and why they think these units have been chosen.

Unit 1 Estimating, measuring, recording and comparing mass

In this unit learners relate the concepts gram and kilogram to the kinds of objects that have masses measured in each of these units.

In Grades 4 and 5 they learned how to measure the mass of an object using grams (g) and kilograms (kg).

In the Mental Maths activity, the learners convert fractions of kilograms to grams and calculate fractions of grams. They work with common and mixed fractions in preparation for the concepts they will engage in during the main lesson. Ask them to record their solutions on their Mental Maths grids.

In Activity 1.1, they compare masses and choose appropriate measuring units for them. Spend time working through the conversion table in the Learner's Book, and ask learners to use the table to practise converting masses given in grams to kilograms, and vice versa. For example, show them a margarine tub and ask them to convert the measurement shown on the tub from g to kg, using the method set out in the table. They should also practise writing the same mass in g, kg, as a common fraction of a kg and as a decimal fraction of a kg.

In Activity 1.2, pay special attention to learners who struggle to convert large numbers of g into kg and g, or fractions of a kg. If you notice that learners have difficulty with these conversions, revise some of the number work done earlier in the year.

MENTAL MATHS

Learner's Book page 212

1. $\frac{1}{2}$ kg = 500 g
2. $\frac{1}{4}$ kg = 250 g
3. $\frac{3}{4}$ kg = 750 g
4. $1\frac{1}{2}$ kg = 1 000 + 500
= 1 500 g
5. $1\frac{1}{4}$ kg = 1 000 + 250
= 1 250 g
6. $1\frac{3}{4}$ kg = 1 000 + 750
= 1 750 g
7. $\frac{1}{10}$ of 100 g
= (100 ÷ 10) × 1
= 10 g
8. $\frac{7}{10}$ of 200 g
= (200 ÷ 10) × 7
= 20 × 7
= 140 g
9. $\frac{4}{5}$ of 500 g = (500 ÷ 5) × 4
= 100 × 4
= 400 g
10. $4\frac{1}{2}$ kg = 4 000 + 500
= 4 500 g

Activity 1.1

Learner's Book page 213

1. **a)** No **b)** Yes **c)** No **d)** No
2. **a)** No **b)** No **c)** Yes **d)** Yes
3. **a)** kg **b)** g **c)** g
d) kg or possibly g **e)** g **f)** g
g) g **h)** kg
4. Learners' own answers

Activity 1.2

Learner's Book page 214

1. **a)** 1 kg
b) 7,5 kg or $7\frac{1}{2}$ kg
c) 12 kg
d) 0,5 kg or $\frac{1}{2}$ kg
e) $\frac{45}{1\,000}$ kg = $\frac{9}{200}$ kg or 0, 045 kg
f) $9\frac{425}{1\,000}$ kg or 9,425 kg
g) 230 000 kg
h) 100 000 kg
2. **a)** 1 000 g **b)** 2 300 g
c) 8 500 g **d)** 6 450 g
e) $3\frac{2}{5}$ kg = $3\frac{4}{10}$ kg = $3\frac{400}{1\,000}$ kg = 3 400 g
f) 3 200 g **g)** 4 300 000 g
h) 567 500 000 g
3. **a)** 439 500 kg; 843 925 kg; 5 300 250 kg; 892 100 000 kg
b) 75 000 000 g; 94 000 500 g; 123 430 821 g; 352 943 760 g

Unit 2 Measuring with analogue and digital scales

Learner's Book page 214

For this unit it is important to have at least one example each of an analogue and digital bathroom scale and an analogue and digital kitchen scale in the classroom. Learners use the scales to measure different masses and to practise reading the numbers and measuring units on the scales correctly. Give learners plenty of practice in reading un-numbered calibrations on the analogue scales.

In this unit learners also choose appropriate measuring units for different objects, estimate and compare masses, and describe the mass of one object in terms of the mass of another object – for example, the mass of a particular book is about the same as the mass of a shoe. They base these comparisons on accurate measurements of the individual objects. This is a way for learners to develop their ability to estimate masses reasonably.

Use the Mental Maths session for this unit to assist learners in interpreting and understanding the information about different types of scales. Ask them to explain their understanding.

Activity 2.1

Learner's Book page 215

1. **a)** Bathroom scale
   b) Kitchen scale
   c) Kitchen scale
   d) Bathroom scale if it is less than 3 kg,
   e) Kitchen scale or a bathroom scale, depending on the weight
   f) Bathroom scale
2. Record your mass without the suitcase, then record your mass with the suitcase (you stand on the scale holding the suitcase). The difference between these two masses will give you the mass of the suitcase.
3. **a)** 70 g **b)** 520 g
   c) 175 g **d)** 825 g
4. Answering from kitchen scales
   a) They are different.
   b) The intervals on the scales (c) and (d) are the same. Each interval represents 25 g.
5. **a)** 47,5 kg **b)** 103 kg
6.

	Column A	Column B
a)	12 kg	a child of two years
b)	500 g	a packet of butter
c)	50 g	a chicken egg
d)	2 000 kg	a polar bear
e)	680 kg	a small car

7. **a)** A baby whale; a human baby; a baby meerkat; a baby mouse
   b) A piano; a guitar; a drum; a trumpet
8. Learners' own work

Unit 3 Measuring with a balance scale

Learner's Book page 218

Working with a balance scale enhances understanding of measurement as a way of comparing a known mass (the weights on one side of the scale) with an unknown mass (the object on the other side of the scale). Learners do practical work with a balance scale that they make themselves. They estimate and compare masses, and discuss how accurate their estimations are. They also solve problems in practical contexts using methods they have learned to write number sentences, do calculations and work with ratios. They work with whole numbers, common fractions and decimal numbers, including money problems that involve decimal values to two decimal places.

MENTAL MATHS

Learner's Book page 218

Before you do the Mental Maths activity, remind the learners that they have worked with balancing scales as representations (models) of equations that are equal or that balance (equivalent equations). The number values on both sides of the = sign should be equal. Tell them that they will develop or enhance their knowledge of different balancing scales. They fill in numbers in equations that will make them equal. Encourage them to try to write the equal signs below each other in an equation. Ask them to explain their strategies and solutions to the class.

1.	$100 \div ■ = 20 \div ■$	$100 \div 25 = 20 \div 5$ $4 = 4$
2.	$■ \times 9 = 6 \times 6$	$4 \times 9 = 6 \times 6$ $36 = 36$
3.	$48 \div 6 = 32 \div ■$	$48 \div 6 = 32 \div 4$ $8 = 8$
4.	$250 \times ■ = 500 \times 2$	$250 \times 4 = 500 \times 2$ $1\,000 = 1\,000$
5.	1 kg $+ ■$ kg $= 1\,000$ g $+ 500$ g	1 kg $+ \frac{1}{2}$ kg $= 1\,000$ g $+ 500$ g $1\frac{1}{2}$ kg $= 1\,500$ g
6.	$\frac{1}{4}$ kg $+ \frac{3}{4}$ kg $= ■ + 500$ g	$\frac{1}{4}$ kg $+ \frac{3}{4}$ kg $= 500$ g $+ 500$ g 1 kg $= 1\,000$ g
7.	750 g $- ■$ g $= 250$ g $\times 2$	750 g $- 250$ g $= 250$ g $\times 2$ 500 g $= 500$ g
8.	$■$ g $- 200$ g $= 400 \times ■$	$1\,000$ g $- 200$ g $= 400$ g $\times 2$ 800 g $= 800$ g

Activity 3.1
Learner's Book page 219

Learners' own work

Activity 3.2
Learner's Book page 220

1. Total mass

	= 10 × 5 kg	50 kg
	+ 27 × 1,5 kg	40,5 kg
	+ 20 × 0,45 kg	9 kg
	+ 44 × 6,650 kg	292,6 kg
		392,1 kg

2. Total mass

	= 1,5 kg × R11,90	R17,85
	+ 0,5 kg × R21,70	R10,85
	+ 2,5 kg × R48,80	R122,00
		R150,70

3. **a)** 57c
b) 57c
c) 57c × 3 = R1,71
d) 57c × 2 = R1,14

4.

Mass of photos	15 g × 23 = 345 g
Total mass of letter	345 g + 35 g + 12 g = 392 g
Cost to post the photos and letters	4 × 57c = R2,28

Assessment 3.1 Mass

1. Convert each mass in kilograms to a mass in grams.
   a) 1 kg
   b) 1,25 kg
   c) 10,4 kg
   d) 5,1 kg
   e) 0,5 kg
   f) 27,6 kg
2. Order the masses in question 1 from smallest to largest.
3. Convert each mass in grams to a mass in kilograms.
   a) 7 500 g
   b) 43 200 g
   c) 1 700 g
   d) 10 750 g
   e) 90 500 g
   f) 845 g
4. Order the masses in question 3 from largest to smallest.
5. Order each set of masses from smallest to largest.
   a) 545 700 kg; 1 342 260 kg; 663 721 500 kg; 233 835 kg
   b) 71 563 000 g; 27 640 340 g; 691 241 340 g; 421 621 743 g
6. Which of the following has a mass of less than 1 kg?
   a) an orange
   b) a sandwich
   c) a brick
   d) a litter of three kittens
7. If one pencil has a mass of 10 g and an eraser has a mass of 21 g, what will the total mass of 500 pencils and 500 erasers be?
8. The masses of six children are given below. Group the children so that if three children sit together on each side of the seesaw, it will be balanced.

   18,25 kg
   10,2 kg
   21,5 kg
   17,75 kg
   12,4 kg
   16,7 kg

1. **a)** 1 kg = 1 000 g
   b) 1,25 kg = 1 250 g
   c) 10,4 kg = 10 400 g
   d) 5,1 kg = 5 100 g
   e) 0,5 kg = 500 g
   f) 27,6 kg = 27 600 g
2. 500 g; 1 000 g; 1 250 g; 5 100 g; 10 400 g; 27 600 g
3. **a)** 7 500 g = 7,5 kg
   b) 43 200 g = 43,2 kg
   c) 1 700 g = 1,7 kg
   d) 10 750 g = 10,75 kg
   e) 90 500 g = 90,5
   f) 845 g = 0,845 kg
4. 90 500 g; 43 200 g; 10 750 g; 7 500 g; 1 700 g; 845 g
5. **a)** 233 835 kg; 545 700 kg; 1 342 260 kg; 663 721 500 kg
   b) 27 640 340 g; 71 563 000 g; 421 621 743 g; 691 241 340 g
6. **a)** an orange
   b) a sandwich
7. Mass of 1 pencil → 10 g
   Mass of 500 pencils → $10 \times 500 = 5\,000$ g
   Mass of 1 eraser → 21 g
   Mass of 500 erasers → $21 \times 500 = (21 \times 100) \div 2$
   $= 2\,100 \div 2$
   $= 1\,050$ g
8. 18,25 kg + 17,75 kg + 12,4 kg = 21,5 kg + 16,7 kg + 10,2 kg
   48,4 kg = 48,4 kg

Whole numbers

Learner's Book page 221

Counting, ordering, comparing, representing numbers and place values

Tell the learners that they will estimate, count and represent whole numbers in the next two units. During this term they will work with addition and subtraction of up to 6-digit numbers. They will continue to do Mental Maths before every unit and record solutions on their Mental Maths grids. In the first unit they will work together as a class and in their groups to play games, solve some basic counting and calculation problems and work with different numbers.

Unit 4 Factors and prime numbers

MENTAL MATHS

Learner's Book page 221

Allow the learners to work together as a class or in their groups to perform the activities. They will spend the whole lesson on completing these tasks. Ask the learners to explore the shapes in the three squares. Let them to estimate the number of shapes in each square and explain how they make the estimates. They should make each estimate to the nearest multiple of 10. They could, for example find that there are about 8 triangles in a row and make a rough estimate of the number of rows. If there are about 5 or 6 rows they can estimate the number of triangles as 40 or 50. They can also estimate how many triangles are in a quarter of the square, i.e. about 10, and multiply by 4 to estimate the total number as about 40.

Let them discuss the best ways to find the accurate totals. You can give them copies of the shapes (in the resources section) so that they can circle the squares making groups of 5 or 10. Let them find out how close their estimates are to the accurate solutions.

You should record learners' estimates on the board. They have a tendency to change their estimates. Explain to them that it does not matter whether estimates are too far from the accurate solutions. Estimation is a skill that they will keep on practising.

In question 2(a) they find the best estimates for each addition and subtraction calculation. Allow the learners to use calculators to find the accurate solutions. They assess the estimates to find out if the ones they have chosen are the best. They calculate the differences between the estimates and the accurate solutions to find out how close the estimates are. You can divide the class into four groups to do this.

In question 3 the learners work in their groups to play the addition game. You can make enlarged copies of the template in the resources section and laminate them so learners can play the game often to practise basic addition skills. They choose 3 numbers from the list each time to find the sum of the numbers. If the sum is on the board, they cover it with a counter. They should record the calculations as evidence. The group that covers a row, column or diagonal first is the winner. You can change the rules the next time they play the game. In question (e) the learners find easy ways to count the number of cubes in the different groups. Ask them to estimate the number in each group before they calculate. They can use grouping (the associative property) to calculate. You can ask the learners to build the cube constructions to demonstrate counting strategies, e.g. build up towers of 10 or 5. You could ask them to demonstrate effective strategies to find the total sum of the counters in all the groups.

You should check their counting strategies and allow them to share the strategies with the class to find the most effective ones. Remember not to be judgemental but rather encouraging when learners compare and suggest the best strategies.

In question 4 they play the subtraction game based on the same principles as the addition game they played earlier. They choose two numbers each time and find the differences which they cover with counters. Use the template in the resources section to make the boards.

1. Learners' own work

2. **a)** Ask the learners to use a table as below to record expressions, estimates and differences.

	Expressions	Best estimates	Accurate solutions	Differences
(i)	678 + 884	680 + 980 = 1 660	1 662	2
(ii)	4 673 + 2 756	4 670 + 2 760 = 7 430	7 429	1
(iii)	23 824 – 14 986	23 820 – 14 980 = 8 840	8 838	2
(iv)	437 685 – 256 448	437 690 – 256 450 = 181 240	181 237	3

3. (a–d) Learners play the addition game.

4. **A** 10 + 7 + 6 + 5 + 4 + 3 + 1
= (10 + 5) + (7 + 3) + (6 + 4) + 1
= 36

B 9 + 8 + 6 + 4 + 3 + 2 + 1
= (9 + 1) + (8 + 2) + (6 + 4) + 3
= 33

C 15 + 13 + 12 + 8 + 7 + 4 + 3 + 2
= (15 + 5) + (13 + 7) + (12 + 8) + 4
= 64

5. Learners play the subtraction game.

Activity 4.1

Learner's Book page 223

The learners work as a class or in their groups to explore and learn more about factors and prime numbers, but you could also ask learners to record the work in their own books. Remind the learners that they have worked with factors and prime numbers in the first term. Tell them that they will extend their knowledge of these numbers. Ask them if they remember what factors and prime numbers are. Let them name different numbers they have worked with before, i.e. odd and even numbers, multiples, square and triangular numbers, and so on. Ask the learners to explore the two equations to find relationships between the numbers in the calculations. They should note that the numbers in brackets are the digits in 18 and 27, the sum of the digits is 9, 18 and 27 are multiples of 9, and 2 × 9 = 18 and 3 × 9 = 27. They explore 2-digit numbers that are 4, 5, 6, 7, 8 and 9 times the sum of their digits in questions 2(a) to (f). In (g) they determine the factors of 9. They should realise that 1 × 9 and 3 × 3 are factor pairs of 9 and that 1 is always a factor of any number.

In question 2 they list the factors of the numbers and write multiplication expressions to show the factor pairs of the numbers. Ask them to work systematically – starting with 1 and the number itself and then exploring the natural numbers 2, 3, 4, and so on to find the factor pairs.

In question 3 they have to find out if 105 is a multiple of the numbers indicated using general knowledge of numbers. They explore strategies to find out how to decide whether numbers are multiples of factors of bigger numbers.

In question 4 the learners use the suggested strategies to find out if 15 is a factor of the numbers indicated.

In question 5 they explore and determine the factors of the numbers 1 to 20. Give them copies of the grid in the resources section. They shade the blocks to indicate the factors. Ask the learners to list the numbers that have only two factors and to say what kinds of numbers they are. Ask them if they think 1 is a prime number. In question (e) they explore the rule given for identifying prime numbers, i.e. any whole number, except 1, is either a prime number or the sum of two prime numbers. They explore this rule by applying it to the numbers 2 to 30. They should realise that the numbers they add are prime numbers. They will find that the rule is true. In question 6 the learners test the second rule given for recognising prime numbers, i.e. if you add 1 to any multiple of 6, the answer is always a prime number. Let them list the multiples of 6 up to 6 × 12, i.e. 72, to explore the rule.

1. **a)** 36 = 4 × (3 + 6) **b)** 45 = 5 × (4 + 5)
c) 54 = 6 × (5 + 4) **d)** 72 = 8 × (7 + 2)
e) 81 = 9 × (8 + 1)
f) The products are multiples of 9. Their digits have a sum of 9.
g) Factors of 9 → 9; 3; 1

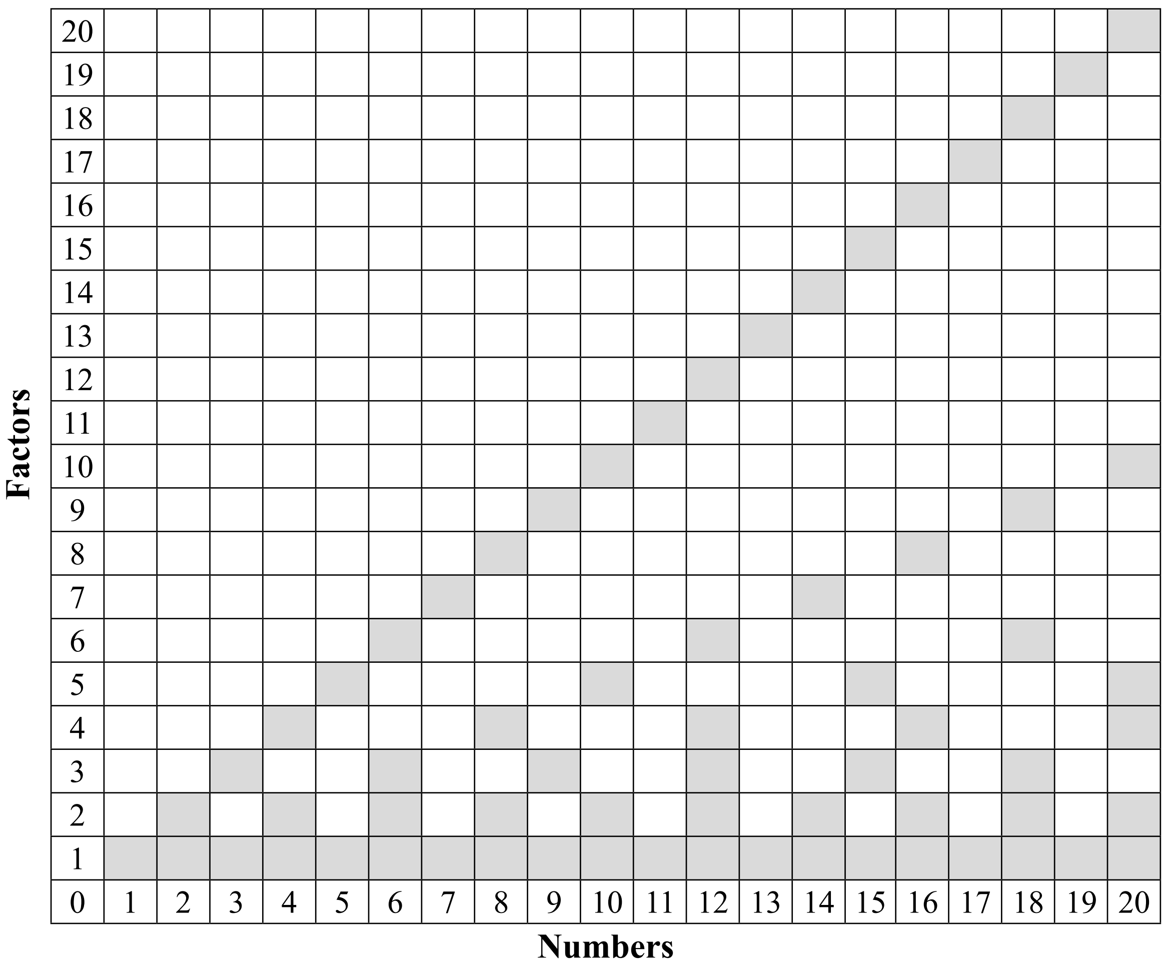
2.

	Number	Factors	Expressions		
a)	8	8; 4; 2; 1	1 × 8	2 × 4	
b)	24	24; 12; 8; 6; 4; 3; 2; 1	1 × 24 3 × 8	2 × 12 4 × 6	
c)	15	15; 5; 3; 1	1 × 15	3 × 5	
d)	27	27; 9; 3; 1	1 × 27	3 × 9	
e)	30	30; 15; 10; 6; 5; 3; 2; 1	1 × 30 3 × 10	2 × 15 5 × 6	
f)	36	36; 18; 12; 9; 6; 4; 3; 2; 1	1 × 36 3 × 12	2 × 18 4 × 9	6 × 6
g)	40	40; 20; 10; 8; 5; 4; 2; 1	1 × 40 4 × 10	2 × 20 5 × 8	

3. a) No. 105 is not an even number or a multiple of 2.
   b) Yes. Any number that ends with 0 and 5 is a multiple of 5.
   c) No. These are even numbers and 105 is not an even number.

4. a) 300 ÷ 15 = 20 → 15 is a factor of 300
   b) 225 ÷ 15 = 15 → 15 is a factor of 225
   c) 215 ÷ 15 = 14 rem 5 → 15 is not a factor of 215
   d) 245 ÷ 15 = 16 rem 5 → 15 is not a factor of 245
   e) 290 ÷ 15 = 19 rem 5 → 15 is not a factor of 290

5. a) Completed table



b) 2; 3; 5; 7; 11; 13; 17; 19
c) Prime numbers
d) No. a prime number has two factors – one and the number itself. The number one only has one factor.

6. You should help learners to understand that the numbers they add to give sums for numbers that are not prime numbers should both be prime numbers to prove the rule.
11 is a prime number
12 = 5 + 7
13 is a prime number
14 = 3 + 11 or 7 + 7
15 = 2 + 13
16 = 3 + 13 or 5 + 11
17 is a prime number
18 = 7 + 11
19 is a prime number
20 = 3 + 17 or 7 + 13
21 = 2 + 19
22 = 3 + 19 or 5 + 17 or 11 + 11
23 is a prime number
24 = 5 + 19 or 7 + 17 or 11 + 13
25 = 2 + 23
26 = 3 + 23 or 7 + 19 or 13 + 13
27: there are no combinations of prime numbers with a sum of 27
28 = 5 + 23 or 11 + 17
29 is a prime number
30 = 7 + 23 or 11 + 19 or 13 + 17
The rule works for most numbers but not for 27.

7.

Multiples of 6	6	12	18	24	30	36	42	48	54	60
+ 1	7	13	19	25	31	37	43	49	55	61

The rule is not always true. 25, 49 and 55 are not prime numbers.

Unit 5 Addition and subtraction

Learner's Book page 225

Addition and subtraction of whole numbers

Tell the learners that they will work with addition and subtraction in the next eight units. They will solve problems with up to 6-digit numbers but also work with problems to develop and enhance basic addition and subtraction skills. You should look at the learners' Mental Maths grids to see whether their mental calculations skill performance is improving.

MENTAL MATHS

Learner's Book page 225

You should keep in mind that Mental Maths is about applying and practising effective mental calculation strategies. The learners therefore have to demonstrate their strategies and you should also suggest strategies that they do not come up with. Tell them that they will solve some basic calculation skills. In question 1 they solve number puzzles, use formal terminology such as sum, difference and product and apply doubling when solving the puzzles. They might apply trial and improvement to solve puzzles 3 to 6. In question 2 they explore numbers to find the numbers in the circles that give the sums on the squares.

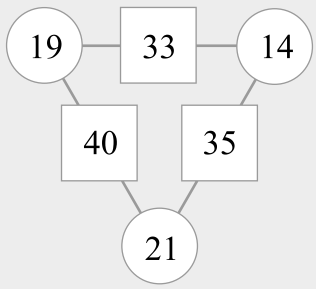
1. **a)** 39 + 39 = 40 + 40 – 2 or 2 × 40 – 2
= 78 years old

b) 37 × 2 = (40 × 2) – 6
= 74 years old

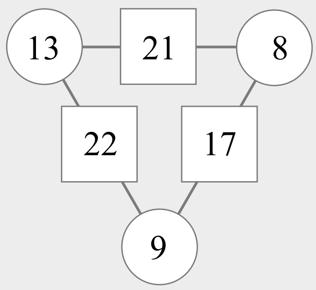
c) 2 × 12 = 24 and 12 + 2 = 14. The numbers are 2 and 12.
d) 15 + 10 = 25 and 15 – 10 = 5. The numbers are 15 and 10.
e) 4 × 9 = 36 and 9 – 5 = 4. The numbers are 9 and 5.
f) 20 + 10 = 30 and 20 – 10 = 10. The numbers are 20 and 10.

2. The learners might find various solutions. Below is an example for each diagram.

a)



b)



Activity 5.1

Learner's Book page 226

Tell the learners they will work with a restaurant menu and the game of darts to practise addition and subtraction. Let them study the prices on the menu. They should note that the price for the chips, egg and sausage has been smudged. Remind the learners that money amounts are also decimal numbers. They should be able to solve the problems using vertical column calculations because they have practised this method in Term 2.

In solving the problems in question 2 the learners need to understand that in a game of darts, the players each start with 301 points. They subtract the totals that they throw with three darts at a time from 301. The player who reaches 0 first is the winner. Ask the learners to study the children's scores on the scoreboard. They calculate the scores and subtract them from 301 to find out how many points each one needs to win. They find out how 151 points can be achieved with one round of throws with three darts. There are two ways this can be done.

1. Share the strategies below with the learners during feedback if they do not apply them.
   a) Cost of an egg: R35,25
   $- \underline{R27,50}$
   R7,75
   b) Cost of sausage:
   R38,65 – R27,50 = (R30 – R20) + (R8,65 – R7,50)
   = R10 + R1,15
   = R11,15
   c) Cost of chips, egg and sausage: R27,50
   R 7,75
   $+ \underline{R11,15}$
   R46,40
   d) Cost of beans: R40,25 – R35,25 = R5,00
2. The learners apply compensation, the commutative and associative properties and use brackets to show doubling and tripling of numbers.
   a) Willem: 50 + (2 × 20) + (3 × 20) = 50 + 40 + 60
   = 150

   Manu: 11 + 15 + 19 = 19 + 11 + 15
   = 45

   Willem needs to throw: 301 – 150 = 300 – 150 + 1
   = 151

   Manu needs to throw: 301 – 45 = 300 – 40 – 5 + 1
   = 260 – 5 + 1
   = 256

   Willem's throws in 1 round:

Double	20	40	or	Triple	18	54
Triple	20	60		Triple	19	57
Triple	17	+ 51		Double	20	+ 40
		151				151

Unit 6 More addition and subtraction

MENTAL MATHS

Learner's Book page 227

The learners solve basic addition and subtraction problems. Ask them to record the solutions to question 1 on their Mental Maths grids. They use the numbers in the circles to find the combinations for the sums and differences indicated.

In question 2 they solve money problems involving brackets in preparation for the problems in context that they will solve in the main lesson. They should know that the calculations in brackets are performed first. They can work with the money amounts as whole numbers and insert the R sign in the solutions.

You can ask the learners to estimate the solutions first, for example in (5 × R0,75) + (3 × R0,25) the answer should be between R5 and R6, because five 75s are almost R5 and 3 × 25c is almost R1.

1. **a)** 25 = 17 + 8
   b) 28 = 11 + 17
   c) 19 = 11 + 8
   d) 27 = 11 + 8
   e) 30 = 19 + 11
   f) 9 = 17 – 8
   g) 11 = 19 – 8
   h) 6 = 17 – 11
   i) 2 = 19 – 17
   j) 8 = 19 – 11

2. **a)** Double R18 + R40,00 = R36 + R40
   = R76

   b) R8,00 – (4 × 80c) = R8,00 – R3,20
   = R5,00 – 20c
   = R4,80

   c) (5 × R0,75) + (3 × R0,25) = (70 × 5) + (5 × 5) + (3 × 25)
   = 350 + 25 + 75
   = R4,50

   d) R70,00 + (9 × R6,55) = 70 + (9 × 600) + (9 × 50) + (9 × 5)
   = R70 + R54,00 + R4,50 + R0,45
   = R128,95

   e) R40,00 – (double × R8,50) = R40,00 – R17,00
   = R23,00

Activity 6.1

Learner's Book page 228

The learners solve addition and subtraction problems in financial context. They need to realise that only the prices of the pineapples and sweet melons are provided. They use this information to calculate the prices of the other items. Ask them to write number sentences to show how they will solve each problem.

1. Share the following strategies with learners during feedback if they do not apply them. The strategies involve doubling, breaking up numbers and the distributive property. Ask the learners to check their solutions on calculators.
   a) Pineapples: 2 × R9,35 = R18,70 (doubling)
   b) 1 bag of oranges:
   R40,60 – R18,70 = (R38,00 – R18,00) + (R2,60 – R0,70)
   = R20,00 + R1,90
   = R21,90

2. **a)** 2 bags of oranges: R21,90 × 2 = (2 × R21) + (2 × 90c)
   = R42 + R1,80
   = R43,80

   b) Watermelon:
   R75,00 – R43,80 = (R70 – R40) + (R5,00 – R3,80)
   = R30 + R1,20
   = R31,20

3. Oranges, pineapples and watermelon:
   R21,90 + (3 × R9,35) + R31,20
   = R53,10 + (3 × R9) + (3 × 35c)
   = R53,10 + R27 + R1,05
   = R81,15

4. Apples:
   R80,50 – (2 × R30,55) = R80,50 – (2 × R30) + (2 × 55c)
   = R80,50 – (R60 + R1,10)
   = R80,50 – R61,10
   = R19,40

5. Sweetmelon, apples and oranges:
   R30,55 + R17,40 + R21,90
   = (R30 + R17 + R21) + (55c + 40c + 90c)
   = R68 + R1,85
   = R69,85

Unit 7 Add and subtract in expanded notation

MENTAL MATHS

Learner's Book page 228

The learners solve problems involving multiples of 10, 100 and 1 000. They do this in preparation for the expanded notation strategy they will apply when solving the problems in the main lesson. Remind the learners that they have to look for and apply the relationships between the numbers.

1. 14 + 8 = 22
   140 + 80 = 220
   1 400 + 800 = 2 200
   14 000 + 8 000 = 22 000
2. 9 + 7 = 16
   90 + 70 = 160
   900 + 700 = 1 600
   9 000 + 7 000 = 16 000
3. 8 + 6 = 14
   800 + 600 = 1 400
   8 000 + 6 000 = 14 000
   80 000 + 60 000 = 140 000
4. 15 + 9 = 24
   150 + 90 = 240
   1 500 + 900 = 2 400
   15 000 + 9 000 = 24 000
5. 13 – 8 = 5
   130 – 80 = 50
   1 300 – 800 = 500
   13 000 – 8 000 = 5 000
6. 17 – 9 = 8
   170 – 90 = 80
   1 700 – 900 = 800
   17 000 – 9 000 = 8 000
7. 16 – 7 = 9
   160 – 70 = 90
   1 600 – 700 = 900
   16 000 – 7 000 = 9 000
8. 12 – 5 = 7
   120 – 50 = 70
   1 200 – 500 = 700
   12 000 – 5 000 = 7 000

Activity 7.1

Learner's Book page 229

1. Help your slow learners to understand carrying and decomposition. You should ask the learners to try to align the digits in numbers correctly according to their place values. They should take care in calculating effectively because they could

become confused during the expansion of large numbers. One addition and one subtraction example is provided below.

a)
$$\begin{array}{rrrrrrr}
 & 56\,723 & 50\,000 & +\,6\,000 & +\,700 & +\,20 & +\,3 \\
 & 24\,856 & 20\,000 & +\,4\,000 & +\,800 & +\,50 & +\,6 \\
+ & 798 & & & 700 & +\,90 & +\,8 \\
\hline
 & & 70\,000 & +\,10\,000 & +\,2\,200 & +\,160 & +\,17 \\
 & & =80\,000 & +\,2\,000 & +\,300 & +\,70 & +\,7 \\
 & & =82\,377 & & & &
\end{array}$$

b) 13 235 + 5 635 + 7 856 = 26 726

c) 47 863 + 769 + 12 548 = 61 180

d) 79 658 + 24 697 + 32 674 = 137 029

e)
$$\begin{array}{rrrrrr}
58\,421 & 50\,000 & +\,8\,000 & +\,400 & +\,20 & +\,1 \\
-\,35\,635 & 30\,000 & +\,5\,000 & +\,600 & +\,30 & +\,5 \\
\hline
 & 50\,000 & +\,7\,000 & +\,1\,300 & +\,110 & +\,11 \\
 & -\,30\,000 & +\,5\,000 & +\,600 & +\,30 & +\,5 \\
\hline
 & 20\,000 & +\,2\,000 & +\,700 & +\,80 & +\,6 \\
 & =22\,786 & & & &
\end{array}$$

f) 29 652 – 21 678 = 7 974

g) 76 543 – 57 896 = 18 647

h) 51 436 – 38 647 = 12 789

Unit 8 Estimate, then calculate

MENTAL MATHS

Learner's Book page 229

The learners have to recognise the place value of 5- and 6-digit numbers. Ask them to fill in the missing values.

1. **a)** 56 178 = 50 000 + 6 000 + 100 + 70 + 8
   b) 11 342 = 10 000 + 1 000 + 300 + 40 + 2
   c) 617 234 = 600 000 + 10 000 + 7 000 + 200 + 30 + 4
   d) 246 107 = 200 000 + 40 000 + 6 000 + 100 + 7
   e) 984 763 = 900 000 + 80 000 + 4 000 + 700 + 60 + 3
   f) 205 632 = 200 000 + 5 000 + 600 + 30 + 2

Activity 8.1

Learner's Book page 230

Ask the learners to estimate the solutions to the addition and subtraction calculations. They have to estimate whether the solutions will be in the 1 000 000s, 100 000s or 10 000s. To do this they have to round the numbers off to the nearest power of 10.

Ask them to use the expanded notation strategy to calculate the accurate solutions. They tell the class how close their estimates are to the accurate solutions.

1. Learners' estimations
2. **a)** 823 289 + 245 678 = 1 068 967
   b) 767 436 + 123 789 = 891 225

c) 67 895 + 56 876 = 124 771
d) 567 453 – 76 564 = 644 017
e) 678 132 – 89 743 = 588 389
f) 956 345 – 27 486 = 928 859

Unit 9 Subtracting 6-digit numbers in expanded notation

MENTAL MATHS

Learner's Book page 230

The learners work with 6-digit numbers. You can ask them to copy the numbers onto paper squares or make sets of numbers. They use each set of digit cards to build the biggest number and then the smallest number possible. In question 3 they write the numbers they have created in question 1 in ascending order on the board. Ask them to read the numbers aloud.

1 and 2.	Biggest numbers	Smallest numbers
a) 362761	766 321	123 667
b) 613906	966 310	103 669
c) 247015	754 012	102 457
d) 906284	986 420	204 689
e) 716549	976 541	145 679
f) 172653	765 321	123 567

3. 754 012; 765 321; 766 321; 966 310; 976 541; 986 420
102 457; 103 669; 123 567; 123 667; 145 679; 204 689

Activity 9.1

Learner's Book page 230

The learners use the numbers they have created in questions 1 and 2 of the Mental Maths section. They calculate the difference between the biggest and the smallest numbers using the expanded notation strategy. Let them explore and discuss the strategy in the example – they should note how the numbers are decomposed. Ask the learners to use calculators to check their solutions.

1. **a)** 766 321 – 123 667 = 642 654
b) 966 310 – 103 669 = 862 641
c) 754 012 – 102 457 = 549 555
d) 986 420 – 204 689 = 781 731
e) 976 541 – 145 679 = 830 862
f) 765 321 – 123 567 = 641 754

Unit 10 Vertical addition and subtraction

MENTAL MATHS

Learner's Book page 231

Remind the learners that they have used vertical column addition and subtraction when they worked with decimal fractions. They will apply this strategy to solve whole number addition and subtraction problems. They discuss the strategies and the learners' reasoning – you should ensure that they understand the carrying and decomposition of digits.

Tell them that these processes are done mentally. They should realise that, although we say, e.g. 'carry 1', it is in fact 10 that is carried or taken away. They solve the 3-digit number addition and subtraction. Allow them to work on the board and to express their thinking aloud. Let them check the solutions on their calculators.

1. $\begin{array}{r} 567 \\ +\ 678 \\ \hline 1\,245 \end{array}$ **2.** $\begin{array}{r} 734 \\ +\ 866 \\ \hline 1\,600 \end{array}$ **3.** $\begin{array}{r} 679 \\ +\ 381 \\ \hline 1\,060 \end{array}$

4. $\begin{array}{r} 895 \\ +\ 215 \\ \hline 1\,110 \end{array}$ **5.** $\begin{array}{r} 807 \\ +\ 293 \\ \hline 1\,100 \end{array}$ **6.** $\begin{array}{r} 7\,648 \\ +\ 362 \\ \hline 8\,010 \end{array}$

7. $\begin{array}{r} 712 \\ -\ 257 \\ \hline 455 \end{array}$ **8.** $\begin{array}{r} 934 \\ -\ 368 \\ \hline 566 \end{array}$ **9.** $\begin{array}{r} 803 \\ -\ 478 \\ \hline 325 \end{array}$

10. $\begin{array}{r} 616 \\ -\ 198 \\ \hline 418 \end{array}$

Activity 10.1

Learner's Book page 231

The learners solve 5- and 6-digit number addition and subtraction problems. You could ask them to estimate the solutions first. They say whether they expect solutions in the millions, hundred thousands, ten thousands or thousands. They check solutions by applying the inverse operations. You can divide the class into five groups to do this and let each group check the solutions to two problems.

1. a) $\begin{array}{r} 2\,345 \\ +\ 5\,678 \\ \hline 8\,023 \end{array}$ **b)** $\begin{array}{r} 6\,793 \\ +\ 967 \\ \hline 7\,760 \end{array}$ **c)** $\begin{array}{r} 14\,579 \\ +\ 47\,829 \\ \hline 62\,408 \end{array}$

d) $\begin{array}{r} 216\,789 \\ +\ 698\,777 \\ \hline 915\,566 \end{array}$ **e)** $\begin{array}{r} 538\,923 \\ +\ 494\,379 \\ \hline 1\,033\,302 \end{array}$ **f)** $\begin{array}{r} 7\,256 \\ -\ 3\,478 \\ \hline 3\,778 \end{array}$

g) $\begin{array}{r} 5\,432 \\ -\ 1\,946 \\ \hline 3\,486 \end{array}$ **h)** $\begin{array}{r} 28\,431 \\ -\ 18\,799 \\ \hline 9\,632 \end{array}$ **i)** $\begin{array}{r} 413\,632 \\ -267\,846 \\ \hline 145\,786 \end{array}$

j) 636 764 − 278 895 = 357 869

2. Learners use inverse operations to check solutions.

Unit 11 More vertical addition and subtraction

MENTAL MATHS

Learner's Book page 231

Tell the learners that they will continue working with 6-digit numbers. Encourage them do the calculations mentally. They should realise that written strategies for solving this type of problem are unnecessary and a waste of time.

Ask the learners to record the solutions on their Mental Maths grids.

1. a) 5 less than 400 004 = 399 999
   b) 7 more than 700 099 = 700 106
   c) 8 more than 199 999 = 200 007
   d) 9 less than 500 000 = 499 991
   e) 50 less than 100 100 = 100 050
   f) 4 more than 300 996 = 301 000
   g) 7 less than 801 000 = 800 993
   h) 9 more than 900 000 = 900 009
   i) 6 less than 400 000 = 399 994
   j) 8 more than 999 997 = 1 000 005

Activity 11.1

Learner's Book page 232

The learners should observe that Peter subtracted the smaller numbers from the bigger numbers in the units each time. He also did not decompose digits when subtracting. In the addition problems he did not perform carrying. Learners often struggle with subtracting digits from zero and adding digits that give 0 as digits. You should assess your learners' competence in performing these calculations.

1. Peter's solutions are all incorrect. He should have done them this way.

a) 500 008 − 278 139 = 221 869

b) 700 000 − 643 289 = 56 711

c) 800 012 − 409 243 = 390 769

d) 601 400 − 194 741 = 406 659

e) 900 101 − 526 787 = 373 314

f) 418 629 + 281 371 = 700 000

g) 842 762 + 57 238 = 900 000

h) 535 716 + 264 284 = 800 000

i) 430 963 + 269 037 = 700 000

j) 672 175 + 127 825 = 800 000

2. With the subtraction, Peter has subtracted the units the wrong way around, So, for example, in question 2(a) he should be saying 8 – 9 and taking 1 from the tens,he is saying 9 – 8, which gives him the incorrect answer of 1.

   With the addition, after correctly adding the units, Peter is forgetting to take 1 over and adding it in the tens columns.

Unit 12 Solving word problems

MENTAL MATHS

Learner's Book page 232

Tell the learners that they will solve addition and subtraction problems in context. Some of the problems involve multiple operations. They use 3-digit numbers so that the calculations are not too challenging. They focus on the context to understand how to solve the problems, using effective calculation strategies and making sure that they understand what to do. The emphasis should be on the processes and not so much on the accurate solutions.

Let them work on the board. They write number sentences to show how they will solve each problem.

1. Amount saved in September and October:
   R165 + R255 = R420
   Sebastian still needs to save: R600 – R420 = R180
2. The amount Julie has to borrow:
   R120 – R93 = R27
3. a) Number of seats open: 800 – 333 = 467 seats
   b) Number of people who went to the cinema on Friday and Saturday: 333 + 247 = 580
4. Total number of books read: 182 +165 + 195 = 542
5. a) Possible answer: 102 + 114 + 132 = 348
   b) Possible answer: 128 + 153 + 120 = 401

Activity 12.1

Learner's Book page 233

You can ask the learners to solve the contextual problems in their groups, in pairs or individually, depending on their abilities. Some of the problems involve multiple operations. They use calculators to check their solutions, but not for the initial calculations.

1. By the end of September Mr Radebe has saved:
   R145 600 + R85 800 = R231 400
   Amount still needed:
   R300 000 – R231 400 = R68 600
2. Amount Mrs de Bruyn needs to borrow:
   R890 000 – R288 650 = R601 350

3. Number of tickets already sold:
45 678 + 26 789 = 72 467
They need to sell 100 000 – 72 467 = 27 533 tickets

4 **a)** It is highly unlikely that the owners will meet their target by the end of the year. If they attracted 15 850 tourist in three months, this means roughly 5 300 tourists per month. It means that they would probably attract 5 300 × 4 people per year at this rate. 5 300 × 4 = 21 200. This is not close to the target.
If we calculate how many tourists they still need to attract by the end of the year to meet their target, we get the following amount:

$$\begin{array}{r} 250\ 000 \\ -\ \ 15\ 850 \\ \hline 234\ 150 \\ \hline \end{array}$$

If we divide 234 150 by 10 (if it is now the end of February there are 10 more months until the end of the year) we get 23 415 tourists per month. The actual number of tourists is 5 300 per month, which we can see is way below the required 23 415 tourists per month needed for them to meet their target.

b) Actual number of tourists: 5 300 per month × 10 = 53 000
Number of tourists for 10 months: 53 000
Shortfall:

$$\begin{array}{r} 234\ 150 \\ -\ \ 53\ 000 \\ \hline 181\ 150 \\ \hline \end{array} \text{ tourists}$$

5. Total number of people attending the concerts:

$$\begin{array}{r} 45\ 988 \\ +\ \ 66\ 759 \\ \hline 112\ 747 \end{array}$$

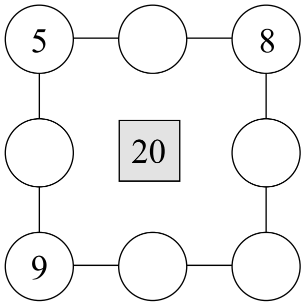
6. Possible answer: 292 326 + 219 284 = 511 610

Assessment 3.2: Addition and subtraction of whole numbers

The learners work on their own to show what they have learnt about division during the last lessons and what they remember from previous lessons. They solve 2-digit and 3-digit by 1-digit division problems with and without remainders, division with 10 and 100 as divisors and dividends that are not multiples of 10 and 100, do inverse operations and solve word problems involving grouping.

Assessment 3.2 Addition and subtraction of whole numbers

1. Write the missing numbers in the circles. Each line of three numbers must have a sum of 20.



2. Use the number cards below.

3	7	5	4	8	2

a) Use all the cards to make the biggest number.
b) Use all the cards to make the smallest number.
c) Find the difference between the two numbers you have created.
d) Find the sum of the two numbers you have created.

3. Write down the best estimates for the calculations below. Choose from the list below each calculation.

a) 67 894 + 87 935 = ■
A. 67 900 + 87 900 = 155 800
B. 68 000 + 88 000 = 156 000
C. 67 890 + 87 940 = 155 830

b) 423 568 – 246 683 = ■
A. 423 57 0 – 246 680 = 185 890
B. 424 000 – 247 000 = 177 000
C. 423 600 – 246 700 = 176 900

c) Calculate the accurate solutions for (a) and (b).
d) Find the difference between the accurate solutions and the estimates you have chosen in (a) and (b).

4. What number is:
a) 15 less than 1 000
b) 20 less than 80 000
c) 10 more than 100 886
d) 8 less than 600 000
e) 9 more than 200 999?

5. Fill in the missing numbers.
a) 6 794 = 6 000 + ■ + ■ + ■
b) 17 213 = ■ + ■ + ■ + ■ + ■
c) 69 007 = ■ + ■ + ■
d) 991 699 = ■ + ■ + ■ + ■ + ■ + ■

6. Solve the following:

a) $\begin{array}{r} 65\ 000 \\ -\ \underline{23\ 678} \end{array}$

b) $\begin{array}{r} 300\ 000 \\ -\ \underline{165\ 732} \end{array}$

c) $\begin{array}{r} 234\ 507 \\ +\ \underline{354\ 693} \end{array}$

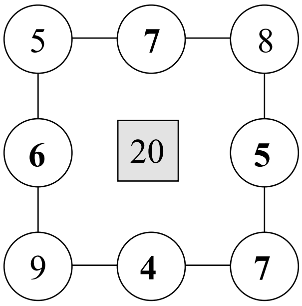
d) $\begin{array}{r} 643\ 142 \\ +\ \underline{257\ 858} \end{array}$

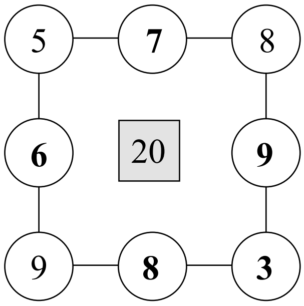
7. Mzwai collected 1 432 stamps. Philip collected 2 768 stamps.
   a) How many more stamps did Philip collect than Mzwai?
   b) How many stamps did they collect altogether?

8. Mrs Adams wants to sell her house. She wants R800 000 for the house. The estate agent says the house is only worth R699 900. How much money will Mrs Adams lose if she sells the house at the agent's offer?

Assessment 3.2 Addition and subtraction of whole numbers **Solutions**

1. Expect more than one solution. Here are some examples.





2. **a)** 875 432
b) 234 578
c) 875 432 – 234 578 = 640 854
d) 875 432 + 234 578 = 111 010

3. **a)** 67 894 + 87 935 = 155 829
A. 67 900 + 87 900 = 155 800
B. 68 000 + 88 000 = 156 000 000
C. 67 890 + 87 940 = 155 830

b) 423 568 – 246 683 = 176 885
A. 423 570 – 246 680 = 185 890
B. 424 000 – 247 000 = 177
C. 423 600 – 246 700 = 176 900

c) (a) 155 830 – 155 829 = 1
d) (b) 176 900 – 176 885 = 15

4. **a)** 15 less than 1 000 = 985
b) 20 less than 80 000 = 79 980
c) 10 more than 100 886 = 100 896
d) 8 less than 600 000 = 599 992
e) 9 more than 200 999 = 201 008

5. **a)** 6 794 = 6 000 + 700 + 90 + 4
b) 17 213 = 10 000 + 7 000 + 200 + 10 + 3
c) 69 007 = 60 000 + 9 000 + 7
d) 991 699 = 900 000 + 90 000 + 1 000 + 600 + 90 + 9

6. **a)** 65 000 – 23 678 = 41 322
b) 300 000 – 165 732 = 134 268
c) 234 507 + 354 693 = 589 200
d) 643 142 + 257 858 = 901 000

7. Mzwai collected 1 432 stamps. Philip collected 2 768 stamps.
a) 2 768 – 1 432 = 1 336
Philip collected 1 336 more stamps than Mzwai.
b) 1 432 + 2 768 = 4 200

8. 800 000 – 699 900 = 101 000
Mrs Adams will lose R101 000.

Viewing objects

In the next two units the learners will identify different views of objects as seen from different viewpoints. They have already been introduced to the concepts of views and viewpoints in Grades 4 and 5. The activities in these units provide further practice. The focus also shifts from views of everyday objects more towards views of geometric objects. The learners will work with views of single objects and groups of objects, both of which include geometric objects.

Unit 13 Viewing single objects

Explain what the words *view* and *viewpoint* mean. Work through the example in the Learner's Book, which shows different views of the same book that remains in the same position.

MENTAL MATHS

Learner's Book page 236

This activity reflects the example in the Learner's Book. It will help the learners to understand the concept when they see the drawings of different views and viewpoints in later activities.

Activity 13.1

Learner's Book page 236

If the learners struggle with this activity, have similar objects available in class for them to view. Use cardboard models of the geometric objects.

1. A → 1 or 4
B → 1 or 4
C → 3
D → 2

2. A → 2
B → 1 or 4
C → 3
D → 1 or 4

3. A → 2
B → 1 or 3
C → 4
D → 1 or 3

Assessment points

- Do the learners know what a *view* is?
- Do the learners know what a *viewpoint* is?
- How well are they able to match viewpoints to views of single objects?

Unit 14 Viewing groups of objects

Looking at views of more than one object is more complex than looking at views of single objects. The learners will have to hold pictures in their minds of the shape of each object and how it would look from different viewpoints. Then they will also have to visualise where the view of each object would be in relation to the views of the other objects. Give the learners enough time to do the mental processing.

MENTAL MATHS

Learner's Book page 237

This activity reflects the example in the Learner's Book. Let the learners do this physical activity before they continue to practise matching views in the next activity.

Activity 14.1

Learner's Book page 237

1.	2.	3.	4.
A: 4	A: 3	A: 1	A: 1 or 5
B: 5	B: 2	B: 4	B: 2 or 4
C: 1	C: 4	C: 2	C: 5 or 1
D: 2	D: 5	D: 3	D: 3
E: 3	E: 1	E: 5	E: 4 or 2

Assessment points

- How easily are the learners able to match views with viewpoints of a group of objects?

Revision

Learner's Book page 239

1. A: 5
B: 1
C: 2
D: 4
E: 3

2. **a)** A: 2 or 5
B: 3
C: 5 or 2
D: 1
E: 4

b) A: 2
B: 5
C: 4
D: 1
E: 3

Remedial activities

- Let the learners practise with single geometric objects only. Let them physically move around each stationary object to match the views. Then ask them to match the views on paper.
- Once the learners are comfortable doing this with single objects, let them move on to two objects. Place cardboard models of two 3-D objects next to one another. Let them move to look at the two objects from four different positions and draw what they see each time. Then let them place the objects in different positions to one another, view them from different positions and draw each view. Next, let them work with two other 3-D objects, and follow the same method. In this way, the learners can practise building up their mental visualisation and spatial skills slowly and progressively.
- Give the learners cubes. Let them build their own cube stacks with two, three and then more cubes. Ask them to draw the views they see on paper.

Extension activity

Let the learners draw the views of a group of objects instead of only matching views to viewpoints. The learners can set their own questions about matching views to viewpoints. They can work in pairs and solve each other's questions.

Properties of 2-D shapes

In the next unit the learners revise and practise the concepts they have learned in Term 1 about 2-D shapes. They also explore circles. They learn how to use a set of compasses to draw circles and make patterns with circles.

Unit 15 Describing and drawing shapes

Learner's Book page 240

Remind the learners about the different features or properties of 2-D shapes that they have learned about. Work through the text in the Learner's Book to help the learners revise the work they covered on 2-D shapes in Term 1.

Investigation

Learner's Book page 241

The investigations are meant to let the learners explore features of shapes. They will try to draw the various shapes on scrap paper. Let them present their conclusions with neat drawings and explanations.

1. The learners will realise that the angles inside a closed shape can never be a straight angle. Some learners may mark a straight angle on one of the sides of a shape. But they should then realise that this straight line counts as one side of the shape, not two, so there is really no straight angle between *two* sides of the shape.

2. For a revolution, the learners should realise that a closed shape can never have an angle that is a revolution. A revolution would have two sides that fit directly on top of one another. Again, these 'two' sides would then count as one side.

Activity 15.1

Learner's Book page 241

1. **a)** A, B, E, F, H
b) D
c) C and G

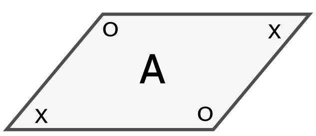
2.

A: 4	B: 8	C: 2	D: 1
E: 6	F: 4	G: 2	H: 4

3. **a)** No
b) Yes: all four sides
c) Yes: opposite sides
d) Yes: opposite sides

4. F and H

5.



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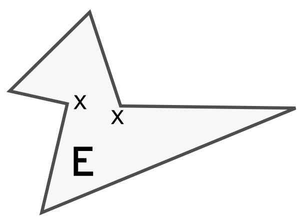


Activity 15.2

Learner's Book page 241

1. Three sides: A, K, M
   Five sides: B, H, R
   Seven sides: F, O,
   Four sides: E, G, J, L
   Six sides: D, Q, N
   Eight sides: C, I, P
2. Three sides: triangles
   Five sides: pentagons
   Seven sides: heptagons
   Four sides: quadrilaterals
   Six sides: hexagons
   Eight sides: octagons
3. These shapes each have at least two sides with the same length:
   E, F, G, H, J, K, P, Q
4. These shapes each have at least one right angle:
   C, D, E, G, I, M, R

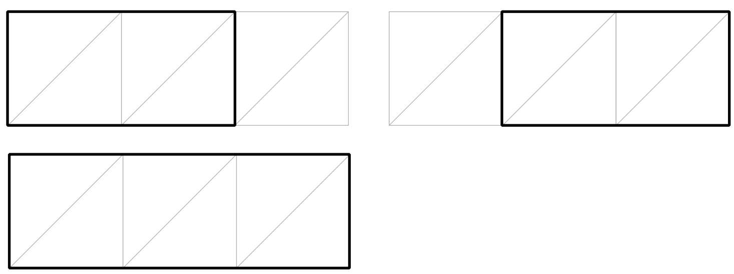
Assessment points

- How well are the learners able to recognise and name different polygons?
- Are they able to sort and describe polygons easily?
- Can they distinguish between and describe different types of angles?

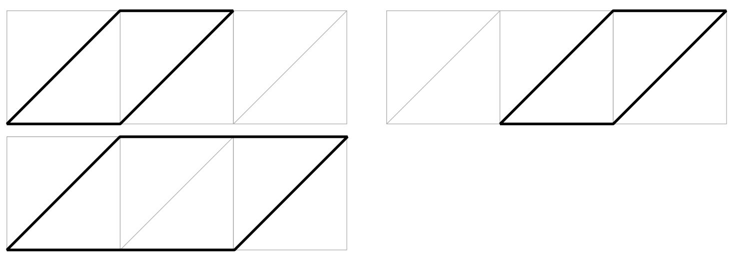
Activity 15.3

Learner's Book page 242

1. **a)** Quadrilaterals
   b) A: square
   B: rectangle
   C: parallelogram
   c) A: All four sides are equal.
   B: Opposite sides are equal.
   C: Opposite sides are equal.
   d) A: All four angles are right angles.
   B: All four angles are right angles.
   C: None of its angles are right angles.
2. **a)** 3 squares
   b) 6 triangles
   c) The three rectangles are shown:

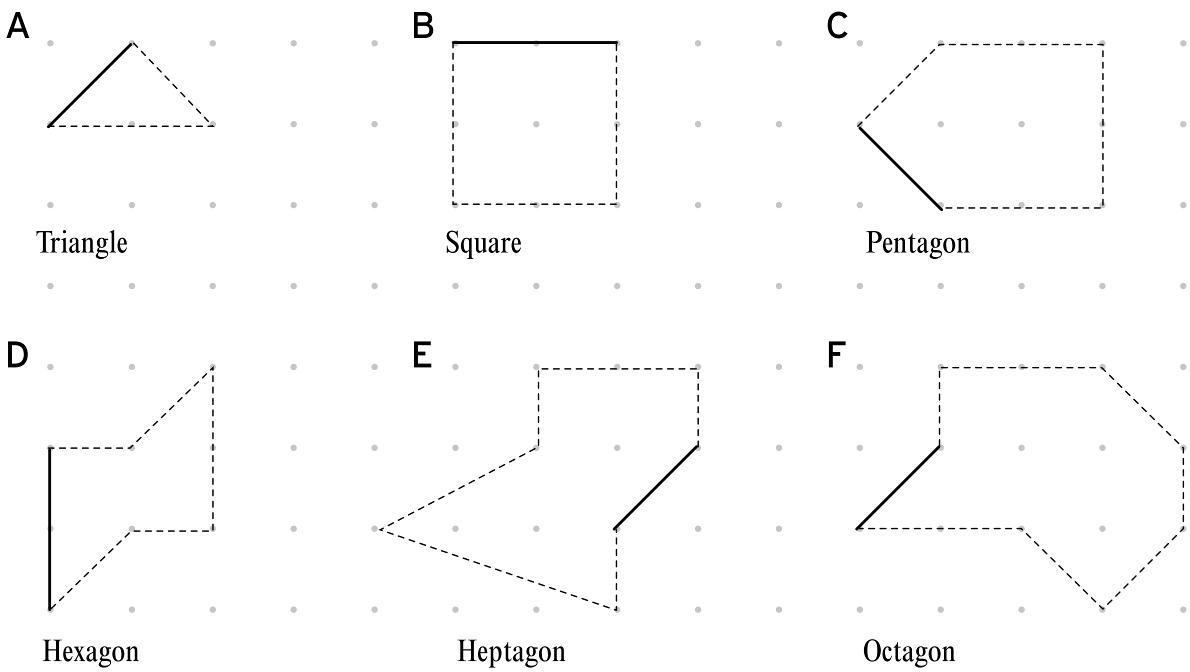


   d) The three parallelograms are shown.



Activity 15.4
Learner's Book page 242

1. There are various options for each shape. One for each is shown below.



2. There are various options for each drawing. Check that the learners are able to draw each shape according to the description given.

Activity 15.5
Learner's Book page 243

Give the learners sufficient time to build the composite shapes.

You could make copies of the triangles and squares in the resources section for them to cut out and build their shapes.

Help the learners to describe their shapes using appropriate terminology.

Assessment points

- Can the learners recognise parallelograms?
- Can they describe the similarities and differences between rectangles and parallelograms?
- Are they able to draw various polygons?
- Can they describe how smaller shapes can be used to create bigger shapes?

Unit 16 Circles

In this unit, the learners begin to explore the properties of circles. However, this is an informal introduction to circles, which means that they explore the properties of circles mainly by drawing patterns made of circles.

Activity 16.1

Learner's Book page 244

Learners' own work. Let the learners do this activity to find the midpoint or centre of a circle.

Activity 16.2

Learner's Book page 244

Do this activity as a class. Take the learners outside to an appropriate area and follow the steps in the Learner's Book. In this activity, the learners start to get an idea of the radius of a circle without formally being introduced to this property yet.

Activity 16.3

Learner's Book page 245

The learners will need a set of compasses to draw circles. Show them how to screw the pencil firmly in place in and how to hold the compasses as they draw the circles. They should always ensure that the pencil point is sharp before drawing the circle.

The only way in which the learners can become competent at drawing circles using a set of compasses is through practice. So provide sufficient time for them to do these activities, and to become skilled at manipulating the compass arms and holding them steady as they draw.

Revision

Learner's Book page 247

1. These are the general descriptions that the learners should be able to give.

A: It has two straight sides and two curved sides.
Its opposite sides are the same length.

B: It has straight sides only.
It has six sides. It is a hexagon.
No sides have the same length.
It has four acute angles and two reflex angles.

C: It has straight sides only.
It has six sides. It is a hexagon.
No sides have the same length.
It has five right angles and one reflex angle.

D: It has straight sides only.
It has four sides. It is a quadrilateral.
The opposite sides are the same length.
It has four right angles. It is a rectangle.

E: It has straight sides only.
It has three sides. It is a triangle.
Two sides have the same length.
It has three acute angles.

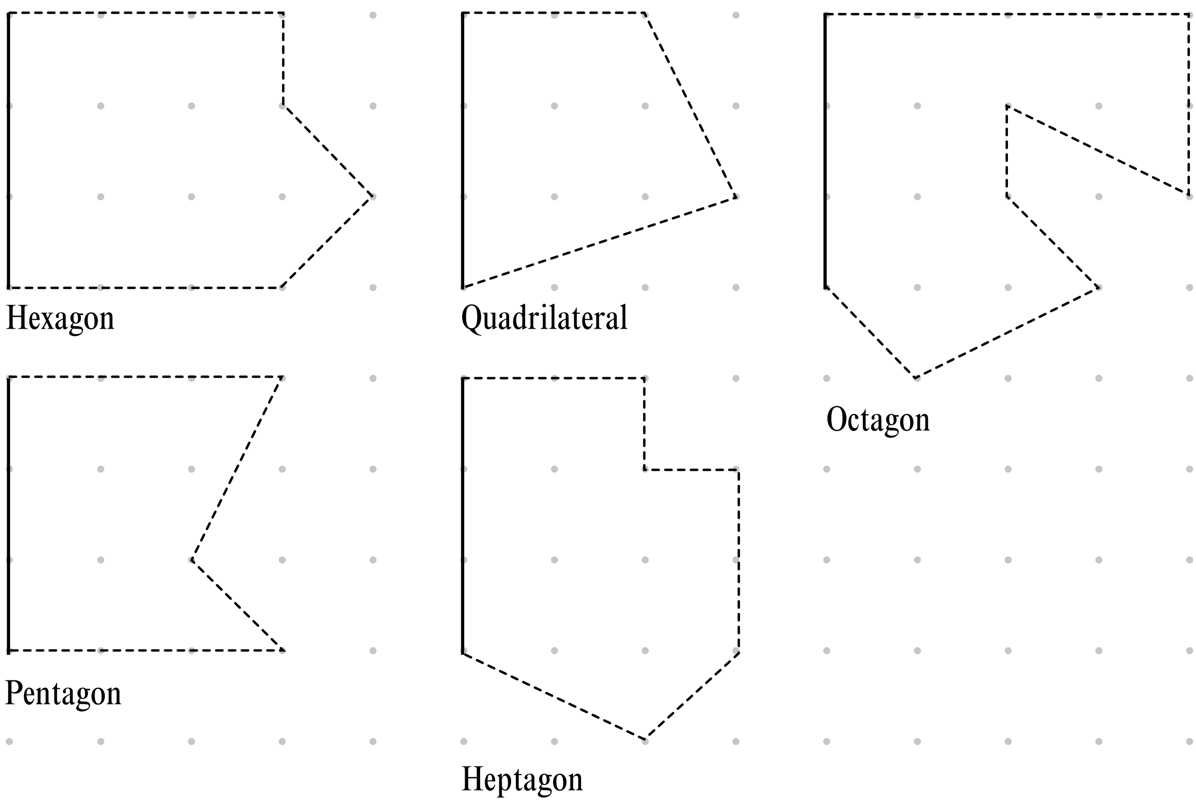
F: It has straight sides only.
It has four sides. It is a quadrilateral.
The opposite sides are the same length.
It has two acute angles and two obtuse angles.
It is a parallelogram.

G: It has straight sides only.
It has eight sides. It is an octagon.
Its four outer sides are equal and its four inner sides are equal.
It has four acute angles, four obtuse angles and two reflex angles.

H: It has straight sides only.
It has five sides. It is a pentagon.
All its sides are equal in length.
It has five obtuse angles.

I: It has one curved side.
The side is the same distance from its midpoint. It is a circle.

2. There are various options. Make sure the learners get the number of sides correct.



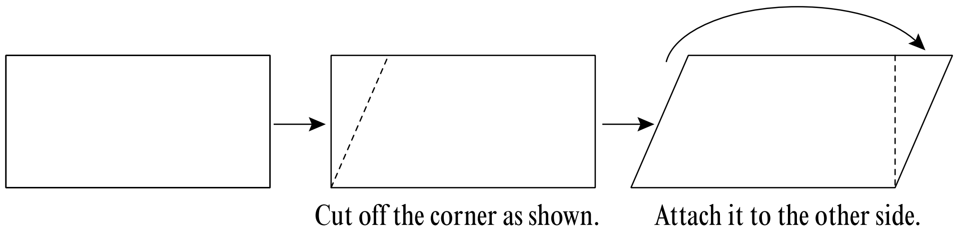
3. Let the learners use a set of compasses to make their patterns. Check that they are able to use them correctly.

Remedial activities

- Make cardboard cut-outs of 2-D shapes. Also make word cards with the names of 2-D shapes written on them. Let the learners work in pairs to match each 2-D shape with its word card. When the learners are more familiar with the names of the 2-D shapes, you can turn this activity into a team game whereby the learners could score points for their team if they get it right.
- Draw simple patterns with circles and let the learners try to copy the pattern as closely as possible. This will provide some focus as the learners practise working with the set of compasses. They will have to work out how closely or how far apart to set the arms of the compass as they copy the given patterns.

Extension activities

- Let the learners practise drawing parallelograms on dotted paper. Give them the lengths of the sides of the parallelograms that they need to draw.
- Let the learners cut out a shape of a rectangle. Ask them how to turn this rectangle into a parallelogram by making just one cut, as shown below.



Transformations

In Grade 6, the learners are expected to be able to describe geometric patterns seen in nature, in cultural heritage objects and in everyday items. In order to describe the patterns, they need to be able to name 2-D and 3-D shapes, and they need to understand and use the language of transformations, such as rotations, translations, tessellations and reflections.

Unit 17 Words to describe patterns

Learner's Book page 248

In this unit, the learners are reminded about the mathematical vocabulary and concepts they need in order to describe patterns in later units. Work through the text and examples in the Learner's Book as you revise the concepts with the learners.

Activity 17.1

Learner's Book page 250

This activity helps the learners to check what they know and what they are unsure of. Clarify any concepts if necessary.

Assessment points
• Do the learners understand the terms needed to describe geometric patterns?

Unit 18 Patterns in nature

Learner's Book page 250

In this unit, the learners describe patterns that are found in nature. Work through the example that is given of how to describe a pattern. Then encourage the learners to use the structure given in the example, and the words they learned in Unit 17, to describe the other patterns on the page.

If the learners find it difficult to describe the patterns or shapes, let them try to copy pattern shapes first. This might help them to clarify which shapes to use and how to move each shape to make the bigger shape or pattern.

In today's Mental Maths session you will assist learners in interpreting and understanding the information about shapes, objects and transformations.

MENTAL MATHS

Learner's Book page 251

Honeycomb

1. • The pattern is made up of hexagons.
   • There are no spaces or overlaps between the hexagons, so this is a tessellation.
2. I can make this pattern by translating a hexagon.

Starfish

1. • The shape of the starfish is a 2-D shape made up of 10 sides.
   • The shape is made up of five quadrilaterals.
   • The shape is symmetrical.
2. I can make the shape by rotating a quadrilateral five times.

Unit 19 Patterns in cultural objects

Learner's Book page 251

In this unit, the learners describe patterns that are found on items from our cultural heritage. Some of the patterns are quite intricate. Let the learners choose to describe only a part of the pattern.

MENTAL MATHS

Learner's Book page 252

1. **Basket**
   - The pattern is made up of a set of triangles inside a circle and a set of bigger triangles outside of the circle.
   - I can make the pattern by rotating a smaller triangle inside the circle and then rotating a bigger triangle outside of the circle.

   Beaded apron
   - This part of the pattern is made up of quadrilaterals. (Some learners may say diamonds and others may say parallelograms.)
   - I can make the pattern by translating a quadrilateral (or diamond or parallelogram).

   Quilted blanket
   The learners can choose to describe any part of this intricate pattern. For example:
   - The pattern is made up of four squares of different sizes, fitted inside one another.
   - There are smaller squares and triangles in the corners of the biggest square.
   - I can make the pattern of the triangles in the corners by reflecting a triangle.
   - I can make the pattern of the squares in the corners by translating a square.

Activity 19.1

Learner's Book page 252

1, 2. Learners' own answers. Check that they describe the patterns appropriately.

Unit 20 Patterns from everyday items

Learner's Book page 252

In this unit, the learners describe patterns found on everyday items.

Activity 20.1

Learner's Book page 253

1. **Mug**

- The top and bottom parts of the pattern are made up of triangles of different sizes.
- I can make the pattern by translating both sets of triangles.

Cushion

- The pattern is made up of a square and hexagons around it.
- I can make the pattern by rotating the hexagon around the square.

Brick-paving

- The pattern is made up of rectangles.
- I can make this pattern by translating and rotating a rectangle in a tessellating pattern.

2. Learners' own answers. Check that they describe the patterns appropriately.

Assessment points

- How well are the learners able to describe geometric patterns?
- Are they able to identify shapes in patterns?
- Can they use appropriate terminology to describe how to transform the shape to create the pattern?
- Are they able to copy patterns they see?

Revision

Learner's Book page 253

Rug pattern: B
Tortoise pattern: A

Remedial activities

- Make sure that the learners are able to recognise and name 2-D shapes correctly.
- Check that the learners understand what translating, reflecting and rotating a shape means. Also check that they know what a tessellation is. Let them do some activities in which they do these transformations with simple shapes.

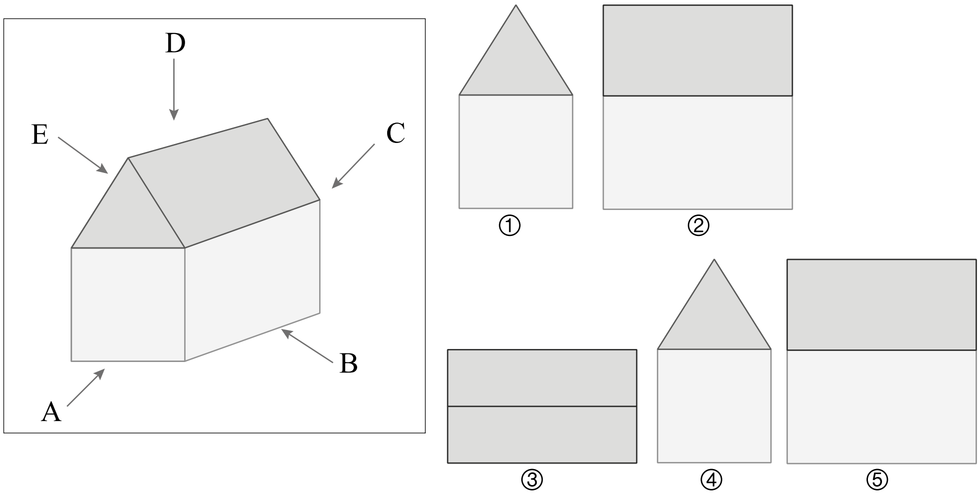
- Draw simple geometric patterns on the board consisting of one shape only. Let the learners use the appropriate terminology to describe these patterns. Make the patterns a little more complex as the learners become more familiar with the concept of describing patterns.

Extension activity

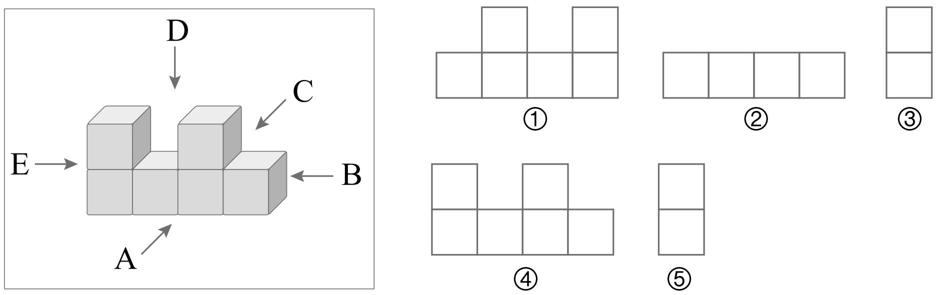
Let the learners work in pairs. Ask the pairs to sit back to back. Let partner A draw a simple pattern that partner B does not see. Partner A then describes the pattern as clearly and accurately as possible for partner B to draw. Partner B must try to recreate the pattern as closely as possible. The partners then switch roles. When the pairs can describe and draw simple patterns, challenge them to move on to more complex patterns.

Assessment 3.3 Viewing objects, 2-D shapes and transformations

1. Match each view with a viewpoint in the following picture.



2. Match each view with a viewpoint in the following pictures.



3. Draw the shapes on dotted paper to match each of these descriptions:

a) A triangle with one right angle
b) A quadrilateral with two sides the same length and one obtuse angle
c) A parallelogram
d) An octagon with at least one reflex angle.

4. The photographs on the next page show geometric patterns on objects. The picture on the right of each photograph shows a simplified mathematical drawing of the pattern. Use the names of shapes and words such as the ones in the boxes to describe the patterns. Write your description in two or three sentences.

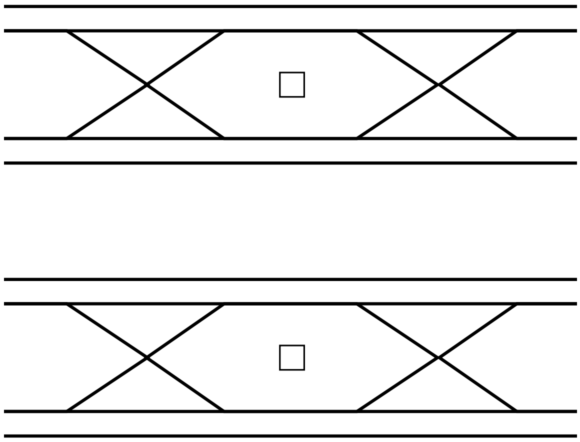
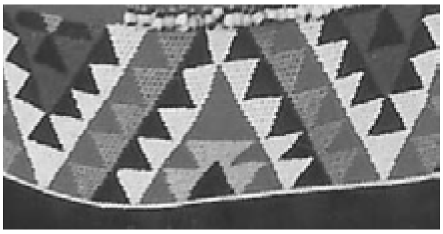
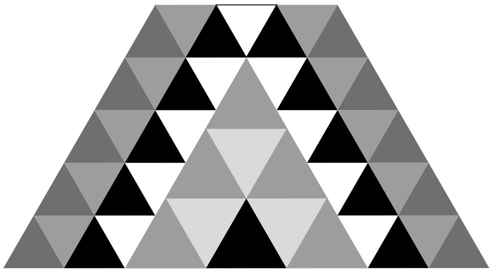
translation

reflection

rotation

tessellation

symmetry

<table>
<tr><td></td><td></td></tr>
<tr><td>a) A mat</td><td></td></tr>
<tr><td>
b) Beadwork</td><td></td></tr>
</table>

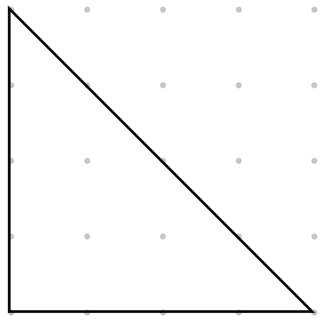
Assessment 3.3 Viewing objects, 2-D shapes and transformations — Solutions

1. A → 1 or 4 B → 2 or 5 C → 1 or 4
D → 3 E → 2 or 5

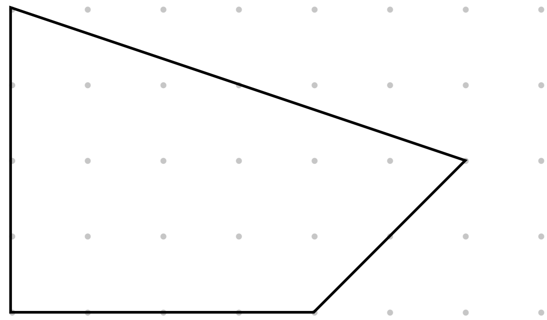
2. A → 4 B → 3 or 5 C → 1
D → 2 E → 3 or 5

3.

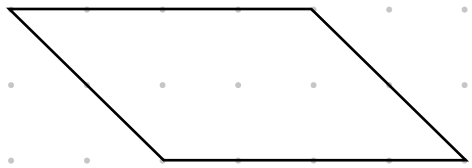
a)



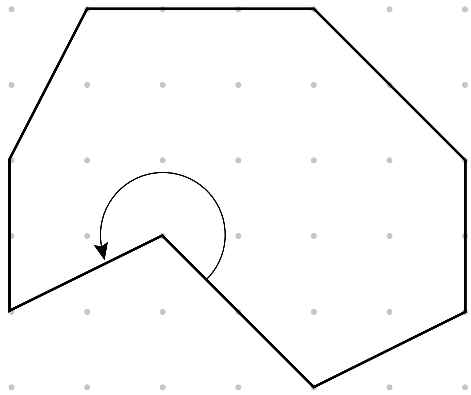
b)



c)



d)



4. The learners can describe any part of the pattern. Here are examples:

a) The pattern is symmetrical and is made up of hexagons.
I can make the pattern by translating hexagons in rows.

b) The pattern is symmetrical and is made up of triangles.
I can make the left outer row of triangles by translating a triangle.
I can make the right outer row of triangles by reflecting the same triangle and then translating it.
I can make the inner set of triangles by rotating a triangle.

Temperature

In the next two units learners continue to develop the methods and skills they learned in Grades 4 and 5: reading thermometers, estimating, measuring and recording temperatures, and solving problems in context with temperatures. They work only with positive numbers, although many learners may be familiar with negative numbers from the weather forecasts they see on TV.
In Grade 6 learners can also work with readings from digital thermometers that show temperatures using decimal fractions (up to two decimal places). Bring a variety of analogue and digital thermometers to class such as those used in clinics to measure body temperature, in kitchens to measure food temperature, and outside to measure weather, water and other temperatures.

Unit 21 Estimating, measuring, recording and comparing temperatures

Learner's Book page 254

Learners practise measuring and recording temperatures in °C. They order temperatures in order to compare which are hotter and which are colder temperatures, and develop their understanding of what number values relate to hot, warm and cold temperatures. They do a Mental Maths activity to practise ordering and rounding off temperature values, including values that use decimal fractions. They draw and read analogue thermometers and temperature scales to practise identifying the values at un-numbered intervals on the scales. They read values shown on digital thermometers, and write decimal fractions of temperatures as common fractions.

Learners also interpret temperatures and relate them to the time of day (for example, it gets hotter during the day, and then starts to cool down towards evening) and to the health or sickness of different types of animals. Relate the facts about temperatures of different liquids and so on to other substances learners may know about. For example, let them estimate the temperature of a freshly baked loaf of bread, the topsoil in the yard at midday, the water in a cup standing outside the fridge, and so on. Let them test their estimates using a thermometer. They can practise rounding their readings up or down to the nearest whole number, and comparing readings of the same item in different positions, for example the soil temperature in the open yard and under a tree, or in a cup of water placed inside a cupboard for a while, or on the window sill in the classroom.

MENTAL MATHS

Learner's Book page 255

1. 36,45 °C; 36,5 °C; 36,7 °C; 36,9 °C; 37,1 °C; 37,15 °C; 37,4 °C
2. 54 °C; 18 °C; 9 °C; 71 °C; 66 °C; 56 °C; 82 °C; 15 °C; 33 °C
3. 36 °C; 37 °C; 37 °C; 37 °C; 37 °C; 38 °C; 37 °C

Activity 21.1

Learner's Book page 256

1. A: 39 °C
   B: 37,0 °C
2. A: 0,1 °C
   B: 1 °C
3. **a)** 41,5 °C **b)** 35,8 °C
   c) 41 °C **d)** 37 °C
4. **a)** Jelly
   b) A hot day in Upington
   c) Steaming bowl of soup
   d) Healthy boy
5. **a)** $4\frac{1}{10}$ °C **b)** $41\frac{6}{10}$ °C **c)** $61\frac{4}{10}$ °C **d)** $37\frac{8}{10}$ °C
6. **a)** 4 **b)** 42 **c)** 61 **d)** 38
7. Learners' own work

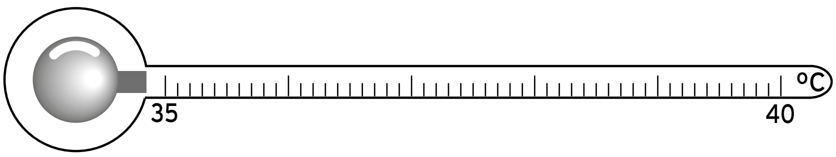
Activity 21.2

Learner's Book page 258

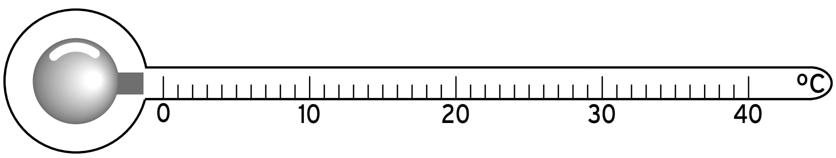
1. **a)** Cats: 1 °C **b)** Snakes: 29 °C
   c) Horses: 1 °C **d)** Turtles: 30 °C
   e) Dogs: 2 °C **f)** Lizards: 35,4 °C
2. **a)** Temperature range < 4 °C:
   Cats
   Horses
   Dogs

   Temperature range > 4 °C:
   Snakes
   Turtles
   Lizards

   b) Learners' own research
3. **a)**



b)



Unit 22 Temperature and weather

Learner's Book page 259

In this unit learners read and interpret temperature information relating to the weather in different places. Adapt the tables given in the Learner's Book to include information relevant to your own town or village (you will find temperature information for places around South Africa on the website of the South African Weather Service, www.weathersa.co.za). Bring weather maps from local newspapers to class for the learners to read. Talk about the concepts of *minimum* and *maximum* temperatures and make sure that learners can identify these on maps and in tables. Introduce the concept of a *temperature range* – the temperature between a certain minimum and a certain maximum, in which learners could feel hot, or cold, or comfortable. They should relate the weather temperature to the way their bodies feel when it is hot or cold outside. They can also use thermometers to compile their own table of temperatures for a week, and compare these with temperatures given in the newspaper or on TV. Talk about why their own temperature readings may be different from those given in the official weather forecast.

MENTAL MATHS

Learner's Book page 260

1. Maximum temperatures for Upington are much higher than those for Port Elizabeth.

2. The minimum temperatures for the two towns are similar.

3. a) (Upington) 35 °C; 38 °C; 40 °C
b) (Port Elizabeth) 23 °C; 25 °C; 26 °C; 27 °C

4. a) 5 °C
b) 4 °C

5. a) 21 °C on the 14th January
b) 7 °C on the 12th, 13th; 15th and 16th January.

Activity 22.1

Learner's Book page 261

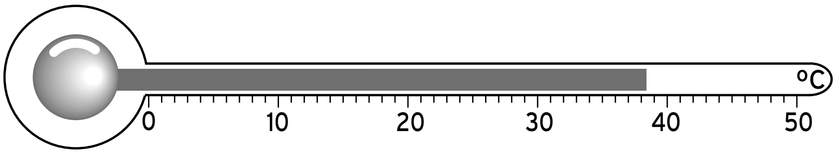
Learners' own work

Assessment 3.4: Temperature

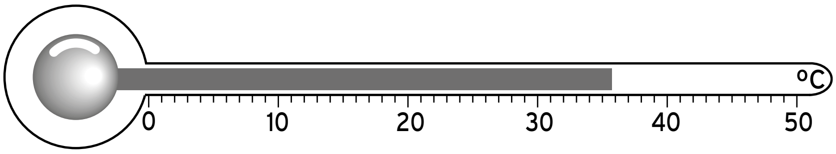
The assessment task for this section will allow you to assess whether learners can read, order and compare temperatures, do simple calculations with temperature values, and interpret temperature data in tables and on weather maps.

1. Write down the temperature on each thermometer.

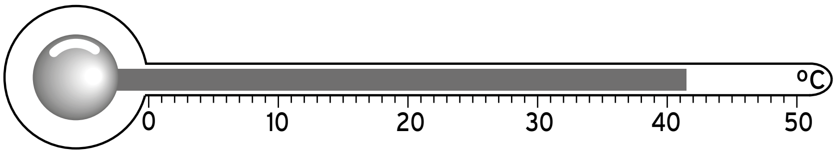
   a)



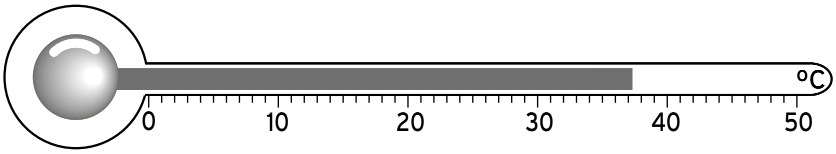
   b)



   c)



   d)



2. Round off each temperature in question 1 to a whole number.

3. A vet took the temperatures of eight dogs that were brought to her on one day. These were their temperatures:

   37,9 °C; 38,2 °C; 42,8 °C; 38,0 °C;
   39,3 °C; 37,3 °C; 37,5 °C; 38,7 °C

   a) Arrange the temperatures from lowest to highest.

   b) The normal temperature range for a healthy dog is 37,2 °C to 39,2 °C. Which temperatures above are not in this range?

4. A nurse took the temperatures of four children in the sickroom at school. The normal temperature for people is 37 °C. These were the children's temperatures.

   Neo → 37,9 °C
   Lerato → 36,8 °C
   Joe → 40,3 °C
   Asmal → 37,5 °C

   a) By how much is each child's temperature above or below 37 °C?

   b) Which children could have a slight cold or fever?

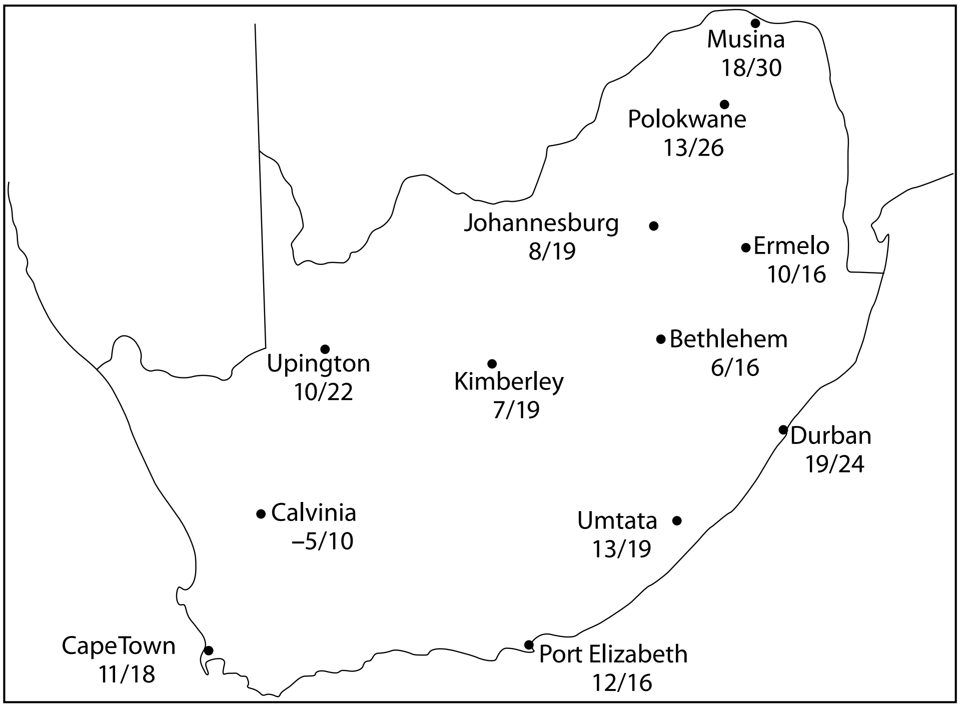
   c) Which child could be very sick?

5. Below are the forecast maximum and minimum temperatures for two cities for the same day.

City	Minimum	Maximum
Amsterdam, Netherlands	3 °C	7 °C
Perth, Australia	22 °C	32 °C

a) In which city is it winter? Give a reason for your answer.
b) If the minimum temperature in Perth is at 02:00 and the maximum temperature is at 14:00, what do you think the temperature could be at 08:00?

6. Look at the minimum and maximum temperatures on this weather map.



a) In which place is it the coldest at night?
b) In which place is it the hottest during the day?
c) In which place is it the warmest at night?
d) In which place is it the coolest during the day?

1. **a)** 38,5 °C
   b) 36,5 °C
   c) 41,5 °C
   d) 37,5 °C

2. **a)** 38,5 °C → 39 °C
   b) 36,5 °C → 37 °C
   c) 41,5 °C → 42 °C
   d) 37,5 °C → 38 °C

3. **a)** 37,3 °C; 37,5 °C; 37,9 °C; 38,0 °C; 38,2 °C; 38,7 °C; 39,3 °C; 42,8 °C
   b) 39,3 °C; 42,8 °C

4. **a)** Neo → 37,9 – 37 = 0,9 °C above 37 °C
   Lerato → 37,0 – 36,8 = 0,2 °C below 37 °C
   Joe → 40,3 – 37 = 3,3 °C above 37 °C
   Asmal → 37,5 – 37 = 0,5 °C above 37 °C
   b) Neo, Lerato and Asmal
   c) Joe

5. **a)** Amsterdam. Both the minimum and maximum temperatures are very low.
   b) Between 25 °C and 26 °C.

6. **a)** Calvinia
   b) Musina
   c) Durban
   d) Calvinia

Percentages

Learner's Book page 262

Remind the learners that they worked with a new topic in Term 2, i.e. decimal fractions. They will now learn about percentages, a topic not covered in the lower grades. Tell them that they have probably heard about percentages in real life. Let them talk about percentages used in newspapers, on TV and in other contexts, for example discounts during sales, the percentage rain forecast in the weather report, and in exam marks. Tell the learners that they will not find work with percentages difficult because it is closely related to common fraction and decimal fraction concepts. They will use the knowledge they have developed about common and decimals fractions to make sense of percentages. They will start working with percentages in familiar contexts.

Unit 23 Percentages

MENTAL MATHS

Learner's Book page 262

Ask the learners to explore the information on the pamphlet. Ask them what they think 50% discount means. They should know that it means you pay half the price. Link this to common fractions, i.e. $\frac{1}{2} = \frac{50}{100} = 50\%$.

Remind the learners that they already know how to calculate fractions of whole numbers. Let them look at the strategy to calculate 50% of the price of the kiddies' tricycle to get the discount price. Let them calculate the discount amounts for the other items using this strategy. Remind them that they have learned that per cent means out of a hundred. When you talk about 50 per cent (50%), it means 50 out of 100.

We often use the symbol % instead of the word per cent or percentage. Explain that the symbol % is like the number 100; the two zeros and the 1. Ask the learners to look at the capacity of and the calibrations on the tank in question 2. They should understand what 100% full and 50% full mean. Explain to them that 100% is the same as a whole, 1, $\frac{100}{100}$ or the decimal 1,0. They learn that 50% is the same as the common fraction $\frac{50}{100}$ and the decimal fraction 0,5. If you divide the tank into 100 equal parts, 50 of the 100 parts are full. They identify and read the capacity of the water in the tanks.

In question 3 they look at the content of the glasses to assert that the glasses are 100% full, 75% full, 50% full and 25% full.

Let them relate the readings to common fractions and decimals, i.e. 75% means $\frac{3}{4}$ or 0,75; 50% = $\frac{1}{2}$ = 0,5 and 25% = $\frac{1}{4}$ = 0,25. Allow the learners to reflect on their learning experience about percentages. Let them tell the class what they have learned about percentage.

1. The learners could use the distributive property or halving to calculate the discount prices.

a)

$\frac{1}{2}$ of 200 = 100

$\frac{1}{2}$ of 18 = 9

$\therefore \frac{1}{2}$ of 218 = R109

b)

$\frac{1}{2}$ of 100 = 50

$\frac{1}{2}$ of 70 = 35

$\frac{1}{2}$ of 2 = 1

$\therefore \frac{1}{2}$ of 172 = R86

2. A: 50% full B: 45% full

3. **a, b)** Ask the learners to record their solutions in a table as below. In this way they are able to see the relationship between fractions and percentages more effectively.

	Fraction	Percentage
A	$\frac{100}{100}$ or $\frac{10}{10}$ or 1	100% full
B	$\frac{1}{2}$ or $\frac{5}{10}$ or $\frac{50}{100}$	50% full
C	$\frac{1}{4}$ or $\frac{25}{100}$	25% full

Activity 23.1

Learner's Book page 264

Ask the learners to look at the chocolate slab and the blocks that have been broken off. Tell them to write the chocolate parts as common and decimal fractions and percentages.

In question 2 they will understand that percentages can be represented on a number line. They copy and complete the number lines (or you can give them copies of the blank number lines in the resources section). They should know the common and decimal fractions. At this stage they might complete the percentages by looking for patterns in the common and decimal fractions.

In question 3 they study the paper strips and estimate which percentage is shaded in each strip.

In question 4 they draw 5 paper strips and shade the percentage parts. Show the learners how to make accurate drawings. Suggest that they divide the strips into 10 equal parts and then shade the percentages. For example, to shade 70% they have to shade 7 parts of 10 parts.

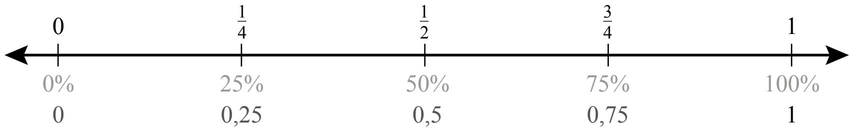
Ask them to write the common and decimal fractions as indicated in question 5. Let the learners share their solutions. Ask them to write a short paragraph in their books to report on what they have learned about percentage today.

1.

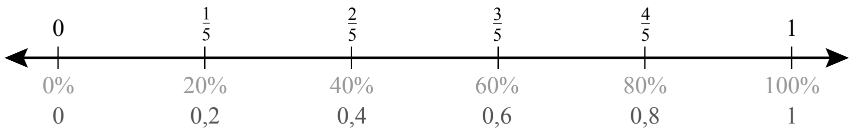
	Common fraction	Decimal fraction	Percentage
a)	$\frac{8}{16}$ or $\frac{1}{2}$	0,5	50%
b)	$\frac{4}{16}$ or $\frac{1}{4}$	0,25	25%

2.

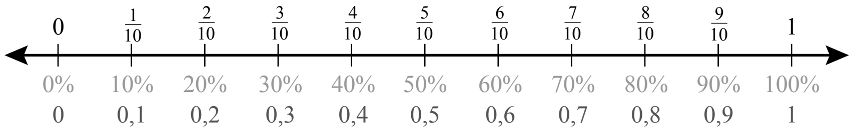
a)



b)



c)



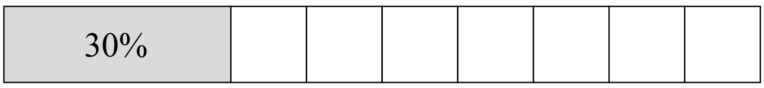
3. **a)** Strip B has 40% shaded.
b) Strip D has 20% shaded.
c) Strip C has 60% shaded.
d) Strip A has 80% shaded.

4. **a)**

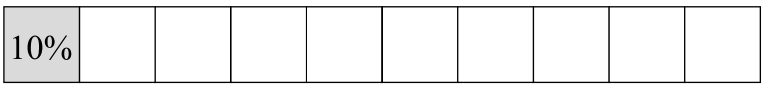
b)

c)

d)



e)



5. Remind the learners to give equivalent fractions.

	Percentage	Common fraction	Decimal fraction
a)	50%	$\frac{50}{100} = \frac{5}{10} = \frac{1}{2}$	0,5
b)	20%	$\frac{20}{100} = \frac{2}{10} = \frac{1}{5}$	0,2
c)	70%	$\frac{70}{100} = \frac{7}{10}$	0,7
d)	30%	$\frac{30}{100} = \frac{3}{10}$	0,3
e)	10%	$\frac{10}{100} = \frac{1}{10}$	0,1

Unit 24 Representing percentages on a pie chart

MENTAL MATHS

Learner's Book page 265

Tell the learners that they will represent and estimate percentages. In question 1 they estimate the capacity of the measuring cylinders to report the percentage of each cylinder that is filled. In question 2 they explore the shaded parts in the diagrams. They discuss the fraction and percentage that are shaded in each figure. They give the common and decimal fractions and the percentages shaded in (a) to (h).

1. **a)** S is 80% full. **b)** P is 50% full.
c) R is 90% full. **d)** Q is 30% full.

2. Remind the learners to write equivalent fractions.

	Common fraction	Decimal fraction	Percentage
a)	$\frac{12}{20} = \frac{6}{10} = \frac{3}{5}$	0,6	60%
b)	$\frac{18}{20} = \frac{9}{10}$	0,9	90%
c)	$\frac{7}{10}$	0,7	70%
d)	$\frac{1}{10}$	0,1	10%
e)	$\frac{25}{100} = \frac{1}{4}$	0,25	25%
f)	$\frac{75}{100} = \frac{3}{4}$	0,75	75%
g)	$\frac{20}{100} = \frac{2}{10} = \frac{1}{5}$	0,20	20%
h)	$\frac{2}{100} = \frac{1}{50}$	0,02	2%

Activity 24.1

Learner's Book page 266

The learners already know that percentages can be represented on a number line like common and decimal fractions. Tell them that percentages can also be represented in circles called pie charts. They have already worked with pie charts in the data handling section of the course. Ask them to look at the giant pizza and the parts that the children are about to eat.

In question 2 they study the pie chart showing the ingredients for making short-crust pastry, the kind of pastry used as a base in some tarts, fruit mince pies etc. They write the percentage for each ingredient and then the common and decimal fractions for each percentage.

In question 3 they explore the ingredients for making puff pastry, the kind of pastry used for making sausage rolls, Cornish pasties and other savoury pies. They determine the percentage for each ingredient and write the common and decimal fractions for each percentage. Ask the learners to share their solutions with the class.

In the (b) sections of questions 2 and 3 they write the percentages in all the solutions as decimal and common fractions.

1. When you go through the answers with the learners, ask them what they notice about the three numbers in the solutions below. They should notice that the percentages have a sum of 100%.
   a) Tumi: 30% **b)** David: 50% **c)** Lisa: 20%
2. **a)** **(i)** Water: 25% **(ii)** Flour: 50%
   (iii) Butter: 25%
3. **a)** **(i)** Flour: 41% **(ii)** Butter: 41%
   (iii) Water: 17% **(iv)** Salt: 1%

2(b) and 3(b)

Percentage	Common fraction	Decimal fraction
30%	$\frac{30}{100} = \frac{3}{10}$	0,3
50%	$\frac{50}{100} = \frac{5}{10} = \frac{1}{2}$	0,5
20%	$\frac{20}{100} = \frac{2}{10} = \frac{1}{5}$	0,2
25%	$\frac{25}{100} = \frac{1}{4}$	0,25
41%	$\frac{41}{100}$	0,41
17%	$\frac{17}{100}$	0,17
1%	$\frac{1}{100}$	0,01

Unit 25 Percentages of money

MENTAL MATHS

Learner's Book page 268

Tell the learners that they will calculate percentages of whole numbers and money amounts. In some cases they do not need to do calculations – they can work out the percentage in their heads. Let them explore the fraction wall to note how the percentages and the fraction parts are related. They use the knowledge that $\frac{1}{2}$ = 50% and halving to calculate percentages of money amounts in questions 2 and 3. They should realise that they have to calculate half of each amount.

In questions 4 and 5 they apply knowledge of $\frac{1}{4}$ = 25% to calculate the percentages of the amounts. They should realise that they have to divide the amounts by 4.

In questions 6 and 7 they use their understanding of $\frac{3}{4}$ = 75% to determine the percentages of the amounts. They have to realise that they should divide by 4 and multiply by 3.

1. $\frac{1}{2}$ = 50%
2. 50% of R10 → 10 ÷ 2 = R5
3. **a)** 50% of R250 → 250 ÷ 2 = R125
   b) 50% of R600 → 600 ÷ 2 = R300
   c) 50% of R420 → 420 ÷ 2 = R210

d) 50% of R12,40 → 1 240 ÷ 2 = R620
e) 50% of R8,60 → 860 ÷ 2 = R430

4. $\frac{1}{4}$ = 25%

5. **a)** 25% of R100 → 100 ÷ 4 = R25
b) 25% of R20 → 20 ÷ 4 = R5
c) 25% of R80 → 80 ÷ 4 = R20
d) 25% of R120 → 120 ÷ 4 = R30
e) 25% of R36 → 36 ÷ 4 = R9

6. $\frac{3}{4}$ = 75%

7. **a)** 75% of R8,00 → 800 ÷ 4 × 3 = 200 × 3
= R600

b) 75% of R12,00 → 1 200 ÷ 4 × 3 = 300 × 3
= R900

c) 75% of R20 → 20 ÷ 4 × 3 = 5 × 3
= R15

d) 75% of R40 → 40 ÷ 4 × 3 = 10 × 3
= R30

e) 75% of R100 → 100 ÷ 4 × 3 = 25 × 3
= R75

Activity 25.1

Learner's Book page 268

Ask the learners to look at the tenths-strip to find out that $\frac{1}{10}$ = 10%. They explore and discuss the strategy for calculating 10% of an amount. They should realise that you just divide by 10.

In question 3 they have to find 5% of amounts. Ask them to explore the strategy – they find 10% and then halve the amount to get 5%.

In question 4 the learners explore a scale representing percentages of R40. They use the scale to find percentages of R40.

1. $\frac{1}{10}$ = 10%

2. **a)** 10% of R50 → 50 ÷ 10 = R5
b) 10% of R500 → 500 ÷ 10 = R50
c) 10% of R95 → 95 ÷ 10 = R9,50
d) 10% of R86 → 95 ÷ 10 = R8,60
e) 10% of R6 000 → 6 000 ÷ 10 = R600
f) 10% of R750 → 750 ÷ 10 = R75
g) 10% of R149 → 149 ÷ 10 = R14,90
h) 10% of R599 → 599 ÷ 10 = R55,90

3. **a)** 5% of R40 → (10% of R40) ÷ 2 = 4 ÷ 2
= R2

b) 5% of R80 → (10% of R80) ÷ 2 = 8 ÷ 2
= R4

c) 5% of R50 → (10% of R50) ÷ 2 = 5 ÷ 2
= R2,50

d) 5% of R800 → (10% of R800) ÷ 2 = 80 ÷ 2
= R40

e) 5% of R1 000 → (10% of R1 000) ÷ 2 = 100 ÷ 2
= R2

4. a) 5% of R40 = R2 b) 25% of R40 = R10
c) 45% of R40 = R18 d) 75% of R40 = R30
e) 95% of R40 = R38

Unit 26 Percentage and decimal fractions

MENTAL MATHS

Learner's Book page 269

Ask the learners to record the solutions to the problems on their Mental Maths grids. They write percentages as decimals and decimals as percentages.

1. 10% = 0,1
2. 70% = 0,7
3. 40% = 0,4
4. 80% = 0,8
5. 100% = 1 or 1,0
6. 0,2 = 20%
7 0,9 = 90%
8. 0,3 = 30%
9. 0,5 = 50%
10. 0,6 = 60%

Activity 26.1

Learner's Book page 269

Tell the learners that they will use their existing knowledge of decimal hundredths to solve the percentage problems. Ask them to study the calibrations and markings on the jug.

In question 1 they use the markings on the jug to write the percentages as decimals and in question 2 they write percentages for the decimals. Ask them to look at the markings under the magnifying glass. They should note that 5% is the same as 0,05 or $\frac{5}{100}$. They use this observation to write the percentages as decimals in question 3, and the decimals as percentages in question 4.

1. a) 80% = 0,80 b) 75% = 0,75
c) 90% = 0,90 d) 45% = 0,45
e) 35% = 0,35

2. a) 0,85 = 85% b) 0,15 = 15%
c) 0,24 = 24% d) 0,18 = 18%
e) 0,99 = 99%

3. a) $3\% = \frac{3}{100} = 0{,}03$ b) $7\% = \frac{7}{100} = 0{,}07$
c) $2\% = \frac{2}{100} = 0{,}02$ d) $9\% = \frac{9}{100} = 0{,}09$
e) $6\% = \frac{6}{100} = 0{,}06$

4. a) $0{,}01 = \frac{1}{100} = 1\%$ b) $0{,}05 = \frac{5}{100} = 5\%$
c) $0{,}08 = \frac{8}{100} = 8\%$ d) $0{,}04 = \frac{4}{100} = 4\%$

Unit 27 Using a calculator to work out percentages

MENTAL MATHS

Learner's Book page 270

Tell the learners that they will write the solutions to the problems on their Mental Maths grids.

They will use knowledge gained in the previous lessons and existing knowledge of common fractions to calculate percentages of money amounts.

1. 50% of R48: 48 ÷ 2 = R24
2. 25% of R24: 24 ÷ 4 = R6
3. 75% of R60: 60 ÷ 4 × 3 = R45
4. 10% of R80: 80 ÷ 10 = R10
5. 10% of R555:555 ÷ 10 = R55,50
6. 5% of R120: 120 ÷ 10 ÷ 2 = R6
7. 50% of R90: 90 ÷ 2 = R45
8. 25% of R400: 400 ÷ 4 = R100
9. 75% of R100: 100 ÷ 4 × 3 = R75
10. 5% of R600: 600 ÷ 10 ÷ 2 = R30

Activity 27.1

Learner's Book page 270

Ask the learners to work in their groups. Give them big sheets of paper and koki pens to record their strategies. Allow them to present and display their work in the class. They need calculators to work out percentages of large amounts and to learn to use the percentage key.

In question 1 they have to find out what amount will be left in Grandma's will for each pet. You should ask the learners if Grandma's decision is wise. What else could she have done with the money?

Explain to them how to use the calculator keys to calculate each pet's share of the money. Ask them how they can check if the solutions are correct. They should realise that they have to find the sum of the three amounts to get the total of R72 500. They do this without a calculator.

In question 1(c) they work out the same percentages for R60 000 to find how much each pet will get. They check the solutions without a calculator.

In question 2 the learners have to calculate 12% service charge of the indicated amounts. Explain what is meant by 'service charge', i.e. in some restaurants you are advised not to give waiters a tip. The service charge is included in the bill.

In question 2(b) they have to work out what the total bill will be if the meal costs R120. To do this they calculate 12% of R120 and add the answer to the cost of the meal.

In question 3 the learners have to calculate 15% discount of each item and subtract the discount from the price to get the discount price. They calculate the total amount that will be paid for all the items.

In question 3(b) the learners calculate the discount price of each item. They then calculate the sum of the items at the discount prices. Ask them to calculate the total amount that they save. They can also calculate the difference between the total amounts before and after the discounts. They do these calculations without using calculators.

1. a) Parrot 27% of R72 000 = R19 440
Goldfish 17% of R72 000 = R12 240
Cat 56% of R72 000 = R40 320

b)
$$\begin{array}{r} \text{R19 440} \\ \text{R12 240} \\ +\ \underline{\text{R40 320}} \\ \text{R72 000} \end{array}$$

c) 27% of R60 000 = R16 200
17% of R60 000 = R10 200
56% of R60 000 = R33 600

d)
$$\begin{array}{r} \text{R16 200} \\ \text{R10 200} \\ +\ \underline{\text{R33 600}} \\ \text{R60 000} \end{array}$$

2. a) **(i)** 12% of R150 = R18 **(ii)** 12% of R180 = R21,60
(iii) 12% of R350 = R42,00 **(iv)** 12% of R105 = R12,60
(v) 12% of R250 = R30

b) 12% of R120 = R14,40
Total bill: R120 + R14,40 = R134,40

3. a) **(i)** Swimsuit 15% of R120 = R18
(ii) Boogie board 15% of R600 = R90
(iii) Folding chair 15% of R80 = R12
(iv) Fishing rod 15% of R350 = R52,50
(v) Sun umbrella 15% of R160 = R24

b) **(i)** Swimsuit R120 – R18 = R102
(ii) Boogie board R600 – R90 = R510
(iii) Folding chair R80 – R12 = R68
(iv) Fishing rod R350 – R52,50 = R297,50
(v) Sun umbrella R160 – R24 = R136

The learners apply the associative property and breaking up of numbers to calculate the total cost of the following.
Items at discount prices:
(R102 + R136) + (R510 + R68) + R297,50
= R238 + R578 + R297,50
= (R200 + R500 + R200) + (R30 + R70 + R90) + (R8 + R8 + R7,50)
= R900 + R190 + R23,50
= R1 000 + R110 + R3,50
= R1 113,50

Amount saved by buying at discount prices:
R18 + R90 + R12 + R52,50 + R24
= R18 + 12 + R90 + R10 + R52,50 + R14
= R30 + R100 + R66,50
= R100 + R96,50
= R196,50

Total cost of items before the discount:
R120 + R600 + R80 + R350 + R160
= R120 + R80 + R160 + R40 + R600 + R310
= R200 + R200 + R910
= R1 310

Amount paid after discount:
R1 310 – R196,50 → R196,50 + R3,50 = R200
R1 310 – R200 = R1 110
R1 110 + R3,50 = R1 113,50

Assessment 3.5: Percentages

The learners will use the knowledge they have gained during the past five units to complete the assessment.

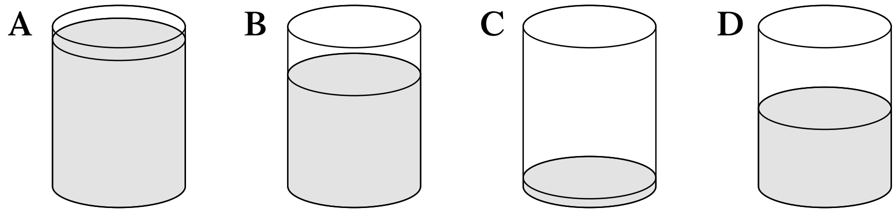
They will identify fractions represented in containers and on a number line, calculate percentages and write percentages in common and decimal fraction forms, and solve a problem in context.

In question 3 they will use knowledge of common fractions to calculate the percentages.

Explain to them that 60% = $\frac{60}{100} = \frac{6}{10}$. They calculate $\frac{6}{10}$ of the amount, i.e. divide by 10 and multiply by 6.

Assessment 3.5 Percentages

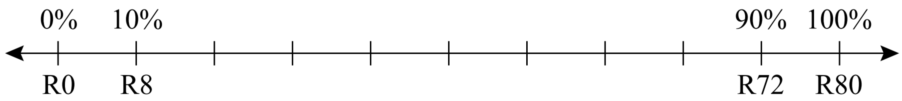
1. Look at these measuring beakers.



Which beaker is:

a) 20% full **b)** 0,5 full **c)** 70% full **d)** $\frac{9}{10}$ full?

2. The number line shows percentages of R80.
Copy and complete the number line.



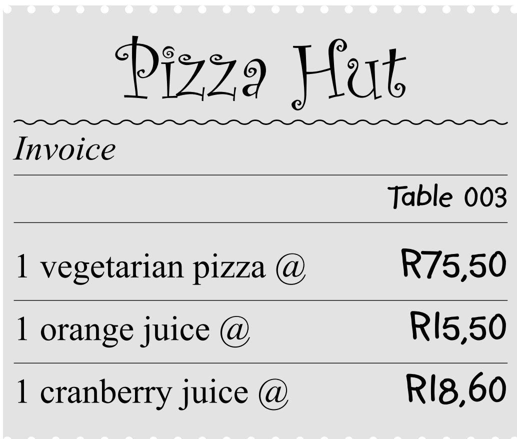
3. Work out the following.

a) 60% of R80
b) 20% of R80
c) 40% of R80
d) 70% of R80
e) 30% of R80

4. Write these percentages as decimals and common fractions.

a) 60% **b)** 30%
c) 25% **d)** 10%
e) 6%

5. Two friends ordered a pizza and drinks at the Pizza Hut. They agree that each one will pay 50% of the bill.


Pizza Hut

Invoice

Table 003

1 vegetarian pizza @	R75,50
1 orange juice @	R15,50
1 cranberry juice @	R18,60

How much should each one pay?

1. **a)** C is 20% full
b) D is 0,5 full
c) B is 70% full
d) A is 90% full

2.

0%	10%	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	90%	100%
R0	R8	**R16**	**R24**	**R32**	**R40**	**R48**	**R56**	**R64**	R72	R80

3. **a)** 60% of R80 = R48
b) 20% of R80 = R16
c) 40% of R80 = R32
d) 70% of R80 = R56
e) 30% of R80 = R24

4. **a)** $60\% = \frac{60}{100} = 0{,}6$
b) $30\% = \frac{30}{100} = 0{,}3$
c) $25\% = \frac{25}{100} = 0{,}25$
d) $10\% = \frac{10}{100} = 0{,}1$
e) $6\% = \frac{6}{100} = 0{,}06$

5. Pizza → R75,50 ÷ 2 = (75 ÷ 2) + (50 ÷ 2)
= R37,50 + 25c
= R37,75

Orange juice → R15,50 ÷ 2 = (15 ÷ 2) + (50 ÷ 2)
= R7,50 + 25c
= R7,75

Cranberry juice → R18,60 ÷ 2 = (18 ÷ 2) + (60 ÷ 2)
= R9 + 30c
= R9,30

Total amount each person has to pay:
R37,75 + R7,75 + R9, 30 = R54, 80

Data handling

Learner's Book page 272

The work in this section serves as revision and consolidation of most of the work done on data handling in Term 1. It also extends the work done there, by introducing the use of percentages on bar graphs and pie charts, numerical data sets that have two modes, and data sets where the median lies between two middle numbers and must be calculated.

As in Term 1, the learners will have to collect data from fellow learners. Your class can ask learners in other classes to complete the questionnaires during break times. Teachers in the other classes should encourage their learners to cooperate with and assist your learners.

Unit 28 Collecting and organising data

Learner's Book page 272

In this unit the learners use questionnaires to collect data. They organise the data by drawing up tally tables and ordering the data from smallest to biggest values. The learners also answer simple questions about the data they collected and organised.

Tally tables, questionnaires and ordering data

Work through the example in the Learner's Book with the learners, as it revises the process of collecting and organising data. Remind them what a questionnaire is and how it is used to draw up a tally table of the data on the questionnaires.

Activity 28.1 Learner's Book page 273

Learners' own work.

For questions 1 to 5, read through all the steps of the activity with the learners to make sure they know what to do. As this is the first activity on data handling since Term 1, you may want to provide a lot of guidance. For example, let them do one step at a time, while you check that each of the steps have been done correctly.

In question 6, remind the learners that a summary of the data should include at least the following:

- what the data are about, for example data about healthy eating habits of schoolchildren, or goods in working condition in households
- what the smallest category and largest category of data are
- anything else that is of interest or that is unexpected.

In question 7, the learners should realise that the hygiene habit that the fewest of their friends have, will probably be the habit of which they should be reminded.

Activity 28.2
Learner's Book page 273

Learners' own work.
Use a questionnaire to find out about the kinds of chores that the learners do at home. They can work in pairs to complete this activity and support and assist one another as they work through the steps of collecting and organising data.

Activity 28.3
Learner's Book page 274

Learners' own work.
Let the learners complete this activity on their own as far as possible. The questions for the questionnaire are not provided, but they will be very simple, for example:

- Do you have a refrigerator at home?
- Do you have a television at home?
- Do you have a radio at home?

Assessment points

- Do the learners know how to use a questionnaire to collect data?
- Can they organise data from a set of questionnaires in the form of a tally table?
- Can they put the categories of data in order from smallest to largest?
- How well are they able to summarise the data they collected?

Unit 29 Showing data using graphs

Learner's Book page 274

In this unit the learners will draw pictographs, bar graphs and double bar graphs. They have already learned how to do this, so the activities here provide reminders and practice in their graph-drawing skills.

Pictographs

The learners will have to draw pictographs in which one picture stands for more than one item. The challenge is to decide how many items one picture in the pictograph should represent. This will take some practice. Encourage the learners to work on scrap paper first if they are unsure. They can try different numbers and see which one works best for them. Then they can draw their neat pictographs in their books.

MENTAL MATHS Learner's Book page 275

Question 1 helps the learners to think through the process they will follow in constructing their pictographs. The learners should realise that they must follow the same process for question 2 that they used when drawing the first pictograph.

1. **a)** The smallest number of girls is 15.
   The largest number of girls is 60.
   b) One picture will represent 10 girls.

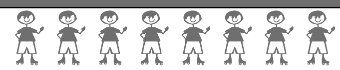
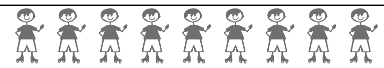
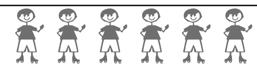
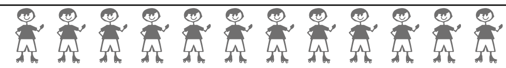
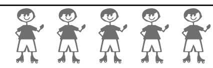
2.

Favourite colour	Number of girls who like this colour best	Number of pictures in the pictograph
Blue	40	4 pictures
Yellow	35	$3\frac{1}{2}$ pictures
Orange	25	$2\frac{1}{2}$ pictures
Pink	60	6 pictures
Green	15	$1\frac{1}{2}$ pictures

Activity 29.1

Learner's Book page 275

1.

Favourite sport	Number of children who like this sport best
Netball	
Table tennis	
Softball	
Soccer	
Volleyball	

Key:  = 10 children.

Assessment points

- Can the learners explain what a pictograph is?
- How easily can they draw pictographs where one picture stands for many items?

Bar graphs

The learners should not need a lot of instruction on how to draw a bar graph. They have been doing this since Grade 4. However, remind them of the method to use if they need help.

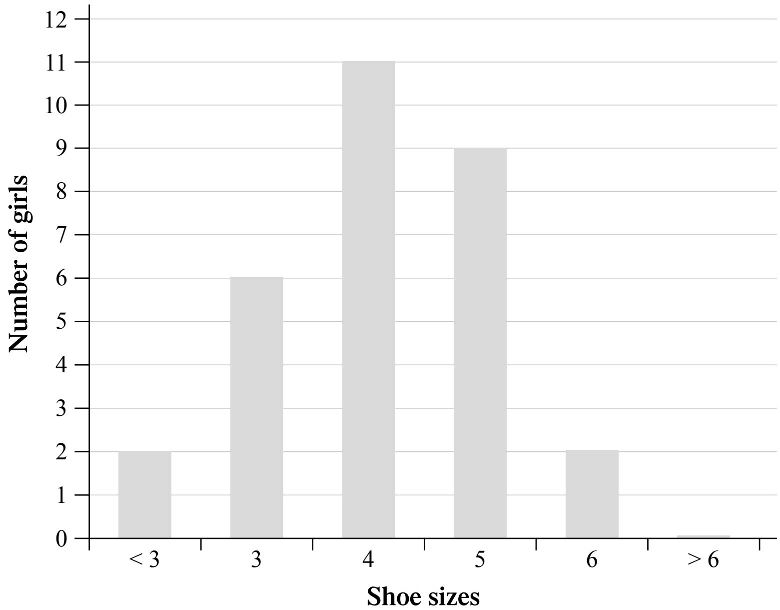
MENTAL MATHS

Learner's Book page 276

1. **a)** > 6 means the group of girls who have a shoe size greater than 6.
   b) 6
   c) 2
   d) 2
   e) 0
   f) 4

> **NOTE**
> For a histogram, the bars are connected with no spaces between the bars.

1. Shoe sizes of Grade 6 girls



Bar graphs and grouping categories

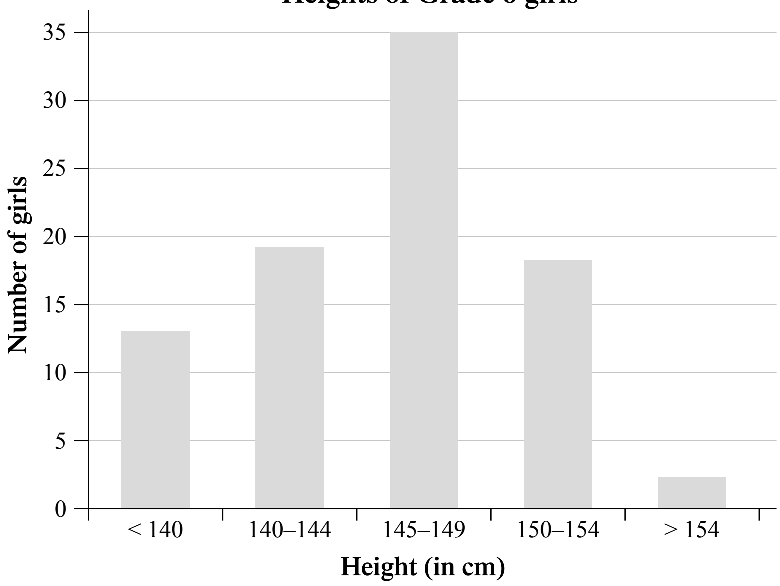
So far, the learners have worked with single data categories. Now they will work with categories that consist of a range. The concepts and principles are still the same, so the learners should not find this too difficult to understand. If necessary, first discuss data that they are used to seeing as a range of values – for example, it takes 5 to 10 minutes to drive to school, but 20 to 25 minutes to walk to school.

Work through the example in the Learner's Book with the learners to make sure that they understand how to draw a bar graph with categories consisting of ranges of numbers.

Activity 29.3

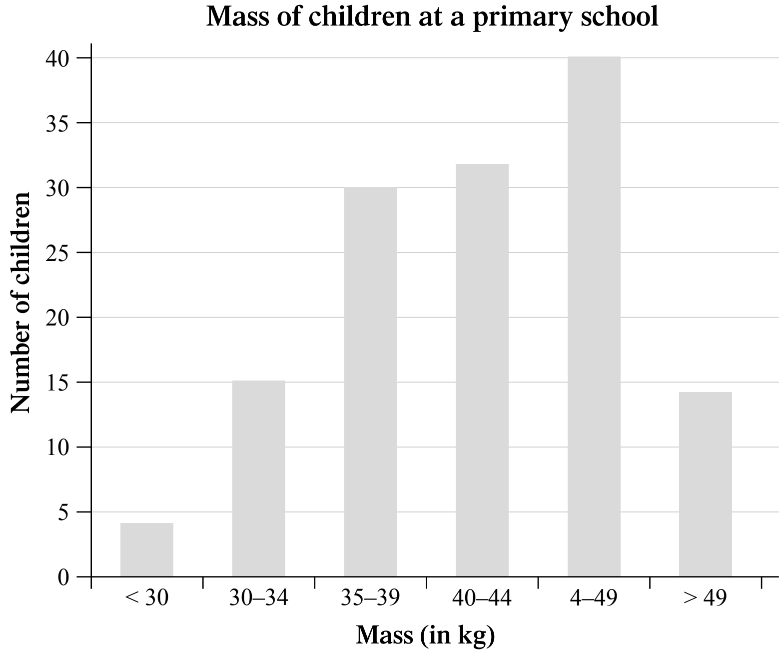
Learner's Book page 277

1. a) 5
   b) Heights of Grade 6 girls



c) 145–149 cm
d) 2 girls

2. a) 6
b) 6
c) Each interval could represent 4 kg.
d)



e) 45–49 kg
f) < 30 kg

Assessment points

- How well are the learners able to draw bar graphs?
- Are they able to work with bar graphs where the category consists of a range of data?

Learner's Book page 278

Double bar graphs

Work through the example of a double bar graph to remind the learners what it is and how it works.

MENTAL MATHS

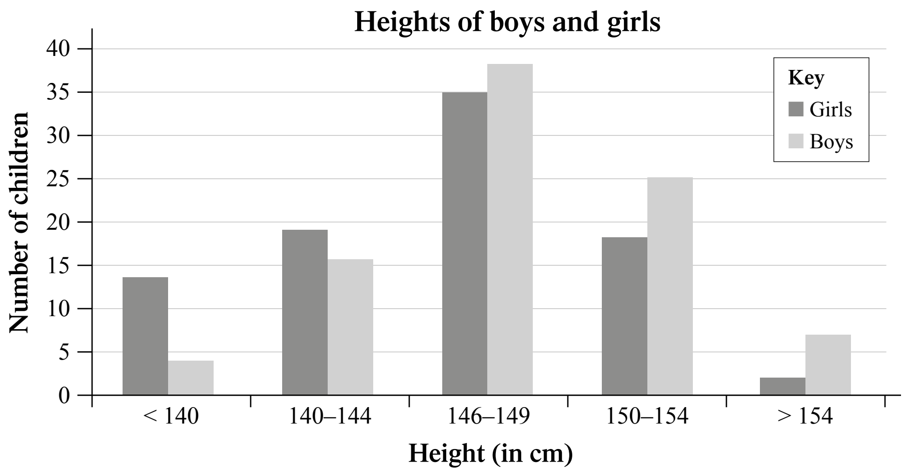
Learner's Book page 279

1. a) 5
b) 13
c) 4
d) 145–149 cm
e) 145–149 cm

Activity 29.4

Learner's Book page 279

1.



2. **a)** More girls **b)** More boys **c)** Yes

MENTAL MATHS

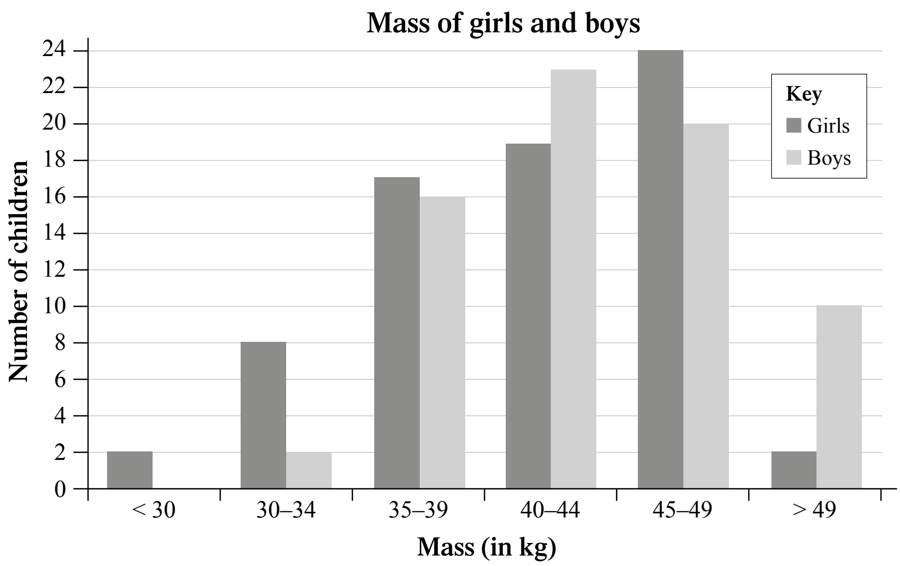
Learner's Book page 279

1. **a)** 6 **b)** 1 **c)** 0
   d) 45–49 kg **e)** 40–44 kg

Activity 29.5

Learner's Book page 280

1.



2. **a)** More girls **b)** More boys
   c) No, no girls weigh 45–49 kg, but most boys weigh 40–44 kg.

Assessment point

- How easily are the learners able to draw double bar graphs?

Activity 29.6: Double bar graph project

Learner's Book page 280

The activities in this section are suitable for a project for Grade 6. The learners use the context of personal data to collect and sort data, draw a double bar graph and summarise the data.

Let the learners work individually on the project. The activity guides them through the steps they need to take to complete all aspects of the project.

You can use the following grid to assess the learners and allocate a mark out of 20.

Criteria	Mark allocation		
	3	2	0–1
Asking a question		Posed a suitable question clearly for which to collect data	Posed a question that was not suitable or clear
Collecting data	Collected appropriate data from all the learners in the class	Collected appropriate data from most of the learners in the class	Did not collect appropriate data from the learners in the class
Recording and organising data		Used a suitable tally table with clear categories to record data	Did not use a suitable tally table with clear categories to record data
		Recorded data clearly and neatly for girls and boys	Did not record data clearly and neatly for boys and girls
Presenting data	Drew a double bar graph with a heading, key and axes labelled clearly	Drew a double bar graph with a heading, key or axes not labelled very clearly	Did not draw a bar graph; shows no understanding of requirements
	Drew the bars of the double bar graph accurately	Made one or two errors in drawing the bars of the bar graph	Made many errors or did not have a clue about how to draw the bars of a bar graph
Analysing data	Able to accurately describe similarities and differences between the data for girls and boys	Able to describe most similarities and differences between the data for girls and boys	Not able to describe most similarities and differences between the data for girls and boys
		Is able to clearly answer the initial question posed	Does not answer the initial question posed

Unit 30 Explaining data

Learner's Book page 281

In this unit, the learners practise reading and explaining data shown in the form of words, pictographs, bar graphs, double bar graphs and pie charts. They also further explore the mode and the median of numerical sets of data.

Data in words and pictographs

Sometimes learners develop a mental block when they see paragraphs of text in Maths, and they struggle to find numerical data in the sentences. Often data are presented in text form rather than as graphs, so the learners should develop the skill to extract the relevant data from paragraphs of texts. Remind them to read one sentence at a time and not to become overwhelmed by a whole block of text. Let learners copy down each sentence separately, then find the data in that sentence, before moving on to the next sentence.

MENTAL MATHS

Learner's Book page 281

1.

School	Number of cans collected
Westonaria	12 070
Kwaggafontein	24 960
Thathani	24 320
Motjoli	17 920
Ikwezi	19 200

2. Kwaggafontein; Thathani; Ikwezi; Motjoli; Westonaria
3. Kwaggafontein came first and Thathani came second.
4. Westonaria
5. June 2011
6. Estimated number of cans that Kwaggafontein collects in one year:
   24 960 × 12 = 299 520 cans
7. Collect-a-can

Activity 30.1

Learner's Book page 282

1. 30
2. 80
3. 150
4. 100
5. 5
6. 2
7. **a)** No
   b) Fewer: The number 100 includes all the categories that have more than 10 people, so there have to be fewer than 100 people in the category of 12 people.
8. There were no learners who lived alone at home.
9. Complete these sentences to summarise the data:
   - The pictograph shows the number of people living in the homes of 1 000 learners.
   - Most learners had 4, 5, 6, or 7 people living in their households.

- The fewest learners had less than 4 or more than 7 people living in their households.

Assessment points

- How well are the learners able to extract data presented in words?
- How easily are the learners able to read a many-to-one pictograph?

Learner's Book page 283

Bar graphs and double bar graphs with percentages

Remind the learners of the difference between bar graphs and double bar graphs. For example:

- Bar graphs help us to compare the different categories of one set of data. Each category has one bar. We use the heights of the bars on the graph to see which category has more or fewer items in it. The higher the bar, the more items there are in that category.
- Double bar graphs help us to compare two sets of data that have the same categories. Each category has two bars – one bar for the first set of data and a second bar for the second set of data. We can see which set of data has more items in a particular category by checking which set's bar is higher for that category.

From this stage on, the learners work with graphs that include percentages. Refer to the activities they have done with percentages in the Numbers section earlier this term, to remind them how to compare percentages.

Activity 30.2

Learner's Book page 283

1. 2004 to 2009

2. **a)** 2006
b) 82%

3. **a)** 2004
b) 67%

4. 2004, 2005, 2007, 2009, 2008, 2006

5. 2004 and 2005: The dam levels were lowest, so perhaps there was less rain than usual.

6. Department of Environmental Affairs

Activity 30.3

Learner's Book page 284

1. An example of a paragraph:

The graph shows the levels of dams in South Africa for the years 2004 to 2009. In these years, the dams were at their lowest in 2004, at a level of 67% of their full capacity. The dams were at their highest in 2006, at a level of 82% of their full capacity.

2. Learners can discuss what *causes* dam levels to rise or fall (how much rain falls in a particular year) and how much water is used by people who get their water supply from this water. They can then talk about whether we can *predict* rainfall and/or human behaviour. Guide the discussion so that learners see that we cannot predict factors such as rainfall amounts, but we can try to limit the danger of low rainfall by saving more water in our daily lives to keep the dam levels as high as possible in the future.

Activity 30.4

Learner's Book page 284

1. **a)** USA and UK
   b) USA: 17% UK: 17% Germany: 7%
   Netherlands: 6% Australia 5%
2. **a)** Germany
   b) Different
   c) Germany: 20% UK: 10% **France: 7%**
   Netherlands: 5% USA: 5%
3. **a)** The percentage for the USA on Graph A: 17%
   The percentage for the USA on Graph B: 5%
   The difference is 12%.
   b) The percentage for the UK on Graph A: 17%
   The percentage for the UK on Graph B: 10%
   The difference is 7%.
   c) The percentage for Germany on Graph A: 7%
   The percentage for Germany on Graph B: 20%
   The difference is 10%.
   d) Australia
   e) France
4. **a)** The data were collected by different people at different places.
   b) No, we cannot say that her data are incorrect. However, she should not say that her data represent all the tourists to South Africa. Her data only show the percentages of tourists visiting her shop.
   c) Graph A, because it shows the percentages of tourists from different countries (and therefore language groups) for the whole of South Africa
   d) Graph B, because the data are more accurate for the tourists visiting Mbombela. (Not all tourists who come to South Africa will visit this city.)
   e) Yes, we should change the title for Graph B to more accurately describe what it shows, possibly to:
   Tourists from the top five foreign countries visiting Mrs Dlamini's shop in July 2011.

Activity 30.5

Learner's Book page 285

1. **a)** Red **b)** Yellow
2. **a)** Millimetres **b)** 10 mm
3. **a)** 126 mm **b)** 4 mm
4. **a)** 13 mm **b)** 82 mm

5. **a)** November, December and January
   b) Summer
6. **a)** June, July and August
   b) Winter
7. **a)** False **b)** True **c)** False **d)** True
8. Hermanus: probably in June, July and August
   Pretoria: probably in November, December and January

Activity 30.6

Learner's Book page 286

1. An example of a paragraph:
   The graph shows the monthly rainfall for Johannesburg and Cape Town. Johannesburg gets most of its rain during November, December and January. During these months, Cape Town gets its least rain. Johannesburg gets its least rain during June, July and August. During these months, Cape Town gets most of its rain.

Activity 30.7

Learner's Book page 286

1. **a)** 1990 and 2010 **b)** 20
2. Botswana, Malawi, Namibia, South Africa, Zambia
3. **a)** 30% **b)** 10% **c)** 50%
   d) South Africa **e)** Malawi
4. **a)** 61% **b)** 38% **c)** 62%
   d) South Africa **e)** Malawi
5. **a)** Botswana: Its urban population increased by 31%.
   b) Botswana and Malawi
6. Disagree. The urban population of Zambia decreased.
7. **a)** It could be 92% if it increases by 31% again over the 20 years. If learners offer different answers – e.g. that the population won't increase as much in future – accept the answers if they give sensible reasons for them.
   b) It could be 74% if it increases by 12% again over the 20 years. Accept other answers given by learners, if they can justify their answers in reasonable ways.
   c) Botswana: There is a difference of 31% between 1990 and 2010, while the difference in South Africa's urban population is 12%.
8. An example of a paragraph:
   The graph shows the population of some African countries living in urban areas. The urban population is measured as a percentage of each country's total population. In 1990 and 2010, South Africa had the highest percentage of urban population. In 1990 and 2010, Malawi had the lowest percentage of urban population. Botswana's urban population increased the most in the 20 years. Zambia's urban population was the only one that decreased over the 20 years.

Assessment points

- Can the learners read bar graphs and double bar graphs that use percentages?
- How well can the learners compare different bar graphs?
- Do they understand that data collected to answer the same question may be different if the data are collected by different people or in different places?
- How well are the learners able to read and compare data shown on double bar graphs?

Learner's Book page 288

Pie charts and percentages

Remind the learners what a pie chart is and how it works. Relate the pie and its 'slices' to work done in Grades 4 to 6 with pie diagrams showing fraction parts. Tell learners that they will now use percentages, as a type of fraction, to describe the sizes of the parts of each pie chart.

You can use the following example to explain or revise the concept before learners do the activities in this section. If the whole pie stands for the whole population of South Africa, the parts of the pie could show:

- the percentage of the population living in urban areas (towns and cities) and the percentage of the population living in rural areas (villages and farms) – the pie divided into two parts
- the percentage of females and the percentage of males in the population – the pie divided into two parts
- the percentages of women, men, girls and boys in the population – the pie divided into four parts
- the percentages of the whole population living in each of South Africa's nine provinces – the pie divided into nine parts.

Activity 30.8

Learner's Book page 288

1. 9
2. Gauteng and KwaZulu-Natal
3. Northern Cape
4. **a)** 22%
b) 21%
c) 11%
d) 2%
5. Northern Cape, Free State, North West, Mpumalanga (or Mpumalanga, North West), Western Cape, Limpopo (or Limpopo, Western Cape), Eastern Cape, KwaZulu-Natal, Gauteng
6. **a)** Eastern Cape
b) KwaZulu-Natal
c) Western Cape

Activity 30.9

Learner's Book page 289

1. An example of a summary:
   - The pie chart shows the percentage of South Africa's population that lives in each of the nine provinces.
   - Gauteng and KwaZulu-Natal had the largest populations. 22% of the population lived in Gauteng and 21% of the population lived in KwaZulu-Natal.
   - Northern Cape had the smallest population. Only 2% of the population lived there.
2. Learners should discuss what causes a population increase or decrease in a province, and then predict whether these causes would affect any provinces in the pie chart. Possible causes: people move from one province to live in another province; more babies are born in a province than in the past; more people die in a province than in the past. You could relate this discussion to any changes that learners may notice in their immediate environment (suburb, neighbourhood, school, and so on) – are there more people moving to the area, or fewer people living there? Are the numbers of children in the school increasing or decreasing?

Activity 30.10

Learner's Book page 289

1. **a)** Europe **b)** 51%
2. Europe, North America, Asia, Australasia, Central and South America, Middle East
3. **a)** North America **b)** North America
   c) Central and South America
4. July 2011
5. **a)** Africa
   b) No. This pie chart only shows tourists from other continents, as mentioned in the title of the pie chart.
6. **a)** No, we cannot.
   b) No, we cannot. There could be many Canadian tourists too.
7. An example of a description of the pie chart that learners could give orally and in written form:
   The pie chart shows the percentages of tourists coming to South Africa from other countries. Most of the tourists (51%) came from Europe and North America (20%). The fewest tourists (2%) came from the Middle East.
8. **a)** Possible reasons could be: to train tour guides to speak the languages that these people speak; to advertise more in countries where only a few tourists come to South Africa.
   b) Possible answers could include: South Africans could open restaurants to serve the foods that people from these countries like to eat; South Africans could learn to speak the languages that these tourists speak.

Assessment points
• Do the learners know what a pie chart is? • Can the learners read a pie chart easily? • How well are they able to read percentages on a pie chart?

Learner's Book page 290

The mode and median of a set of data

This section revises and extends learners' ability to find modes and medians. Begin by reminding them of the work they did on these concepts in Term 1, and check if they remember what a mode and a median are.

Finding the mode of a set of data

Remind the learners what a numerical set of data is. Work through the examples of finding the single mode of a set of data and then two modes for a set of data. The concept is not too difficult for most learners to understand.

MENTAL MATHS

Learner's Book page 291

1. 34; 34; 35; 36; 37; 37; 37; 38; 39; 39
mode = 37

2. 2; 3; 3; 3; 4; 4; 4; 4; 4; 5; 5; 5; 5
mode = 4

3. 2; 3; 3; 4; 4; 4; 4; 5;5; 5; 5; 5; 5; 6; 6; 6; 7; 7; 7; 8; 8; 9; 10; 11; 12
mode = 5

4. 142; 142; 143; 143; 145; 146; 147; 147; 147; 149; 149; 149; 150; 153
mode = 147 and 149

5. 36; 36; 37; 37; 37; 38; 38; 38; 39; 40; 42; 44; 45; 46; 46; 46; 46; 47; 47; 48; 49; 49; 50; 51
mode = 46

6. 8; 9; 9; 9; 10; 10; 10; 11; 11; 12; 12; 12; 12; 13; 13; 14; 14; 14; 15; 15; 15; 15; 16; 16; 17; 17; 18; 18; 18; 19
mode = 12 and 15

The median of a set of data

Work through the examples of finding the median. Make sure the learners understand that if the set of figures is even, they will have to find the number between the two middle numbers. If necessary, give learners some practice with simple calculations to find the middle number between two numbers (add the two numbers and divide the answer by 2), before they apply this method to finding medians.

Activity 30.11

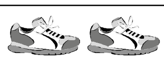
Learner's Book page 292

1. 34; 34; 35; 36; 37; 37; 37; 38; 39; 39
   median = 37
2. 2; 3; 3; 3; 4; 4; 4; 4; 4; 5; 5; 5; 5
   median = 4
3. 2; 3; 3; 4; 4; 4; 4; 5;5; 5; 5; 5; 5; 6; 6; 6; 7; 7; 7; 8; 8; 9; 10; 11; 12
   median = 5
4. 142; 142; 143; 143; 145; 146; 147; 147; 147; 149; 149; 149; 150; 153
   median = 147
5. 36; 36; 37; 37; 37; 38; 38; 38; 39; 40; 42; 44; 45; 46; 46; 46; 46; 47; 47; 48; 49; 49; 50; 51:
   median = $\frac{44 + 45}{2} = \frac{89}{2} = 44{,}5$
6. 8; 9; 9; 9; 10; 10; 10; 11; 11; 12; 12; 12; 12; 13; 13; 14; 14; 14; 15; 15; 15; 15; 16; 16; 17; 17; 18; 18; 18; 19:
   median = $\frac{13 + 14}{2} = \frac{27}{2} = 13{,}5$

Revision

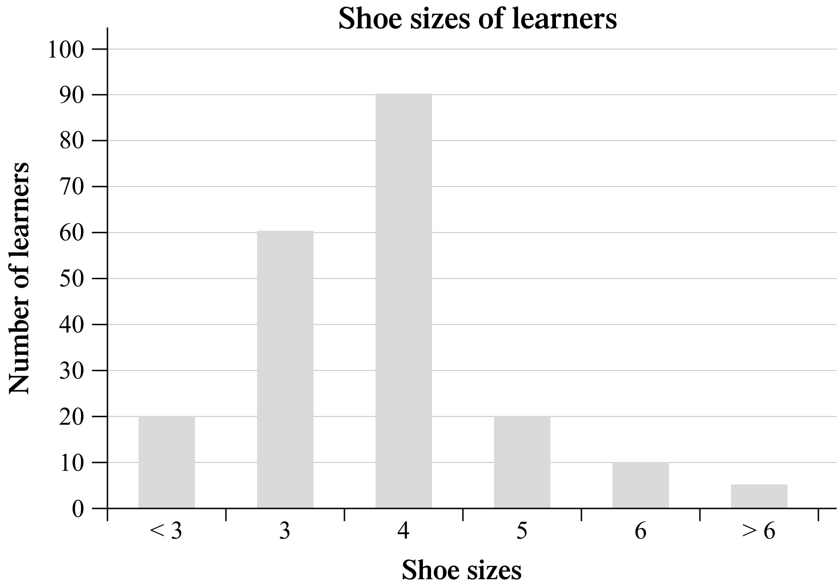
Learner's Book page 292

1. Learners' own work
2. **a)** > 6 means the learners who wear a shoe size greater than 6.
   b) 60
   c) 20
   d) 10
   e) 5
   f) 4
   g) Pictograph

Shoe size	Number of learners who wear this shoe size
< 3	
3	
4	
5	
6	
> 6	

Key:  = 10 learners

h)



3. **a)** Double bar graph
b) The favourite subjects of the boys
c) The favourite subjects of the girls
d) The percentage of all the boys or all the girls
e) Maths
f) Maths
g) 17%
h) 15%
i) Girls
j) Boys
k) Neither; the same percentage of girls and boys like it.

4. **a)** 10–19 minutes
b) Yes
c) 15%
d) 23%
e) 2%
f) 6% + 5% = 11%
g)
- True
- False

h) 2009
i) Statistics South Africa
j) Learners' own answer.
k) An example of a summary:
The pie chart shows the time that children took to get to school. Most of the children (27%) took 10–19 minutes to get to school. The fewest children (2%) took 50–59 minutes to get to school. Most of the children took less than 30 minutes to get to school.

5. 38; 38; 39; 40; 40; 41; 41; 41; 43; 43; 45; 45; 45; 45; 46; 47; 48; 49; 49; 50

   a) Mode = 45

   b) Median = $\frac{43 + 45}{2} = \frac{48}{2} = 24$

Assignment

Learner's Book page 295

Learners' own work

You can use the following grid to assess the learners and allocate a mark out of 20.

<table>
<tr><th rowspan="2">Criteria</th><th colspan="3">Mark allocation</th></tr>
<tr><th>3</th><th>2</th><th>0–1</th></tr>
<tr><td>Asking a question</td><td></td><td>Posed a suitable question clearly for which to collect data</td><td>Posed a question that was not suitable or clear</td></tr>
<tr><td>Collecting data</td><td>Collected appropriate data from all the learners in the class</td><td>Collected appropriate data from most of the learners in the class</td><td>Did not collect appropriate data from the learners in the class</td></tr>
<tr><td rowspan="2">Recording and organising data</td><td rowspan="2"></td><td>Used a suitable tally table with clear categories to record data</td><td>Did not use a suitable tally table with clear categories to record data</td></tr>
<tr><td>Recorded data clearly and neatly for girls and boys</td><td>Did not record data clearly and neatly for boys and girls</td></tr>
<tr><td rowspan="2">Presenting data</td><td>Drew a double bar graph with a heading, key and axes labelled clearly</td><td>Drew a double bar graph with a heading, key or axes not labelled very clearly</td><td>Did not draw a bar graph; shows no understanding of requirements</td></tr>
<tr><td>Drew the bars of the double bar graph accurately</td><td>Made one or two errors in drawing the bars of the bar graph</td><td>Made many errors or did not have a clue about how to draw the bars of a bar graph</td></tr>
<tr><td rowspan="2">Analysing data</td><td rowspan="2">Able to accurately describe similarities and differences between the data for girls and boys</td><td>Able to describe most similarities and differences between the data for girls and boys</td><td>Not able to describe most similarities and differences between the data for girls and boys</td></tr>
<tr><td>Is able to clearly answer the initial question posed</td><td>Does not answer the initial question posed</td></tr>
</table>

Remedial activity

If learners struggle when working with data categories that consist of ranges, let them do a few activities such as the following to help them understand what the ranges mean.

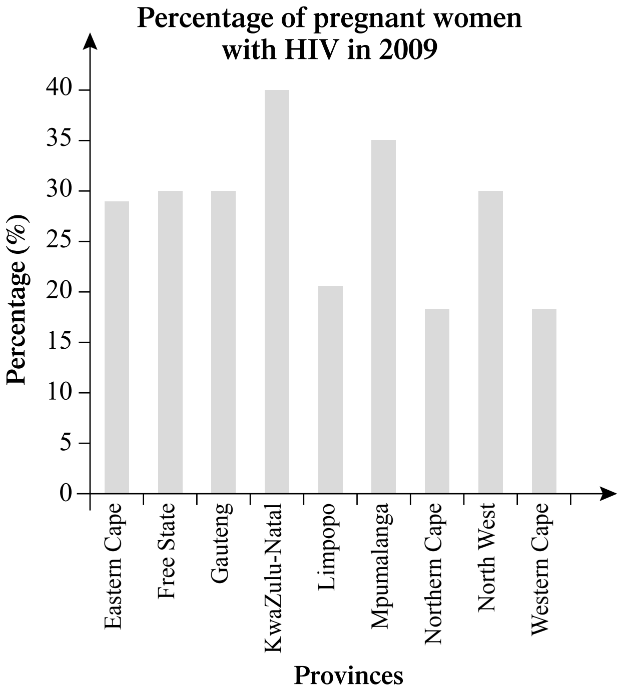
- Let them work on the floor or in an area where they will have sufficient space.
- Put four boxes labelled with height ranges on the floor.
- Write down different heights on strips of paper.
- Ask the learners to sort the strips of paper into the correct box.
- Then let them draw a set of axes on a large sheet of paper or on the board, and write the label for each height range on each box along the horizontal axis.
- Then let them paste each strip of paper in the boxes above the correct label on the big graph. They paste the papers one above the other. They build the bar graph.

Extension activity

Let the learners measure the heights of 30 learners in centimetres. They then draw a bar graph of the learners' heights. Do not let them group the heights into ranges. They should realise that drawing a bar graph in this way is not very practical or useful because there are too many categories to draw on one graph, and it is not easy to compare the categories. They should conclude that this is why we rather use ranges of categories in these cases.

Assessment 3.6 Data handling

1. The bar graph shows the percentage of pregnant women with HIV in each South African province in 2009.



(Based on data from www.avert.org)

   a) In what year were the data collected?
   b) Which province had the highest percentage of pregnant women with HIV?
   c) Which two provinces had the lowest percentage?
   d) Write the names of the following provinces in order from lowest percentage to highest percentage:
   Northern Cape, KwaZulu-Natal, Free State, Mpumalanga, Eastern Cape
   e) Which province do you think needed the most help in educating mothers about HIV? Explain your answer.

2. The paragraph below gives data about the percentage of the populations of different countries who live in urban areas. The data are given for two different years.

> Over the years, more and more people all over the world have moved to urban areas. The following data were collected for four southern African countries: In 2010, 62% of South Africa's population lived in urban areas, compared to 49% in 1981. In 2010, 36% of Zambia's population lived in urban areas, compared to 40% in 1981. In 2010, 20% of Malawi's population lived in urban areas, compared to 9% in 1981. In 2010, 38% of Namibia's population lived in urban areas, compared to 25% in 1981.

   a) For which two years are the data given?
   b) For which countries are the data given?

c) Copy the table and fill in the data given in the paragraph.

Country	Percentage urban population in 1981	Percentage urban population in 2010

d) Draw a double bar graph to show the data.

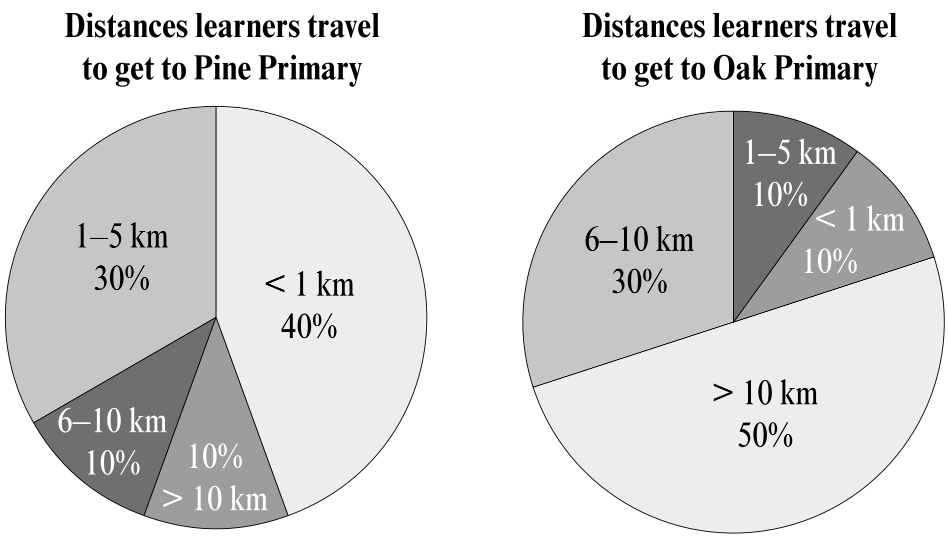
e) Which country had the highest percentage of urban population in 1981?

f) Which country had the highest percentage of urban population in 2010?

g) By how much did the percentage of Namibia's urban population increase from 1981 to 2010?

h) Which country's urban population percentage decreased from 1981 to 2010?

3. The two pie charts show the distances travelled by learners to get to school. The data for each pie chart were collected in different places.



a) What percentage of Pine Primary's learners travel less than 1 km?

b) What percentage of Pine Primary's learners travel more than 10 km?

c) What percentage of Oak Primary's learners travel less than 1 km?

d) What percentage of Oak Primary's learners travel more than 10 km?

e) Which school has half of its learners living further than 10 km from the school?

f) Say whether each sentence is true or false:
   (i) Pine Primary has 70% of its learners living 5 km or less from school.
   (ii) Oak Primary has 50% of its learners living no further than 10 km from school.

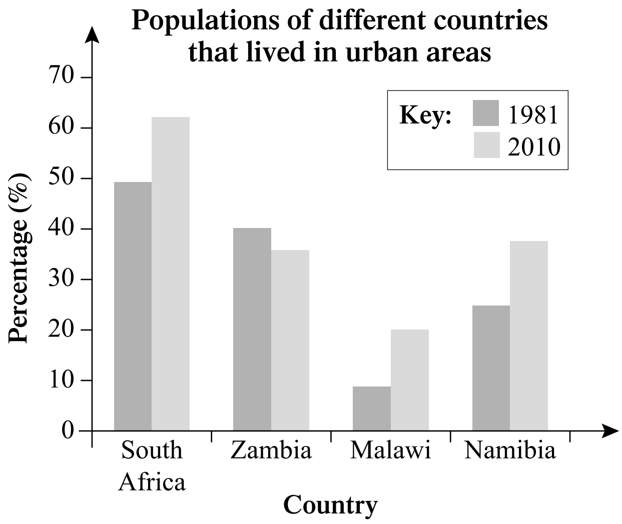
4. The data show test marks of a class. Find the mode and the median.

   31, 29, 30, 49, 31, 40, 38, 31, 50, 32, 34,
   35, 42, 35, 36, 42, 36, 37, 30, 37, 38, 39,
   40, 40, 35, 29, 40, 42, 46, 46, 38, 35

1. **a)** 2009
   b) KwaZulu-Natal
   c) Northern Cape and Western Cape
   d) Northern Cape, Eastern Cape, Free State, Mpumalanga, KwaZulu-Natal
   e) KwaZulu-Natal: It had the highest percentage of pregnant women with HIV.
2. **a)** 1981 and 2010
   b) South Africa, Zambia, Malawi and Namibia
   c) The table could look like this:

Country	Percentage urban population in 1981	Percentage urban population in 2010
South Africa	49%	62%
Zambia	40%	36%
Malawi	9%	20%
Namibia	25%	38%

   d)



   e) South Africa
   f) South Africa
   g) 13%
   h) Zambia
3. **a)** 40%
   b) 10%
   c) 10%
   d) 50%
   e) Oak Primary
   f) **(i)** True
   (ii) False
4. There are two modes: 35 and 37.
   The median is 37.

Numeric patterns

Remind the learners that they have worked with numeric patterns in Term 1. They worked with flow diagrams, function machines and tables to investigate number patterns and to develop and describe rules. During the next five units they will build on the knowledge they have already developed and work with flow diagrams, function machines and tables again to investigate patterns in numbers and to develop and describe rules. In the first unit they will work together as a class to perform investigations, using mental mathematics methods.

Unit 31 Patterns and primes

MENTAL MATHS

Learner's Book page 296

Tell the learners that they will work together as a class to explore and learn more about prime numbers. The learners have worked with prime numbers and factors at the beginning of this term. Ask them if they can explain what prime numbers and factors are. Ask them to name the first four prime numbers.

Tell them that they will explore the 100-grid to see if there are patterns when working with prime numbers. Tell them that a Greek mathematician, Erastosthenes, used a 100-square to identify or 'sift' prime numbers. The square is called the Sieve of Erastosthenes. They will explore prime numbers the way the Greek mathematician did.

Give the learners copies of the 100-grid in the resources section, or you can make a 100-grid on a chart so that the learners can explore prime numbers together as a class. Ask them to circle 2, 3, 5 and 7. They shade the multiples of 2, 3, 5 and 7 and the number 1. They then circle all the numbers that are not shaded – all numbers that have been circled are prime numbers. Ask the learners to count the number of prime numbers between 1 and 100. They should find that there are 25 prime numbers. If they counted more or less than 25 numbers, you could ask them to check the circled numbers by dividing them by a prime number. For example, people often consider 51 and 91 as prime numbers, but 51 is a multiple of 3 and 91 is a multiple of 7, i.e. $51 \div 3 = 17$ and $91 \div 7 = 13$.

In question 3 they use the 100-grid to identify the prime numbers as indicated. Ask them to find out if there are any patterns to observe in these lists of numbers. In question (a), for example, they should observe the differences between the numbers as below to find out if there is consistency.

Ask them to describe any patterns they observe. Except for the difference between 2 and 3 in the first row, it appears that there is always a difference of the even numbers 2, 4 and 6 between the prime numbers, for example:

a) $2 \underbrace{\qquad}_{1} 3 \underbrace{\qquad}_{2} 5 \underbrace{\qquad}_{2} 7 \underbrace{\qquad}_{4} 11 \underbrace{\qquad}_{2} 13 \underbrace{\qquad}_{4} 17 \underbrace{\qquad}_{2} 19$

b) $23 \underbrace{\qquad}_{6} 29 \underbrace{\qquad}_{2} 31 \underbrace{\qquad}_{6} 37$

c) $41 \underbrace{\qquad}_{2} 43 \underbrace{\qquad}_{4} 47 \underbrace{\qquad}_{6} 53 \underbrace{\qquad}_{6} 59$

d) $61 \underbrace{\qquad}_{6} 67 \underbrace{\qquad}_{4} 71 \underbrace{\qquad}_{2} 73 \underbrace{\qquad}_{6} 79$

e) $83 \underbrace{\qquad}_{6} 89 \underbrace{\qquad}_{2} 91 \underbrace{\qquad}_{6} 97$

Ask the learners to look at the general rule given for prime numbers: If a number is not a multiple of a prime number smaller than the number, the number is a prime number.

In question 6 they test the rule by dividing the prime numbers between 20 and 40 and 60 and 80 as listed in question 5, to find if it always works. The rule is true – if the numbers are not divisible by or not multiples of 2, 3, 5, 7 or 11, they are prime numbers. Let them look at the strategy to check if a number is a multiple of another number – if there is a remainder when you divide, it is not a multiple.

In question 7 you should ask them if 1 is a prime number – they should know this from previous experience with prime numbers.

They explore the numbers in the lists in question 6 to find out that 2 is the only even prime number. They also investigate whether all odd numbers are prime numbers. They should conclude that numbers such as 9, 15, 21, 25, 27, and so on are odd but not prime numbers. Ask them to list the uneven numbers between 0 and 40 that are not prime numbers. Ask them to find out if there is a pattern in the sequence by looking at the difference between the numbers.

$$9 \underbrace{\qquad}_{6} 15 \underbrace{\qquad}_{6} 21 \underbrace{\qquad}_{4} 25 \underbrace{\qquad}_{2} 27 \underbrace{\qquad}_{4} 33 \underbrace{\qquad}_{2} 35 \underbrace{\qquad}_{4} 39$$

They should notice that the difference is always 2, 4 and 6 – even with numbers smaller than 8. Ask them to explore whether this is the case for the differences between the non-primes from 40 to 100.

Ask the learners to identify the prime numbers in the list in question 7(f).

In question 8 they investigate another rule for creating prime numbers. They work with the first 10 natural numbers as input values to find out if the output values are always prime numbers. Give them each 10 copies of the blank function machines in the resources section. The learners learn that mathematicians had problems with constructing rules that always work for creating prime numbers. No-one has discovered a rule yet.

1. The first 4 prime numbers are: 2; 3; 5 and 7.
2.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

3. **a)** Primes smaller than 20: 2; 3; 5; 7; 11; 13; 17; 19
   b) Primes between 20 and 40: 23; 29; 31; 37
   c) Primes between 40 and 60: 41; 43; 47; 53; 59
   d) Primes between 60 and 80: 61; 67; 71; 73; 79
   e) Primes between 80 and 100: 83; 89; 97
4. There are various patterns to be observed in the 100-grid and some learners might see patterns that others don't. The most obvious pattern is that 2 is the only even prime number; all the other prime numbers are odd numbers.
   Looking in the columns, they should observe the following patterns.
   Column 1: 31; 41 61; 71
   Column 2: except for 2 there are no prime numbers.
   Column 3: 3; 13; 23 43; 53 73; 83
   Column 4: No prime numbers
   Column 5: except for 5 there are no prime numbers.
   Column 6: No prime numbers
   Column 7: 7 37; 47 67 97
   Column 8: No prime numbers
   Column 9: 19; 29 59 79; 89
   Column 10: No prime numbers
5. Make sure that the learners interpret the rule correctly. They should understand that the rule states in reverse that *a number is a prime if it is not a multiple of a prime number smaller than it.*

6. a) 23 ÷ 2 = 11 rem 1
23 ÷ 3 = 7 rem 2
23 ÷ 5 = 4 rem 3
23 ÷ 7 = 3 rem 2

29 ÷ 2 = 14 rem 1
29 ÷ 3 = 9 rem 2
29 ÷ 5 = 5 rem 4
29 ÷ 7 = 4 rem 1

31 ÷ 2 = 15 rem 1
31 ÷ 3 = 10 rem 1
31 ÷ 5 = 6 rem 1
31 ÷ 7 = 4 rem 3

37 ÷ 2 = 18 rem 1
37 ÷ 3 = 12 rem 1
37 ÷ 5 = 7 rem 2
37 ÷ 7 = 5 rem 2

23, 29, 31 and 37 are not multiples of 2, 3, 5 and 7 because there are remainders.
23, 29, 31 and 37 are prime numbers.

b) 61 ÷ 2 = 30 rem 1
61 ÷ 3 = 20 rem 1
61 ÷ 5 = 12 rem 1
61 ÷ 7 = 8 rem 5

67 ÷ 2 = 33 rem 1
67 ÷ 3 = 22 rem 1
67 ÷ 5 = 13 rem 2
67 ÷ 7 = 9 rem 4

71 ÷ 2 = 35 rem 1
71 ÷ 3 = 23 rem 2
71 ÷ 5 = 14 rem 1
71 ÷ 7 = 10 rem 1

73 ÷ 2 = 36 rem 1
73 ÷ 3 = 24 rem 1
73 ÷ 5 = 14 rem 3
73 ÷ 7 = 10 rem 3

79 ÷ 2 = 39 rem 1
79 ÷ 3 = 26 rem 1
79 ÷ 5 = 15 rem 4
79 ÷ 7 = 11 rem 2

61, 67, 71, 73, 79 are not multiples of 2, 3, 5 and 7 because there are remainders.

61, 67, 71, 73, 79 are prime numbers.

7. a) The number 1 is not a prime number. It only has one factor: 1 × 1 = 1. Prime numbers have two factors – 1 and the number itself. Ask the learners to look at the grid they have completed in Unit 4, Activity 4.1, question 6 and the Sieve of Erastosthenes they worked with in this unit.

b) 2 is the smallest and only even prime number.

c) No. 9, 15 and 21, for example, are uneven numbers but they are not prime numbers.

d) 9; 15; 21; 25; 27; 33; 35; 39

e) The differences between the numbers form the pattern:
4; 6; 4; 2; 6; 2; 4; ...

f) 61 and 89. They are not multiples of prime numbers smaller than them. For example:
61 ÷ 11 = 5 rem 6; 89 ÷ 13 = 6 rem 11

The numbers have only two factors:
1 × 61 = 61 and 1 × 89 = 89.

8. **a, b)**

Input			Output
1	× 12	– 7	5
2	× 12	– 7	17
3	× 12	– 7	29
4	× 12	– 7	41
5	× 12	– 7	63
6	× 12	– 7	75
7	× 12	– 7	77
8	× 12	– 7	89
9	× 12	– 7	101
10	× 12	– 7	123

c) The rule does not always work.
63, 75, 77 and 123 are not prime numbers.

63 ÷ 63 = 1
63 ÷ 3 = 21   63 ÷ 7 = 9 → 63 has six factors.

75 ÷ 75 = 1
75 ÷ 3 = 25   75 ÷ 5 = 15 → 75 has six factors.

77 ÷ 77 = 1   77 ÷ 11 = 7 → 77 has four factors

123 ÷ 123 = 1   123 ÷ 3 = 41 → 123 has four factors

Unit 32 Rules for creating sequences

MENTAL MATHS

Learner's Book page 298

Tell the learners that they will explore patterns in number sequences. Let them name some number sequences that they know and describe the patterns. In question 1(a) and (b) they explore five different ways to extend a pattern in which only the first two terms are given. Let them describe the rules they have created to extend the pattern. In (c) and (d) they explore and describe Marianne's pattern. They find a rule for the pattern if the fourth term is 23.

In question 2 they study the sequence given for patterns. They fill in the next five terms in the pattern and explore the equation for the first term in this pattern.

In question 3 they give the equations for the next four terms and determine the 10th and 20th terms in the sequence.

1. **a, b)** Here are some examples to share with the learners.
   2; 5; 8; 11; 14; 17; ... Add 3
   2; 5; 10; 17; 28; 41; ... Add consecutive prime numbers

2; 5; 7; 12; 19; 31; ...	Add the previous two terms (as in the Fibonacci series)
2; 5; 10; 17; 26; 36; ...	Add consecutive odd numbers
2; 5; 7; 10; 12; 15; ...	Add 3, add 2, add 3, add 2, and so on

c) Marianne's rule: 2; 5; 7; 10; 12; ... Add 3, add 2; add 3, add 2 and so on.

Explain that the ratio in Marianne's sequence is constant (regular or consistent). Ask them to read the sequences in the examples above in which the ratios are non-constant (irregular or inconsistent).

d) 2; 5; 11; 23; 65; 131; ... Multiply by 2 plus 1

2. **a)** 8; 13; 18; 23; ... Add 5. The units are 8; 3; 8; 3

b) 8; 13; 18; 23; 28; 33; 38; 43; 48

3. **a)** $8 = (1 \times 5) + 3$
$13 = (2 \times 5) + 3$
$18 = (3 \times 5) + 3$
$23 = (4 \times 5) + 3$
$28 = (5 \times 5) + 3$

b) 10th term: $(10 \times 5) + 3 = 53$
20th term: $(20 \times 5) + 3 = 103$

Activity 32.1

Learner's Book page 298

Ask the learners to explore the numbers in the sequence. They have to extend the pattern by filling in the next five terms. They rewrite the sequence using brackets as in the Mental Maths section. Ask them to determine the 25th and the 57th terms in the sequence.

In question 2 they study the function machine for the sequence in question 1. Let them draw the function machine for the sequence in question 2. They fill in the next five terms in the sequence and use the rule to complete the output values in the table.

In question 3 the learners find the rules for creating the output numbers in the flow diagrams.

Next, ask the learners to study the sequence in question 4. They study the rules created by the learners and complete the flow diagrams using these rules.

Let them explore the sequences in question 5. They have to draw function machines to show the rules for the sequences. They should realise that they could create two rules for describing the same sequence.

1. a) 5; 9; 13; 17; 21; 25; 29; 33; 37; 41

   b) $5 = (1 \times 4) + 1$
   $9 = (2 \times 4) + 1$
   $13 = (3 \times 4) + 1$
   $17 = (4 \times 4) + 1$
   $21 = (5 \times 4) + 1$

   c) 25th term: $(25 \times 4) + 1 = 101$

   d) 57th term: $(57 \times 4) + 1 = 229$

2. a) 6; 10; 14; 18; ...

   Input → × 4 → + 2 → Output

   b) 6; 10; 14; 18; **22; 26; 30; 34; 38**

   c)

Input	10	11	12	20	15	21	30	50
Output	42	46	50	82	62	86	122	202

3. a)

Input	Rule: **+ 0,2**	Output
1	→	1,2
2	→	2,2
3	→	3,2
4	→	4,2
5	→	**5,2**
6	→	**6,2**
7	→	**7,2**
8	→	**8,2**
9	→	**9,2**

b)

Input	Rule: **+ 2**	Output
$1\frac{3}{4}$	→	$3\frac{3}{4}$
$3\frac{3}{4}$	→	$5\frac{3}{4}$
$5\frac{3}{4}$	→	$7\frac{3}{4}$
$7\frac{3}{4}$	→	$9\frac{3}{4}$
$\mathbf{9\frac{3}{4}}$	→	$\mathbf{11\frac{3}{4}}$
$\mathbf{11\frac{3}{4}}$	→	$\mathbf{13\frac{3}{4}}$
$\mathbf{13\frac{3}{4}}$	→	$\mathbf{15\frac{3}{4}}$
$\mathbf{15\frac{3}{4}}$	→	$\mathbf{17\frac{3}{4}}$
$\mathbf{17\frac{3}{4}}$	→	$\mathbf{19\frac{3}{4}}$

c)

Input	Rule: **+ 0,25**	Output
0,75	→	0,5
2,75	→	2,5
4,75	→	4,5
6,75	→	6,5
8,75	→	**8,5**
10,75	→	**10,5**
12,75	→	**12,5**
14,75	→	**14,5**
16,75	→	**16,5**

4. a)

Input	+ 12	Output
5	→	17
17	→	29
29	→	41
41	→	**53**
53	→	**65**
65	→	**77**
77	→	**89**
89	→	**101**
101	→	**113**

b)

Input	× 12	− 7	Output
1	→	→	5
2	→	→	17
3	→	→	29
4	→	→	41
5	→	→	**65**
6	→	→	**77**
7	→	→	**89**
8	→	→	**101**
9	→	→	**113**

5. a) 11; 19; 27; 35; **43; 51; 59; 67; 75**

Input $\boxed{+\ 8}$ output Input $\boxed{\times\ 8}$ $\boxed{+\ 3}$ output

b) 10; 21; 32; 43; **54; 65; 76; 87**

Input $\boxed{+\ 11}$ output Input $\boxed{\times\ 11}$ $\boxed{-\ 1}$ output

c) 3; 5; 9; 17; **33; 65; 129; 257; 513**

Input $\boxed{\times\ 2}$ $\boxed{-\ 1}$ output

d) 54; 49; 44; 39; **34; 29; 24; 19; 14**

Input $\boxed{-\ 5}$ output Input $\boxed{+\ 2}$ $\boxed{+\ 4}$ output

e) 99; 89; 79; 69; **59; 49; 39; 29; 19**

Input $\boxed{-\ 10}$ output Input $\boxed{\times\ 10}$ $\boxed{-\ 1}$ output

Unit 33 Finding patterns in number grids

MENTAL MATHS

Learner's Book page 300

Tell the learners that they will explore number grids for patterns and sequences. The numbers are arranged differently than in a normal 100-grid. Ask them to explore the arrangement of the numbers. They explore the numbers in the first column, i.e. square numbers that they have worked with before. They list the sequence on the board and fill in the next two terms. They might describe the pattern as 1 × 1; 2 × 2, and so on, or as the natural numbers multiplied by themselves.

In question 2 they explore the numbers in the first row and determine the next two terms. They explore the numbers in the second and sixth rows to find out if there are patterns. They describe the patterns and find the next two terms.

In question 5, they explore the numbers in the diagonals and describe any patterns they observe. Draw the grid on a chart. The learners complete the numbers in the grid.

1. **a)** Square numbers
b) 1; 4; 9; 16; 25; 36
c) 1; 4; 9; 16; 25; 36; **49; 64**
$1 = 1 \times 1$; $4 = 2 \times 2$; $36 = 6 \times 6$; $49 = 7 \times 7$; $64 = 8 \times 8$

2. 1; 2; 5; 10; 17; 26; **37; 50**
You add consecutive odd numbers:
$17 + 9 = 26$ $26 + 11 = 37$ $37 + 13 = 50$

3. 4; 3; 6; 11; 18; 27
The differences between the terms form the pattern:
1; 3; 5; 7; 9
You add consecutive odd numbers.

4. **a)** Counting backwards in natural or counting numbers. Counting or natural numbers arranged in descending order.
b) 36; 35; 34; 33; 32; 31; 30; 29

5. 1; 3; 7; 13; 24; 31
The differences between the numbers form the pattern:
2; 4; 6; 11; 7. There is no definite pattern.
26; 18; 12; 14; 24; 36
The differences between the numbers form the pattern:
8; 6; 2; 10; 12. There is no definite pattern.

6. Draw the following squares on the board so they can see the relationships. The natural numbers are arranged horizontally and vertically.

1	2
4	3

		5
		6
9	8	7

			10
			11
			12
16	15	14	13

1	2	5	10	17	26	**37**	**50**
4	3	6	11	18	27	**38**	**51**
9	8	7	12	19	28	**39**	**52**
16	15	14	13	20	29	**40**	**53**
25	24	23	22	24	30	**41**	**54**
36	35	34	33	32	31	**42**	**55**
49	**48**	**47**	**46**	**45**	**44**	**43**	**56**
64	**63**	**62**	**61**	**60**	**59**	**58**	**57**

Activity 33.1

Learner's Book page 300

Tell the learners that they will continue to explore patterns in number grids. Give the learners each a copy of the number grid in the resources section. Let them list the numbers in the 1st row of the grid in question 1. They should know that these are triangular numbers.

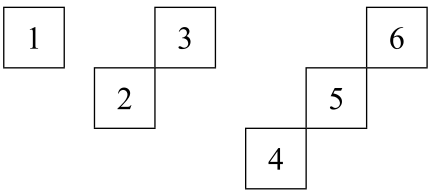
In question 2 they fill in the next four terms in the sequence that appear in one of the diagonals. Ask them to write down a rule for this sequence.

In question 3 the learners to list five sequences they identify and are able to describe. Encourage them to look at the rows, columns and diagonals. They should write sentences to describe the rules or patterns. Give them copies of the grid. They complete the numbers in the grid.

In question 5 they explore the sequences in the diagonals. Ask them to copy the sequences and to fill in the first two terms and the last two terms.

Give them copies of the grid in the resources section for question 6 and let them complete the numbers. Let them share their solutions with the class.

1. Triangular numbers
2. 1; 5; 13; 25; **41; 61; 85; 113**
   Rule: Multiply by 4 minus 3 (× 4 – 3), for example:
   1 = (1 × 4) – 3
   5 = (2 × 4) – 3
   13 = (4 × 4) – 3 and so on.
3. There are various patterns to be observed. Here are a few examples.
   Row 2: 2; 5; 9; 14; 20; 27; ...
   Differences: 3; 4; 5; 6; 7; ... Add consecutive natural/counting numbers.
   Diagonal: 4; 12; 24; 40; 60; 84
   Differences: 8; 12; 16; 20; 24 ... Add consecutive multiples of 4.
   Diagonal: 15; 14; 13; 12; 11 ... Counting back inconsecutive natural numbers.
4. The learners should discover that the natural numbers are arranged diagonally from the 1st column upwards. Draw the following squares on the board to help them to see the relationships.



1	3	6	10	15	21	28	**36**
2	5	9	14	20	27	**35**	**44**
4	8	13	19	26	**34**	**43**	**53**
7	12	18	25	**33**	**42**	**52**	**63**
11	17	24	**32**	**41**	**51**	**62**	**74**
16	23	**31**	**40**	**50**	**61**	**73**	**86**
22	**30**	**39**	**49**	**60**	**72**	**85**	**99**
29	**38**	**48**	**59**	**71**	**84**	**98**	**113**

5. **101; 65**; 37; 17; 5; 1; 9; 25; 49; **81**; **121**
111; 73; 43; 21; 7; 1; 3; 13; 31; **57**; **91**

37	36	35	34	33	32	31
38	17	16	15	14	13	30
39	18	5	4	3	12	29
40	19	6	1	2	11	28
41	20	7	8	9	10	27
42	21	22	23	24	25	26
43	44	45	46	47	48	49

6. The learners should discover that the natural numbers are arranged in an anti-clockwise spiral from the centre. Draw the following squares on the board to help them make the observation if they are stuck.

1

5	4	3
6		2
7	8	9

17	16	15	14	13
18				12
19				11
20				10
21	22	23	24	25

101	**100**	**99**	**98**	**97**	**96**	**95**	**94**	**93**	**92**	**91**
102	**65**	**64**	**63**	**62**	**61**	**60**	**59**	**58**	**57**	**90**
103	**66**	37	36	35	34	33	32	31	**56**	**89**
104	**67**	38	17	16	15	14	13	30	**55**	**88**
105	**68**	39	18	5	4	3	12	29	**54**	**87**
106	**69**	40	19	6	1	2	11	28	**53**	**86**
107	**70**	41	20	7	8	9	10	27	**52**	**85**
108	**71**	42	21	22	23	24	25	26	**51**	**84**
109	**73**	43	44	45	46	47	48	49	**50**	**83**
110	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**	**81**	**82**
111	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**	**121**

You should use the two grids in this activity to allow learners to discover more patterns. They should look for patterns with natural, counting, square, rectangular and prime numbers, for example.

Unit 34 Finding rules in flow diagrams

MENTAL MATHS

Learner's Book page 301

Tell the learners that by now they should be more than familiar with working with flow diagrams. They will work with flow diagrams again to find output values and determine rules to find input and output values. Give them copies of the blank flow diagrams in the resources section. They will also work with common fractions and decimals in the flow diagrams. In question 3 they use the consecutive numbers 1 to 10 to create sequences for the output numbers in each of the flow diagrams.

1. a)

Input	÷ 2	Output
10	→	5
16	→	8
18	→	9
24	→	12
64	→	32
78	→	39
96	→	48
104	→	52

b)

Input	$-\frac{1}{4}$	Output
1	→	$\frac{3}{4}$
3	→	$2\frac{3}{4}$
$2\frac{1}{4}$	→	2
$4\frac{3}{4}$	→	$4\frac{1}{2}$
5	→	$4\frac{3}{4}$
$7\frac{2}{4}$	→	$7\frac{1}{4}$
9	→	$8\frac{3}{4}$
$10\frac{1}{4}$	→	10

2. a) Input → + 2 → Output

b) Input → – 2 → Output

c) Input → + 5 → Output

d) Input → – 10 → Output

e) Input → + 0,4 → Output

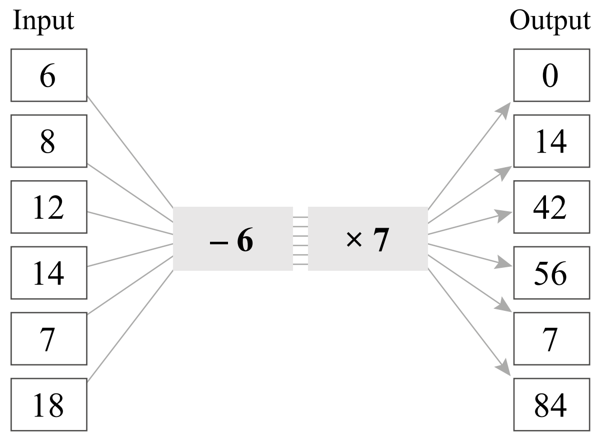
f) Input → × 3 → Output

3. Learners' own work

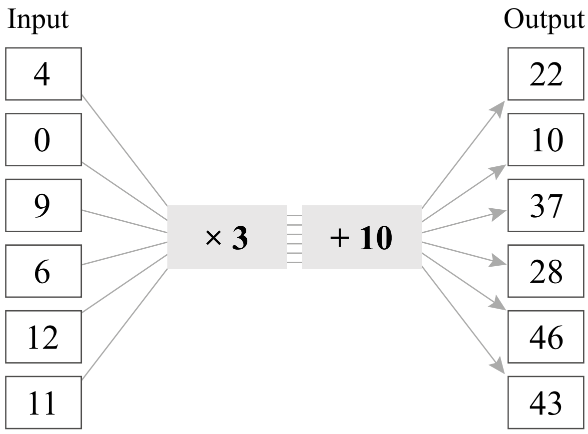
Activity 34.1

Learner's Book page 302

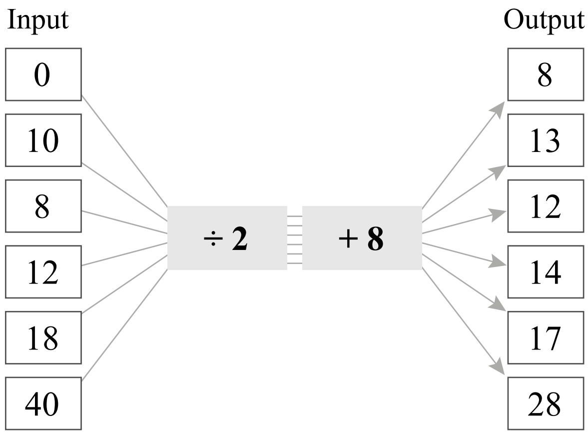
1. a)



b)



c)



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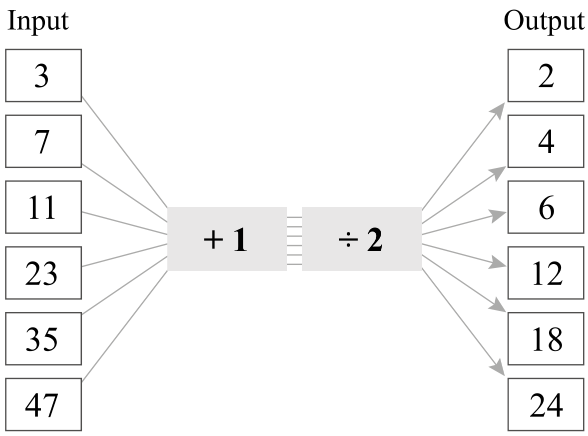


2.

Input	+ 2	× 3	– 1	Output
2				**11**
3				**14**
4				**17**
8				**29**
20				**65**
105				**320**

3. The learners apply inverse operations to determine the input values.

a)

Input	× 5	+ 2	Output
0		→	2
3		→	17
8		→	42
6		→	32
9		→	47
10		→	52

b)

Input	+ 3	+ 2	Output
1		→	2
7		→	5
17		→	10
47		→	25
33		→	18
27		→	15

Unit 35 Rules in tables

MENTAL MATHS

Learner's Book page 304

Ask the learners to record the output numbers in the table on their Mental Maths Grids. They discuss and share the rule for determining the output numbers with the class.

1.

Input	1	2	5	7	9	3	0	6	8	4	10	12	11
Output	8	13	28	38	48	18	3	33	43	23	53	63	58

2. Rule: Input multiplied by 5 plus 3, or
Input → × 5 + 3 → output

Activity 35.1

Learner's Book page 304

In this lesson the learners will discuss different ways of greeting people in different societies. Some people greet with kisses, others with hugs and others with handshakes. Children in some parts of the USA give 'high fives'. Chinese and Japanese people have a tradition of bowing to each other. Tell the learners that they will now explore a handshake problem. Ask them how many handshakes they think will be given if 5 people shake hands with one another. They will probably perform addition or multiplication calculations. Ask 5 learners to role-play the situation. They solve problems in question 3 by saying how many handshakes are given between different numbers of people.

In question 4 they copy and complete the table. They should find out that the output numbers are the sequence of triangular numbers. They then explore a rule for finding the number of handshakes given among any number of people.

The learners should realise that in question 6 they have to perform the calculations in brackets first. Remind them to use short cuts in calculations. They use rules they have learned for multiplying by 50, the distributive property and compensation to find the different number of handshakes for large numbers of people. Do not allow them to use calculators.

In question 7 the learners explore patterns in the addition of consecutive numbers. They have worked with consecutive numbers in Grades 4 and 5 and should be familiar with the concept. They copy the table and complete the pattern as indicated. Ask them to predict the next two solutions in the pattern. They should list the first 10 terms in the sequences they observe in the table. Ask them to describe the rules for creating the sequences in word sentences. Let them share their solutions with the class.

1. 10 handshakes (This does not imply that the rule 2 × 5 = 10 in the example is correct.)

2. Learners explore the problem practically.

3. **a)** 1 handshake **b)** 3 handshakes
c) 6 handshakes **d)** 10 handshakes
e) 45 handshakes

4.

Number of people	1	2	3	4	5	6	7	8	10	15
Number of handshakes	0	1	3	6	10	15	21	28	45	105

5. Triangular numbers

6. **a)** 50 × (50 – 1) ÷ 2 = 50 × 49 ÷ 2
= (49 × 100 ÷ 2) ÷ 2
= 4 900 ÷ 2 ÷ 2
= 2 850 ÷ 2
= 1 425 handshakes

b) 80 × (80 – 1) ÷ 2 = 80 × 79 ÷ 2
= (80 × 80) – (1 × 80) ÷ 2
= (6 400 – 80) ÷ 2
= 6 320 ÷ 2
= 3 160 handshakes

c) 150 × (150 – 1) ÷ 2 = 150 × 149 ÷ 2
= (150 × 150) – (150 × 1) ÷ 2
= (15 × 15 × 100 – 150) ÷ 2
= 22 500 – 150 ÷ 2
= 22 350 ÷ 2
= 11 175 handshakes

d) 200 × (200 – 1) ÷ 2 = 200 × 199 ÷ 2
= (200 × 200) – (200 × 1) ÷ 2
= (40 000 – 200) ÷ 2
= 39 800 ÷ 2
= 19 900 handshakes

e) 500 × (500 – 1) ÷ 2 = (500 × 499) ÷ 2
= (500 × 500) – (500 × 1) ÷ 2
= (250 000 – 500) ÷ 2
= 249 500 ÷ 2
= 124 750 handshakes

7. a)

Adding 2 consecutive numbers	Adding 3 consecutive numbers	Adding 4 consecutive numbers	Adding 5 consecutive numbers
1 + 2 = 3	1 + 2 + 3 = 6	1 + 2 + 3 + 4 = 10	1 + 2 + 3 + 4 + 5 = 15
2 + 3 = 5	2 + 3 + 4 = 9	2 + 3 + 4 + 5 = 14	2 + 3 + 4 + 5 + 6 = 20
3 + 4 = 7	3 + 4 + 5 = 12	3 + 4 + 5 + 6 = 18	3 + 4 + 5 + 6 + 7 = 25
4 + 5 = 9	4 + 5 + 6 = 15	4 + 5 + 6 + 7 = 22	4 + 5 + 6 + 7 + 8 = 30
5 + 6 = 11	5 + 6 + 7 = 18	5 + 6 + 7 + 8 = 26	5 + 6 + 7 + 8 + 9 = 35
6 + 7 = 13	6 + 7 + 8 = 21	6 + 7 + 8 + 9 = 30	6 + 7 + 8 + 9 + 10 = 40
7 + 8 = 15	7 + 8 + 9 = 24	7 + 8 + 9 + 10 = 34	7 + 8 + 9 + 10 + 11 = 45
8 + 9 = **17**	8 + 9 + 10 = **27**	8 + 9 + 10 + 11 = **38**	8 + 9 + 10 + 11 + 12 = **50**

b) Adding 2 consecutive numbers: 19; 21
Adding 3 consecutive numbers: 30; 33
Adding 4 consecutive numbers: 42; 46
Adding 5 consecutive numbers: 55; 60

c) 3; 5; 7; 9; 11; 13; 15; 17; 19; 21
6; 9; 12; 15; 18; 21; 24; 27; 30; 33
10; 14; 18; 22; 26; 30; 34; 38; 42; 46
15; 20; 25; 30; 35; 40; 45; 50; 55; 60

d) **(i)** Consecutive uneven numbers. Add 2 each time, i.e. sum + 2

(ii) Multiples of 3. Add 3 each time, i.e. sum + 3

(iii) Even numbers. Add 4 each time, i.e. sum + 4

(iv) Multiples of 5. Add 5 each time, i.e. sum + 5
You could also ask the learners to explore patterns in the sums of consecutive numbers in the rows. For example:

Row 1: 3; 6; 10; 15: Triangular numbers
Row 2: 5; 9; 14; 20: Add consecutive natural or counting numbers
Row 3: 7; 12; 18; 25: Add 5, then 6, then 7, i.e. add consecutive natural numbers, and so on.

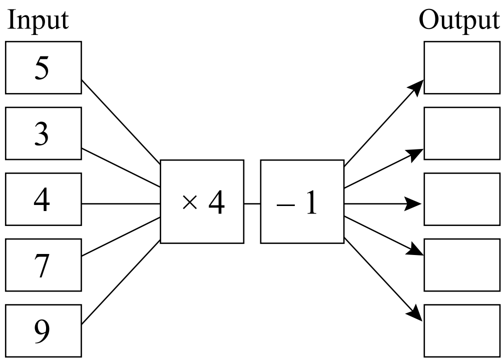
Assessment 3.7: Numeric patterns

The learners will extend number sequences, complete flow diagrams and tables, and identify and name numbers in sequences.

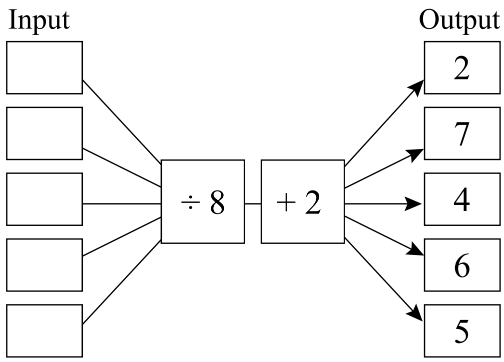
1. Fill in the next three terms in each sequence.
   a) 12; 24; 36; 48; ■; ■; ■
   b) 13; 24; 35; 46; ■; ■; ■
   c) 89; 79; 70; 62; ■; ■; ■
   d) 1; 4; 9; 16; ■ ; ■; ■
   e) 1; 3; 6; 10; ■; ■; ■

2. Complete the flow diagrams.

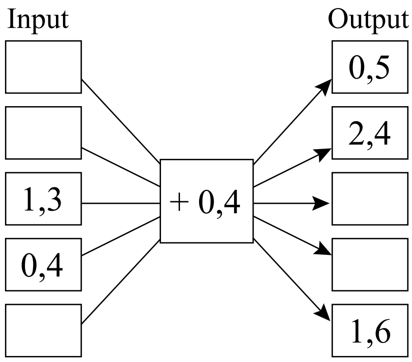
a)



b)



c)



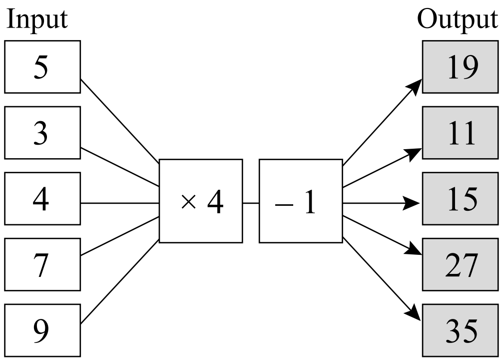
3. Fill in the next number in each sequence.
   a) 1; 3; 5; 7; ■
   b) 2; 4; 6; 8; ■
   c) 1; 3; 6; 10; ■
   d) 1; 4; 9; 16; ■
   e) 2; 3; 5; 7; ■
   f) 0; 5; 10; 15; ■

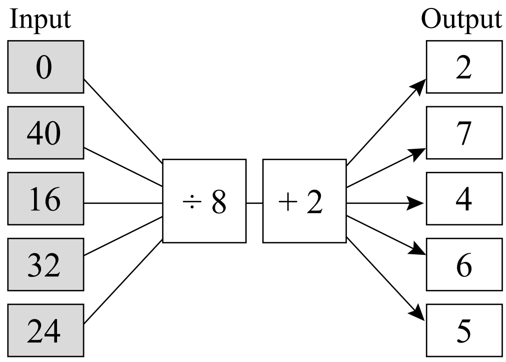
4. Complete the table.

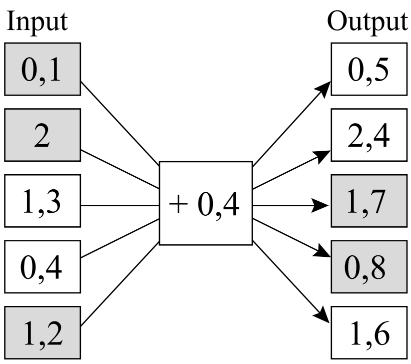
Input	0	1	2	7	9	6	8	4	10	12	11
Output	1	5	9								

1. **a)** 12; 24; 36; 48; 60; 72; 84 — Multiples of 12
b) 13; 24; 35; 46; 57; 68; 79 — Intervals of 11
c) 89; 79; 70; 62; 55; 49; 44 — Subtract 10, 9, 8, 7, 6, 5
d) 1; 4; 9; 16; 25; 36; 49 — Square numbers
e) 1; 3; 6; 10; 15; 21; 28 — Triangular numbers

2.

a)


b)


c)


3. **a)** 1; 3; 5; 7; ... — Uneven or odd numbers
b) 2; 4; 6; 8; ... — Even numbers or multiples of 2
c) 1; 3; 6; 10; ... — Triangular numbers
d) 1; 4; 9; 16; ... — Square numbers
e) 2; 3; 5; 7; ... — Prime numbers
f) 0; 5; 10; 15; ... — Multiples of 5

4. Completed table

Input	0	1	2	7	9	6	8	4	10	12	11
Output	1	5	9	**29**	**37**	**25**	**33**	**17**	**41**	**49**	**45**

The rule is: input → × 4 + 1 → output.

Length

Learner's Book page 306

In Grade 6, learners continue to work with the same measuring units (mm, cm, m and km) that they used in Grades 4 and 5. They also use the same measuring instruments to carry out practical measuring activities: rulers, tape measures, metre sticks and trundle wheels.

In Grade 6 they use decimal fractions for the first time to record and calculate lengths, and practise rounding off, estimating and converting measurements with decimal fractions to two decimal places, as well as with whole numbers and common fractions. They work with numbers up to 9 digits, using methods they have learned in the Numbers, operations and relationships sections of the course.

Unit 36 Measuring length

Read the text about length with the class, and talk about how people use their bodies to estimate length. Remind them about the metric measuring units for length, and ask them to give examples of things they would measure with a mm, a cm and a km. Then let them do the Mental Maths activities.

Learners also revise and practise working with mm, cm and m to measure lengths, and do conversions with mm, cm, m and km. They develop their understanding of how long each of these metric units is, and what kinds of lengths are appropriately measured with each unit.

They do a practical activity to make a metre stick, and use this instrument to estimate they accuracy of measurements they make relative to other instruments such as a tape measure, work with fractions of a metre, and estimate the lengths of objects around them.

They read tape measures calibrated in different ways, and identify the values of un-numbered intervals on rulers and tape measures.

They write measurements in different forms using mixed units, fractions and decimal fractions.

They estimate lengths of a range of objects and then compare their estimates with accurate measurements.

MENTAL MATHS

Learner's Book page 307

1. Learners' own work

2. **a)** mm **b)** mm **c)** cm or mm
d) mm **e)** cm **f)** m or cm

3. **a)** cm **b)** cm **c)** cm
d) m **e)** cm **f)** cm

Activity 36.1 Learner's Book page 308

Learners' own work

Activity 36.2 Learner's Book page 310

1. **a)** The intervals are 0,5 cm apart.
   b) mm
   c) They both measure cm. The second tape measure keeps a running total of the cm, while the first one marks off the metres after every 100 cm. The second tape measure measures mm along the top and the bottom while the first measures mm only along the bottom.
2. Learners' own answers
3. **a)** A: 950 mm
   B: 6, 66 m
   C: 228,3 cm
   D: 99,4 cm
   b) A: 950 mm = 95 cm = 0,95 m
   B: 6 660 mm = 666 cm = 6 m 60 cm 6 mm
   C: 2 283 mm = 117, 3 cm = 2 m 28cm 3 mm
   D: 994 mm = 99, 4 cm = 0,994 m
4. More than 1 mm

5.–7. Learners' own work

8. Table

Rectangle	Estimate of length	Measurement of length	Difference between estimate and measurement of length
A	Learners' own	12	Learners' own
B	Learners' own	25	Learners' own
C	Learners' own	18	Learners' own
D	Learners' own	35	Learners' own
E	Learners' own	47	Learners' own
F	Learners' own	55	Learners' own

Unit 37 Converting between mm, cm, m and km

Learner's Book page 312

The learners already know how to convert metric units of length, and in this unit they practise this skill in different ways. They use mental maths to order and compare lengths, round off lengths to given values, add lengths given in different units and convert the answers to different units. They use a conversion table to do further conversions. If some learners struggle to use the table to find the correct conversion method, give them extra practice with simple conversions in which they follow the methods and examples set out in the table.

Learners use rulers and tape measures to make accurate measurements in mm, cm and m. They use accurate measurements of some items, for example a shoe, to help them estimate other lengths in relation to these items. This enhances their ability to make reasonable estimates of length when there is no measuring instrument available. They also do calculations and comparisons involving metres and kilometres, and order 9-digit numbers in different measuring units. They solve practical problems in context, using whole numbers, decimal and common fractions, and percentages of whole numbers.

MENTAL MATHS

Learner's Book page 312

1. a) Longer than 1 cm: 13 mm; 11 mm; 18 mm
   Shorter than 1 cm: 8,9 mm; 2,75 mm; 9,1 mm; 1,8 mm
   b) 18 mm; 13 mm; 11 mm; 9,1 mm; 8,9 mm; 2,75 mm; 1,8 mm
2. Completed table

Length (mm)	Round off to nearest:		
	5 mm	10 mm	100 mm
46	45	5	0
71	70	70	0
923	925	920	1 000
758	760	760	800
647	650	650	600
492	490	490	500
505	505	510	500
852	850	850	900
394	395	390	400
287	290	290	300

3. a) 106 mm b) 89 mm c) 158 mm
   d) 120 mm e) 103 mm f) 81 mm
   g) 138 mm h) 168 mm i) 176 mm
   j) 580 mm
4. a) 10 cm 6 mm b) 81 cm 9 mm c) 15 cm 8 mm
   d) 12 cm e) 10 cm 3 mm f) 8 cm 1 mm
   g) 13 cm 8 mm h) 16 cm 8 mm i) 17 cm 6 mm
   j) 58 cm
5. a) 30 mm b) 100 mm c) 400 mm
   d) 50 mm e) 600 mm f) 1 000 mm
   g) 800 mm h) 10 000 mm i) 2 000 mm
   j) 6 000 mm
6. a) 3 cm b) 10 cm c) 40 cm
   d) 5 cm e) 60 cm f) 100 cm
   g) 80 cm h) 1 000 cm i) 200 cm
   j) 600 cm

Activity 37.1

Learner's Book page 314

1. a) 4; 5 b) 110; 5
   c) 80 d) 9
2. a) 20 b) 150
   c) 1; 8 d) 2 m 7 cm
3. a) 1 m = 1 000 mm = 100 cm
   b) 150 cm
   c) 3,4 m = 340 mm = 340 cm
4. a) 37 mm b) 63 mm
   c) 89 mm d) 106 mm
   e) 50 mm f) 117 mm
5. a) 3 cm 7 mm b) 6 cm 3 mm
   c) 8 cm 9 mm d) 10 cm 9 mm
   e) 5 cm f) 11 cm 7 mm
6. a) 40 mm b) 65 mm
   c) 90 mm d) 105 mm
   e) 50 mm f) 120 mm
7. a) 75 mm; 7,5 cm b) 90 mm; 9 cm
   c) 52 mm; 5,2 cm d) 38 mm; 3,8 cm
   e) 104 mm; 10,4 cm f) 84 mm; 84 cm
8. Learners' own work
9. Learners' own work

Activity 37.2

Learner's Book page 317

Learners' own work

Activity 37.3

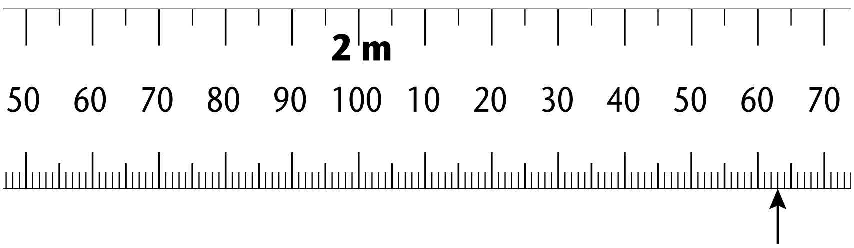
Learner's Book page 318

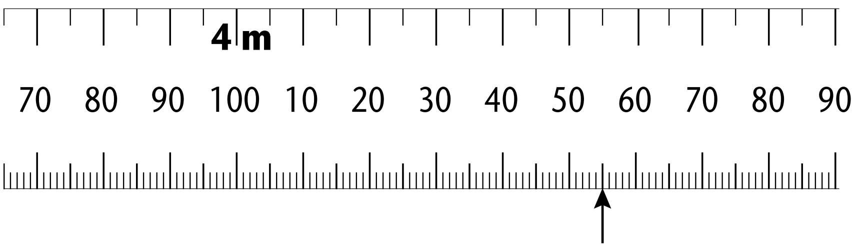
1. a) 1,9 mm; 3,4 mm; 7,2 mm; 9,0 mm
   b) 17,25 cm; 28,8 cm; 71,9 cm; 79,5 cm
   c) 73,5 m; 84,9 m; 92,3 m; 102,5 m
   d) 2 983, 75 km; 4 499,95 km; 5 391,3 km; 8 381,45 km
   e) 19 321 432, 6 mm; 28 634 891, 7 mm; 75 561 826,2 mm; 82 442 549,3 mm
   f) 7 521 932,75 m; 7 553 924,84 m; 7 563 828,25 m; 7 754 429,55 m
2. a) 2 mm; 3 mm; 7 mm; 9 mm
   b) 17 cm; 29 cm; 72 cm; 80 cm
   c) 74 m; 85 m; 92 m; 103 m
   d) 2 984 km; 4 500 km; 5 391 km; 8 381 km
   e) 19 321 433 mm; 28 634 892 mm; 75 561 826 mm; 82 442 549 mm
   f) 7 521 933 m; 7 553 925 m; 7 563 828 m; 7 754 430 m

3. a) 164 mm
   b) 201,9 mm
4. 74,1 km
5. $3\frac{1}{2} \times 3 = 10\frac{1}{2}$ m.
   Mr Omar will not have enough fabric for 3 jackets.
6. 15 m = 1 500 cm
   $\frac{1\,500}{85} = 17,65$
   Miriam will have enough edging for 17 aprons.
7. If Joe drives 60% of the distance on the first day, he will need to drive the remaining 40% of the way on the second day.
   40% of 1 500 km = $\frac{40}{100} \times \frac{1\,500}{1}$ = 600 km
8. a) 25% of 4 km = $\frac{25}{100} \times \frac{4}{1}$ = 1 km
   b) 40% of 4 km = $\frac{40}{100} \times \frac{4}{1}$ = 1,6 km
   c) 35% of 4 km = $\frac{35}{100} \times \frac{4}{1}$ = 1,4 km

Assessment 3.8: Length

The assessment task covers concepts and skills learners have worked with in both units. Use it to assess whether learners can read, order, compare and calculate with different units of measurement, measure accurately, convert measurements between units, and solve measurement problems in everyday contexts.

1. Which unit would you use to measure each length or height below: millimetres, centimetres, metres or kilometres?
   a) the short edge of a ruler
   b) the height of a tall building
   c) the length of a pen
   d) the height of a window pane
   e) the height of a tree
   f) the distance to the next town
2. Which instrument would you use to measure each length below?
   a) 47 mm of ribbon
   b) the width of a driveway
   c) the thickness of 30 pieces of paper
   d) the length of a minibus taxi
   e) the height of a two-year-old child
   f) the length of a knitting needle
3. Arrange these lengths from shortest to longest. Make sure the lengths are all in the same unit.
   a) 45 mm; 4,6 cm; $4\frac{1}{4}$ cm; 47,8 mm
   b) 15,8 km; $15\frac{3}{4}$ km; 1 570 000 cm; 157 890 m
4. Read the length shown on each tape measure.
   a)


   b)


   c)


   d)


5. Measure the length of each line and write the measurements in the table below.

	Length in millimetres	Length rounded off to the nearest 5 mm	Length rounded off to the nearest 10 mm
a)			
b)			
c)			
d)			

a) ________________________

b) ___________

c) ____

d)

____

6. Convert the following lengths to lengths in centimetres.

a) 230 mm **b)** 920 mm **c)** 30 mm

d) 95 mm **e)** 0,5 m **f)** $\frac{1}{4}$ m

g) 1,4 m **h)** 2,6 m)

7. The Nelson Mandela bridge is 284 m long.

a) Which instrument would you use to check this length?

b) Write the length of the bridge in centimetres.

8. The length of cables for the cable car on Table Mountain in Cape Town is 1 200 m.
Write this length in (a) centimetres and (b) kilometres.

9. Nelson Mandela's statue in Sandton was unveiled in 2004.

a) The statue is 6 m high. The tallest giraffe ever measured was 5,9 m tall. How much higher is Mandela's statue than the giraffe? Give your answer in centimetres.

b) The shoulder width of the statue 1,7 m. The height of most doorways is 2 m. How much shorter is the statue's shoulder width than a doorway? Give the answer in centimetres.

c) The shoes on the statue are almost 1 m long. If the length of a learner's shoe is 250 cm, about how many of the learner's shoes will fit heel-to-toe into the statue's shoe?

1. **a)** Short edge of a ruler → centimetres or millimetres
   b) Height of a tall building → meters
   c) Length of a pen → centimetres
   d) Height of a window pane → centimetres
   e) Height of a tree → metres
   f) Distances to the next town → kilometres
2. **a)** Metre stick or tape measure **b)** Tape measure
   c) Ruler **d)** Tape measure
   e) Metre stick or tape measure **f)** Ruler or tape measure
3. **a)** 45 mm; 4,6 cm; $4\frac{1}{4}$ cm; 47,8 mm
   4,5 cm; 4,6 cm; 4,25 cm; 4,78 cm
   4,25 cm; 4,5 cm; 4,6 cm; 4,78 cm

   b) 15,8 km; $15\frac{3}{4}$ km; 1 570 000 cm; 157 890 m
   15 800 m; 15 750 m; 15 700 m; 157 890 m
   15 700 m; 15 750 m; 15 800 m; 157 890 m
4. **a)** 2 063 mm or 2 m 63 mm **b)** 4 155 mm or 4 m 155 mm
   c) 2 752 mm or 2 m 752 mm **d)** 2 988 mm or 2 m 988 mm
5.

	Length in millimetres	Length rounded off to the nearest 5 mm	Length rounded off to the nearest 10 mm
a)	47 mm	45 mm	50 mm
b)	23 mm	25 mm	20 mm
c)	82 mm	80 mm	80 mm
d)	103 mm	105 mm	100 mm

6. **a)** 230 mm = 23 cm **b)** 920 mm = 92 cm
   c) 30 mm = 3 cm **d)** 95 mm = 9,5 cm
   e) 0,5 m = 50 cm **f)** $\frac{1}{4}$ m = 25 cm
   g) 1,4 m = 140 cm **h)** 2,6 m = 260 cm
7. **a)** A builder's tape **b)** 284 m × 100 = 28 400 cm
8. **a)** 1 200 m × 100 = 120 000 cm
   b) 1 200 m ÷ 1 000 = 1,2 km
9. **a)** Height of statue → 600 cm
   Height of giraffe → 590 cm
   Difference between statue and giraffe → 600 – 590 = 10 cm

   b) Width of statue → 170 cm
   Height of doorway → 200 cm
   Difference → 200 – 170 = 30 cm

   c) 1 000 ÷ 250 = (1 000 ÷ 10) ÷ (250 ÷ 10)
   = 100 ÷ 25
   = 4
   A learner's shoe will fit 4 times into the statue's shoe

TERM 4

Whole numbers

Learner's Book page 320

Count, order, compare and represent numbers and place value

Remind the learners that they have worked with numbers up to 7 digits, i.e. numbers into the millions, in Term 2. They have developed their understanding of place value with large numbers. This term they will count, order, compare and represent 9-digit numbers and work with place value of these numbers. Allow them to work together as a whole class and in groups in the first lesson.

Unit 1 Place value and powers of 10

MENTAL MATHS

Learner's Book page 320

Tell the learners that the beads in the strings are special. The different coloured beads have values of powers of 10. Tell them again which numbers are powers of 10. You can explain that $10 = 10^1$, i.e. 10 to the power 1; $10^2 = 100$, i.e. 10 to the power 2. The numbers in superscript are called exponents. They will learn more about this in Grade 7. Ask them to look at the values of the different colour beads. They should understand that, for example, the value of each bead in the green string is 10; in the string with black beads, the value of each bead is 1 million. The learners count the beads in the powers of 10 to find the total value of the beads in the strings. Let them write the values on the board in digits and in words, e.g. 35 000 000 = thirty-five million; 320 000 = three hundred and twenty thousand. Ask questions such as, 'How many 100s are there in 320 000?'

This exercise forces learners to apply effective counting strategies. They will discover that counting individual beads is a laborious task. You should check their counting strategies to see if they count individual beads, count in sub-groups or use multiplication instead of repeated addition. Suggest effective strategies, for example, if you observe them counting single beads, suggest that they count 2 beads, 5 beads or 10 beads at a time.

Ask the learners to study the numbers in the place value table in question 2. Let them read the numbers aloud and look at the example written in expanded notation. Let them write the rest of the numbers in expanded notation on the board. You can also let them do this in their groups and allow them to write with a koki pen on a big sheet of paper that they can display it on the wall after presenting their work to the class.

Ask them to write the numbers in words and then order the numbers in question 3 in ascending order. You can write these numbers on card strips and give each group a set to order for more practice.

In question 4 they write the numbers in descending order. Ask them which set of numbers they found easier to put in order. They should find that it is easier to work with the numbers in question 4 because there are fewer digits.

Remind the learners that they have learned to write numbers in the millions in Term 2. Ask them to explain why 16 768 921 is written as 16,8 million. They should note that the 7 became 8, and the 4 changed to 5 in 345 483 201 = 345,5 million. Use simpler numbers to explain how numbers are rounded off to one and two decimal places, e.g. 3 560 000 rounded off to one decimal place is 3,6 million; 3 567 000 rounded off to two decimal places is 3,57 million.

Ask the learners to study the prices of the rather expensive houses in question 5. Ask them who they think could afford to stay in such high-priced houses. Let them read the prices aloud, write the numbers as decimals rounded off to one decimal place and then order the decimals from the smallest to the largest number.

In question 6 you could ask the learners to use calculators but they can also do the exercise without calculators if you do not have these available. It is, however, important that you have some calculators in the classroom. The learners have to recognise the value of digits in large numbers. They should understand that they can only use the specified keys and they cannot change any numbers other than the ones indicated. To change the 0 to 1 in 603 455 699, for example, they have to add 10 000 000.

In question 7 the learners have to identify the numbers that are exactly halfway between those displayed on the number lines, for example 1 250 is exactly halfway between 1 000 and 1 500.

Ask the learners to complete the number sequences in question 8 by counting in different multiples and intervals applied to large numbers.

In question 9 the learners explore the clues on the cards to estimate how many schools there are in South Africa. They should conclude that 10 000 000 ÷ 500 = 20 000. The actual number of schools in South Africa should be closer to 30 000 but they will need to do some research to find this out. Ask them to do this by searching the Internet, and looking in newspapers and library books.

In question 10 they perform an investigation to find out if the statements are true. The learners will probably not be able to complete all these activities in one lesson. You should decide which they can do as group assignments, for example.

1. Here are some counting strategies that learners could possibly apply.
   a)
   - 10; 20; 30; ... ; 250 (counting in 10s)
   - 50; 100; 150; 200; 250 (counting groups of 5 tens)
   - 100; 200; 250 (counting groups of 10 tens)
   - 25 × 10 = 250 (counting the number of tens and multiplying by 10)

   b)
   - 100; 200; 300; ... ; 2 300 (counting single beads in 100s)
   - 200; 400; 800; ... ; 2 200; 2 300 (counting 2 beads in 200s)
   - 500; 1 000; 1 500; 2 000; 2 300 (counting 5 beads in 500s)
   - 1 000; 2 000; 2 300 (counting 10 beads in 1 000s)
   - 23 × 100 = 2 300 (counting the number of 100s and multiplying by 100)

   Below are some of the most effective ways of counting in 10 000s, 100 000s and 1 000 000s.

   c)
   - 5 000; 10 000; 15 000; 20 000; 25 000; 26 000
   - 10 000; 20 000; 26 000
   - 26 × 1 000 = 26 000

   d)
   - 50 000; 100 000; 150 000; 200 000; 250 000; 260 000
   - 100 000; 200 000; 260 000
   - 200 000; 260 000
   - 26 × 10 000 = 260 000

   e)
   - 500 000; 1 000 000; 1 500 000; 2 000; 000; 2 500 000; 3 000 000; 3 200 000
   - 1 000 000; 2 000 000; 3 000 000; 3 200 000
   - 32 × 100 000 = 3 200 000

   f)
   - 5 000 000; 10 000 000; 15 000 000; 20 000 000; 25 000 000; 30 000 000; 35 000 000
   - 10 000 000; 20 000 000; 30 000 000; 35 000 000
   - 35 × 1 000 000 = 35 000 000

2. **a)** Learners read numbers in million aloud.
   b)
   (i) 1 111 111 = 1 000 000 + 100 000 + 10 000 + 1 000 + 100 + 10 +1
   (ii) 23 004 500 = 23 000 000 + 4 000 + 500
   (iii) 222 134 542 = 222 000 000 + 100 000 + 30 000 + 4 000 + 500 + 40 + 2
   (iv) 100 100 100 = 100 000 000 + 100 000 + 100
   (v) 821 345 673 = 821 000 000 + 300 000 + 40 000 + 5 000 + 600 + 70 + 3
   (vi) 670 408 391 = 670 000 000 + 400 000 + 8 000 + 300 + 90 + 1
   (vii) 700 000 000 = 700 000 000
   (viii) 14 984 213 = 14 000 + 900 000 + 80 000 + 4 000 + 200 +10 + 3

c) (i) 1 111 111 = One million one hundred and eleven thousand one hundred and eleven
   (ii) 23 004 500 = Twenty-three million four thousand five hundred
   (iii) 222 134 542 = Two hundred and twenty-two million one hundred and thirty-four thousand five hundred and forty-two
   (iv) 100 100 100 = One hundred million one hundred thousand one hundred
   (v) 821 345 673 = Eight hundred and twenty-one million three hundred and forty-five thousand six hundred and seventy-three
   (vi) 670 408 391 = Six hundred and seventy million four hundred and eight thousand three hundred and ninety-one
   (vii) 700 000 000 = Seven hundred million
   (viii) 14 984 213 = Fourteen million nine hundred and eighty-four thousand two hundred and eighty-four thousand two hundred and thirteen

3. 9 000 000; 89 000 000; 98 000 000; 365 000 000; 653 000 000; 989 000 000

4. a) 768 million; 700 million; 90 million; 78 million; 8 million; 4 million
   b) The single digit number such as 8 million

5. a) Learners read the house prices into the millions out loud.
   b)

(i)	R2 567 599	R2,6 million
(ii)	R20 789 400	R20,8 million
(iii)	R7 695 500	R7,7 million
(iv)	R15 276 900	R15,3 million
(v)	R4 570 000	R28,7 million
(vi)	R28 659 775	R28,7 million

   c) 2,6 million; 4,6 million; 7,7 million; 15,3 million; 20,8 million; 28,7 million

6. a) Change the 0 to 1 → 603 455 699 → + 10 000 000 → 613 455 699
   b) Change the 2 to 4 → 132 600 900 → + 2 000 000 → 134 600 900
   c) Change the 6 to 1 → 405 675 000 → – 500 000 → 405 175 000
   d) Change the 7 to 2 → 713 000 000 → – 500 000 000 → 213 000 000
   e) Change the 5 to 9 → 400 546 801 → + 400 000 → 400 946 801

f) Change the 8 to 5 → 624 781 999 → – 50 000 → 624 751 999

7.

a)	1 000	**1 250**	1 500
b)	5 000	**7 500**	10 000
c)	50 000	**75 000**	100 000
d)	500 000	**750 000**	1 000 000
e)	200 000 000	**250 000 000**	300 000 000

8. **a)** 5 005; 5 000; 4 995; 4990
   b) 200 000 900; 200 000 875; 200 000 850; 200 000 825
   c) 999 999; 1 000 000; 1 000 001; 1 000 002
   d) 20 000; 20 020; 20 040; 20 060
   e) 750 950; 751 050; 751 150; 751 250

9. Between the ages of 7 and 12 there are about 5 million learners.

   Between the ages of 13 and 18 there are about 6 million learners.

   5 million + 6 million = 11 million

   11 million rounded off to the nearest million = 10 000 000

   10 000 000 ÷ 500 = 10 000 000 ÷ 100 ÷ 5
   = 100 000 ÷ 5
   = 20 000

   There are about 20 000 schools in South Africa.

10. The learners should realise that they have to convert, for example, seconds to minutes first, then minutes to hours, then hours to days, and so on. Allow them to use calculators to solve these problems. They can ignore the decimal digits and use even numbers.

    a) 1 000 000 seconds ÷ 60
    = 1 000 000 ÷ 60
    = 1 000 000 ÷ 10 ÷ 6
    = 100 000 ÷ 6
    = 16 666 remainder 4 (make this number approximately 16 666)
    =16 666 minutes

    16 666 minutes ÷ 60 is about 278 hours

    278 hours ÷ 24 is about 12 days. The statement is true.

    b) 1 000 000 hours ÷ 24 days are about 41 666 days
    41 666 days ÷ 365 are about 114 years.
    The statement is not true but the estimate is close.

    c) 1 000 000 days ÷ 365 are about 2 740 years.
    The statement is not true. The estimate is not very accurate.

    A closer estimate would be about 3 000 years.

Learner's Book page 323

Multiplication

The learners have done multiplication in Term 2. Remind them that they have worked with basic multiplication facts up to 12 × 12, multiplied multiples and powers of 10, multiplied 2-digit by 2-digit and 3-digit by 2-digit numbers and solved multiplication problems in different contexts. During the next five units they will build on the knowledge they have developed so far to solve multiplication problems. Tell them they will start with some problems involving ratio.

Unit 2 Multiplication and ratio

MENTAL MATHS

Learner's Book page 323

Let the learners explain what they remember about the concept of ratio from Grades 4 and 5. They should recall that ratio is about the comparison of (the relationship between) two different groups of objects or quantities. Ask them to explore and describe the relationships between the objects in the pictures.

In question 1 the learners name the ratios represented by the objects in the pictures. Ask them how the ratio would change if there are 9 instead of 3 children. They should realise that 3 : 4 is the same as 9 : 12.

In question 2 they apply the strategy to increase the numbers and see how the numbers in the ratios change while the value stays the same. Tell them they will learn more about this concept later this term.

1. **a)** books : child = 4 : 1
b) skirts : girl = 3 : 1
c) lollipops : boy = 5 : 1

2. **a)** The ratio of children to books → 1 : 4 = 9 : 36
9 × 4 = 36
12 × 4 = 48
There are 48 books. The ratio is now 12 : 48, which is the same as 1 : 4 and 9 : 36.
b) The ratio of girls to skirts → 1 : 3 = 4 : 12
3 × 4 = 12
3 × 20 = 60
There are 60 skirts. The ratio is now 20: 60, which is the same as 1 : 3 and 4 : 12.
c) The ratio of boys to lollipops → 1 : 4 = 5 : 20
4 × 5 = 20
4 × 30 = 120
There are 120 lollipops. The ratio is now 30 : 120, which is the same as 1 : 4 and 5 : 20.

Activity 2.1

Learner's Book page 325

Ask the learners to work individually to solve the problems. Learners with language barriers could work in pairs with more able learners. They have to give the ratio in each case and solve the related problems.

In question 1, they should realise that, for example, if there are 42 learners, there will be 42 ÷ 6 = 7 groups of desks, which means there will be 7 × 3 = 21 desks. Encourage the learners to make drawings if they struggle.

They use this strategy to solve questions 2 to 5.

In question 6 the learners increase the quantities as indicated. They realise that the ratio stays the same when the quantities are changed. They should discover that they could present the ratio as 1 : 3 or 7 : 21 or even 2 : 6 or 3 : 9, and so on. These ratios are all equivalent. You could relate the concept to fractions, i.e. the black beads are $\frac{1}{3}$ of the pink beads. Ask them what the ratios have in common. They should observe that 7 is $\frac{1}{3}$ of 21, 2 is $\frac{1}{3}$ of 6 and 3 is $\frac{1}{3}$ of 9. To get the number of black beads if there is any number of pink beads, they divide by 3.

1. **a)** desks : learners → 1 : 2 or 2 : 4 or 3 : 6
b) learners : desks → 2 : 1 or 4 : 2 or 6 : 3
c) 42 learners → ■ × 2 = 42 or 42 ÷ 2 = ■
21 × 2 = 42 or 42 ÷ 2 = 21
The ratio of desks : learners is now 21 : 42, which is equivalent to 1 : 2 or 2 : 4 or 3 : 6.
The ratio of learners : desks is now 42 : 21, which is equivalent to 2 : 1 or 4 : 2 or 6 : 3.

2. **a)** trees : apples → 1 : 12 or 2 : 24
b) apples : trees→ 12 : 1 or 24 : 2
c) 24 × 12 = 288
The ratio changes to 24 : 288, but the value is still 1 : 12 or 2 : 24.
24 ÷ 12 = 2 288 ÷ 12 = 24
or 24 ÷ 24 = 1 288 ÷ 24 = 12

3. **a)** children : dominoes → 1 : 7 or 2 : 14 or 4 : 28
b) 5 × 28 = 140 dominoes
5 × 4 = 20
20 : 140 = 1 : 7 = 2 : 14 = 4 : 28

4. **a)** books : shelves → 15 : 1 or 30 : 2
20 × 15 = 300 books
300 : 20 = 15 : 1 or 30 : 2 because:
20 ÷ 20 = 1 and 300 ÷ 20 = 15

5. **a)** The ratio of red paint : white paint → 1 : 4
12 ÷ 4 = 3 tins of red paint 3 : 12 is equivalent to 1 : 4
b) The ratio of white : red paint → 4: 1
5 × 4 = 20 tins of white paint 20 : 5 is equivalent to 4 : 1

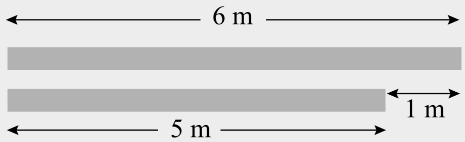
6. **a)** The ratio of black : pink beads
→ 1 : 3 or 2 : 6 or 3 : 9, and so on.
b) 9 × 3 = 27 pink beads
→ 9 : 27 = 1 : 3 = 2 : 6 = 3 : 9, and so on
c) 36 ÷ 3 = 12 black beads
→ 12 : 36 = 1 : 3 = 2 : 6 = 3 : 9, and so on.

Unit 3 Basic multiplication facts

MENTAL MATHS

Learner's Book page 327

Tell the learners that they will work with basic multiplication facts that require knowledge of the times tables, which they should know off by heart by now. Ask them to imagine the situation where they are stranded on an island and have to build a shelter. They only have two lengths of bamboo rods with which to measure, i.e. 5 m and 6 m lengths of bamboo. They need different lengths of rods from 1 m to 40 m lengths. The problem requires that they investigate how they could create different lengths of rods using the 5 m and the 6 m lengths as measurements. To create a 1 m rod, they put a 5 m and a 6 m together and cut off 1 m. They should realise that they cannot tie two 1 m rods together to get a 2 m rod. They need to use the 5 m and 6 m rods only, i.e. working with multiples of 5 and 6.



If they put together 2 × 5 m and 2 × 6 m they will have a 2 m length to cut off: (2 × 6) – (2 × 5) = 2 m.

To get a 3 m rod, they put together 3 × 5 m and 3 × 6 m, that is, (3 × 6) – (3 × 5) = 18 – 15 = 3 m. They carry on in this way to get the lengths from 4 m to 40 m. You can let them use paper strips to perform the first part of the activity practically.

(1 × 6) – (1 × 5) → 6 – 5 = 1 m
(2 × 6) – (2 × 5) → 12 – 10 = 2 m
(3 × 6) – (3 × 5) → 18 – 15 = 3 m
(2 × 5) – (1 × 6) → 10 – 6 = 4 m
(5 × 6) – (5 × 5) → 30 – 25 = 5 m
(6 × 6) – (6 × 5) → 36 – 30 = 6 m and so on, up to combinations of rods that measure 40 m.

Learners should realise that they could also use the pieces that are cut off to make combinations, for example, they could measure 7 m by combining the 3 m and 4 m rods.

Activity 3.1

Learner's Book page 327

Ask the learners to explore the pattern in the solutions when they multiply pairs of consecutive numbers. They should notice that the units are 2, 6, 2, 0, 0 ... for every five numbers. They check the tens to realise that the first five tens are 1, 2, 3, 4, 5 and then are followed by uneven numbers.

From 10 × 11 they explore the tens and hundreds and observe the pattern as 11; 13; 15; 18; 21; 24; 27; 30. From 18 × 19 they add 4 each time so that 20 × 21 will be 420 – determining this without calculating.

In question 2 they explore the relationship between the first two expressions and use doubling and halving to fill in the missing numbers so that it becomes 8 × 100, 4 × 200, 2 × 400 and 1 × 800, which all result in 800. So, 32 × 25 = 800 and 16 × 50 = 800, without calculating.

Tell the learners that the numbers in the circles in the diagram in question 3 are multiplied and the products are written in the squares between adjacent squares (numbers next to and below each other). Ask them to complete the diagram. They find the sum of the numbers on the squares.

Give them copies of the blank diagram in the resources section. They should explore different arrangements of the numbers 1 to 9 on the circles to get the biggest sum possible of the numbers in the squares.

1. **a)**

$1 \times 2 = 2$	$6 \times 7 = 42$
$2 \times 3 = 6$	$7 \times 8 = 56$
$3 \times 4 = 12$	$8 \times 9 = 72$
$4 \times 5 = 20$	$9 \times 10 = 90$
$5 \times 6 = 30$	$10 \times 11 = 110$

b) The products are rectangular numbers. The differences form the pattern of consecutive even numbers: 4; 6; 8; 10; 12; 14; 16; 18; 20.

c)

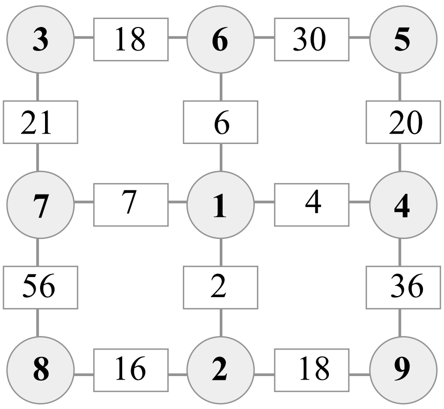
$11 \times 12 = 132$	$16 \times 17 = 272$
$12 \times 13 = 156$	$17 \times 18 = 306$
$13 \times 14 = 182$	$18 \times 19 = 342$
$14 \times 15 = 210$	$19 \times 20 = 380$
$15 \times 16 = 240$	$20 \times 11 = 220$

Ask the learners to describe the relationships between numbers in the two sets of products.

2. 32 × 25
= 16 × 50
= 8 × 100
= 4 × 200
= 2 × 400
= 1 × 800
32 × 25 = 800
16 × 50 = 800

Halving the multiplicand and doubling the multiplier in expressions result in the same product.

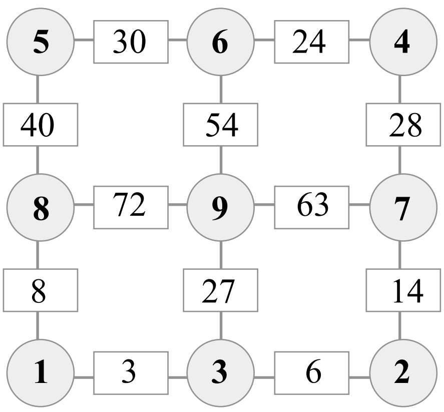
3. **a)**



b) Check which of your learners apply the associative and commutative properties, brackets and building up numbers to calculate smartly.

18 + **30** + 21 + **6 + 20 + 7 + 4** + 56 + **2 + 36 + 16 + 18**
= (36 + 4) + (18 + 2) + (30 + 20) + (21 + 9 + 9)
+ (16 + 4 + 2) + (56 + 4 + 3)
= 40 + 20 + 50 + 39 + 22 + 63
= 110 + (39 + 1 + 21) + 63
= 110 + 61 + 63
= 110 + 120 + 4
= 234

c) Allow the learners to work in groups to perform the investigation. After arranging the numbers in different positions, they should eventually realise that the bigger numbers should be written in the circles in the centre column of the diagram to get the biggest sum of the products on the squares. The biggest sum they can get is 396.



Unit 4 Multiplication rules

MENTAL MATHS

Learner's Book page 329

Remind the learners that they have worked with factors of numbers during the year. Ask them to explore the learners' reasoning to find three factors of 60 each time. Encourage them to work systematically. Ask them how they know when a number is a factor of a product. They should realise that factors come in pairs.

Let them explore the factor tree for 20 and discuss why you do not have to find factor pairs beyond 2, 3 and 5. They should realise that these are prime numbers – the factors will always be 1 and the number itself.

1. Check where learners apply the commutative property, for example $2 \times 2 \times 15 = 60$ and $2 \times 15 \times 2 = 60$. Tell them that the factors in both number sentences are correct, but they are the same factors. They only need to record one of the number sentences.

$1 \times 1 \times 60 = 60$	$1 \times 6 \times 10 = 60$
$1 \times 2 \times 30 = 60$	$2 \times 2 \times 15 = 60$
$1 \times 3 \times 20 = 60$	$2 \times 3 \times 10 = 60$
$1 \times 4 \times 15 = 60$	$2 \times 5 \times 6 = 60$
$1 \times 5 \times 12 = 60$	$3 \times 4 \times 5 = 60$

2. **a)** 4 and 5 is a factor pair of 20 because $4 \times 5 = 20$.

2 and 10 is a factor pair of 20 because $2 \times 10 = 20$.

$2 \times 2 = 4$ so 2 and 2 is a factor pair of 4.

$2 \times 5 = 10$ so 2 and 5 is a factor pair of 10.

There are no branches after the numbers 2 and 5.

b) There are no other factor pairs for 2 and 5 other than 1×2 and 1×5.
2 and 5 are prime numbers.
The tree stops branching out when you reach factors that are prime numbers.

Did you know?

Learner's Book page 329

Work with the learners through the information about the significance of the number 6 to extend their general knowledge of mathematics. They will learn about the based 60 number system with its origin in the ancient Middle East, degrees of angles measured in multiples of 60 and factors of 60. They also have to find a number between 100 and 130 that has more factors than 60. Use a map or globe to show the learners where the ancient Sumerians and Babylonians lived in the Middle East. They were some of the peoples who made considerable contributions to the development of mathematics.

Activity 4.1

Learner's Book page 330

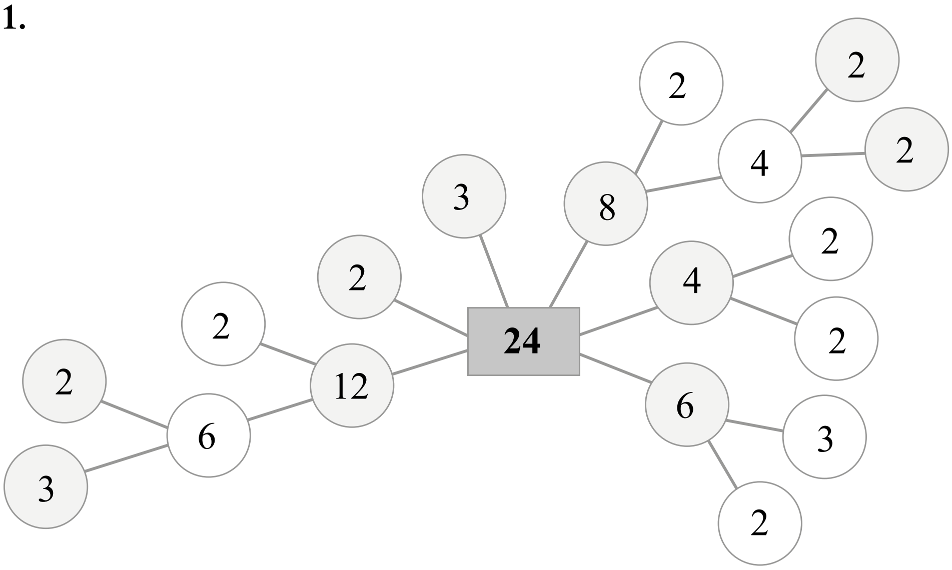
The work in this unit mainly relates to number sentences. Let the learners copy and complete the factor tree for 24. They then create a factor tree for 40.

In question 3 the learners can work with or without calculators to create equivalent number sentences for 28 × 37 = ■. They use different combinations of 28 to create and solve five equivalent number sentences.

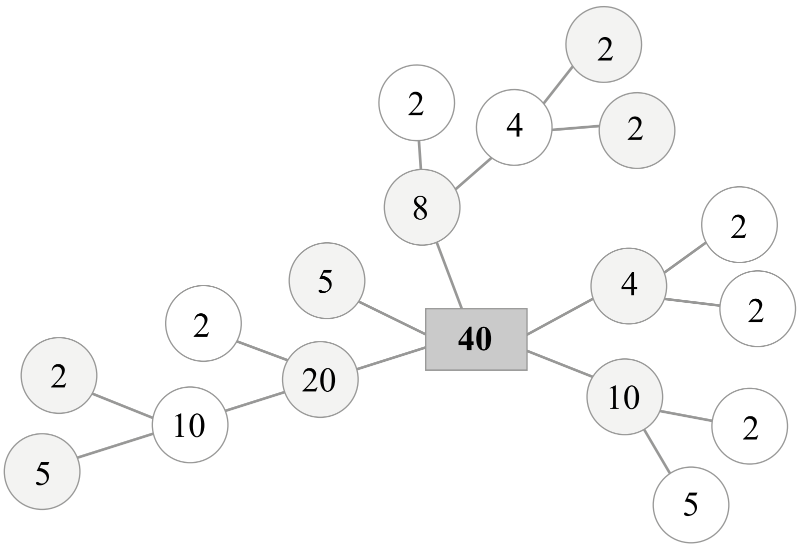
In question 4 the learners work with the factors of square numbers. They should solve the equations by looking at the relationships. They will find that, for example, 15 × 16 = 240 is 15 more than 15 × 15 = 225.

In question 5 they explore a rule for finding the square numbers when numbers ending in 5 are squared. Ask them to use the rule to find the square numbers of the factors ending in 5.

1.



2.



3. This exercise requires of learners to apply the distributive property. You should expect various solutions. Ask the learners to share their solutions with the class. They should realise, however, that working out the problems on sequential calculators might give inaccurate solutions. Ask them how they would do the calculations to get the correct solutions, for example,

performing operations in this order:
$(20 \times 37) + (2 \times 4 \times 37) = 109\ 816$
performing operations in the correct order: $740 + 296 = 1\ 036$

a) 28×37 – some possible answers
$(2 \times 37) + (26 \times 37)$
$(16 \times 37) + (12 \times 37)$
$(14 \times 37) + (14 \times 37)$
$(22 \times 37) + (6 \times 37)$
$(4 \times 37) + (24 \times 37)$

b) $(2 \times 37) + (26 \times 37) = 74 + 962 = 1\ 036$
$(16 \times 37) + (12 \times 37) = 592 + 444 = 1\ 036$
$(14 \times 37) + (14 \times 37) = 518 + 518 = 1\ 036$
$(22 \times 37) + (6 \times 37) = 814 + 222 = 1\ 036$
$(4 \times 37) + (24 \times 37) = 148 + 888 = 1\ 036$

4. **a)** $15 \times 15 = 225$
$15 \times 16 = 240$

b) $25 \times 25 = 625$
$25 \times 26 = 650$

c) $35 \times 35 = 1\ 225$
$35 \times 36 = 1\ 260$

d) $45 \times 45 = 2\ 025$
$45 \times 46 = 2\ 070$

5. **a)** $(5 + 1) \times 5 = 30$ $5 \times 5 = 25$ $55 \times 55 = 3\ 025$
b) $(6 \times 1) \times 6 = 42$ $5 \times 5 = 25$ $65 \times 65 = 4\ 225$
c) $(7 \times 1) \times 7 = 56$ $5 \times 5 = 25$ $75 \times 75 = 5\ 625$
d) $(8 + 1) \times 8 = 72$ $5 \times 5 = 25$ $85 \times 85 = 7\ 225$
e) $(9 + 1) \times 9 = 90$ $5 \times 5 = 25$ $95 \times 95 = 9\ 025$

Unit 5 Vertical multiplication

MENTAL MATHS

Learner's Book page 331

Tell the learners they will solve multiplication problems by applying the vertical column method. Give them a copy of the digit card template in the resources section to cut out. Let them copy the digits onto the cards so that they can manipulate them easily. They explore different arrangements of the digits 2, 3, 4 and 5 to get the biggest and the smallest products in questions 1 and 2.

In question 3 they work together to find the missing digits in the 4-digit by 2-digit multiplication example using the vertical column strategy.

1.
$$\begin{array}{r} 52 \\ \times \quad 43 \\ \hline 156 \\ 2\,080 \\ \hline 2\,236 \\ \hline \end{array}$$

2.
$$\begin{array}{r} 24 \\ \times \quad 35 \\ \hline 120 \\ 720 \\ \hline 840 \\ \hline \end{array}$$

3.
$$\begin{array}{r} 2\,346 \\ \times \quad 53 \\ \hline 7\,038 \\ 117\,300 \\ \hline 124\,338 \\ \hline \end{array}$$

Activity 5.1

Learner's Book page 331

Ask the learners to make cards for the digits 1, 2, 3 and 4 to explore the smallest and largest product in a 2- by 2-digit multiplication example.

In question 2 they arrange the different digit sets to create the largest products using 2-digit by 2-digit and 3-digit by 1-digit multiplication.

In question 3 the learners use 5 digits to explore the arrangements of the digits to create the biggest products in 3-digit by 2-digit multiplication. These exercises should assist learners in developing an understanding of the processes involved in vertical column multiplication.

Ask the learners to fill in the missing digits in the calculations in question 4.

1. 2- by 2-digit or 3- by 1-digit multiplication to get the smallest and largest products.

a) Smallest product
$$\begin{array}{r} 13 \\ \times \quad 24 \\ \hline 52 \\ 260 \\ \hline 312 \\ \hline \end{array}$$

b) Largest product
$$\begin{array}{r} 41 \\ \times \quad 32 \\ \hline 82 \\ 1\,230 \\ \hline 1\,312 \\ \hline \end{array}$$

2. 2- by 2-digit or 3- by 1-digit multiplication to get the largest products.

a)
$$\begin{array}{r} 72 \\ \times \quad 54 \\ \hline 288 \\ 3\,600 \\ \hline 3\,888 \\ \hline \end{array}$$

b)
$$\begin{array}{r} 93 \\ \times \quad 84 \\ \hline 372 \\ 7\,440 \\ \hline 8\,812 \\ \hline \end{array}$$

c)
$$\begin{array}{r} 421 \\ \times \quad 6 \\ \hline 2\,526 \\ \hline \end{array}$$

3. 3- by 2-digit multiplication to get the smallest products.

a)
$$\begin{array}{r} 356 \\ \times \quad 24 \\ \hline 1\,424 \\ 7\,120 \\ \hline 8\,544 \\ \hline \end{array}$$

b)
$$\begin{array}{r} 356 \\ \times \quad 47 \\ \hline 2\,492 \\ 14\,240 \\ \hline 16\,732 \\ \hline \end{array}$$

c)
$$\begin{array}{r} 689 \\ \times \quad 47 \\ \hline 4\,823 \\ 27\,560 \\ \hline 32\,383 \\ \hline \end{array}$$

4. 3- by 2-digit, 3- by 3-digit and 4- by 3-digit multiplication.

a)
$$\begin{array}{r} 287 \\ \times \quad 43 \\ \hline \mathbf{8}60 \\ 1\,148 \\ \hline 12\,341 \\ \hline \end{array}$$

b)
$$\begin{array}{r} 342 \\ \times \quad 231 \\ \hline 3\mathbf{42} \\ 1026 \\ 68\mathbf{4} \\ \hline 7\mathbf{9}\,002 \\ \hline \end{array}$$

c)
$$\begin{array}{r} 4\,560 \\ \times \quad 324 \\ \hline 18\,240 \\ 9\,120 \\ 13\,680 \\ \hline 1\,477440 \\ \hline \end{array}$$

Unit 6 Solving word problems

MENTAL MATHS

Learner's Book page 332

Let the learners work together to solve the problems in context. They should use vertical column multiplication to calculate the solutions. The problems involve small numbers so that the focus is not on advanced calculation skills but rather on the understanding of the contexts of the problems. In the main lesson they will work with larger numbers. Ask the learners to write number sentences to show how they will solve the problems.

1. $24 \times 7 = \blacksquare$

$$\begin{array}{r} 24 \\ \times \quad 7 \\ \hline 168 \\ \hline \end{array}$$ books

2. $58 \times 8 = \blacksquare$

$$\begin{array}{r} 58 \\ \times \quad 8 \\ \hline 464 \\ \hline \end{array}$$ people

3. $(14 \times 12) + (34 \times 14) = \blacksquare$

$$\begin{array}{rl} 14 & \\ \times \quad 12 & \\ \hline 28 & (14 \times 2) \\ 140 & (14 \times 10) \\ \hline 168 & \text{seats} \\ \hline \end{array}$$

$$\begin{array}{rl} 34 & \\ \times \quad 14 & \\ \hline 136 & (34 \times 4) \\ 340 & (34 \times 10) \\ \hline 476 & \text{seats} \\ \hline \end{array}$$

$$\begin{array}{r} 168 \\ +476 \\ \hline 644 \\ \hline \end{array}$$ people in the 2 theatres

4. $(6 \times 8) \times 6 = \blacksquare$

$$\begin{array}{r} 48 \\ \times \quad 6 \\ \hline 288 \\ \hline \end{array}$$ pieces of fudge

5. **a)**

Monday:	3 h
Tuesday:	2 h 45 min. ($2\frac{3}{4}$ h)
Wednesday:	4 h 15 min. ($4\frac{1}{4}$ h)
Thursday:	2 h 30 min. ($2\frac{1}{2}$ h)
Friday:	3 h 30 min. ($3\frac{1}{2}$ h)
Saturday:	4 h

Justin works 20 hours per week.

b) **(i)** $(5 \times R75{,}80) + \left(\frac{3}{4} \text{ of } R75{,}80\right) = \blacksquare$

$$\begin{array}{r} 7\,580 \\ \times \quad 5 \\ \hline 37\,900 \end{array} = R379{,}00$$

$(7\,580 \div 4) \times 3 = 1\,895 \times 3$

$$\begin{array}{r} 1\,895 \\ \times \quad 3 \\ \hline 5\,685 \end{array} = R56{,}85$$

$$\begin{array}{r} R379{,}00 \\ + \; R56{,}85 \\ \hline R435{,}85 \end{array}$$

is the amount he earns for working from Monday and Tuesday.

(ii) Hours worked from Monday to Thursday

$= 3 + 2\frac{3}{4} + 4\frac{1}{4} + 2\frac{1}{2}$

$= 12\frac{1}{2}$ hours

$(12 \times R75{,}80) + \left(\frac{1}{2} \text{ of } R75{,}80\right) = \blacksquare$

$$\begin{array}{rl} 7\,580 & \\ \times \quad 12 & \\ \hline 15\,160 & (7\,580 \times 2) \\ 75\,80 & (7\,580 \times 1) \\ \hline 90\,960 & = R909{,}60 \end{array}$$

$\frac{1}{2}$ of R75,80 = R37,90

$$\begin{array}{r} R909.60 \\ + \; R37{,}90 \\ \hline R947{,}50 \end{array}$$

is the amount he earns for working Monday to Thursday.

(iii) $R75{,}80 \times 20 = \blacksquare$

$(R75{,}80 \times 2) \times 10$

$$\begin{array}{r} 7\,580 \\ \times \quad 2 \\ \hline 15\,160 \end{array}$$

R151,60 × 10 = R1 516,00

Justin earns R1 516,00 for 6 days' work.

Activity 6.1

Learner's Book page 333

Tell the learners that the problems they will solve in this activity are based on the type of problems they have solved in the Mental Maths activity above. The numbers they work with are bigger and some problems involve more than one operation. They have to write number sentences before they solve the problems.

1. Number of books: 224 × 85 = 19 040
2. People watching the match:
(126 × 55) + (115 × 78) = 6 930 + 8 970
= 18 600
3. **a)** Pieces of fudge: (56 × 56) × 132 = ■
3 136 × 132 = 413 952
b) Pieces to fill bags: 124 × 12 = 1 488
c) Money raised: R18 × 124 = R2 232
d) Money spent on ingredients: R8,50 × 124 = R1 054
Profit made: R2 232 – R1 054 = R1 178
4. Monday 3 h
Tuesday 2 h 15 min. ($2\frac{1}{4}$ h)
Wednesday 2 h 30 min. ($4\frac{1}{2}$ h)
Thursday 3 h 30 min. ($3\frac{1}{2}$ h)
Friday 3 h 30 min. ($3\frac{1}{2}$ h)
Saturday 4 h
Total hours worked during a week:
$3 + 2\frac{1}{4} + 4\frac{1}{2} + 3\frac{1}{2} + 3\frac{1}{2} + 4 = 16\frac{3}{4}$ hours
a) (12 × R39,50) + $\left(\frac{3}{4}\right.$ of R39,50$\left.\right)$ = R474 + R29,60
= R503,60
Double pay for Saturday: R39,50 × 4 = R158
R158 × 2 = R316
Total earnings per week: R503,60 + R316 = R819,60
b) Earnings for two weeks: R819,60 × 2 = R1 639,20
c) Ann's salary: R1 365,75 × 2 = R2 731,50

Assessment 4.1: Multiplication of whole numbers

The learners will apply prior knowledge they have developed in the preceding 5 units in solving the problems.

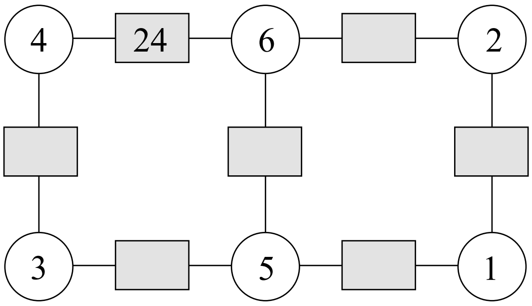
They display knowledge of basic multiplication facts by completing the products of the numbers on the circles. They use the numbers that are arranged to give the biggest sum and arrange the numbers in the blank diagram to give the smallest sum of the products on the squares.

In question 2 they solve a ratio problem by deciding whether the statements are true or false.

In question 3 they complete the factor tree for 16.

They work with the distributive property in question 4 and use a short cut to multiply factors of square numbers that end in 5. They apply the vertical column multiplication method and solve problems in context using methods that they prefer.

1. The products of the numbers in the circles are written in squares in this diagram.

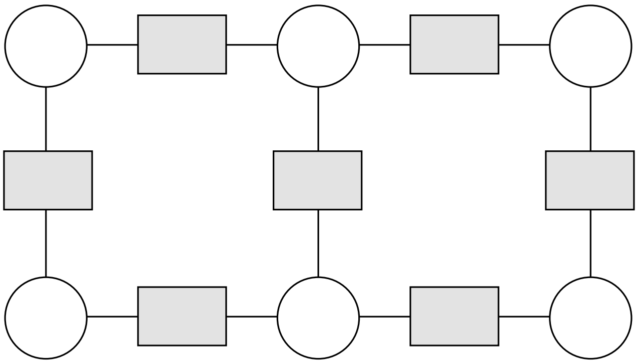


a) Fill in the missing products in the squares.

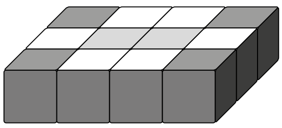
b) The sum of the numbers in the squares is 100. Check if this is true.

The numbers in the circles are arranged to give the biggest sum of the numbers in the squares, i.e. 100.

c) Now arrange the above numbers to get the smallest sum of the numbers in the squares.



2. Study the cube construction.



Write true or false for each statement below.

a) The ratio of grey cubes to black cubes is 2 : 4.

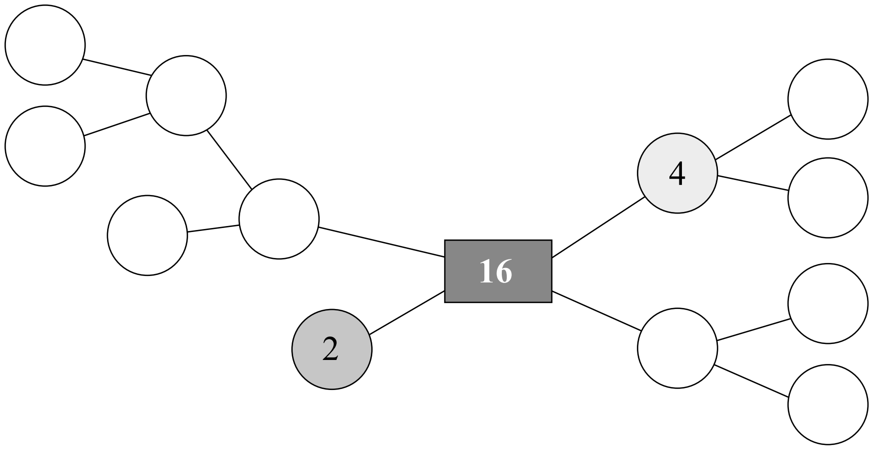
b) The number of black cubes is twice the number of grey cubes.

c) The number of black cubes is half the number of white cubes.

d) The ratio of white cubes to black cubes is 4 : 8.

e) The ratio of grey cubes to white cubes is 2 : 6.

3. This is a factor tree for 16. Complete the tree.



4. Solve the following.

a) 26 × 14 = (20 × ■) + (■ × 14)
= ■ + ■
= ■

b) 234 × 24 = (■ × 20) + (■ × 20) + (■ × 20) + (■ × 4)
+ (■ × 4) + (■ × 4)
= ■ + ■ + ■ + ■ + ■ + ■
= ■

5. Use a short cut to solve the following.

a) 25 × 25 = ■ **b)** 95 × 95 = ■

6. Calculate.

a) $\begin{array}{r} 47 \\ \times\ \underline{26} \end{array}$ b) $\begin{array}{r} 142 \\ \times\ \underline{\ \ 8} \end{array}$ c) $\begin{array}{r} 316 \\ \times\ \underline{23} \end{array}$

d) $\begin{array}{r} 2\,034 \\ \times\ \underline{28} \end{array}$ e) $\begin{array}{r} 1\,462 \\ \times\ \underline{214} \end{array}$

7. Use your own methods to solve the following problems.

a) There are 36 eggs in a tray. How many eggs are there in 9 trays?

b) There are 12 rows in a box of biscuits and 15 biscuits in each row. How many biscuits are there in the box?

c) A gardener planted 8 rows with 15 mealie seeds per row. She also planted 7 rows with 18 green bean seeds per row. How many seeds did she plant altogether?

d) Lizo is a part-time waiter in a coffee shop. He earns R98,80 for 2 hours' work.

(i) What does he earn if he works 4 hours?

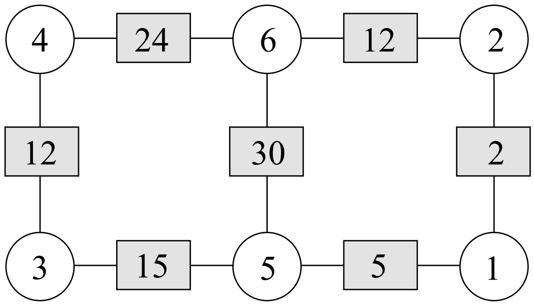
(ii) What does he earn for 5 hours' work?

e) Nomonde studies to become a mechanic. She works in a workshop on a part-time basis. She earns R1 286 every two weeks.

(i) How much does she earn in 6 weeks?

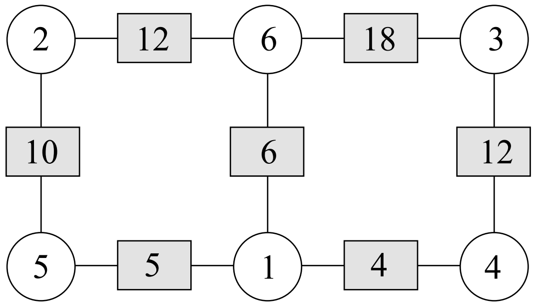
(ii) How much does she earn in 6 months?

1. a)



b) (15 + 5) + (12 + 12 + 24) + 30 + 2
= 20 + 48 + 2 + 30
= 20 + 50 + 30
= 100
The statement is true.

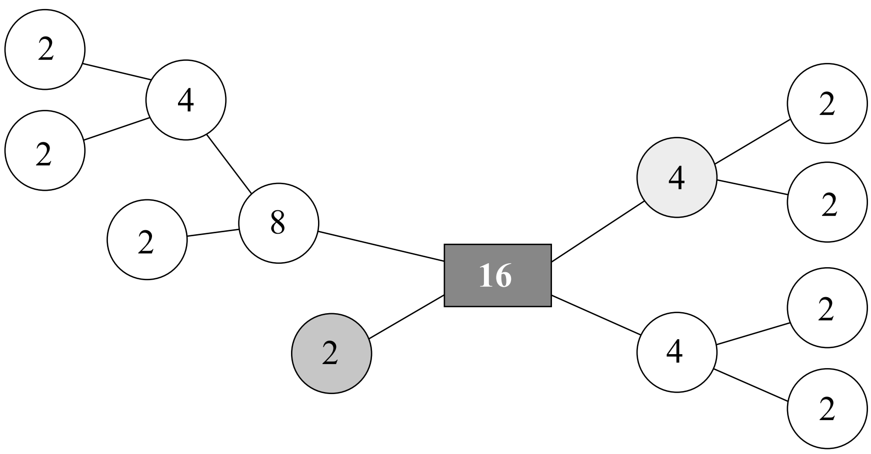
c)



The smallest number is 67.

2. a) True. Black cubes → 4; Grey cubes → 2; Ratio → 2 : 4
b) True. 4 is twice as many as 2.
c) False. 4 is not the half of 6.
d) False. The ratio of white to black cubes is 6 : 4.
e) True. Grey cubes → 2; White cubes → 6. Ratio → 2 : 6

3.



4. **a)** $26 \times 14 = (20 \times 14) + (6 \times 14)$
$= 280 + 84$
$= 364$

b) 234×24
$= (200 \times 20) + (30 \times 20) + (4 \times 20) + (200 \times 4) + (30 \times 4) + (4 \times 4)$
$= 4\,000 + 600 + 80 + 800 + 120 + 16$
$= 4\,600 + 400 + 400 + 200 + 16$
$= 5\,616$

5. **a)** $25 \times 25 = (25 \times 100) \div 4$
$= 2\,500 \div 4$
$= 625$

b) $95 \times 95 = (100 \times 95) - (95 \times 5)$
$= 9\,500 - (95 \times 10 \div 2)$
$= 9\,500 - (950 \div 2)$
$= 9\,500 - 475$
$= 9\,025$

6. **a)** $47 \times 26 = 1\,222$ **b)** $142 \times 8 = 1\,136$
c) $316 \times 23 = 7\,268$ **d)** $2\,034 \times 28 = 56\,952$
e) $1\,462 \times 214 = 312\,868$

7. **a)** $36 \times 9 = (30 \times 9) + (6 \times 9)$
$= 270 + 54$
$= 270 + 30 + 24$
$= 324$ eggs

b) $15 \times 12 = (15 \times 10) + (15 \times 2)$
$= 150 + 30$
$= 180$ biscuits in the box

c) $(15 \times 8) + (18 \times 7) = (10 \times 8) + (5 \times 8) + (10 \times 7) + (8 \times 7)$
$= 80 + 40 + 70 + 56$
$= 150 + 50 + 40 + 6$
$= 246$ seeds altogether

d) **(i)** R98,80 × 2 = (90 × 2) + (8 × 2) + (80 × 2)
= 180 + 16 + 160
= R196 + R1,60
= R197,60

Lizo earns R197,60 for 4 hours' work.

(ii) 1 hour's work: R98,80 ÷ 2 = R49,40
5 hours' work: R197,60 + R49,40
= R197 + R3 + R46 + R1
= R247

e) 2 weeks' work: R1 286
4 weeks' work: R1 286 × 2 = R2 572
6 weeks' work: R1 286 + R2 572 = R3 858
6 months' work: R2 572 × 6 = R15 432

Common fractions

Learner's Book page 335

Remind the learners that they have counted, ordered, compared and represented fractions in Term 2. They have also worked with equivalent fractions, done equal sharing with remainders that have to be shared, found fractions of whole numbers and done fraction addition and subtraction in different contexts. They have learned about different kinds of common fractions.

Ask them to name fractions such as $\frac{1}{4}$; $3\frac{1}{2}$ and $\frac{12}{10}$.

Tell the learners that they have often worked with $\frac{1}{10}$s and $\frac{1}{100}$s when they worked with decimal fractions and percentages in Term 2 and Term 3. During the next five units they will build on what they have already learned to develop their understanding of common fractions. They will start with some fun fraction activities first. Allow them to work in pairs, in groups and as a whole class in the first unit.

Unit 7 Fun with fractions

MENTAL MATHS

Learner's Book page 335

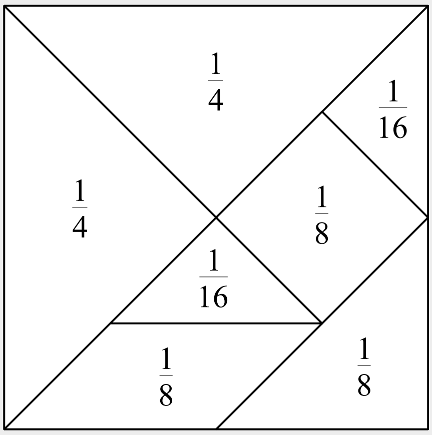
Let the learners play *Fraction Dominoes* in teams of four to recap naming and representing fractions and *Fraction Snap* in pairs to revise addition of proper and mixed fractions. Refer to the resources section for templates of the cards and instructions on how to play the games, if necessary.

In question 3 the learners copy the fraction magic square. They have worked with magic squares before and should know that the sum of the numbers in the rows, columns and diagonals should be the same. The magic number in this square is 9. They add whole numbers, proper and mixed fractions.

Ask the learners to solve the fraction puzzles in question 4. They should realise, for example, that if $\frac{3}{4} = 15$ then $\frac{1}{4}$ must be 5, so the age is 20 years.

In question 5 they solve the *I think of a number* puzzles. If $\frac{1}{5}$ of a number is 12 then the number should be $5 \times 12 = 60$, for example.

In question 6, the learners should realise that all the fractions should add up to 1 (1 whole). Although they have not worked with sixteenths before, they use the shapes to develop their understanding of these fractions. They should notice the relationship between quarters, eighths and sixteenths.



They should also notice that $\frac{1}{4} + \frac{1}{4} = \frac{1}{2}$ of the tangram so that the eighths and sixteenths should have a sum of $\frac{1}{2}$. They use the sizes of the shapes to develop the understanding that $\frac{1}{16} + \frac{1}{16} = \frac{2}{16} = \frac{1}{8}$, i.e. extending their knowledge of equivalent fractions. Give them a copy of the template in the resources section to cut out the shapes and discover, for example, that $\frac{2}{16}$ is the same size as $\frac{1}{8}$ and $\frac{1}{4} = \frac{2}{8}$. They also enhance understanding of fraction addition.

1. The learners play *Fraction Dominoes* in teams of 4.
2. They play *Fraction Snap* in pairs.
3. The magic sum = 9

$2\frac{1}{4}$	$3\frac{2}{4}$	$3\frac{1}{4}$
4	3	2
$2\frac{3}{4}$	$2\frac{2}{4}$	$3\frac{3}{4}$

4. **a)** If $\frac{3}{4} = 15$, then $\frac{1}{4} = 5$, i.e. $15 \div 3$

   Age: $\left(\frac{3}{4} \text{ of } 20\right) + \left(\frac{1}{4} \text{ of } 20\right) = 15 + 5$
   $= 20$ years

   b) If $\frac{2}{10} = 14$, then $\frac{1}{10} = 7$, i.e. $14 \div 2$

   $\frac{1}{10} = 7$ $\frac{6}{10} = 42$

   $\frac{2}{10} = 14$ $\frac{7}{10} = 49$

   $\frac{3}{10} = 21$ $\frac{8}{10} = 56$

   $\frac{4}{10} = 28$ $\frac{9}{10} = 63$

   $\frac{5}{10} = 35$ $\frac{10}{10} = 70$

   Age: $10 \times 7 = 70$ years

c) If $\frac{1}{5} = 10$, then $\frac{4}{5} = 40$

Age: $\left(\frac{1}{5} \text{ of } 50\right) + \left(\frac{4}{5} \text{ of } 50\right) = 10 + 40$

$= 50$ years

d) If $\frac{5}{6} = 30$, then $\frac{1}{6} = 6$, i.e. $30 \div 5 = 6$

Age: $\left(\frac{5}{6} \text{ of } 36\right) + \left(\frac{1}{6} \text{ of } 36\right) = 30 + 6$

$= 36$ years

e) If $\frac{2}{3} = 30$, then $\frac{1}{3} = 15$, i.e. $30 \div 2$

Age: $\left(\frac{2}{3} \text{ of } 45\right) + \left(\frac{1}{3} \text{ of } 45\right) = 30 + 15$

$= 45$ years

f) If $\frac{3}{8} = 24$, then $\frac{1}{8} = 8$, i.e. $24 \div 3 = 8$

$\frac{1}{8} = 8$ $\frac{5}{8} = 40$

$\frac{2}{8} = 16$ $\frac{6}{8} = 48$

$\frac{3}{8} = 24$ $\frac{7}{8} = 56$

$\frac{4}{8} = 32$ $\frac{8}{8} = 64$

Age: $\left(\frac{3}{8} \text{ of } 64\right) + \left(\frac{5}{8} \text{ of } 64\right) = 24 + 40$

$= 64$ years

or $8 \times 8 = 64$

5. **a)** If $\frac{1}{5} = 12$, then $\frac{5}{5} = 12 \times 5$.

The number is 60.

b) If $\frac{1}{3} = 150$, then $\frac{3}{3} = 150 \times 3$.

The number is 450.

c) If $\frac{3}{4} = 24$, then $\frac{1}{4} = 8$, i.e. $24 \div 3$.

The number is $24 + 8 = 32$.

d) If $\frac{1}{8} = 12$, then $\frac{8}{8} = 12 \times 8$.

The number is 96.

e) If $\frac{3}{10} = 27$, then $\frac{1}{10} = 9$, i.e. $27 \div 3$.

The number is $9 \times 10 = 90$.

f) If $\frac{5}{12} = 60$, then $\frac{1}{12} = 12$, i.e. $60 \div 5$.

The number is $12 \times 12 = 144$.

6. $\frac{1}{4} + \frac{1}{4} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{16} + \frac{1}{16} = \frac{2}{4} + \frac{1}{4} + \frac{2}{16} + \frac{1}{8}$

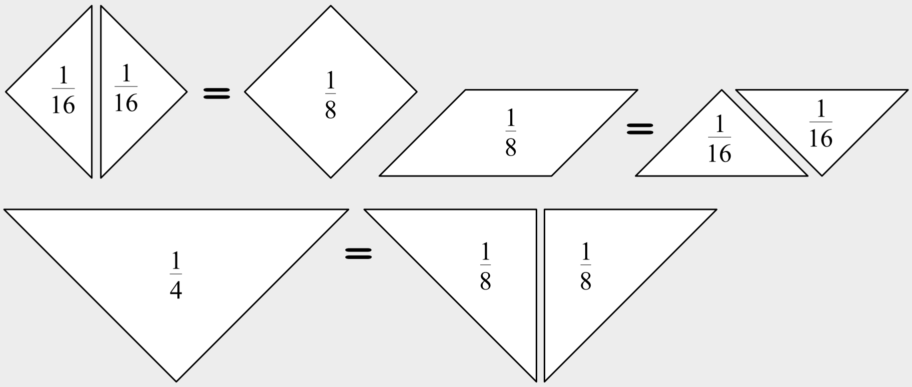
$= \frac{3}{4} + \frac{1}{8} + \frac{1}{8}$

$= \frac{3}{4} + \frac{2}{8}$

$= \frac{3}{4} + \frac{1}{4}$

$= 1$

or $\frac{4}{16} + \frac{4}{16} + \frac{2}{16} + \frac{2}{16} + \frac{2}{16} + \frac{2}{16} = \frac{16}{16} = 1$ whole



Unit 8 Fractions of wholes

Activity 8.1

Learner's Book page 336

You could ask the learners to work in pairs to solve these problems. They draw the fraction or the whole according to the information they work with. If 6 bananas are $\frac{1}{5}$ then the whole box should contain $6 \times 5 = 30$ bananas, for example.

In question 2 they should realise, for example, that if 16 coins represent $\frac{3}{4}$ then $\frac{1}{4} = 4$ coins, so there are 20 coins on the table.

1. **a)** If $\frac{1}{5} = 6$, then $\frac{5}{5} = 6 \times 5 = 30$ bananas.
   b) If $\frac{3}{3} = 15$, then $\frac{1}{3} = 5$ and $\frac{2}{3} = 10$ apples.
   c) If $\frac{8}{8} = 24$, then $\frac{1}{8} = 3$ and $\frac{5}{8} = 15$ pies.
   d) If $\frac{1}{4} = 12$, then $\frac{4}{4} = 48$ eggs or 4 dozen, which is equal to 8 half dozens.
   e) If $\frac{6}{6} = 24$, then $\frac{1}{6} = 4$ and $\frac{5}{6} = 20$ books.
   f) If $\frac{1}{8} = 4$, then $\frac{5}{8} = 20$ oranges.

2. **a)** If $\frac{1}{4} = 12$, then $\frac{3}{4} = 36$; $36 + 12 = 48$ coins are on the table.
   b) $\frac{5}{6}$ of $48 = (48 \div 6) \times 5$
   $= 8 \times 5$
   $= 40$ coins are heads up

3. If there are 12 coins: $\frac{1}{2}$ of $12 = 6$ coins are heads up.
   She turns over 2 coins: $6 - 2 = 4$, so $\frac{1}{3}$ of $12 = 4$

Unit 9 Representations of fractions

MENTAL MATHS

Learner's Book page 337

The learners work with fraction representation in flags. They identify the shaded fraction parts. Ask them to give the equivalent fractions. You could also let the learners copy the rectangles and shade a variety of different fraction parts for practice.

1. **a)** $\frac{4}{10} = \frac{2}{5}$ **b)** $\frac{3}{9} = \frac{1}{3}$ **c)** $\frac{4}{8} = \frac{1}{2}$ **d)** $\frac{4}{12} = \frac{1}{3}$ **e)** $\frac{1}{4}$

Activity 9.1

Learner's Book page 338

The learners continue to identify the shaded fraction parts in the shapes. It requires investigation so you could ask the learners to work in groups to solve the problems.

In question 2 they shade the fraction parts of the wholes consisting of single units. They apply knowledge of the relationship between fractions, decimals and percentages.

You could give the learners copies of the shapes in the template in the resources section. Enlarge the copies and let them display their work in the class.

1. **a)** A: $\frac{1}{3}$ B: $\frac{1}{3}$ C: $\frac{1}{6}$ D: $\frac{1}{6}$

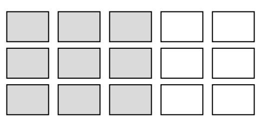
b) A: $\frac{1}{6}$ B: $\frac{1}{12}$ C: $\frac{1}{12}$ D: $\frac{1}{3}$ E: $\frac{1}{6}$ F: $\frac{1}{6}$

c) This exercise could be challenging. The learners will work with fractions up to sixty-fourths. They worked with sixteenths in Unit 7. They should first recognise that H is $\frac{1}{4}$ of the whole shape. A, B and C should make up $\frac{1}{4}$, which is $\frac{2}{8}$. B is half of $\frac{1}{4}$, which is $\frac{1}{8}$. Each of A and C is half of $\frac{1}{8}$, which is $\frac{1}{16}$, and so on. They should discover that half of $\frac{1}{16}$ is $\frac{1}{32}$ and half of $\frac{1}{32}$ is $\frac{1}{64}$.

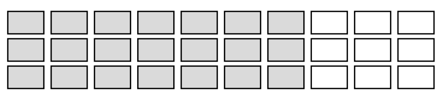
A: $\frac{1}{16}$	B: $\frac{1}{8}$	C: $\frac{1}{16}$
D: $\frac{1}{24}$	E: $\frac{1}{24}$	F: $\frac{1}{12}$
G: $\frac{1}{12}$	H: $\frac{1}{4}$	I: $\frac{1}{32}$
J: $\frac{1}{16}$	K: $\frac{1}{32}$	L: $\frac{1}{16}$
M: $\frac{1}{32}$	N: $\frac{1}{64}$	L: $\frac{1}{64}$

2. Expect different solutions.

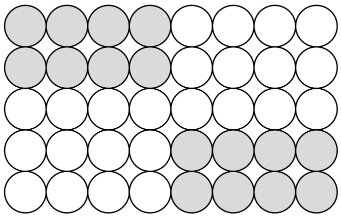
a) $\frac{3}{5}$ or 0,6



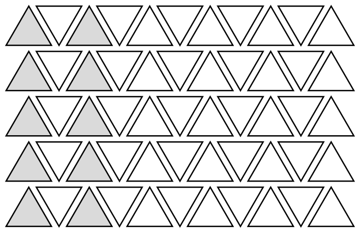
b) $\frac{7}{10}$ or 0,7



c) $\frac{4}{10}$ or 0,4



d) $\frac{2}{10}$ or 0,2



Unit 10 Fractions and ratio

MENTAL MATHS

Learner's Book page 339

The learners should have a good understanding of the concept of ratio by now. Ask them again what their understanding of ratio is. In this unit they will enhance their understanding of the relationship between fractions and ratio.

Ask the learners to study the lengths of the two crocodiles. They should find that the adult crocodile's length is 3 times the length of the young one, or the young one's length is $\frac{1}{3}$ of the adult's length.

Make sure that they understand how the expression, ratio and fraction are represented. They describe the lengths of the animals in terms of the expression, ratio and fraction for each picture. Ask the learners to give equivalent fractions or ratios where necessary.

1. Expression: Adult rat's length = 2 × young rat's length.
   Ratio: The ratio of the young rat to the adult's length is 2 :10 or 1 : 5.
   Fraction: The young rat's length = $\frac{1}{2}$ or $\frac{5}{10}$ of the adult's length.
2. Expression: Adult shark's length = 4 × young shark's length.
   Ratio: The ratio of the young shark to the adult's length is 50 : 200 or 1 : 4.
   Fraction: The young shark's length = $\frac{1}{4}$ or $\frac{50}{200}$ of the adult's length.
3. Expression: Adult snake's length = 6 × young snake's length.
   Ratio: The ratio of the young snake to the adult's length is 10 : 60 or 1 : 6.
   Fraction: The young snake's length = $\frac{1}{6}$ or $\frac{10}{60}$ of the adult's length.

Activity 10.1

Learner's Book page 340

Ask the learners to study the lengths of the animals. They write the expression, ratio and fraction for each picture.

In question 2 they study the heights of the trees in the picture. They find the heights of the trees in relation to each other and fill in the fractions to complete the expressions.

For question 3 you need to give the learners copies of squared paper to explore fractions equivalent to $\frac{2}{3}$.

They should find that $\frac{2}{3} = \frac{4}{6} = \frac{6}{9}$.

1. a, b) The learners explore and describe the relationships between the lengths of the animals. Ask them to give equivalent fractions or ratios where necessary.

c) Expression: Adult whale's length = 2 × the young whale's length.
Ratio: The ratio of the adult whale's length to the young whale's length = 20 : 10 or 2 : 1.
Fraction: The young whale's length = $\frac{1}{2}$ or $\frac{10}{20}$ of the adult's length.

Expression: Adult lizard's length = 3 × the young lizard's length.
Ratio: The ratio of the adult lizard's length to the young lizard's length = 12 : 4 or 3 : 1.
Fraction: The young lizard's length = $\frac{1}{3}$ or $\frac{4}{12}$ of the adult's length.

2. a) D's height = $\frac{1}{3}$ of A's height

b) D's height = $\frac{1}{6}$ of B's height

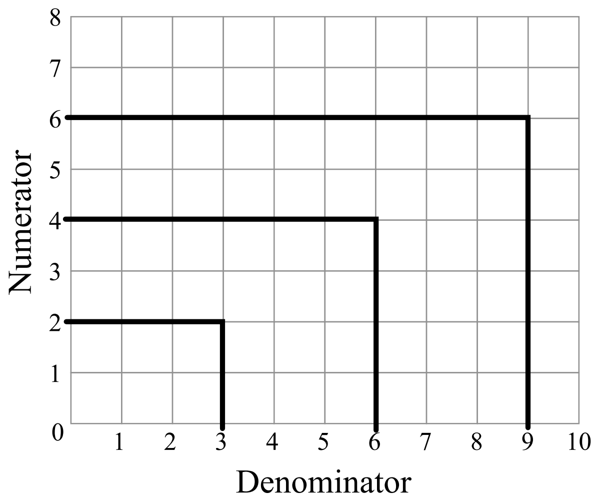
c) C's height = $\frac{4}{12}$ or $\frac{1}{3}$ of G's height

d) J's height = $\frac{5}{10}$ or $\frac{1}{2}$ of F's height

e) A's height = $\frac{3}{9}$ or $\frac{1}{3}$ of E's height

f) A's height = $\frac{3}{12}$ or $\frac{1}{4}$ of G's height

3.



Unit 11 Fractions, decimals and percentages

MENTAL MATHS

Learner's Book page 341

Tell the learners that they will use knowledge of fractions, decimals and percentages to solve the problems. Help them to understand that learners conducted a survey involving 100 learners during break time (relate this to work they have done with surveys in the Data handling sections of the course). Let them draw a table. They write the findings as common fractions, decimals and percentages, for example $\frac{74}{100} = 0{,}74 = 74\%$.

In question 2 they write the solutions on their Mental Maths grids. They convert between fractions, decimals and percentages. Let them write the equivalent fractions where necessary.

1.

Disease	Common fraction	Decimal fraction	Percentage
Measles	$\frac{74}{100} = \frac{37}{50}$	0,74	74%
Mumps	$\frac{87}{100}$	0,87	87%
Chicken pox	$\frac{93}{100}$	0,93	93%
Whooping cough	$\frac{85}{100} = \frac{17}{20}$	0,85	85%

2. a) $\frac{6}{10} = \frac{60}{100}$
   b) $\frac{1}{4} = 25\%$
   c) $\frac{4}{5} = 80\%$
   d) $0{,}75 = 75\%$
   e) $0{,}03 = 3\%$
   f) $\frac{9}{10} = 90\%$
   g) $20\% = \frac{1}{10}$ or $\frac{20}{100}$
   h) $1{,}5 = 1\frac{1}{2}$
   i) $\frac{2}{5} = 40\%$
   j) $\frac{8}{100} = 8\%$

Activity 11.1

Learner's Book page 342

Ask the learners to study the findings in the survey. They write the findings as fractions, decimals and percentages. They should understand that they have to find equivalent fractions of 100 for the data out of 50, for example, $\frac{18}{50} = \frac{36}{100} = 0{,}36 = 36\%$.

In question 2 they study the data obtained from 25 learners involving their favourite fruit. They convert the $\frac{1}{25}$s to $\frac{1}{100}$s by multiplying by 4 so that, for example, the number of apples are represented as $\frac{9}{25} = \frac{36}{100} = 0{,}36 = 36\%$.

In question 3 the learners calculate fractions of whole numbers and in 4 they create equivalent fractions.

You can ask them to solve the puzzle in question 5 for homework or they can complete it as a whole class.

1.

Vegetable	Common fraction	Fractions of 100	Decimal	Percentage
Pumpkin	$\frac{18}{50}$ or $\frac{9}{25}$	$\frac{36}{100}$	0,36	36%
Cauliflower	$\frac{27}{50}$	$\frac{54}{100}$	0,54	54%
Spinach	$\frac{7}{50}$	$\frac{14}{100}$	0,14	14%
Mealies	$\frac{42}{50}$ or $\frac{21}{25}$	$\frac{84}{100}$	0,84	84%
Potatoes	$\frac{37}{50}$	$\frac{74}{100}$	0,74	74%
Squashes	$\frac{32}{50}$ or $\frac{16}{25}$	$\frac{64}{100}$	0,64	64%

2.

Fruit	Common fraction	Fraction of 100	Decimal fraction	Percentage
Apples	$\frac{9}{25}$	$\frac{36}{100}$	0,36	36%
Oranges	$\frac{4}{25}$	$\frac{16}{100}$	0,16	16%
Peaches	$\frac{3}{25}$	$\frac{12}{100}$	0,12	12%
Watermelon	$\frac{3}{25}$	$\frac{12}{100}$	0,12	12%
Litchi	$\frac{3}{25}$	$\frac{12}{100}$	0,12	12%
Grapes	$\frac{3}{25}$	$\frac{12}{100}$	0,12	12%

3. **a)** $\frac{1}{3}$ of 30 $\rightarrow (30 \div 3) \times 1 = 10$
   b) $\frac{1}{4}$ of 40 $\rightarrow (40 \div 4) \times 1 = 10$
   c) $\frac{1}{5}$ of 60 $\rightarrow (60 \div 5) \times 1 = 12$
   d) $\frac{1}{8}$ of 80 $\rightarrow (80 \div 8) \times 1 = 10$
   e) $\frac{1}{6}$ of 48 $\rightarrow (48 \div 6) \times 1 = 8$
   f) $\frac{2}{3}$ of 21 $\rightarrow (21 \div 3) \times 2 = 14$
   g) $\frac{4}{5}$ of 100 $\rightarrow (100 \div 5) \times 4 = 80$
   h) $\frac{7}{10}$ of 50 $\rightarrow (50 \div 10) \times 7 = 35$
   i) $\frac{5}{8}$ of 72 $\rightarrow (72 \div 8) \times 5 = 45$
   j) $\frac{2}{3}$ of 27 $\rightarrow (27 \div 3) \times 2 = 18$

4. **a)** $\frac{8}{10} = \frac{16}{20} = \frac{24}{10} = \frac{32}{40}$
   b) $\frac{3}{5} = \frac{6}{10} = \frac{9}{15} = \frac{12}{20}$
   c) $\frac{1}{4} = \frac{15}{20} = \frac{10}{40} = \frac{15}{60}$
   d) $\frac{1}{2} = \frac{8}{16} = \frac{10}{20} = \frac{20}{40} = \frac{30}{60}$
   e) $\frac{2}{7} = \frac{4}{14} = \frac{10}{35} = \frac{20}{70}$
   f) $\frac{5}{12} = \frac{10}{24} = \frac{15}{36} = \frac{20}{48}$
   g) $\frac{1}{6} = \frac{3}{18} = \frac{4}{24} = \frac{5}{30}$
   h) $\frac{3}{25} = \frac{9}{75} = \frac{12}{100} = \frac{18}{150}$
   i) $\frac{14}{50} = \frac{7}{25} = \frac{28}{100} = \frac{42}{150}$
   j) $\frac{4}{20} = \frac{1}{5} = \frac{6}{30} = \frac{8}{40}$

5. The learners would probably use trial and improvement to solve the problem. They should keep in mind that the coins should add up to 20, so they have to work with factors of 20. There are various solutions. They could start with the men because their number of coins is a whole number and then break up the remainders into groups of $1\frac{1}{2}$s and $\frac{1}{2}$s.

If there are 5 men:
Men: $5 \times 3 = 15$
Women: $1\frac{1}{2} + 1\frac{1}{2} = 3$
Children: $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 2$
$15 + 3 + 2 = 20$ coins

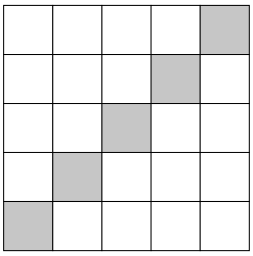
If there are 4 men:
Men: $4 \times 3 = 12$
Women: $1\frac{1}{2} + 1\frac{1}{2} + 1\frac{1}{2} + 1\frac{1}{2} = 6$
Children: $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 2$
$12 + 6 + 2 = 20$ coins
or $4 \times 3 = 12$
$1\frac{1}{2} + 1\frac{1}{2} = 3$
$\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 5$
$12 + 3 + 5 = 20$ and so on

Assessment4.2: Common fractions

The learners will use knowledge of fractions, decimals and percentages to solve the problems.

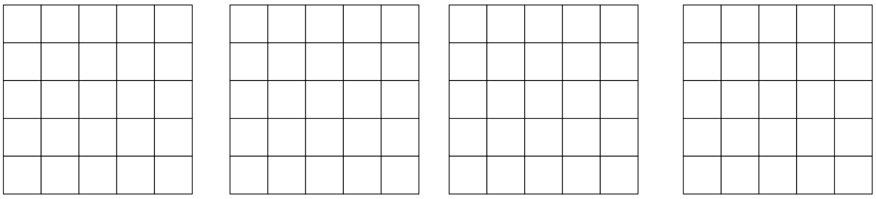
Assessment 4.2 Common fractions

1. $\frac{1}{5}$ of the shape below is shaded.

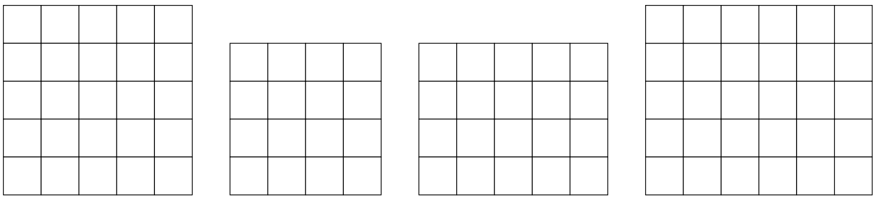


Shade the shapes below. Find 4 different ways to shade $\frac{1}{5}$.

a) **b)** **c)** **d)**

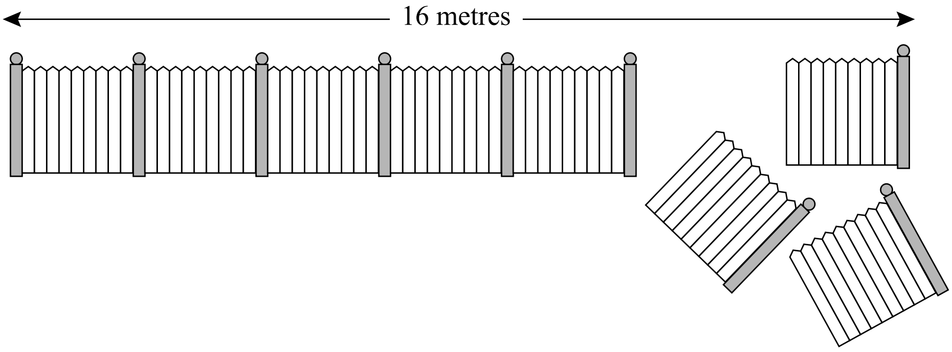


2. Use the shapes below to show fractions of a whole. Shade the shapes as indicated.



a) $\frac{3}{5}$ of 25 **b)** $\frac{3}{8}$ of 16 **c)** $\frac{3}{4}$ of 20 **d)** $\frac{5}{6}$ of 30

3. Three sections of this fence must still be put up.



a) What fraction of the fence has been put up already?
b) What fraction must still be put up?
c) How long is the section that still needs to be put up?

4. Here are 8 fraction cards.

$1\frac{1}{4}$ $\frac{3}{4}$ $2\frac{1}{4}$ $\frac{1}{3}$

$1\frac{2}{3}$ $2\frac{3}{4}$ $2\frac{1}{5}$ $2\frac{4}{5}$

a) Write the fractions from the smallest to the largest.
b) Write down fractions with a sum of 2.

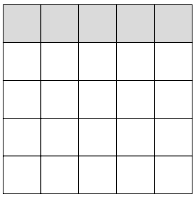
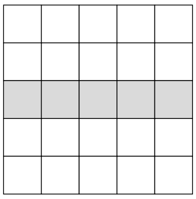
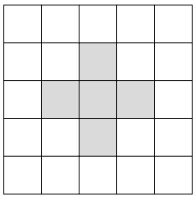
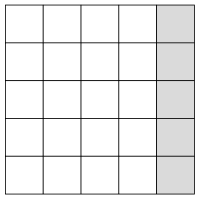
c) Write down fractions with a sum of 4.
d) Write down fractions with a sum of 7.
e) Write down fractions with a difference of 1.
f) Write down fractions with a difference of 2.
g) Write down fractions with a difference of $1\frac{2}{4}$.

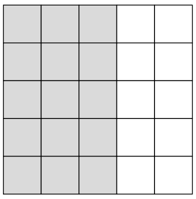
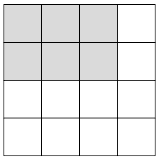
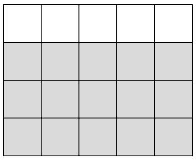
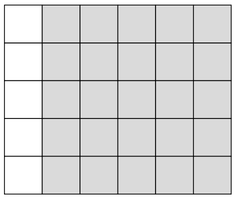
5. Write a decimal fraction and a percentage for each of the following fractions.
a) $\frac{1}{10} = \blacksquare = \blacksquare$
b) $\frac{25}{100} = \blacksquare = \blacksquare$
c) $\frac{1}{4} = \blacksquare = \blacksquare$
d) $\frac{3}{4} = \blacksquare = \blacksquare$
e) $\frac{1}{2} = \blacksquare = \blacksquare$
f) $\frac{1}{5} = \blacksquare = \blacksquare$

6. Solve the following equal sharing problems. You can do drawings to show your understanding.
a) Five friends share 12 chocolate bars equally among themselves. How many chocolate bars does each one get?
b) Seven friends share 17 sweets equally among themselves. How many sweets does each one get?

7. Marianne uses $1\frac{1}{3}$ balls of wool to knit a beanie.
a) How much wool does she use to knit 8 beanies?
b) If she had bought 12 balls of wool, how much wool does she have left?

1. Different ways to shade $\frac{1}{5}$

a)

b)

c)

d)


2.





a) $\frac{3}{5}$ of 25 $= 15$ **b)** $\frac{3}{8}$ of 16 $= 6$ **c)** $\frac{3}{4}$ of 20 $= 15$ **d)** $\frac{5}{6}$ of 30 $= 25$

3. **a)** $\frac{5}{8}$ sections of this fence must still be erected.
   b) $\frac{3}{8}$ sections of this fence must still be erected.
   c) Each sections is 16 m ÷ 8 = 2 m
   Length of section to be put up: 3 × 2 m = 6 m

4. **a)** $\frac{1}{3}$; $\frac{3}{4}$; $1\frac{1}{4}$; 1 and $\frac{2}{3}$; 2 and $\frac{1}{5}$; $2\frac{1}{4}$; $2\frac{3}{4}$; 2 and $\frac{4}{5}$
   b) 2 fractions with a sum of 2 → $1\frac{1}{4} + \frac{3}{4} = 2$ 1 and $\frac{2}{3} + \frac{1}{3} = 2$
   c) 2 fractions with a sum of 4 → $1\frac{1}{4} + 2\frac{3}{4} = 4$
   d) 4 fractions with a sum of 7 → 2 and $\frac{4}{5}$ + 2 and $\frac{1}{5} + \frac{1}{3}$ + 1 and $\frac{2}{3} = 7$
   e) 2 fractions with a difference of 1 → $2\frac{1}{4} - 1\frac{1}{4} = 1$
   f) 2 fractions with a difference of 2 → $2\frac{3}{4} - \frac{3}{4} = 2$
   g) 2 fractions with a difference of 1 and $\frac{2}{4}$ → $2\frac{3}{4} - 1\frac{1}{4}$ = 1 and $\frac{2}{4}$

5. **a)** $\frac{1}{10} = 0{,}1 = 10\%$ **b)** $\frac{25}{100} = 0{,}25 = 25\%$
   c) $\frac{1}{4} = 0{,}25 = 25\%$ **d)** $\frac{3}{4} = 0{,}75 = 75\%$
   e) $\frac{1}{2} = 0{,}5 = 50\%$ **f)** $\frac{1}{5} = \frac{2}{10} = 0{,}2 = 20\%$

6. **a)** Five friends share 12 chocolate bars equally among themselves.
   $2 + 2 + 2 + 2 + 2 = 10$
   $\frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} = 1$
   $\frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} = 1$
   Each one gets $2\frac{2}{5}$ chocolate bars.
   b) Seven friends share 17 sweets equally among themselves.
   17 ÷ 7 = 2 rem 3
   Each one gets $2\frac{3}{7}$ of the sweets.

7. **a)** $1\frac{1}{3} + 1\frac{1}{3} \rightarrow 2$ caps

$1\frac{1}{3} + 1\frac{1}{3} \rightarrow 2$ caps

$1\frac{1}{3} + 1\frac{1}{3} \rightarrow 2$ caps

$1\frac{1}{3} + 1\frac{1}{3} \rightarrow 2$ caps

$4 + 4 + \frac{4}{3} + \frac{4}{3} = 4 + 4 + 1 + 1 + \frac{1}{3} + \frac{1}{3}$

$= 10$ and $\frac{2}{3}$ balls

Marianne needs $10\frac{2}{3}$ balls of wool to knit 8 woollen caps.

b) If she bought 12 balls of wool, how much wool does she have left?

For 8 caps she needs:

$$1\frac{1}{3} + 1\frac{1}{3} + 1\frac{1}{3} + 1\frac{1}{3} + 1\frac{1}{3} + 1\frac{1}{3} + 1\frac{1}{3} + 1\frac{1}{3} = \blacksquare$$

$$= 8\frac{8}{3}$$

$$= 8 + 2 + \frac{2}{3}$$

$$= 10\frac{2}{3} \text{ balls of wool}$$

$12 - 10\frac{2}{3} = \blacksquare$

$12 - 10 = 2$

$2 - \frac{2}{3} = 1\frac{1}{3}$

She has 1 and $\frac{1}{3}$ balls of wool left.

Properties of 3-D objects

Learner's Book page 343

This section revises the work done on 3-D objects in Term 1, and introduces the concepts *edges* and *vertices*. Learners explore the number of edges and vertices of the 3-D objects whose properties they have already been studying. They also use straws to make frameworks or skeletons of 3-D objects.

Unit 12 Describing and sorting 3-D objects

Remind the learners that we can describe the following properties of 3-D objects:

- their types of surfaces (flat, curved or both flat and curved)
- their number of surfaces
- the shapes of their surfaces.

MENTAL MATHS

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Do the Mental Maths activity to determine how much the learners remember about the work they did on 3-D objects in Term 2.

1. False. A cube has 6 flat surfaces.
2. True
3. True
4. False. A cube has 6 faces.
5. True
6. False. A rectangular prism has 6 faces.
7. True
8. False. Only one type of pyramid has triangular faces only. The other pyramids each have triangular faces and one face (the base) that is another polygon.
9. False. A tetrahedron is a type of pyramid.
10. True

Activity 12.1

Learner's Book page 343

1. A, F **2.** B, D **3.** C, H **4.** E, G

5. **a)** A: cube
D: triangular-based pyramid or tetrahedron
b) A: flat surfaces
D: flat surfaces
c) A: 6
D: 4
d) A: squares
D: triangles

Activity 12.2

Learner's Book page 344

1. Spheres: D, J
   Cones: E, M
   Pyramids: C, H, I, L, P
   Cylinders: A, N
   Prisms B, F, G, K, O, Q, R
2. **a)** G, Q **b)** F, O
   c) Three other types of prisms (B: pentagonal prism; K: triangular prism; R: hexagonal prism)
3. **a)** H and L **b)** Triangular-based pyramid
   c) C and P
   d) One other type of pyramid (I: hexagonal-based pyramid)

Assessment points

- How well are the learners able to recognise and name different 3-D objects?
- How well can they describe and sort 3-D objects in terms of the number and shape of faces?

Unit 13 Faces, edges and vertices

Learners are already familiar with the faces of 3-D objects. This unit introduces them to *edges* and *vertices* of 3-D objects. Explain what these terms mean and show the learners the edges and vertices on models of 3-D objects.

MENTAL MATHS

Learner's Book page 345

1. Vertex	**2.** Face	**3.** Edge
4. Edge	**5.** Face	**6.** Vertex
7. Vertex	**8.** Face	**9.** Edge
10. Face	**11.** Edge	**12.** Vertex
13. Edge	**14.** Face	**15.** Vertex
16. Face	**17.** Vertex	**18.** Edge

Activity 13.1

Learner's Book page 345

1. Prisms
2. Let the learners do this activity even though it may take some time. It is a good way to help them identify the parts of the 3-D objects and visualise the 3-D objects when they look at drawings of these objects.
3.

	Box A	Box B	Box C
Number of faces	6	5	7
Number of vertices	8	6	10
Number of edges	12	9	15

Activity 13.2
Learner's Book page 346

1, 2. Completed table

3-D object	Number of faces	Number of vertices	Number of edges
A	6	8	12
B	5	6	9
C	4	4	6
D	5	5	8
E	6	8	12
F	7	10	15

Investigation
Learner's Book page 346

The learners will have to do the calculations for each row in their completed tables for Activity 13.2. They will find that this formula is true.

Assessment points

- Can the learners correctly point out the faces, edges and vertices of 3-D objects?
- Are they able to accurately count the number of faces, edges and vertices of 3-D objects?

Unit 14 Models of 3-D objects

In this unit, the learners match nets to drawings of 3-D objects. Then they also use straws to build models of the frameworks or skeletons of 3-D objects.

MENTAL MATHS
Learner's Book page 347

Square-based pyramid: D
Rectangular prism: A
Tetrahedron: C
Cube: E
Triangular prism: B

Models from straws

Help the learners to understand that the straws they use in their models represent the edges of the 3-D objects that they make. You could give the learners Fruit Jubes (small, sugar-coated multi-coloured sweets) to build their models. It would be more secure and cheaper than Prestik – and a lot more fun!

Activity 14.1
Learner's Book page 248

1. A: cube
B: rectangular prism
C: square-based pyramid
D: tetrahedron
E: triangular prism

2. Let the learners work on their own to build 3-D models.

Assessment points
• How easily are the learners able to match nets with drawings of 3-D objects? • Can the learners accurately make the skeletons of 3-D objects using straws and Prestik (or Fruit Jubes)?

Remedial activity

Let the learners build more cardboard models of 3-D objects. For each model, let them number all the faces, then paint all the vertices red and all the edges blue. Next, let them complete a table such as the one below by counting the faces, vertices and edges of their painted models.

Model	Number of faces	Number of vertices	Number of edges
A			
B			
C			

Extension activity

Let the learners play the following game to practise working with edges, vertices and faces. This is a challenging game, so make sure they understand the basic concepts before they attempt it. It will be a good idea to have models of 3-D objects that they can refer to as they play the game.

1. Make a word card for each of the following words: faces, vertices and edges.
2. Make number cards with the numbers 4 to 15. Make about four cards with each number.
3. Divide the class into two teams, or the learners could play the game in smaller groups.
4. Place the word cards face up on the table.
5. Each player takes a turn to choose three number cards from the shuffled deck.
6. The player then sees if it is possible to make a 3-D object with those numbers by placing each card under one of the word cards (faces, vertices and edges). If the player manages to do this, he or she scores a point.
7. If the player thinks it is not possible, then the number cards are returned to the deck and the deck is shuffled before the next player takes a turn.
8. The learner who manages to make three 3-D objects first is the winner.

Perimeter, area and volume

Learner's Book page 349

In Grades 4 and 5 learners worked with the concepts of perimeter, area and volume, and used informal methods to measure them. They continue to use informal measurement methods, rather than formulas, in Grade 6. They measure lengths around shapes (perimeters) accurately in mm, cm and m, measure the areas of 2-D shapes in terms of squares covering the shapes, and measure volume and capacity in terms of cubes (blocks) and rectangular prisms (boxes).

Since they have already studied cubes and rectangular prisms in the Shape and space sections of the Grade 6 course, you can use the activities with volume in this section to reinforce their understanding of the properties of these 3-D objects.

Unit 15 Perimeter

Remind learners about the meaning of the term *perimeter* at the start of this unit. Let them demonstrate their understanding of the concept by doing some accurate perimeter measurements before they start doing the activities in the Learner's Book. They begin with a Mental Maths activity in which they practise counting on, rounding, calculating and converting units of length measurement. They will use these number and conversion skills in the activities that follow.

They calculate the perimeters of 2-D shapes with given metric measurements, as well as of shapes that occur in real-world contexts such as fields and house foundations.

They use tape measures and rulers to measure perimeters of smaller shapes and surfaces accurately. They also calculate perimeters of irregular geometric shapes, find the lengths of missing parts of the perimeters of shapes, and use the sides of squares in a grid as measuring units to calculate the perimeter of shapes on the grid.

They investigate the relationship between the diagonal of a square and the lengths of the sides of the square.

MENTAL MATHS

Learner's Book page 349

1. Classroom activity

2. Classroom activity

3. **a)** 700 mm **b)** 950 mm **c)** 800 mm
d) 1 500 mm **e)** 900 mm **f)** 2 550 mm

4. **a)** 71 m **b)** 135 mm **c)** 460 cm **d)** 165 km

5. **a)** 140 mm **b)** 80 m **c)** 70 cm **d)** 200 km

6. **a)** 92 mm = 9 cm 2 mm **b)** 359 mm = 35 cm 9 mm
c) 47 mm = 3 cm 5 mm **d)** 35 mm = 3 cm 5 mm

7. **a)** 4,5 cm = $\frac{45}{10}$ = $\frac{9}{2}$ cm **b)** 23,3 mm = $\frac{233}{100}$ mm
   c) 11,9 m = $\frac{119}{10}$ m **d)** 12,25 cm = $\frac{1\,225}{100}$ = $\frac{49}{4}$ cm
   e) 32,75 km = $\frac{3\,275}{100}$ = $\frac{131}{4}$ km **f)** 91,7 m = $\frac{917}{10}$ m

Activity 15.1

Learner's Book page 351

Learners' own work.

Activity 15.2

Learner's Book page 351

1. **a)** Perimeter: 2 cm + 3 cm + 4 cm = 9 cm
b) Perimeter: 1 cm + 4 cm + 1 cm + 4 cm = 10 cm
c) Perimeter: 2 cm + 5 cm + 3,5 cm + 2 cm = 12,5 cm
d) Perimeter:
1,5 cm + 3 cm + 3 cm + 1,5 cm + 2,5 cm + 3 cm = 14,5 cm
e) Perimeter: 23 mm + 3 mm + 23 mm+ 33 mm = 112 cm
f) Perimeter: 35 mm + 35 mm + 45 mm + 115 mm

2.

	Missing side	Perimeter
a)	20 mm	113 mm
b)	50 mm	140 mm
c)	8 mm	136 mm
d)	55 mm	120 mm
e)	35 mm	130 mm
f)	20 mm	120 mm

3. Learners do the measurements.

4. **a)** Perimeter = 28 units
b) Perimeter = 26 units
c) Perimeter = 24 units
d) Perimeter = 28 units

5. **a)** Length of side = 4 cm
b)–c) The diagonal is longer than the length
d) Learners do the measurements.

6. Yes. Learners' own work.

7. **a)** Perimeter: 4 + 4 + 2 + 1 + 2 + 3 = 16 units
b) Perimeter: 6 + 2 + 6 + 2 = 16 units
c) Perimeter: 4 + 4 + 4 + 4 = 16 units
d) Perimeter: 2 + 1 + 1 + 2 + 1 + 1 + 2 + 1+ 1 + 2 + 1 + 1 = 16

8. Although the shapes are irregular, the perimeter is the same as if the shape was regular. For example if (a) was a square shape with all four sides 4 units long, the perimeter would be 4 + 4 + 4 + 4 = 16 units. This is the same answer we got when we calculated the perimeter of the irregular shape.

9. **a)** Perimeter = 5 mm + 5 mm + 5 mm + 5 mm = 20 mm
b) Perimeter = 2 cm

Unit 16 Area

Learner's Book page 355

In Grade 6 learners continue to use squares to measure the area of a shape. They find the area of regular and irregular shapes with straight sides and with some curved sides. They use short cuts to find the areas of shapes on a square grid; this introduces the idea that area can be calculated by multiplying the length and breadth of a shape. This method is not expressed as a formula in the Intermediate Phase, but learners may get used to calculating area using multiplication in this way.

Learners apply their skill at calculating area to solving contextual problems such as finding the area of rooms on a floor plan.
They explore the connection between the area of a shape and its perimeter. You can relate this investigation to the Space and shape sections of the course in which learners enlarge and reduce the area of geometric shapes, using grid paper to draw these transformations.

MENTAL MATHS

Learner's Book page 356

1. **a)** 3 + 5 + 1 + 1 + 1 + 1 + 1 + 1 + 4 + 2 = 20
   b) 7 + 9 + 15 + 11 + 3 + 5 = 50
   c) 6 + 6 + 6 + 6 = 24
   d) 15 + 15 + 15 + 15 = 60
   e) 45 + 35 + 45 + 35 = 160
   f) 30 + 30 + 30 + 30 + 30 + 30 = 180
   g) 47 + 47 + 47 + 47 = 188
   h) 25 + 25 + 25 + 25 = 100
   i) 250 + 250 + 250 + 250 = 1 000
   j) (3 + 3 + 3 + 3) + (7 + 7 + 7 + 7) = 40

Activity 16.1

Learner's Book page 356

1.

	(i) Perimeter	(ii) Area
a)	16 units	15 squares
b)	12 units	9 squares
c)	16 units	12 squares
d)	20 units	21 squares

Activity 16.2

Learner's Book page 357

1. **a)** Area = 12 squares
   Area = 3 × 4 = 12 squares
   b) Area = 22 squares
   Area = (3 × 4) + (5 × 2) = 12 + 10 = 22 squares
   c) Area = 32 squares
   Area = (9 × 2) + (7 × 2) = 32 squares
   d) Area = 32 squares
   Area = (7 × 4) + (2 × 2) = 28 + 4 = 32 squares

2. (c) and (d) are the same shapes. The only difference is that they have been divided differently.

Activity 16.3

Learner's Book page 358

1. a) 30 whole squares
   2 pieces that are bigger than half square +
   2 pieces that are smaller than half square = 2 whole squares.
   Area = 30 squares + 2 squares = 32 squares

   b) 16 whole squares
   8 half squares = 4 whole squares
   Area = 16 squares + 4 squares = 20 squares

   c) About 12 whole squares
   2 half squares = 1 whole square
   3 pieces that are bigger than half a square
   + 2 pieces that are smaller than half a square = 3 squares
   Area = 14 squares + 1 square + 3 squares = 18 squares

   d) 12 whole squares
   3 pieces that are bigger than half a square
   + 5 pieces that are smaller than half a square
   = 3 squares + about another 1 square
   Area = 12 squares + 3 squares + 1 square = 14 squares

   e) 12 whole squares
   12 half squares = 6 whole squares
   Area = 12 squares + 6 squares = 18 squares

   f) 16 whole squares
   2 half squares = 1 whole square
   2 pieces that are bigger than half a square
   + 7 pieces smaller than half a square
   = 2 whole squares + roughly 2 more whole squares
   Area = 16 + 1 + 2 + 2 = 21 squares.

2. Learners' own work

3. a) Perimeter lounge = 26 units
   Perimeter bedroom 1 = 17 units
   Perimeter bedroom 2 = 20 units
   Perimeter bedroom 3 = 20 units
   Perimeter bathroom 1 = 13 units
   Perimeter bathroom 2 = 16 units
   Perimeter kitchen 1 = 20 units
   Perimeter passage 1 = 14 units

   b) Perimeter whole house = 52 units

   c) 26 cm

   d) Area bedroom 1 = 18 squares
   Area bedroom 2 = 24 squares
   Area bedroom 3 = 25 squares
   Area bathroom 1 = 10 squares
   Area bathroom 1 = 16 squares

Area of lounge = 42 squares
Area of kitchen = 25 squares
Area of passage = 10 squares

e) Area of whole house = 165 squares

Activity 16.4

Learner's Book page 359

1.

Shape	Length and breadth	Perimeter	Area
A	length = 7 squares breadth = 1 square	16 units	7 × 1 = 7 squares
B	length = 6 squares breadth = 2 squares	16 units	6 × 2 = 12 squares
C	length = 5 squares breadth = 3 squares	16 units	3 × 5 = 15 squares
D	length = 4 squares breadth = 4 squares	16 units	4 × 4 = 16 squares

2. The sum of the length and breadth = 8. The longer the sides the bigger the area. The biggest area is when both sides are 4 units.
3. The area of a square give the biggest area.
4. C will be the best shape. The perimeter of all three shapes is the same, but shape C gives the biggest area.

Unit 17 Volume

Learner's Book page 30

In this unit the learners use cubes and rectangular prisms to measure how much space there is inside different containers. They count and calculate with these objects to find the capacity and the volume of a container, and demonstrate that they understand the difference between *capacity* and *volume* in this context. They investigate the concept surface area with reference to the properties of 2-D shapes that they have studied in Space and shape, and learn how to calculate the surface area of a 3-D object using multiplication and addition methods.

MENTAL MATHS

Learner's Book page 362

Learners' own work

Activity 17.1

Learner's Book page 362

1. a) Volume = 9 cubes
   b) Volume = 18 cubes
   c) Volume = 27 cubes
2. a) Volume = 8 cubes
   b) Volume = 18 cubes
   c) Volume = 36 cubes
   d) Volume = 16 cubes
   e) Volume = 100 cubes
   f) Volume = 9 cubes

3. **a)** The bottom of a box is covered by two rectangular prisms. The height of the is box is five units. To find the number of prisms needed to fill the box:
2 rectangular prisms × 5
= 10 rectangular prisms.

   b) The bottom of the box is covered by eight rectangular prisms. The height of the box is four units. To find the number of prisms needed to fill the box:
8 rectangular prisms × 4
= 32 rectangular prisms

4. **a)** Volume = 10 cubes
   b) Volume = 32 cubes

5. **a)** Number of rectangular prisms needed to cover bottom of box = 16 prisms
Height of the box = 4 units
Volume = 16 × 4 = 64 cubes

   b) Number of rectangular prisms needed to cover bottom of box = 12 prisms
Height of box = 6 units
Volume = 12 × 6 = 72 units

   c) Number of rectangular prisms needed to cover bottom of box = 42 prisms
Height of box = 5 units
Volume = 42 × 5 = 210 units

   d) Number of rectangular prisms needed to cover bottom of box = 3 prisms
Height of box = 6 units
Volume = 18 cubes

Activity 17.2

Learner's Book page 364

1. a) Surface area
= 2 × (3 × 6) squares
+ 2 × (4 × 6) squares
+ 2 × (3 × 4) squares
= (2 × 18) squares
+ (2 × 24) squares
+ (2 × 12) squares
= (36 + 48 + 24) squares
= 108 squares

   b) Area of each face is the same
Total surface area
= 6 × (5 × 5) squares
= 6 × 25 squares
= 150 squares

2. **a)** Total surface area
$= 2 \times (4 \times 7)$ squares
$+ 2 \times (4 \times 3)$ squares
$+ 2 \times (3 \times 7)$ squares
$= (2 \times 28)$ squares
$+ (2 \times 12)$ squares
$+ (2 \times 21)$ squares
$= (56 + 24 + 42)$ squares
$= 128$ squares

3. Total square area
= area of bottom face
= area of top faces + 2 × area of one side face
+ area of the other side face + area of the other side faces
$= (5 \times 2)$ squares $+ (2 \times 2)$ squares $+ (3 \times 2)$ squares
$+ 2 \times [(3 \times 3) + (6 \times 2)]$ squares
$+ (3 \times 2)$ squares $+ (3 \times 2)$ squares
$= 10$ squares $+ 4$ squares $+ 6$ squares $+ 2 \times (9 + 12)$ squares
$+ 12$ squares $+ 6$ squares $+ 6$ squares
$= (10 + 10 + 42 + 12 + 6 + 6)$ squares
$= 86$ squares

The history of measurement

Unit 18 The history of measuring time, length, volume, mass and distance

Learner's Book page 365

Learners have already read about and discussed the history of time measurement in Term 1. This unit provides a wider discussion of the history of measurement, using examples from ancient times, Biblical contexts and more recent inventions of measuring instruments. Read the text together with the learners, and spend time discussing the instruments shown in the pictures. Let learners talk about how they think each instrument worked or was used.

If learners have easy access to the Internet or a good library, you could organise a research project in which they work in groups to investigate one type of measurement (for example, length or mass) and find out what methods and instruments have been used throughout history to do the measurements. The groups can then present their findings to the class, or prepare a poster to display in the classroom.

Discuss the questions in the Mental Maths section at the end of the unit with the class. Encourage them to express their ideas about why we need to have standardised measuring units, and what kinds of measuring instruments they would like to have. They could take the discussion further by doing drawings or writing stories about an adventure involving their imaginary measuring instrument. If any of their ideas seem workable, you could spend some time in the Science and Technology or Creative Arts classes making their imaginary instruments.

MENTAL MATHS

Learner's Book page 369

There are no fixed solutions or correct answers to the questions posed in this unit. Accept any ideas and arguments from learners that show that they have understood how we use measurement in everyday life, and why accurate measurement is an important skill to have.

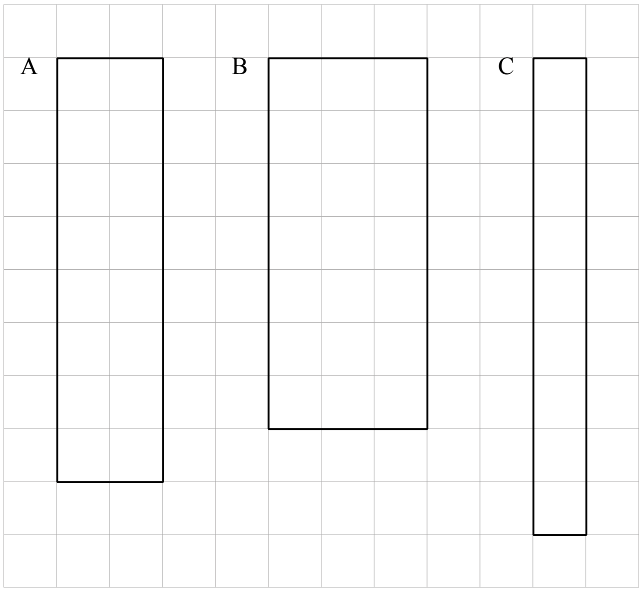
Perimeter and area of shapes

Can shapes have the same perimeters but different areas? Do this investigation with rectangles and squares to find out.

Rectangles

1. On square grid paper, draw a rectangle that is 6 units long and 4 units wide.
   a) Do you agree that the perimeter of this rectangle is 20 units? Do a calculation to show that this is true.
   b) What is the area of the rectangle? Give the answer in squares. (4)

2. Copy these three rectangles onto square paper.
   a) Find the perimeter of each rectangle.
   b) Find the area of each rectangle.



(6)

3. What does your investigation show? Complete the following sentence.
Rectangles with the same _____, do not always have the same _____ . (2)

Squares

4. Draw a square with sides that are 5 units long on the grid paper.
   a) Do you agree that the perimeter of this square is 20 units? Do a calculation to show that this is true.
   b) What is the area of the square? Write down the method you used to find the area. (4)

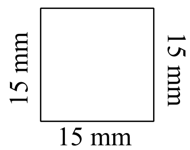
5. Draw another square with a perimeter of 20 units. What is the area of this square? (2)

6. What does your investigation show? Complete the following sentence.
Squares with the same _____ have the same _____. (2)

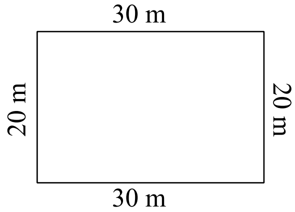
Total: 20

1. Calculate the perimeter of each shape.

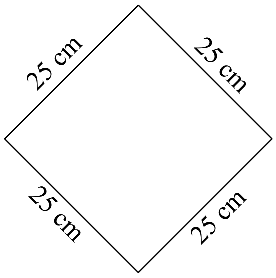
a)



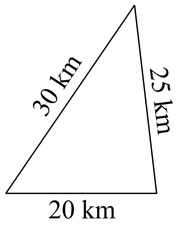
b)



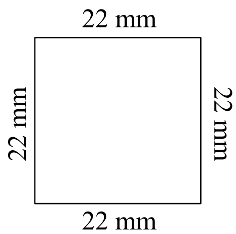
c)



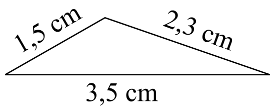
d)



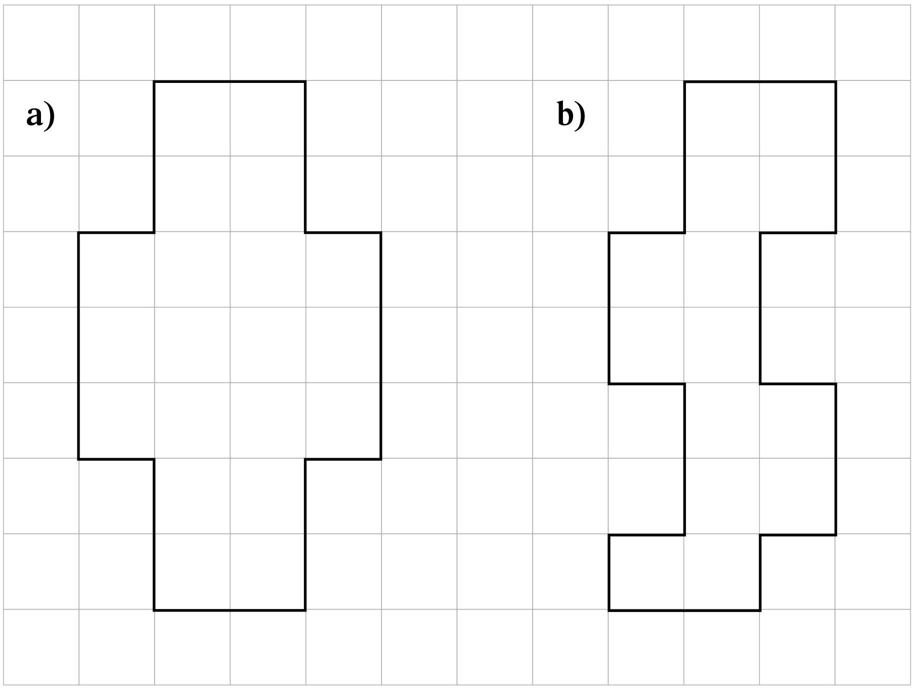
e)

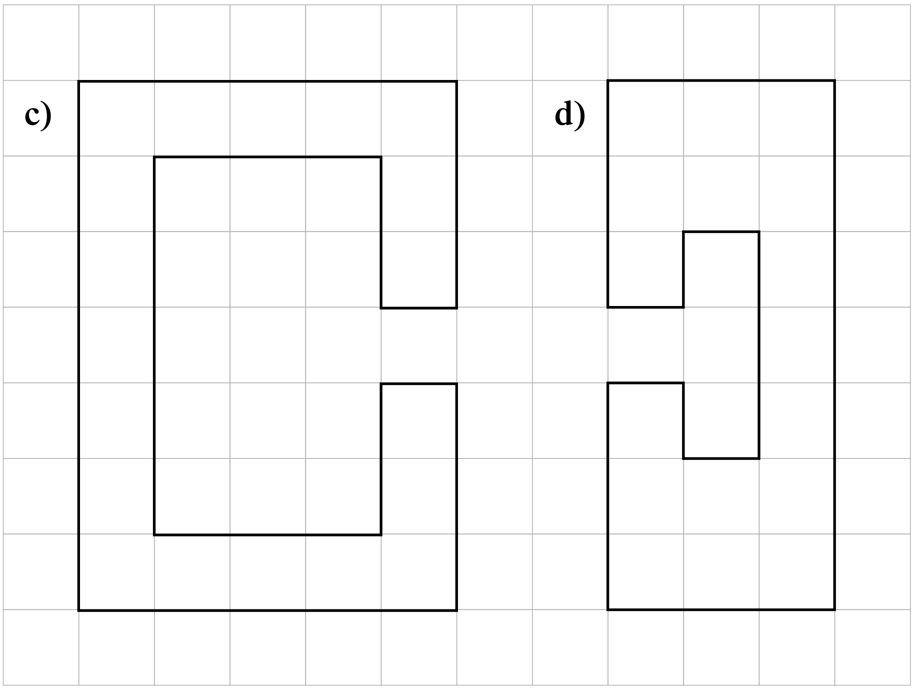


f)



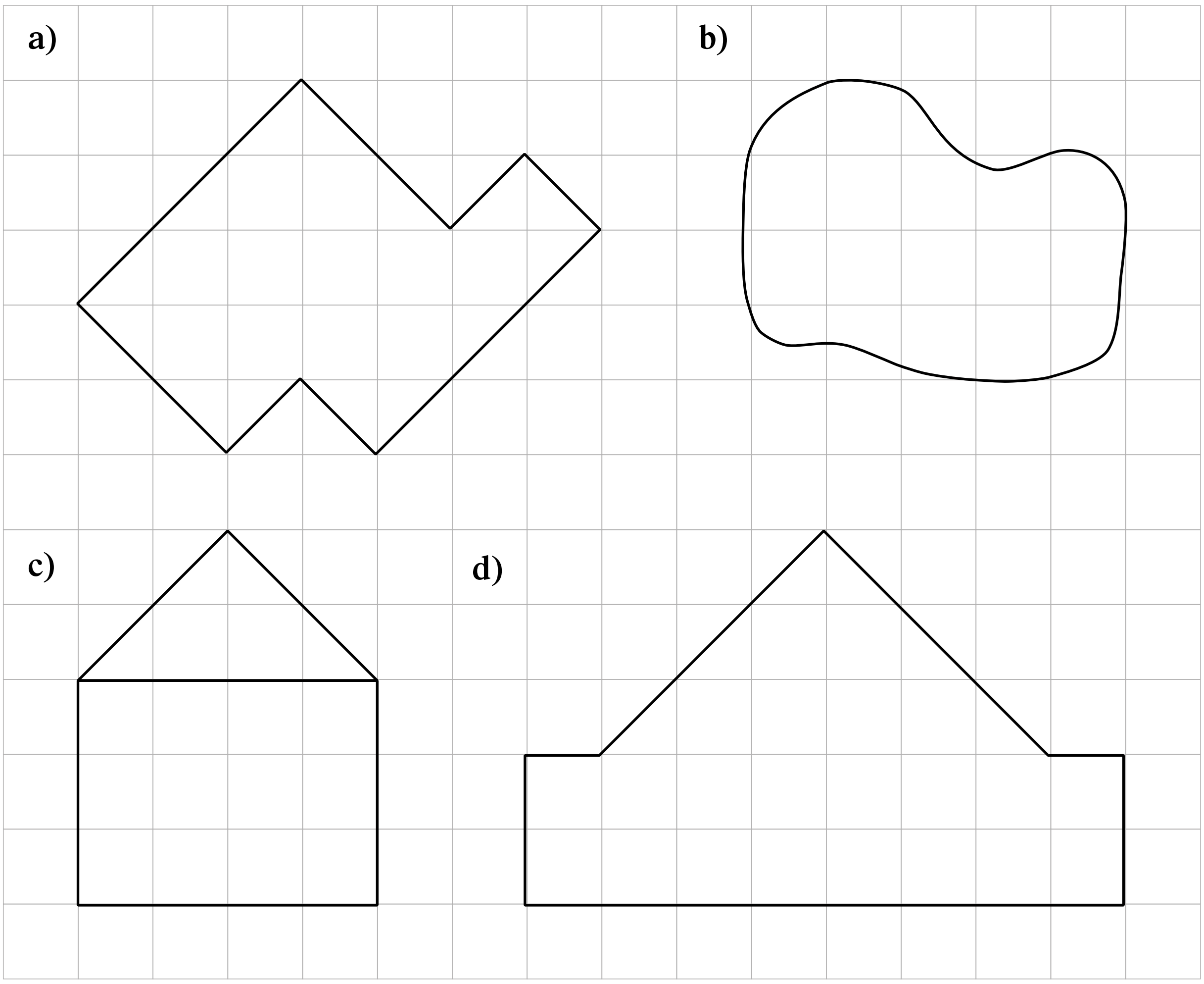
2. Calculate the perimeter of each shape (1 square = 1 unit).



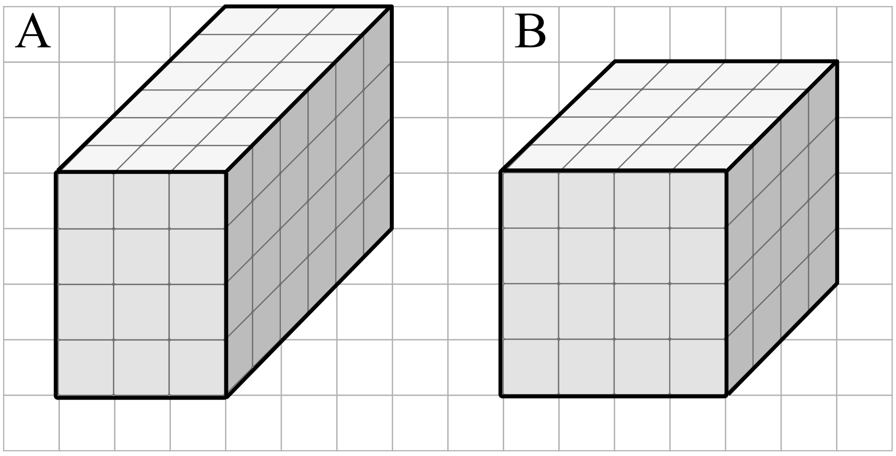


3. Calculate the area of each shape in question 2.

4. Calculate the area of each shape below.



5. The two containers are filled with cubes.



a) Which container has the biggest volume? Show how you worked out the answer.

b) Calculate the surface area of each container.

c) Does the container with the biggest surface area have the biggest volume? Explain.

1. Perimeter:

a) 15 mm + 15 mm + 15 mm + 15 mm = ■
4 × 15 = (4 × 10) + (4 × 5) or (2 × 15) + (2 × 15)
= 40 + 20 = 30 + 30
= 60 mm = 60 mm

b) 20 m + 20 m + 30 m + 30 m = ■
or (20 + 30) + (20 + 30)
Double 20 + double 30 = 40 + 60 = 50 + 50
= 100 m = 100 m

c) 25 cm + 25 cm + 25 cm + 25 cm = ■
or (2 × 25) + (2 × 25)
4 × 25 = 100 cm = 50 + 50
= 100 cm

d) 30 km + 20 km + 25 km = ■ or 30 + 20 + 20 + 5
50 + 25 = 75 km = 75 km

e) 22 mm + 22 mm + 22 mm + 22 mm = ■
or 44 + 44 = 88 mm
(4 × 20) + (4 × 2) = 80 + 8
= 88 mm

f) 1,5 cm + 2,3 cm + 3,5 cm = ■
(3,5 + 1,5) + 2,3 = 5 + 2,3
= 7,3 cm

2. a) (3 × 2) + (2 × 1) + (2 × 3) + (2 × 1) + (3 × 2) = ■
(6 × 2) + (4 × 1) + (2 × 3) = 12 + 4 + 6
= 22 units

b) (8 × 2) + (7 × 1) = ■
16 + 7 = 16 + 4 + 3
= 23 units

c) (3 × 5) + (4 × 3) + (2 × 2) + 2 + 5 + 7 = ■
15 + 12 + 4 + 14
= 15 + (12 + 3) + (14 + 1) or 3 × 15 = (3 × 10) + (3 × 5)
= 15 + 15 + 15 = 30 + 15
= 30 + 15 = 45
= 45 units

d) (5 × 3) + (6 × 1) + 7 = ■
15 + 6 + 7 = 15 + 5 + 7 + 1
= 28 units

3. Area:

a) (2 × 2) + (3 × 4) + (2 × 2) = ■
4 + 12 + 4 = 12 + 4 + 4
= 20 square units

b) (2 × 2) + (2 × 2) + (2 × 2) + (1 × 2) = ■
4 + 4 + 4 + 2 = (3 × 4) + 2 or 4 + 4 + 2 + 4 = 10 + 4
= 12 + 2 = 14
= 14 square units

c) $(1 \times 5) + (1 \times 5) + (5 \times 1) + (2 \times 1) + (2 \times 1) = ■$
$5 + 5 + 5 + 2 + 2 = 15 + 4$ or $(3 \times 5) + 4 = 15 + 4$
$= 19$ square units $= 19$

d) $(7 \times 3) - (1 \times 1) - (3 \times 1)$
$21 - 1 - 3 = 17$ square units
or $(2 \times 3) + (2 \times 3) + (2 \times 1 \times 1) + (3 \times 1)$ $6 + 6 + 2 + 3$
$= 17$ square units

4. Area:

a) $(11 \times 1 \times 1) + \left(14 \times \frac{1}{2}\right) = ■$
$11 + (14 \div 2 \times 1) = 11 + 7$
$= 18$ square units

b) $(8 \times 1 \times 1) + \left(9 \text{ squares} > \frac{1}{2}\right) + \left(3 \text{ squares} < \frac{1}{2}\right) = ■$
$8 + (12 \div 2) = 8 + 6$
$= 14$ square units

c) $(3 \times 4) + 2 + \left(4 \times \frac{1}{2}\right) = ■$
$12 + 2 + (4 \div 2 \times 1) = 14 + 2$
$= 16$ square units

d) $(2 \times 8) + 6 + \left(6 \times \frac{1}{2}\right) = ■$
$16 + 6 + (6 \div 2 \times 1) = 16 + 4 + 2 + 3$
$= 25$ square units

5. a) Volume of A $\rightarrow (4 \times 3) \times 6 = ■$
$12 \times 6 = 72$ cubes

Volume of B: $(4 \times 4) \times 4 = ■$
$16 \times 4 = (16 \times 2) + (16 \times 2)$
$= 32 + 32$
$= 64$ cubes

Container A has the bigger volume.

b) Surface area of A:
$(4 \times 3 \times 2) + (3 \times 6 \times 2) + (4 \times 6 \times 2)$
$= (12 \times 2) + (18 \times 2) + (24 \times 2)$
$= 24 + 36 + 48$
$= (36 + 4) + (48 + 2) + 18$
$= 40 + 50 + 10 + 8$
$= 108$ squares

Surface area of B:
$4 \times 4 \times 6 = 16 \times 6$
$= (6 \times 10) + (6 \times 6)$
$= 60 + 36$
$= 96$ squares

c) Yes. The volume and surface area of A are bigger than the volume and surface area of B.

Whole numbers

Learner's Book page 370

Division

Remind the learners that they have worked with division in Term 2. By now they should know the basic division facts up to 144 ÷ 12 off by heart. They should also know division by powers and multiples of 10. Up until now they have learned and used different strategies to divide 4-digit by 2-digit numbers. During the next seven units they will divide numbers up to 4-digit by 3-digit numbers. Tell them they will practise some basic division facts first. During the first unit they will work together as a class.

Unit 19 Whole number division facts

MENTAL MATHS

Learner's Book page 370

Let the learners play the *I have ….* basic calculations game with the class to refresh their mental calculation skills involving the four basic operations.

In question 2 they use the 36 sticks each time to decide how many of each shape they can make. You can let them use actual counting sticks (ask the Foundation Phase teachers for these) otherwise they could use paper strips or ice cream sticks. They should know the names of the different polygons by now.

In question 3 they solve a division problem by finding the multiple of both 3 and 4 that would leave zero apples if shared among 3 and 4 children.

In question 4 they complete a table with the factor pairs for the numbers indicated.

In question 5 the learners work with rules of divisibility. Ask them how they know numbers can be divided by 2, 5 and 10 without remainders. Tell them that knowledge of rules of divisibility can help them find factors of numbers and assist in checking solutions to division problems. Instead of just telling learners the rules, they investigate the digits to find out how they can know if numbers are divisible by 3, 4, 6 and 9.

They should also know that if numbers are divisible by 8 they are also divisible by 4.

In question 6 they determine, without calculating, whether there will be remainders when dividing numbers by 2, 3, 4, 5, 6, 9 and 10. Let them do the calculations to check their answers.

In question 8 they solve division problems in context.

1. The learners play the *I have ...* basic calculation game as a whole class.

2. **a)** Squares → 36 ÷ 4 = 9
   b) Triangles → 36 ÷ 3 = 12
   c) Hexagons → 36 ÷ 6 = 6
   d) Pentagons → 36 ÷ 5 = 7 remainder 1 stick
   e) Octagons → 36 ÷ 8 = 4 remainder 4 sticks
   f) Heptagons → 36 ÷ 7 = 5 remainder 1 stick
   g) Decagons → 36 ÷ 10 = 3 remainder 6 sticks
   h) Nonagons → 36 ÷ 9 = 4

3. You should expect various solutions to this problem. The problem is open – Johan could have different numbers of apples. The learners should discover that they have to work with common even multiples of 3 and 4.
   12 ÷ 3 = 4 remainder 0
   12 ÷ 4 = 3 remainder 0
   24 ÷ 3 = 8 remainder 0
   24 ÷ 4 = 6 remainder 0
   36 ÷ 3 = 12 remainder 0
   36 ÷ 4 = 9 remainder 0
   48 ÷ 3 = 16 remainder 0
   48 ÷ 4 = 12 remainder 0
   60 ÷ 3 = 20 remainder 0
   60 ÷ 4 = 15 remainder 0, and so on

4.

	Number	Factor pairs
a)	9	1 × 9; 3 × 3
b)	15	1 × 15; 3 × 5
c)	24	1 × 24; 2 × 12; 3 × 8; 4 × 6
d)	28	1 × 28; 2 × 14; 4 × 7
e)	13	1 × 13
f)	30	1 × 30; 2 × 15; 3 × 10; 5 × 6
g)	48	1 × 48; 2 × 24; 3 × 16; 4 × 12; 6 × 8
h)	60	1 × 60; 2 × 30; 3 × 20; 4 × 15; 5 × 12; 6 × 10
i)	84	1 × 84; 2 × 42; 3 × 28; 4 × 21; 7 × 12
j)	120	1 × 120; 2 × 60; 3 × 40; 4 × 30; 5 × 24; 6 × 20; 8 × 15; 10 × 12

5. **a)** 96 and 4 005 are divisible by 3.
   If you add the digits in the numbers the sum is a multiple of 3, i.e. 15 and 9.
   248 is not divisible by 3.
   The sum of the digits is 14, which is not a multiple of 3.
   If you divide 248 by 3 there will be a remainder:
   248 ÷ 3 = 82 rem 2.

b) 324 and 5 748 are divisible by 4.
The last 2 digits in each number is a multiple of 4, i.e. 24 and 48.
127 is not divisible by 4.
The number is an uneven number; multiples of 4 are all even numbers.
127 ÷ 4 = 31 rem 3

c) 462 and 3 906 are divisible by 6.
Multiples of 6 are even numbers and the sum of the digits gives multiples of 6, i.e. 12 and 18.
135 is not divisible by 6.
The number is an uneven number and the sum of the digits is not a multiple of 6.
135 ÷ 6 = 22 rem 3

d) 234 and 6 750 are divisible by 9.
The sum of the digits gives multiples of 9, i.e. 9 and 18.
539 is not divisible by 9.
The sum of the digits is not a multiple of 9.
539 ÷ 9 = 59 rem 8

6. You should ask the learners to justify their answers. You could ask them to record their work as below.

Expression	**Remainder?**	**Reason**
a) 567 ÷ 2	Yes	The divisor is uneven.
b) 936 ÷ 4	No	The last 2 digits is a multiple of 4: 36
c) 7 896 ÷ 5	Yes	The last digits is not 0 or 5
d) 6 246 ÷ 6	No	The sum of the digits is a multiple of 6: 18
e) 48 708 ÷ 9	No	The sum of the digits is a multiple of 9: 27
f) 13 662 ÷ 3	No	The sum of the digits is a multiple of 3: 18
g) 234 109 ÷ 9	Yes	The sum of the digits is not a multiple of 9: 19
h) 168 214 ÷ 6	Yes	The sum of the digits is not a multiple of 6: 22
i) 7 800 607 ÷ 10	Yes	The unit is not 0
j) 8 540 672 ÷ 4	No	The last 2 digits is a multiple of 4: 72

7. **a)** 567 ÷ 2 = 283 rem 1 **b)** 936 ÷ 4 = 234
c) 7 896 ÷ 5 = 1 579 rem 1 **d)** 6 246 ÷ 6 = 1 041
e) 5 412 **f)** 4 554
g) 26 012 rem 1 **h)** 28 035 rem 4
i) 7 800 607 ÷ 10 = 780 060 rem 7
j) 2 135 168

8. **a)** The ratio of Mpho's working days to Wayne's is 2 : 4. Together they work 6 days.

Mpho's share of the money: $\frac{2}{6}$ or $\frac{1}{3}$ $\frac{1}{3}$ of R2 700 = R900

Wayne's share of the money: $\frac{4}{6}$ or $\frac{2}{3}$ $\frac{2}{3}$ of R2 700 = R1 800

Check: R1 800 + R900 = R2 700

Alternatively:	$\frac{1}{6}$ of R2 700 =	R450
Mpho's share:	2 × R450 =	R900
Wayne's share:	4 × R450 = R900 +	R900
		= R1 800

b) Altogether there are 35 rabbits and pheasants in the cage.

We know that rabbits have four feet each and pheasants have two feet.

If we start off by saying that each of the pheasants and rabbits have two feet, that makes 35 × 2 = 70 feet.

94 – 70 = 24 feet left over
24 ÷ 2 = 12

So there are 12 rabbits (each with four feet) and 23 pheasants (each with two feet).

Unit 20 Proportional sharing and unit rate

Learner's Book page 372

Tell the learners that they will solve problems involving proportional sharing and unit rates. Tell them that these concepts are similar to ratio – they are about the relationship between and comparison of quantities. But now they compare quantities of different things (such as books and the cost of the books), whereas with ratio they compared quantities of the same thing (such as fruit).

MENTAL MATHS

Learner's Book page 372

The learners use the concept of rates between the South African rand, the US (American) dollar ($) and the British pound (£) to develop their understanding of rate and currencies. Tell them that currency rates change almost daily. Ask them to watch the TV news to check the rates of currencies for the next three days. Discuss the rates each day during this period. Let them calculate the values of the rand and pounds mentally. They apply multiplication, doubling and division skills and break up numbers. In converting rand to pound they should demonstrate knowledge of division by 12.

1. If 1 US dollar = R9,50:
   a) 2 US dollars = R19
   b) 4 US \$ = R38
   c) 8 US \$ = R76
   d) 16 US \$ = (70 + 70) + (6 + 6)
   = 140 + 12
   = R152
   e) 32 US \$ = (150 + 150) + (2 + 2)
   = R304

2. If 1 British pound (£) = R12:
   a) R84 = £7
   b) R144 = £12
   c) R120 = £10
   d) R72 = £6
   e) R132 = £11

Activity 20.1

Learner's Book page 373

In questions 1 and 2 they solve problems involving proportional sharing and in question 3 they solve problems entailing unit rates.

1. The learners should realise that they have to work with factors of 360. They do not have information about the cost of the books, so they have to imagine the prices. Below are some possible solutions. Encourage them to investigate all the possibilities.

   a) If both books cost R30:
   R360 ÷ 2 = R180
   R180 ÷ 30 = 6
   Number of books sold altogether: 6 × 2 = 12
   Number of each book sold: 12 ÷ 2 = 6

   If both books cost R60:
   R360 ÷ 2 = R180
   R180 ÷ 60 = 3
   Number of books sold altogether: 3 × 2 = 6
   Number of each book sold: 6 ÷ 2 = 3

   b) On Saturday the books were sold at a ratio of 1 : 2.
   Adventures with lions sold:
   2 of 3 parts or $\frac{2}{3}$ $\frac{2}{3}$ of R360 = R240 240 ÷ 30 = 8

   My holiday in a Spaceship sold:
   1 of 3 parts or $\frac{1}{3}$ $\frac{1}{3}$ of R360 = R120 120 ÷ 30 = 4
   If each book cost R60:
   240 ÷ 60 = 4 and 120 ÷ 60 = 2

2. **a)** Let's say the magazines both cost R10.
   R180 ÷ 2 = R90
   Number of magazines sold: (90 ÷ 10) + (90 ÷ 10) = 18
   Number of each magazine sold: 18 ÷ 2 = 9

b) On Wednesday the books were sold at a ratio of 1 : 2.
Brainteasers sold:
2 of 3 parts or $\frac{2}{3}$ $\frac{2}{3}$ of R180 = R120 120 ÷ 10 = 12

Mind Bogglers sold:
1 of 3 parts or $\frac{1}{3}$ $\frac{1}{3}$ of R180 = R60 60 ÷ 10 = 6

3. **a)** 3 oranges = 60c; 1 orange: 60 ÷ 3 = 20c;
6 oranges: 6 × 20c = R1,20
or 6 oranges: 2 × 60c = R1,20

b) 5 magazines: R250
1 magazine: 250 ÷ 5 = R50
15 magazines: 50 × 15 = R750
or 15 ÷ 5 = 3 3 × R250 = R750

c) 12 books: R150
1 book: 150 ÷ 12 = R12,50
4 books: R12,50 × 4 = R50
or 12 ÷ 4 = 3 R150 ÷ 3 = R50

Unit 21 Division word problems

MENTAL MATHS

Learner's Book page 374

Tell the learners that they will solve problems in context that involve more than one operation. Let them work together to solve the problems so they develop an understanding of the contexts. They will continue to solve this type of problem in this unit.

1. Mojalefa travelled: 96 ÷ 3 = 32 km per day.

2. Mpho travelled:

$$(32 - 5) + (27 - 5) + (22 - 5) = 27 + 22 + 17$$
$$27 + 22 + 17 = 66$$
$$96 - 66 = 30$$
$$30 \div 3 = 10$$
$$(27 + 10) + (22 + 10) + (17 + 10) = 37 \text{ km} + 32 \text{ km} + 27 \text{ km}$$

Check: 37 km + 32 km + 27 km = 96 km
Mpho travelled 37 km on day 1, 32 km on day 2 and 27 km on day 3.

Activity 21.1

Learner's Book page 374

The learners continue to solve problems in context. The problems involve multi-operations and rate contexts in which learners have to decide which products give the best value for money.

In questions 1 and 2 the learners should realise that in order to solve the problems, they have to count back and on in 4s, 5s, 6s, 9s, 15s, and so on. In (a), for example, they have to count back in 5s to get 9 multiples with a sum of 315. Dividing 315 by 9, for example, will give them an idea of where to start. In (b) they have to count back in 6s from a decimal fraction. They would probably apply the trial and improvement strategy.

In questions 3 and 4 they have to calculate the petrol that a car consumes during a year and they determine the better buys among products.

1. **a)** 315 ÷ 9 = 35
Day 1: 55 km
Day 2: 55 – 5 = 50 km
Day 3: 50 – 5 = 45 km
Day 4: 45 – 5 = 40 km
Day 5: 40 – 5 = 35 km
Day 6: 35 – 5 = 30 km
Day 7: 30 – 5 = 25 km
Day 8: 25 – 5 = 20 km
Day 9: 20 – 5 = 15 km
Total distance: 315 km

b) 315 ÷ 6 = 52,5
58,5 km
Day 1: 58,5 – 6 = 52,5 km
Day 2: 52,5 – 6 = 46,5 km
Day 3: 46,5 – 6 = 40,5 km
Day 4: 40,5 – 6 = 34,5 km
Day 5: 34,5 – 6 = 28,5 km
Day 6: 28,5 – 6 = 22,5 km
Day 7: 22,5 – 6 = 16,5 km
Day 8: 16,5 – 6 = 10,5 km
Day 9: 10,5 – 6 = 4,5 km
Total distance: 315 km

c) 315 ÷ 9 = 35
Day 1: 71 km
Day 2: 71 – 9 = 62 km
Day 3: 62 – 9 = 53 km
Day 4: 53 – 9 = 44 km
Day 5: 44 – 9 = 35 km
Day 6: 35 – 9 = 26 km
Day 7: 26 – 9 = 17 km
Day 8: 17 – 9 = 8 km
Total distance: 316 km

2. **a)** 855 ÷ 15 = 57
Day 1: 92 km
Day 2: 92 – 5 = 87 km
Day 3: 87 – 5 = 82 km
Day 4: 82 – 5 = 77 km
Day 5: 77 – 5 = 72 km
Day 6: 72 – 5 = 67 km
Day 7: 67 – 5 = 62 km
Day 8: 62 – 5 = 57 km
Day 9: 57 – 5 = 52 km
Day 10: 52 – 5 = 47 km
Day 11: 47 – 5 = 42 km
Day 12: 42 – 5 = 37 km
Day 13: 37 – 5 = 32 km
Day 14: 32 – 5 = 27 km
Day 15: 27 – 5 = 22 km
Total distance: 855 km

b) Day 1: 89 – 4 = 85 km
Day 2: 85 – 4 = 81km
Day 3: 81 – 4 = 77 km
Day 4: 77 – 4 = 73 km
Day 5: 73 – 4 = 69 km
Day 6: 69 – 4 = 65 km
Day 7: 65 – 4 = 61 km
Day 8: 61 – 4 = 57 km
Day 9: 57 – 4 = 53 km
Day 10: 53 – 4 = 49 km
Day 11: 49 – 4 = 45 km
Day 12: 45 – 4 = 41 km
Day 13: 41 – 4 = 37 km
Day 14: 37 – 4 = 33 km
Day 15: 33 – 4 = 29 km
Total distance: 855 km

c) 108 km

3. 100 km → 9 litres
   1 000 km → 90 litres
   500 km → 45 litres
   1 500 km → 135 litres
   His car consumes 135 litres of petrol per year.

4. Cost of 1 cool drink: R7,50
   Cost of 6 cool drinks @ R7,50 each:
   (6 × R7) + (6 × 50c)
   = R42 + R3,00
   = R45,00
   The six-pack of cool drink @ R42,40 is the better buy.

5. 2,5 kg × 10 = 25 kg　　R28 × 10 = R280
   5 kg × 5 = 25 kg　　R54 × 5 = R270
   25 kg dog food = R268
   The 25 kg bag is the best buy.

Unit 22 Ratio and division

MENTAL MATHS

Learner's Book page 375

Tell the learners that they will work with ratio and division. They name the ratios and explore equivalent ratios. They will now learn about giving ratios in their simplest forms. They need to understand that, if both numbers are divided by the same number, the value of the ratio does not change. Ask them to explore the relationships between the numbers to discover this.

1. **a)** The ratio of bulls to cows is 4 : 80.
   b) The ratio of cows to bulls is 80 : 4.
   c) The ratio is now 2 : 80.

2. **a)** dogs : ducks → 3 : 27
   b) 3 × 4 = 12; 27 × 2 = 54
   dogs' legs : ducks' legs → 12 : 54

3. **a)** 2 : 40
   b) 4 : 80 and 2 : 40
   4 ÷ 2 = 2　　2 is half of 4
   80 ÷ 2 = 40　　40 is half of 80

4. The ratio 4 : 80 is equivalent to 2 : 40. The values are both equal to 1 : 20.
   3 : 27 → 3 ÷ 3 = 1; 27 ÷ 3 = 9
   ratio in the simplest form → 1 : 9
   3 : 27 = 1: 9
   12 : 54→ 12 ÷ 6 = 2; 54 ÷ 6 = 9
   ratio in the simplest form → 2 : 9

Note: Ensure that the learners understand the concept of the simplest form. Ask them why they think we say the ratios 1 : 9 and 2 : 9 are in the simplest form. They should understand that there is no common factor that can divide in both numbers except 1.

Activity 22.1

Learner's Book page 375

The learners write ratios in their simplest forms and represent quantities as ratios in questions 2 and 3. In question 4 they determine quantities if one of the quantities increases.

1. **a)** 7 : 14 = 1 : 2 (divide by 7; 7 is the largest common factor)
b) 8 : 12 = 2 : 3 (divide by 4; 4 is the largest common factor)
c) 15 : 45 = 1 : 3 (divide by 15; 15 is the largest common factor)
d) 80 : 20 = 4 : 1 (divide by 20; is the largest common factor)
e) 100 : 25 = 4 : 1 (divide by 25; 25 is the largest common factor)
f) 45 : 90 = 1 : 2 (divide by 45; 45 is the largest common factor)
g) 6 : 18 = 1 : 3 (divide by 6; 6 is the largest common factor)
h) 10 : 12 = 5 : 6 (divide by 2; 2 is the largest common factor)
i) 16 : 40 = 2 : 5 (divide by 8; 8 is the largest common factor)
j) 18 : 27 = 2 : 3 (divide by 9; 9 is the largest common factor)

2. Ask the learners to record their work in a table.

	Relationship	Ratio	Simplest form	Largest common factor
a)	girls to boys	30 : 24	5 : 4	6
b)	jockeys to horses	40 : 25	8 : 5	5
c)	chickens to birds	14 : 28	1 : 2	14
d)	socks to shirts	12 : 9	4 : 3	3
e)	players to balls	4 : 14	2 : 7	2

3. **a)** Lee-Ann's marbles → 65 – 15 = 50 **ratio = 65 : 50**
b) Simplest form → 13 : 10

4. Grandma's age → 21 × 6 = 126
a) grandma's age → Thoko's age = 126 : 21
b) Simplest form → 6 : 1

5. **a)** Red paint needed: 5 × 2 = 10, so 2 × 2 = 4 litres
2 : 5 = 4 : 10
b) Yellow paint needed: 2 × 3 = 6, so 3 × 5 = 15 litres
2 : 5 = 6 : 15

c) The ratio of red to yellow paint is 2 : 5
The whole consists of 7 parts.
The red paint is 2 of 7 parts and the yellow paint is 5 of 7 parts.

Red paint needed: $\frac{2}{7}$ of 35 = (35 ÷ 7) × 2
= 10 litres

Yellow paint needed: $\frac{5}{7}$ of 35 = (35 ÷ 7) × 5
= 25 litres

Check: 25 + 10 = 35 litres

Unit 23 More division

MENTAL MATHS

Learner's Book page 376

Tell the learners that they will perform division problems out of context using the long division strategy. They practise the skills they need to apply in the division strategy they will use in this unit. They subtract and multiply by 10 and multiples of 10.

1. 7 431 – 3 200 = 4 231
2. 4 356 – 2 400 = 1 956
3. 756 – 560 = 196
4. 694 – 670 = 24
5. 9 132 – 7 200 = 1 932
6. 24 × 100 = 2 400
7. 45 × 10 = 450
8. 53 × 100 = 5 300
9. 18 × 10 = 180
10. 36 × 100 = 3 600

Activity 23.1

Learner's Book page 377

Ask the learners to explore the repeated subtraction strategy that Shafiek uses for division. It involves subtraction of multiples of the divisor into the thousands and hundreds. They use the strategy to solve the 4-digit by 2-digit number division.

1. a) 4 456 ÷ 26 = ■

$$\begin{array}{rrr}
 & 4\,456 & \\
- & \underline{2\,600} & 26 \times 100 \\
 & 1\,856 & \\
- & \underline{1\,300} & 26 \times 50 \\
 & 556 & \\
- & \underline{520} & 26 \times 20 \\
 & 36 & \\
- & \underline{26} & 26 \times \underline{1} \\
 & 10 & 171
\end{array}$$

4 456 ÷ 26 = 171 remainder 10

b) 6 529 ÷ 42 = ■

$$\begin{array}{rrr}
 & 6\,529 & \\
- & \underline{4\,200} & 42 \times 100 \\
 & 2\,329 & \\
- & \underline{2\,100} & 42 \times 50 \\
 & 229 & \\
- & \underline{210} & 42 \times \underline{5} \\
 & 19 & 155
\end{array}$$

6 529 ÷ 42 = 155 remainder 19

c) 5 373 ÷ 34 = ■

$$\begin{array}{lrr}
 & 5\,373 & \\
- & \underline{3\,400} & 34 \times 100 \\
 & 1\,973 & \\
- & \underline{1\,700} & 34 \times 50 \\
 & 273 & \\
- & \underline{170} & 34 \times 5 \\
 & 103 & \\
- & \underline{102} & 34 \times \underline{3} \\
 & 1 & 158
\end{array}$$

3 285 ÷ 27 = 151
remainder 1

d) 3 285 ÷ 27 = ■

$$\begin{array}{lrr}
 & 3\,285 & \\
- & \underline{2\,700} & 27 \times 100 \\
 & 585 & \\
- & \underline{540} & 27 \times 50 \\
 & 45 & \\
- & \underline{27} & 27 \times \underline{1} \\
 & 18 & 151
\end{array}$$

5 373 ÷ 34 = 158
remainder 1

e) 4 466 ÷ 29 = ■

$$\begin{array}{lrr}
 & 4\,466 & \\
- & \underline{2\,900} & 29 \times 100 \\
 & 1\,566 & \\
- & \underline{1\,450} & 29 \times 50 \\
 & 116 & \\
- & \underline{116} & 29 \times \underline{4} \\
 & 0 & 154
\end{array}$$

4 466 ÷ 29 = 154

f) 7 634 ÷ 38 = ■

$$\begin{array}{lrr}
 & 7\,634 & \\
- & \underline{7\,600} & 38 \times 200 \\
 & 34 &
\end{array}$$

7 634 ÷ 38 = 200
remainder 34

g) 9 167 ÷ 63 = ■

$$\begin{array}{lrr}
 & 9\,167 & \\
- & \underline{6\,300} & 63 \times 100 \\
 & 2\,867 & \\
- & \underline{2\,520} & 63 \times 40 \\
 & 347 & \\
- & \underline{315} & 63 \times \underline{5} \\
 & 32 & 145
\end{array}$$

7 634 ÷ 38 = 145
remainder 32

h) 8 248 ÷ 56 = ■

$$\begin{array}{lrr}
 & 8\,248 & \\
- & \underline{5\,600} & 56 \times 100 \\
 & 2\,648 & \\
- & \underline{2\,240} & 56 \times 40 \\
 & 408 & \\
- & \underline{392} & 56 \times \underline{7} \\
 & 16 & 147
\end{array}$$

8 248 ÷ 56 = 147
remainder 16

i) 6 521 ÷ 49 = ■

$$\begin{array}{lrr}
 & 6\,521 & \\
- & \underline{4\,900} & 49 \times 100 \\
 & 1\,621 & \\
- & \underline{1\,470} & 49 \times 30 \\
 & 151 & \\
- & \underline{147} & 49 \times \underline{3} \\
 & 4 & 133
\end{array}$$

6 521 ÷ 49 = 133
remainder 4

j) 9 246 ÷ 35 = ■

$$\begin{array}{lrr}
 & 9\,246 & \\
- & \underline{7\,000} & 35 \times 200 \\
 & 2\,246 & \\
- & \underline{1\,750} & 35 \times 50 \\
 & 546 & \\
- & \underline{350} & 35 \times 10 \\
 & 196 & \\
- & \underline{175} & 35 \times \underline{5} \\
 & 21 & 65
\end{array}$$

9 246 ÷ 35 = 65
remainder 21

Unit 24 More division strategies

MENTAL MATHS

Learner's Book page 377

Tell the learners they will work with 4- by 3-digit number division. They practise the skills for repeated subtraction before they apply the long division strategy.

1. $(10 \times 2) \times 154$
$= 308 \times 10$
$= 3\,080$

2. $(10 \times 3) \times 231$
$= 693 \times 10$
$= 6\,930$

3. 20×432
$= 432 \times 2 \times 10$
$= 8\,640$

4. 30×57
$= 57 \times 3 \times 10$
$= 1\,710$

5. $(10 \times 4) \times 78$
$= 312 \times 10$
$= 3\,120$

6. 40×34
$= 34 \times 4 \times 10$
$= 1\,360$

7. $(10 \times 5) \times 65$
$= 325 \times 10$
$= 3\,250$

8. 50×74
$= 74 \times 5 \times 10$
$= 3\,700$

9. $(10 \times 6) \times 72$
$= 432 \times 10$
$= 4\,320$

10. 60×48
$= 48 \times 6 \times 10$
$= 2\,880$

Activity 24.1

Learner's Book page 377

1, 2. Class discussion

3. a) $5\,513 \div 224 =$ ■

$$\begin{array}{rlr} & 5\,513 & \\ - & \underline{4\,480} & (10 \times 2) \times 224 = 224 \times 20 \\ & 1\,033 & \\ - & \underline{976} & = 224 \times \underline{\ 4} \\ & 57 & 24 \end{array}$$

$5\,513 \div 224 = 24$ remainder 57

b) $3\,427 \div 136 =$ ■

$$\begin{array}{rlr} & 3\,427 & \\ - & \underline{2\,720} & (10 \times 2) \times 136 = 136 \times 20 \\ & 707 & \\ - & \underline{680} & = 136 \times \underline{\ 5} \\ & 26 & 25 \end{array}$$

$3\,427 \div 136 = 25$ remainder 26

c) $8\,694 \div 236 = \blacksquare$

$$\begin{array}{rrr}
 & 8\,694 & \\
- & \underline{7\,080} & (10 \times 3) \times 236 = 236 \times 30 \\
 & 1\,614 & \\
- & \underline{1\,180} & = 236 \times 5 \\
 & 434 & \\
- & \underline{236} & = 236 \times \underline{1} \\
 & 198 & 36
\end{array}$$

$8\,694 \div 236 = 36$ remainder 198

d) $6\,673 \div 424 = \blacksquare$

$$\begin{array}{rrr}
 & 6\,673 & \\
- & \underline{4\,240} & 424 \times 10 \\
 & 2\,433 & \\
- & \underline{2\,120} & 424 \times \underline{5} \\
 & 313 & 15
\end{array}$$

$6\,673 \div 424 = 15$ remainder 313

e) $4\,286 \div 157 = \blacksquare$

$$\begin{array}{rrr}
 & 4\,286 & \\
- & \underline{3\,140} & (10 \times 2) \times 157 = 157 \times 20 \\
 & 1\,146 & \\
- & \underline{942} & = 157 \times 6 \\
 & 204 & \\
- & \underline{157} & = 157 \times \underline{1} \\
 & 47 & 27
\end{array}$$

$4\,286 \div 157 = 27$ remainder 47

f) $9\,834 \div 348 = \blacksquare$

$$\begin{array}{rrr}
 & 9\,834 & \\
- & \underline{6\,960} & (10 \times 2) \times 348 = 348 \times 20 \\
 & 2\,874 & \\
- & \underline{1\,740} & = 348 \times 5 \\
 & 1\,134 & \\
- & \underline{1\,044} & = 348 \times \underline{3} \\
 & 90 & 28
\end{array}$$

$9\,834 \div 348 = 28$ remainder 90

g) $7\,956 \div 415 = \blacksquare$

$$\begin{array}{rrr}
 & 7\,956 & \\
- & \underline{4\,150} & = 415 \times 10 \\
 & 3\,806 & \\
- & \underline{2\,075} & = 415 \times 5 \\
 & 1\,731 & \\
- & \underline{1\,660} & = 415 \times \underline{4} \\
 & 71 & 19
\end{array}$$

$7\,956 \div 415 = 19$ remainder 71

h) 8 258 ÷ 263 = ■

$$\begin{array}{rrr} & 8\,258 & \\ - & \underline{7\,890} & (10 \times 3) \times 263 = 263 \times 30 \\ & 368 & \\ - & \underline{263} & = 263 \times \underline{1} \\ & 105 & 31 \end{array}$$

8 258 ÷ 263 = 31 remainder 105

i) 5 952 ÷ 124 = ■

$$\begin{array}{rrr} & 5\,952 & \\ - & \underline{4\,960} & (10 \times 4) \times 124 = 124 \times 40 \\ & 992 & \\ - & \underline{992} & = 124 \times \underline{8} \\ & 0 & 48 \end{array}$$

5 952 ÷ 124 = 48

j) 6 840 ÷ 285 = ■

$$\begin{array}{rrr} & 6\,840 & \\ - & \underline{5\,700} & (10 \times 2) \times 124 = 124 \times 20 \\ & 1\,140 & \\ - & \underline{1\,140} & = 124 \times \underline{4} \\ & 0 & 24 \end{array}$$

6 840 ÷ 285 = 24

Unit 25 Long division

MENTAL MATHS

Learner's Book page 378

Tell the learners that they will solve division problems by applying the long division strategy. They start with 3-digit by 1-digit division to focus on the process. Tell the learners that we normally only apply long division when working with big numbers. The problems they will work with now can be solved mentally or by breaking up numbers. Make sure that all the learners understand the process.

1. 465 ÷ 6 = 77 remainder 3
2. 679 ÷ 8 = 84 remainder 7
3. 834 ÷ 9 = 92 remainder 6
4. 936 ÷ 3 = 312
5. 735 ÷ 4 = 183 remainder 3
6. 953 ÷ 5 = 190 remainder 3

Activity 25.1

Learner's Book page 378

Ask the learners to solve the problems using the long division strategy. They work with 4-digit numbers divided by 2-digit and 3-digit numbers.

1. a) $3\ 245 \div 26 = \blacksquare$

$$\begin{array}{r} 124 \\ 26\overline{)3245} \\ -\underline{26} \\ 64 \\ -\underline{52} \\ 125 \\ -\underline{104} \\ 21 \end{array}$$

3 245 ÷ 26 = 124 remainder 21

b) $5\ 164 \div 34 = \blacksquare$

$$\begin{array}{r} 151 \\ 34\overline{)5164} \\ -\underline{34} \\ 176 \\ -\underline{170} \\ 64 \\ -\underline{34} \\ 30 \end{array}$$

5 164 ÷ 34 = 151 remainder 30

c) $8\ 241 \div 47 = \blacksquare$

$$\begin{array}{r} 175 \\ 47\overline{)8241} \\ -\underline{47} \\ 354 \\ -\underline{329} \\ 251 \\ -\underline{235} \\ 16 \end{array}$$

8 241 ÷ 47 = 175 remainder 16

d) $9\ 923 \div 232 = \blacksquare$

$$\begin{array}{r} 42 \\ 232\overline{)9923} \\ -\underline{928} \\ 643 \\ -\underline{464} \\ 179 \end{array}$$

9 923 ÷ 232 = 42 remainder 179

e) $8\ 852 \div 225 = \blacksquare$

$$\begin{array}{r} 39 \\ 225\overline{)8852} \\ -\underline{675} \\ 2102 \\ -\underline{2025} \\ 77 \end{array}$$

8 852 ÷ 225 = 39 remainder 77

f) $7\ 628 \div 156 = \blacksquare$

$$\begin{array}{r} 48 \\ 156\overline{)7628} \\ -\underline{624} \\ 1388 \\ -\underline{1248} \\ 140 \end{array}$$

7 628 ÷ 156 = 48 remainder 140

g) $9\ 724 \div 167 = \blacksquare$

$$\begin{array}{r} 58 \\ 167\overline{)9724} \\ -\underline{835} \\ 1374 \\ -\underline{1336} \\ 38 \end{array}$$

9 724 ÷ 167 = 48 remainder 38

h) $6\ 248 \div 203 = \blacksquare$

$$\begin{array}{r} 30 \\ 203\overline{)6248} \\ -\underline{609} \\ 158 \\ -\underline{0} \\ 158 \end{array}$$

6 248 ÷ 203 = 30 remainder 158

i) 5 973 ÷ 182 = ■

$$\begin{array}{r} 32 \\ 182\overline{)5973} \\ -\underline{546} \\ 513 \\ -\underline{364} \\ 149 \end{array}$$

5 973 ÷ 182 = 32 remainder 149

j) 8 025 ÷ 321 = ■

$$\begin{array}{r} 25 \\ 321\overline{)8025} \\ -\underline{642} \\ 1605 \\ -\underline{1605} \\ 0 \end{array}$$

8 025 ÷ 321 = 25

Assessment 4.4: Division of whole numbers

The learners will apply prior knowledge and knowledge they have developed during the past seven units to solve the problems. They find factor pairs of numbers, use rules of divisibility, apply knowledge of rate and ratio to solve problems, and use their own strategies to solve division problems out of context.

1. Write the factor pairs of the following numbers.
   a) 20
   b) 14
   c) 22
   d) 29
   e) 40

2. Write down the numbers that are divisible by:
   a) 5 and 10: 234 502 760 2 010 4 090 3 112
   b) 3, 6 and 9: 317 468 990 4 712 5 935 9 108

3. Solve the following.
   a) Three apricots cost R1,20 (120c). What will 9 apricots cost?
   b) Mother paid R10 for 4 pencils. What will 16 pencils cost?

4. A 250 g can of baked beans costs R9,35. A 1 kg can of baked beans costs R38,99.
   Which is the best value for money?

5. There are 60 sheep and 40 cows on a farm.
   a) What is the ratio of cows to sheep?
   b) Write the ratio in the simplest form.
   c) The farmer buys 15 more sheep. What is the ratio now?
   d) Write the new ratio in its simplest form.

6. Use your own strategies to solve the following.
   a) $1\ 305 \div 5 = ■$
   b) $4\ 806 \div 6 = ■$
   c) $497 \div 3 = ■$
   d) $6\ 976 \div 15 = ■$
   e) $9\ 432 \div 34 = ■$
   f) $8\ 529 \div 235 = ■$
   g) $7\ 846 \div 143 = ■$

Assessment 4.4 Division of whole numbers **Solutions**

1. **a)** 20 → 1 × 20; 2 × 10; 4 × 5
b) 14 → 1 × 14; 2 × 7
c) 22 → 1 × 22; 2 × 11
d) 29 → 1 × 29
e) 40 → 1 × 40; 2 × 20; 4 × 10; 5 × 8

2. **a)** Numbers divisible by 5 and 10: 760; 2 010; 4 090
b) Numbers divisible by 3, 6 and 9: 468; 990; 9 108

3. **a)**

3 apricots → R1,20	or	1 apricot R1,20 ÷ 3 = 40c
6 apricots → R2,40		9 apricots → 40 × 9 = R3,60
9 apricots → R3,60		

b)

4 pencils → R10	or	4 × 4 = 16
8 pencils → R20		4 × 10 = R40
16 pencils → R40		

4. 250 g × 4 = 1 kg
R9,35 × 4 = (9 × 4) + (30 × 4) + (5 × 4)
= R36 + R1,20 + 20c
= R37,40
R37,40 < R38,99

Buying four 250 g cans of baked beans is the better buy.

5. **a)** 40:60
b) 2:3
c) 75:40
d) 15:8

6. **a)** 1 305 ÷ 5 = 261
b) 4 806 ÷ 6 = 801
c) 497 ÷ 3 = 164 rem 2
d) 6 976 ÷ 15 = 465 rem 1
e) 9 432 ÷ 34 = 277 rem 14
f) 8 529 ÷ 235 = 36 rem 119
g) 7 846 ÷ 143 = 54 rem 124

Number sentences

Learner's Book page 379

Number sentences

Remind the learners that they have worked with the topic Number sentences in Term 1. They also apply number sentences in various sections of whole numbers. The learners have developed an understanding of the correct order of operations and the importance of the use of brackets. They have applied inverse operations and used number sentences to strengthen their knowledge of operations with multiples and powers of 10.

The work they have done in number sentences also involved the investigation of square numbers, equivalent equations using basic multiplication and division facts, using number rules (properties) and developing rules to describe problem situations.

During the next three units they will continue to develop their understanding of number sentences as preparation for working with algebra in higher grades.

Unit 26 Revising number rules

MENTAL MATHS

Learner's Book page 379

Tell the learners that they will revise the number rules or properties they have worked with before. This involves the use of the commutative, associative and distributive properties of number. It also entails the application of the correct order of operations and the properties of 1 and 0. Ask the learners to work together as a class to solve the number sentences or equations. They discuss the number properties in pairs or in groups and explain to the class how the properties work.

In A they should note that you get the same answer although the numbers are swapped (commutative property) in addition and multiplication, but the rule does not work for subtraction and division. Let them use calculators to check this.

In B they group or associate numbers that they can manage more easily with each other.

In C they break up and distribute the multiplier to calculate easier, and in D they apply the correct order of operations and the use of brackets to get the correct solutions.

In E they have to recognise 0 and 1 as additive inverses. You should check whether the learners remember that division by zero is not allowed, as it is impossible or senseless.

1. $8 + 4 = 4 + 8 = 12$ $\quad$ $8 - 4 \neq 4 - 8$

$8 \times 4 = 4 \times 12 = 48$ $\quad$ $8 \div 4 \neq 4 \div 8$

2. $7 + 6 + 5 + 3 + 5 + 4 = 7 + 3 + 6 + 4 + 5 + 5$

$= 10 + 10 + 10$

$= 30$

3. $12 \times 26 = (12 \times 13) + (12 \times 13)$

$= 156 + 156$

$= 312$

or $26 \times 12 = (26 \times 10) + (26 \times 2)$

$= 260 + 52$

$= 312$

4. $7 \times 8 \div 4 + 9 = 56 \div 4 + 9$

$= 14 + 9$

$= 23$

$8 - 4 \div 2 + 12 = 8 - 2 + 12$

$= 6 + 12$ $(12 + 6)$

$= 18$

$3 \times 4 \div (9 - 6) + 17 = 3 \times 4 \div 3 + 17$

$= 12 \div 3 + 17$

$= 4 + 17$ $\quad (17 + 4)$

$= 21$

5. $8 \times 1 = 8$ $\quad$ $8 \div 8 = 1$

$8 \times 0 = 0$ $\quad$ $0 \div 8 = 0$

$8 \div 0 =$ impossible (division by zero is not allowed)

$8 + 8 - 8 = 8 + 0$

$= 8$

Activity 26.1

Learner's Book page 380

The learners work individually with number sentences involving the commutative and distributive properties. They have to recognise number sentences that are equivalent and use the relationship between numbers to find out how much less one expression is than the other. They should know, for example, that 12 × 11 is 12 less than 12 × 12. Encourage the learners to share their ideas and solutions.

1. a) Tell the learners that there might be more than one solution for some expressions.

19 × ■ **=**

■ – 19 =

■ + 19 =

19 ÷ ■ =

■ × 19 =

19 × ■ **=** ■ **× 19**

19 × 1 = 1 × 19 = 19 (commutative property)

19 × ■ **= 19 ÷** ■

19 × 1 = 19; 19 ÷ 1 = 19 (inverse operations)

$\blacksquare + \mathbf{15} =$
$15 - \blacksquare =$
$\blacksquare \times 15 =$
$15 + \blacksquare =$
$\blacksquare \div 15 =$

$\blacksquare + 15 = 15 + \blacksquare$
$7 + 15 = 15 + 7 = 22$ (commutative property
$\mathbf{\blacksquare + 15 = 15} - \blacksquare =$
$0 + 15 = 15$ $15 - 15 = 0$ (inverse operations)
or $0 + 15 = 15$ $15 - 0 = 15$

b) $\mathbf{(24 \times 23) + (24 \times 2)} = (24 \times 20) + (24 \times 3) + (24 \times 2)$
$= 480 + 72 + 48$
$= 600$

$24 \times 25 = (24 \times 20) + (24 \times 5)$
$= 480 + 120$
$= 600$

$\mathbf{(30 \times 10) + (30 \times 4)} = 300 + 120$
$= 420$

$30 \times 14 = (30 \times 10) + (30 \times 4)$
$= 300 + 120$
$= 420$

2. **a)** $12 \times 12 = 144$
$12 \times 11 = 132$ — 12×11 is 12 less than 12×12

b) $45 \times 30 = 1\ 350$
$44 \times 30 = 1\ 320$ — 44×30 is 30 less than 45×30

c) $101 \times 34 = 3\ 434$
$100 \times 34 = 3\ 400$ — 100×34 is 34 less than 101×34

d) $25 \times 25 = 625$
$25 \times 24 = 600$ — 25×24 is 25 less than 25×25

e) $32 + 34 = 66$
$31 + 34 = 65$ — $31 + 34$ is 1 less than $32 + 34$

f) $46 + 42 = 88$
$40 + 42 = 82$ — $40 + 42$ is 6 less than $46 + 42$

g) $12 \div 3 = 4$
$12 \div 4 = 3$ — $12 \div 4$ is 1 less than $12 \div 3$

h) $100 \div 25 = 4$
$50 \div 25 = 2$ — $50 \div 25$ is 2 less than $100 \div 25$

i) $67 - 13 = 54$
$57 - 13 = 44$ — $57 - 13$ is 10 less than $67 - 13$

j) $125 - 40 = 85$
$125 - 60 = 65$ — $125 - 60$ is 20 less than $125 - 40$

Unit 27 Equations that balance

MENTAL MATHS

Learner's Book page 380

Ask the learners to solve all the equations. They use factors and the distributive property. They should discover that the solution to all the equations, except the last one, is the same, i.e. 576. Ask them to explain why this is the case. They should notice that 12 and 48 have been broken up into smaller factors, which means that they have in fact multiplied 12 × 48 in all the equations with the same solution.

In question 2 they need to explain why some solutions are the same as the solution in the example and why others are not. They should notice that they have divided by factors of 60, which gives the same solution as 120 ÷ 60. Ask them what is different about the expressions that do not have the same solutions as in the multiplication and division examples.

1. a) $12 \times (6 \times 8) = 12 \times 48$
$= 576$

$2 \times 6 \times 3 \times 2 \times 4 \times 2 = 12 \times 6 \times 8$
$= 72 \times 8$
$= (70 \times 8) + (2 \times 8)$
$= 560 + 16$
$= 576$

$12 \times 3 \times 2 \times 8 = 36 \times 16$
$= (36 \times 10) + (36 \times 6)$
$= 360 + (30 \times 6) + (6 \times 6)$
$= 360 + 180 + 36$
$= 576$

$12 \times 3 \times 2 \times 2 \times 4 = 36 \times 4 \times 4$
$= 36 \times 16$
$= (30 \times 16) + (6 \times 16)$
$= 480 + 96$
$= 576$

$(12 \times 3) + (2 \times 8) = 36 \times 16$
$= 576$

$(10 + 2) + (6 \times 4) + (6 \times 2) = 12 + 24 + 12$
$= 48$

b) $120 \div (4 \times 15) = 120 \div 60$
$= 2$

$(120 \div 20) \times 30 = 60 \times 30$
$= 1\ 800$

$120 \div 4 \div 3 \div 5 = 30 \div 3 \div 5$
$= 10 \div 5$
$= 2$

$$
\begin{aligned}
(60 \div 4) + (60 \div 15) &= 15 + 4 \\
&= 16
\end{aligned}
$$

$$
\begin{aligned}
(120 \div 4) \div 15 &= 30 \div 15 \\
&= 2
\end{aligned}
$$

$$120 \div 60 = 2$$

2. **a)**
$$
\begin{aligned}
(23 \times 20) + (23 \times 5) &= 460 + 115 \\
&= 575
\end{aligned}
$$

b)
$$
\begin{aligned}
(31 \times 27) + (31 \times 3) &= (30 \times 27) + (1 \times 27) + 93 \\
&= 810 + 27 + 93 \\
&= 930
\end{aligned}
$$

c)
$$
\begin{aligned}
(52 \times 38) + (52 \times 2) &= (50 \times 38) + (2 \times 38) + 104 \\
&= 1\,900 + 76 + 104 \\
&= 2\,080
\end{aligned}
$$

Activity 27.1

Learner's Book page 381

Tell the learners that in this unit they will enhance their understanding of equivalent number sentences or equations. They have worked with the concept of balancing scales as simulations for solving equations before. They solve the equations by finding the mass of one object.

Let the learners work together as a class to explore the process of finding the mass of 1 bag of dog food.

In question 1 the learners apply the strategy in the example to solve the equations.

In question 2 they work without the balancing scales and solve the equations out of context. In (c) you should explain that, as they have 'taken away' the same number of bags on both sides of the scales, they should also 'take away' (i.e. subtract) the same number value on both sides, so that they get:

$$
\begin{aligned}
\blacksquare + 10 + \blacksquare &= \blacksquare + 12 \qquad \text{(take away one } \blacksquare \text{ and 10 on both sides)} \\
\blacksquare &= 2
\end{aligned}
$$

Ask them to check their solutions by substituting the value of ■ into the equation. If the numbers on both sides of the = signs are the same, the equations balance, i.e. the value of the place holder has been calculated correctly.

1.
$$
\begin{aligned}
\blacksquare + \blacksquare + 3 &= \blacksquare + 7 \\
\blacksquare &= 7 - 3 \\
\blacksquare &= 4 \\
4 + 4 + 3 &= 4 + 7 \\
11 &= 11
\end{aligned}
$$

2. a)

$$\blacksquare + \blacksquare + \blacksquare + \blacksquare = \blacksquare + \blacksquare + 24$$
$$\blacksquare + \blacksquare = 24$$
$$12 + 12 = 24$$
$$\blacksquare = 12$$
$$12 + 12 + 12 + 12 = 12 + 12 + 24$$
$$4 \times 12 = 24 + 24$$
$$48 = 48$$

b)

$$\blacksquare + \blacksquare + \blacksquare + 5 = \blacksquare + \blacksquare + 8$$
$$\blacksquare + 5 = 8$$
$$\blacksquare = 8 - 5$$
$$\blacksquare = 3$$
$$3 + 3 + 3 + 5 = 3 + 3 + 8$$
$$14 = 14$$

c)

$$\blacksquare + 10 + \blacksquare = \blacksquare + 12$$
$$\blacksquare + 10 = 12$$
$$\blacksquare = 12 - 10$$
$$\blacksquare = 2$$
$$2 + 10 + 2 = 2 + 12$$
$$14 = 14$$

d)

$$15 + \blacksquare + \blacksquare + \blacksquare + \blacksquare = \blacksquare + 33$$
$$15 + \blacksquare + \blacksquare + \blacksquare = 33$$
$$\blacksquare + \blacksquare + \blacksquare = 33 - 15$$
$$\blacksquare + \blacksquare + \blacksquare = 18$$
$$6 + 6 + 6 = 18$$
$$\blacksquare = 18$$
$$15 + 6 + 6 + 6 = 33$$
$$33 = 33$$
$$15 + 6 + 6 + 6 = 33$$

e)

$$\blacksquare + \blacksquare + \blacksquare + 100 = \blacksquare + \blacksquare + 120$$
$$\blacksquare + 100 = 120$$
$$\blacksquare = 120 - 100$$
$$\blacksquare = 20$$
$$20 + 20 + 20 + 100 = 20 + 20 + 120$$
$$160 = 160$$

Unit 28 Solving real-life problems

MENTAL MATHS

Learner's Book page 382

Tell the learners that they will now work with equations that do not balance – the value on the one side is not equal to that on the other side of an equation. They should understand the relationship signs <, >, = and ≠ (is not equal to). They investigate the relationships in the expressions and fill in values that make them, less than, greater than, or unequal. Ask them to write the solutions to the inequalities in question 2 on their Mental Maths grids. Let them share their solutions with the class.

1. Learners should realise that the problems are open, i.e. there is more than one solution. Solutions are correct as long as the statements are true.

   a) $8 \times \blacksquare > 8 \times \blacksquare$
   $8 \times 6 > 8 \times 5$
   $8 \times 10 > 8 \times 1$ and so on

   b) $7 + \blacksquare < 19$
   $7 \times 10 < 19$
   $7 + 0 < 19$ and so on

   c) $24 \div 6 \neq \blacksquare$
   $24 \div 6 \neq 30$
   $24 \div 6 \neq 60$ and so on

   d) $20 - \blacksquare \neq 20 - \blacksquare$
   $20 - 9 \neq 20 - 8$
   $20 - 20 \neq 20 - 10$ and so on

   e) $15 + 8 \neq 15 + \blacksquare$
   $15 + 8 \neq 15 + 7$
   $15 + 8 \neq 15 + 10$ and so on

2. The learners should solve for inequalities to justify their solutions.

   a) $5 + 8 > 8 + 5$
   $13 > 13$ False

   b) $9 - 5 = 5 - 9$ False
   You do not subtract a big number from a small number (not at this stage).

   c) $6 \times 5 \neq 5 \times 6$
   $30 \neq 30$ False

   d) $12 \times 12 > 12 \times 13$
   $24 > 25$ True

   e) $10 \times 9 < 8 \times 10$
   $90 < 80$ True

   f) $15 \div 5 = 5 \div 15$
   $3 = \frac{1}{3}$ False
   $5 \div 15 = \frac{5}{15} = \frac{1}{3}$

   g) $12 \div 12 \neq 12 \div 0$
   $1 \neq 12 \div 0$ False
   You cannot divide by 0.

   h) $13 - 4 + 4 < 13$
   $13 < 13$ False

   i) $7 \times 0 > 7 \times 1$
   $0 > 7$ True

   j) $0 \div 100 = 100 \div 0$
   $0 = 100 \div 0$ False
   You cannot divide by 0.

Activity 28.1

Learner's Book page 382

Let the learners work together to solve the first problem. Remind them that they have to write number sentences to show their thinking processes. Let them struggle with the problem first. If they are stuck, tell them that they could solve the problem by applying the trial and improvement strategy (there is an algebraic method to solve it but they will use this method in the higher grades). Let them try out different numbers to find the solution.

If Jack took out 3 litres of water, he will have 17 + 3 = 20 litres in his barrel. Jill will have 13 – 3 = 10 litres in her barrel.

But 20 is not 3 times more than 10. If he pours out 4 litres he will have 17 + 4 = 21. Jill will have 13 – 4 = 7 and 21 is 3 times 7.

Allow the learners to solve questions 2 and 3 in their groups. Let them present their work to the class.

Ask them to solve questions 4 and 5 on their own.

1. If Jack takes out 8 litres of water, his bucket contains
17 + 8 = 25 litres.
Jill's bucket now contains 13 – 8 = 5 litres.
5 × 5 = 25, so Jack's bucket contains 5 times more water than Jill's.

2. If Noor cuts off 7 cm from the short strip, it is 13 – 7 = 6 cm long.
The long strip is now 23 + 7 = 30 cm.
6 cm × 5 = 30 cm
The long strip is now 5 times longer than the short strip.

3. If Xavier gives Lulu R65, he has R150 – R65 = R85.
Lulu now has R190 + R65 = R255.
R85 × 3 = R255
Lulu now has 3 times more money than Xavier.

4. If the grocer moves 23 kg from the first box, it now contains
35 – 23 = 12 kg.
The second box now holds 25 + 23 = 48 kg.
12 × 4 = 48 kg
The second box now contains 4 times more potatoes than the first box.

5. If 6 birds were sitting on the wire there are now
36 + 8 = 42 birds.
6 × 7 = 42
There are now 7 times more birds than before.

1. Fill in the missing numbers.
   - **a)** $9 \times 7 = \square \times 9 = \square$
   - **b)** $22 + 8 = 8 + \square = \square$
   - **c)** $120 \div 4 \div 10 = 120 \div \square \div \square$
     $= 12 \div \square$
     $= \square$
   - **d)** $45 + 37 + 5 + 3 = 45 + \square + 37 + \square$
     $= \square + \square$
     $= \square$
   - **e)** $(20 \times 32) = (20 \times \square) + (20 \times \square)$
     $= \square + \square$
     $= \square$
   - **f)** $23 \times 1 \times 1 = \square$
   - **g)** $11 - 5 + \square = 11$
   - **h)** $0 \div 15 = \square$
   - **i)** $15 \div 0 = \square$
2. Use the equations in the boxes to solve the equations below them.
   - **a)** $\boxed{12 \times 8 = 96}$
     $12 \times 7 = \square$
   - **b)** $\boxed{678 + 456 = 1\ 134}$
     $677 + 455 = \square$
   - **c)** $\boxed{210 - 50 = 160}$
     $209 - 50 = \square$
   - **d)** $\boxed{144 \div 4 = 36}$
     $144 \div 8 = \square$
3. Are the following equations true or false?
   - **a)** $7 \times 8 \neq 8 \times 7$
   - **b)** $45 - 6 = 6 - 45$
   - **c)** $25 + 5 - 5 = 0$
   - **d)** $17 + 6 < 17 - 6$
   - **e)** $8 + \square > \square + 8$
4. Solve the following.
   - **a)** $\square + \square + \square = \square + \square + 9$
   - **b)** $\square + \square + \square + \square + \square = \square + \square + 27$
5. There are two taxi owners in town. The first owner has 16 taxis and the second owner has 8 taxis. The first owner sells some taxis to the second owner. The second owner now has three times as many taxis as the first owner. How many taxis did the first owner sell to the second owner?

1. **a)** $9 \times 7 = 7 \times 9 = 63$

b) $22 + 8 = 8 + 22 = 30$

c) $120 \div 4 \div 10 = 120 \div 10 \div 4$
$= 12 \div 4$
$= 3$

d) $45 + 37 + 5 + 3 = 45 + 5 + 37 + 3$
$= 50 + 40$
$= 90$

e) $(20 \times 32) = (20 \times 30) + (20 \times 2)$
$= 600 + 40$
$= 640$

f) $23 \times 1 \times 1 = 23$

g) $11 - 5 + 5 = 11$

h) $0 \div 15 = 0$

i) $15 \div 0 =$ not allowed

2. **a)** $12 \times 8 = 96$
$12 \times 7 = 84$

b) $678 + 456 = 1\ 134$
$677 + 455 = 1\ 132$

c) $210 - 50 = 160$
$209 - 50 = 161$

d) $144 \div 4 = 36$
$144 \div 8 = 18$

3.

a)	$7 \times 8 \neq 8 \times 7$	False	$7 \times 8 = 8 \times 7$
b)	$45 - 6 = 6 - 45$	False	$45 - 6 \neq 6 - 45$
c)	$25 + 5 - 5 = 0$	False	$25 + 5 - 5 = 25$
d)	$17 + 6 < 17 - 6$	False	$17 + 6 > 17 - 6$
e)	$8 + \blacksquare > \blacksquare + 8$	True	$8 + 6 > 4 + 8$ or $8 + 9 > 2 + 8$

4. **a)** $\blacksquare + \blacksquare + \blacksquare = \blacksquare + \blacksquare + 9$
$9 + 9 + 9 = 9 + 9 + 9$

or $\blacksquare + \blacksquare + \blacksquare = \blacksquare + \blacksquare + 9$
$\blacksquare = 9$
$9 = 9$

b) $\blacksquare + \blacksquare + \blacksquare + \blacksquare + \blacksquare = \blacksquare + \blacksquare + 27$
$\blacksquare + \blacksquare + \blacksquare = 27$
$9 + 9 + 9 = 27$
$27 = 27$

5.

$16 - 1 = 15$	$8 + 1 = 9$
$16 - 2 = 14$	$8 + 2 = 10$
$16 - 3 = 13$	$8 + 3 = 11$
$16 - 4 = 12$	$8 + 4 = 12$
$16 - 5 = 11$	$8 + 5 = 13$
$16 - 6 = 10$	$8 + 6 = 14$
$16 - 7 = 9$	$8 + 9 = 17$
$16 - 8 = 8$	$8 + 8 = 16$
$16 - 9 = 7$	$8 + 9 = 17$
$16 - 10 = 6$	$8 + 10 = 18$

18 is 3 times more than 6.

The first owner has 6 and the second owner 18 taxis. The first owner sold 10 taxis to the second owner.

NOTE

The learners solve this problem by trial and improvement or inspection.

Transformations

In this section the learners revise the language of transformations used to describe patterns. They then learn about enlarging and reducing 2-D shapes, specifically triangles and quadrilaterals, by different factors, and examine how this changes the area of the shapes.

Unit 29 Describing patterns

MENTAL MATHS

Learner's Book page 384

1. Learners' own work
2. E
3. B → 30
   C → 6
   D → 21
   E → 30

Activity 29.1

Learner's Book page 384

Learner's own work

Assessment points

- How well are the learners able to describe geometric patterns?
- Are they able to identify shapes in patterns?
- Can they use appropriate terminology to describe how to transform the shape to create the pattern?

Unit 30 Enlarging and reducing shapes

Learner's Book page 385

This unit focuses on how to enlarge and reduce shapes. The learners also discuss how enlarged and reduced shapes change or remain the same. Enlarging or reducing a shape involves a number of concepts that the learners are introduced to, including:

- the meanings of the terms *enlarge* and *reduce*
- that enlarging a shape means increasing it proportionally, i.e. all its sides must increase by the same factor (this means multiplying and dividing, not adding and subtracting)
- that when we increase the lengths of the sides by twice the amount, it does not mean that the shape increases its size by 2; it actually increases its size by 4, i.e. four of the smaller shape can fit inside the enlarged shape.

Some learners may struggle to understand the third concept mentioned here. Do not expect them to have a complete understanding of it by the end of the unit. The focus here is for learners to be able to enlarge and reduce triangles and quadrilaterals by a given factor, and to start thinking about further implications of enlargements and reductions in terms of size.

Work through the text and examples in the Learner's Book to explain what *enlarge* and *reduce* means. Then focus on how to enlarge a shape by a given factor.

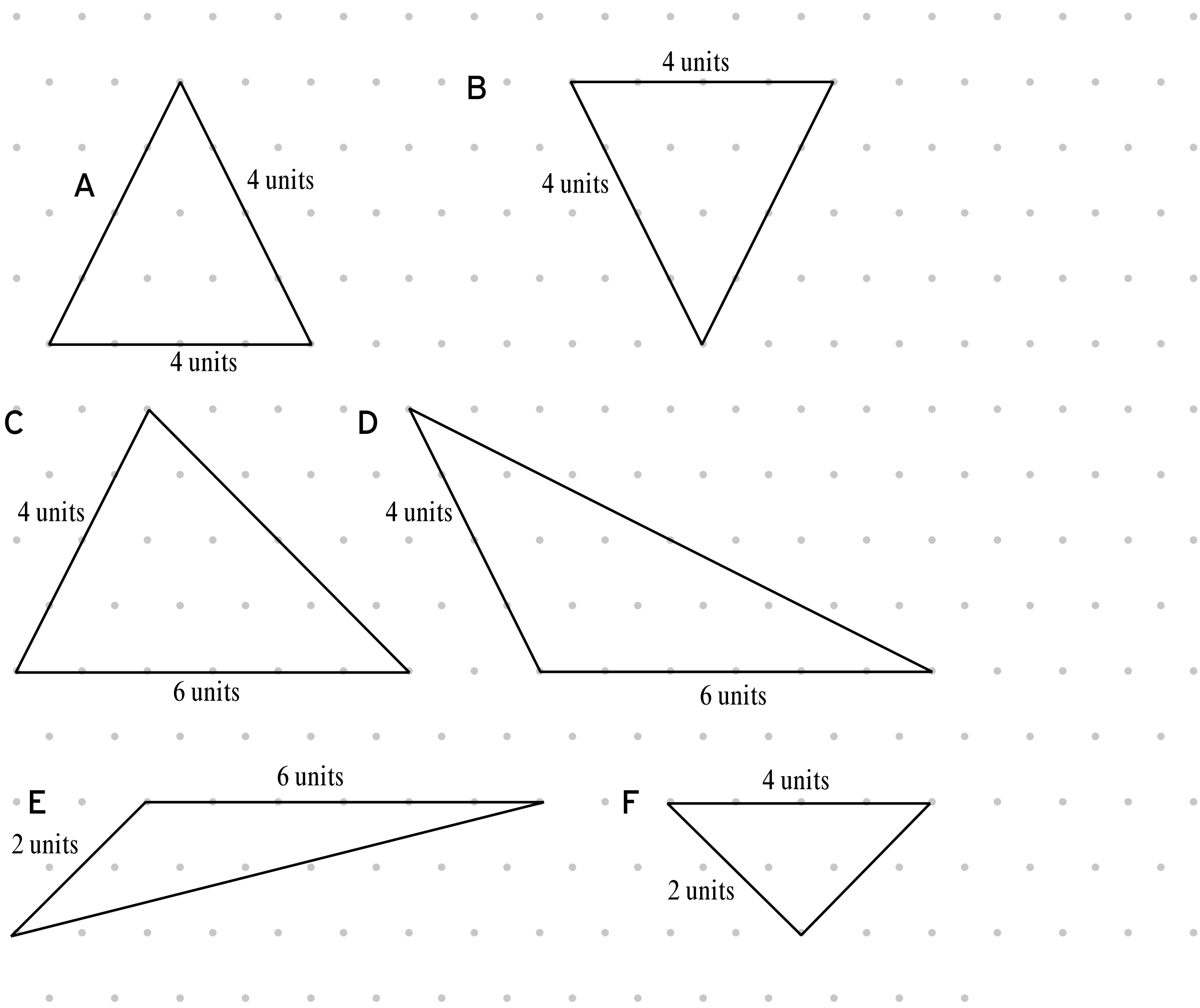
The learners will need triangular as well as square dotted paper for the activities in this unit.

Activity 30.1

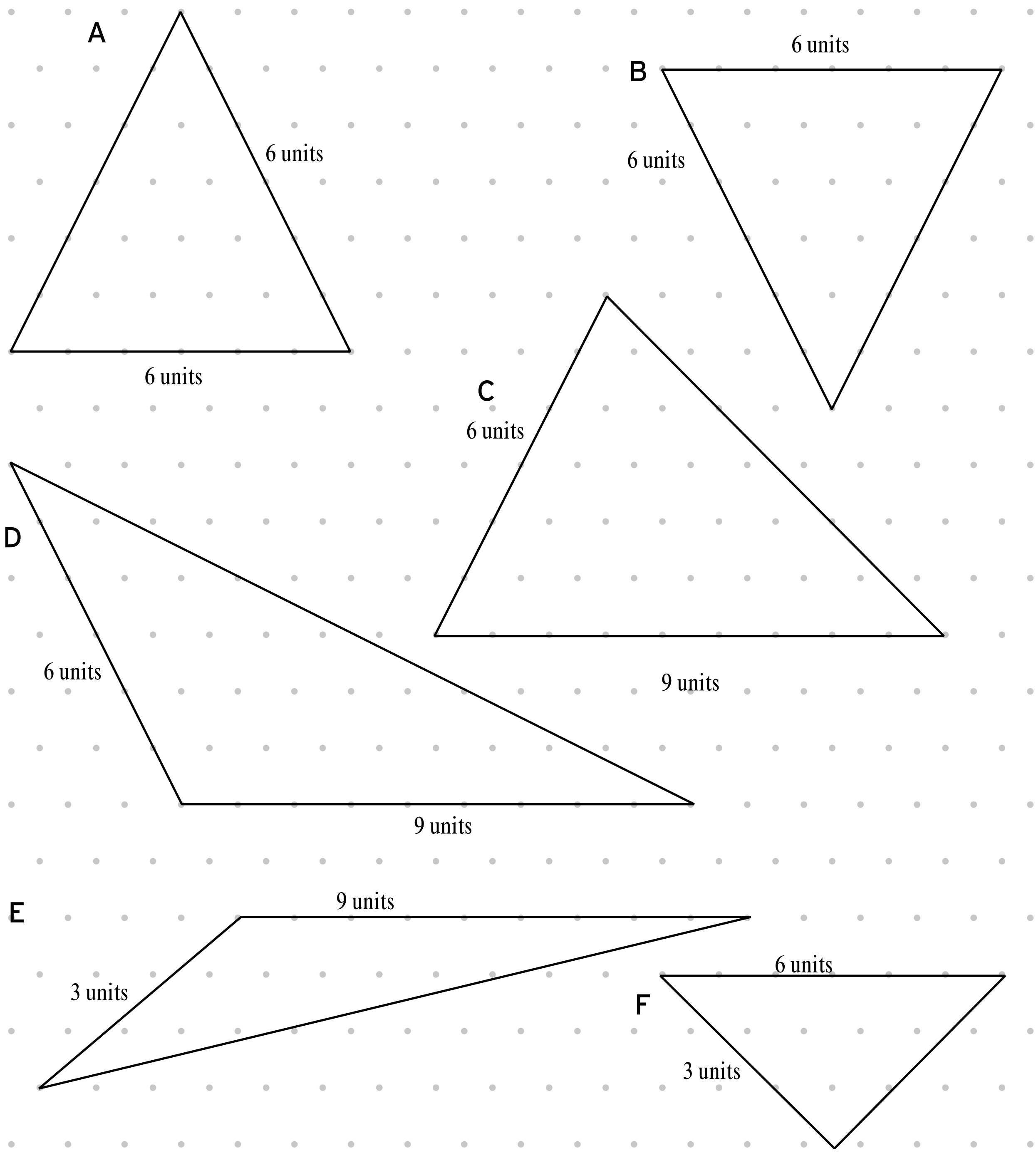
Learner's Book page 387

You can explain to the learners that we can enlarge two sides of a triangle by the same factor. Then, without measuring, we can draw in the third side to join the two enlarged sides. The third side will also be enlarged by the same factor.

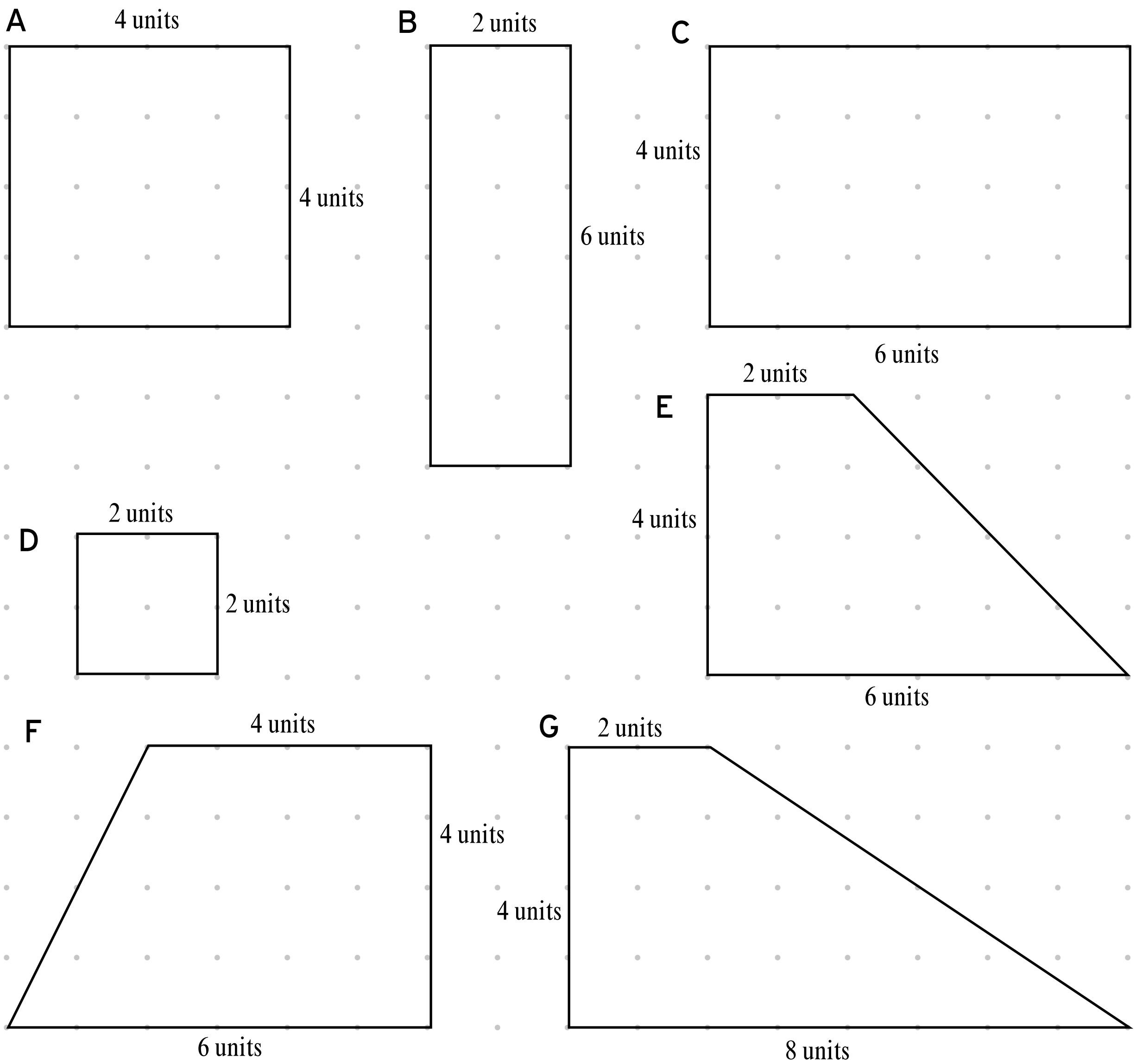
1. a)



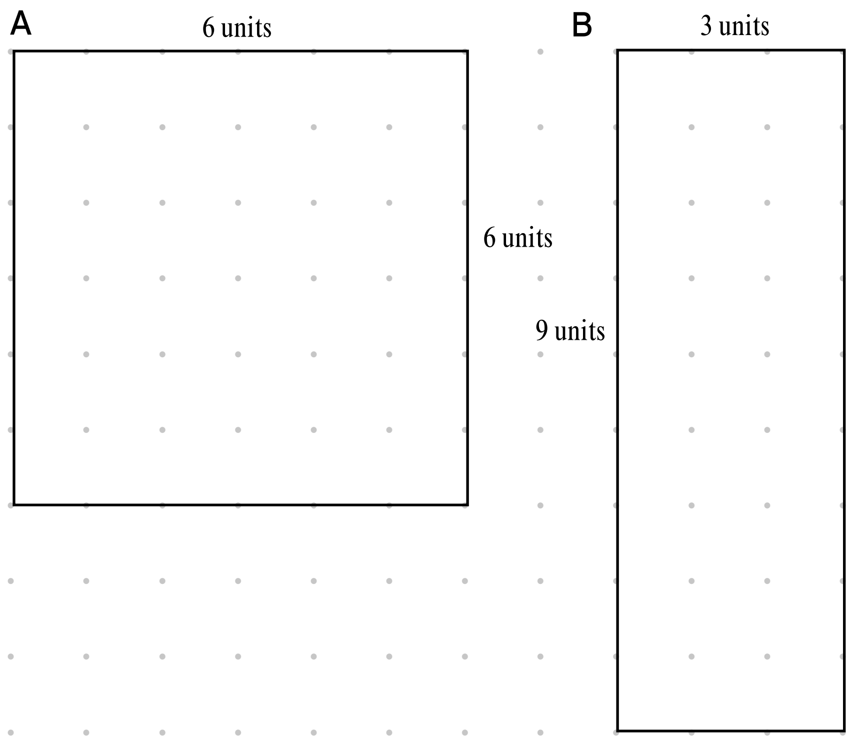
b)

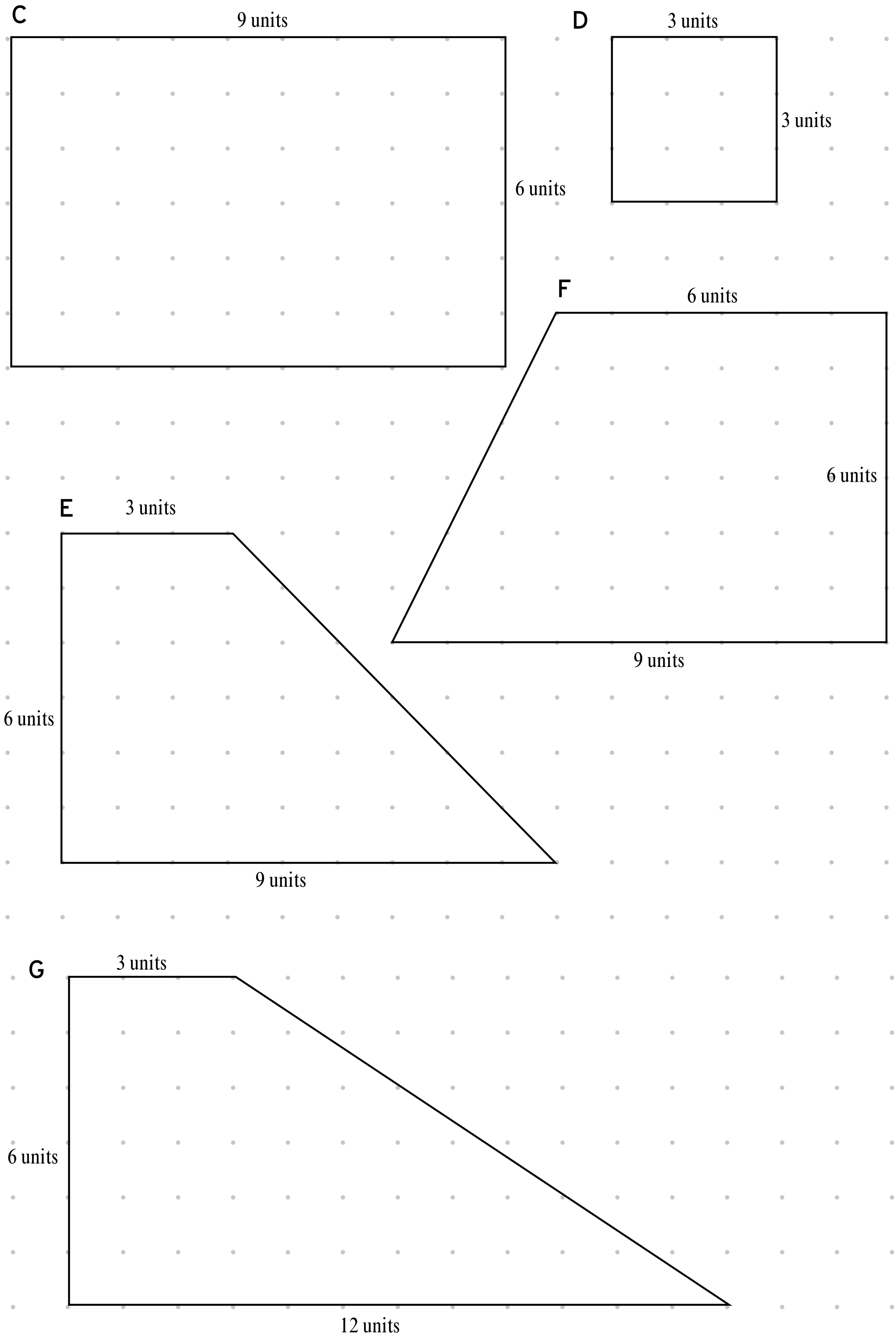

A
6 units
6 units
B
6 units
6 units
C
6 units
9 units
D
6 units
9 units
E
9 units
3 units
F
6 units
3 units

2. a)

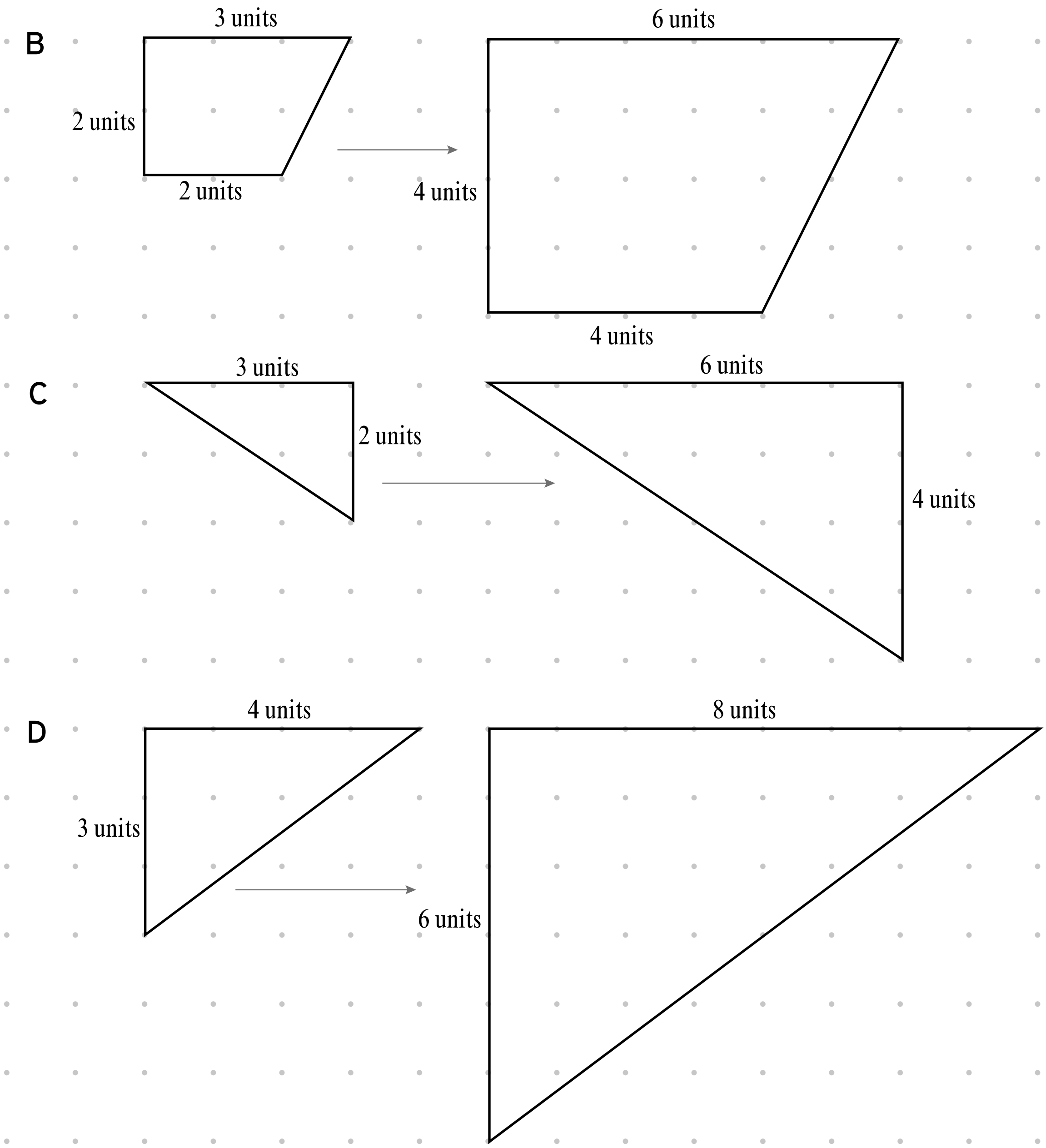

A
4 units
4 units
B
2 units
6 units
C
4 units
6 units
D
2 units
2 units
E
2 units
4 units
6 units
F
4 units
4 units
6 units
G
2 units
4 units
8 units

b)


A
6 units
6 units
B
3 units
9 units


C
9 units
6 units
D
3 units
3 units
F
6 units
6 units
9 units
E
3 units
6 units
9 units
G
3 units
6 units
12 units

3. **a)** A: enlarged by a factor of 2
   b) The learners will probably choose to enlarge the shapes by a factor of 2 or 3. The shapes below were enlarged by a factor of 2.



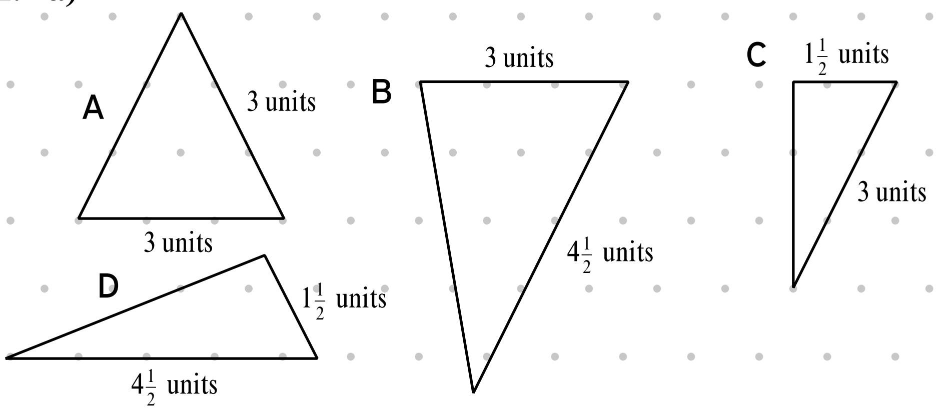
Learner's Book page 389

Reducing shapes

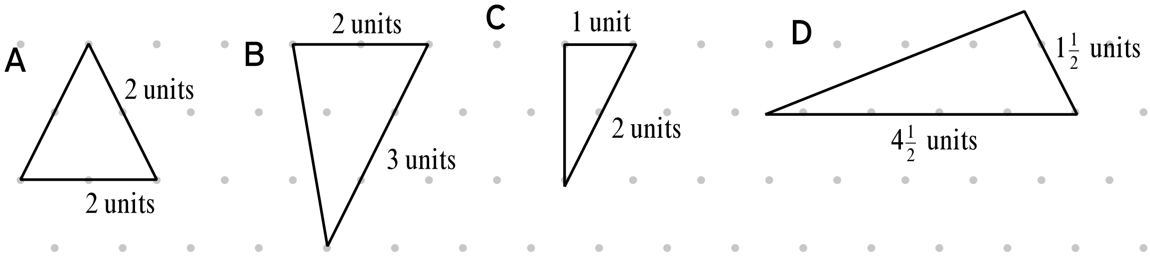
Work through the text and examples in the Learner's Book to explain what *reduce* means and how to reduce a shape by a given factor.

Activity 30.2

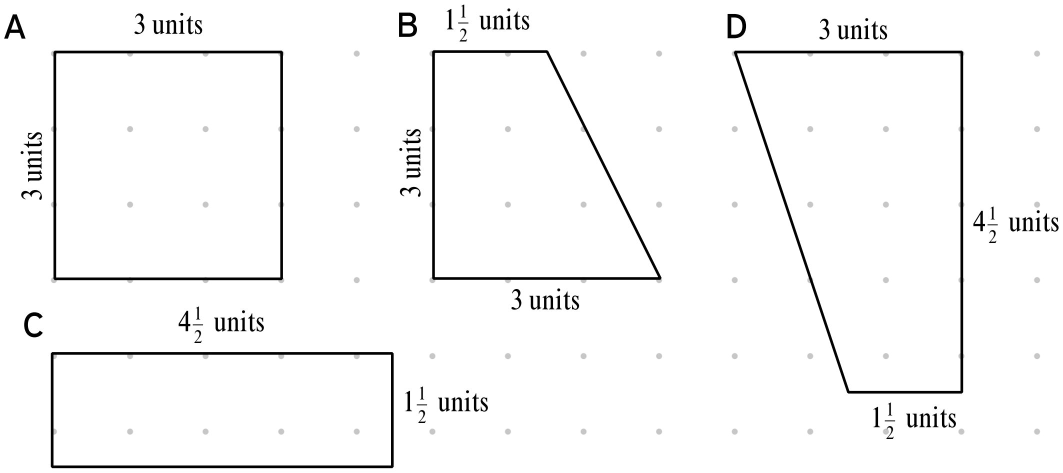
1. a)



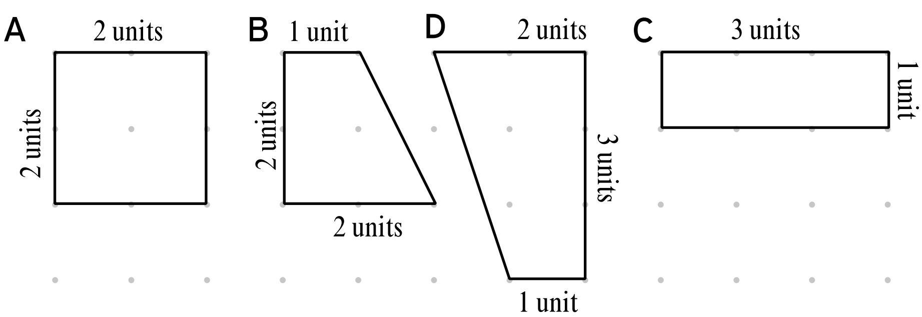
b)



2. a)

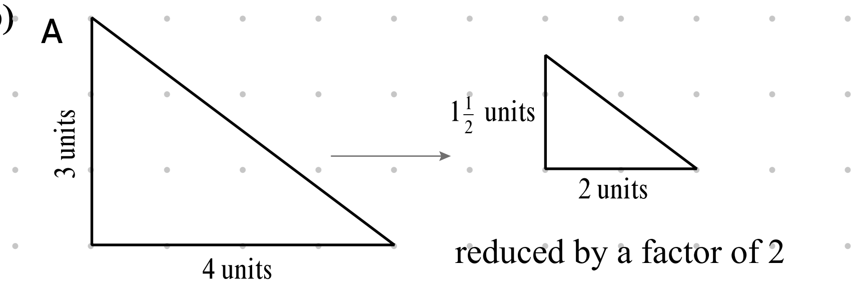


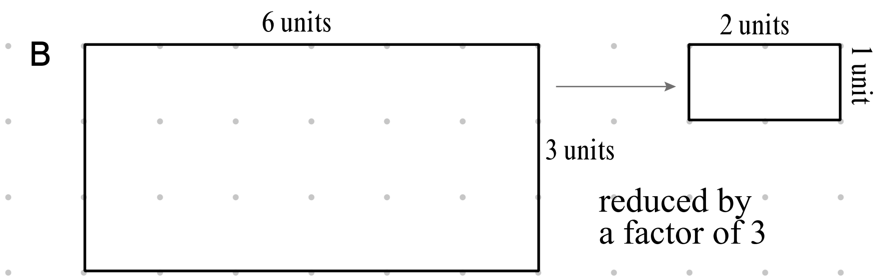
b)



3. a) C: reduced by a factor of 2
D: reduced by a factor of 2

b)





Learner's Book page 393

Areas of enlarged and reduced shapes

Work through the text in the Learner's Book about the areas of enlarged and reduced shapes. Let the learners look at how the lengths of the sides of the enlarged shapes increase by a factor of 2, but the areas increase by more than a factor of 2. For reduced shapes, the lengths of the sides decrease by a factor of 2, but the areas of the shapes decrease by more than a factor of 2. Refer to work done on finding the area of geometric shapes by counting squares in the shapes, earlier in the term.

MENTAL MATHS

Learner's Book page 393

In this Mental Maths activity, the learners work with enlarged and reduced areas of shapes involving doubling of area. Ask them to record the solutions on their Mental Maths grids. They double the numbers in the number sentences and solve them. They should demonstrate knowledge of doubling and the distributive property. Allow them to use paper and pencil to jot down intermediate steps in the mental calculation processes if necessary, especially for questions (f) to (h). Let them explain their strategies to the class. Share the strategies involving the distributive property with them if they do not apply them.

1. $4 \times 5 \rightarrow 8 \times 10 = 80$

2. $5 \times 5 \rightarrow 10 \times 10 = 100$

3. $3 \times 2 \rightarrow 6 \times 4 = 24$

4. $4 \times 3 \rightarrow 8 \times 6 = 48$

5. $3 \times 3 \rightarrow 9 \times 9 = 81$

6. $2 \times 8 \rightarrow 4 \times 16 = (2 \times 16) + (2 \times 16)$
$= 32 + 32$
$= 64$

7. $9 \times 3 \rightarrow 18 \times 6 = (10 \times 6) + (8 \times 6)$
$= 60 + 48$
$= 108$

8. $2 \times 7 \rightarrow 4 \times 14 = (10 \times 4) + (4 \times 4)$
$= 40 + 16$
$= 56$

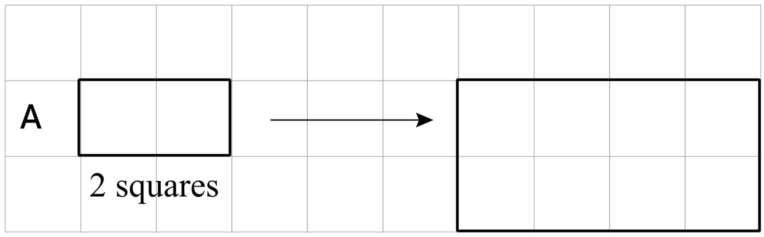
9. $4 \times 4 \rightarrow 8 \times 8 = 64$

10. $5 \times 6 \rightarrow 10 \times 12 = 120$

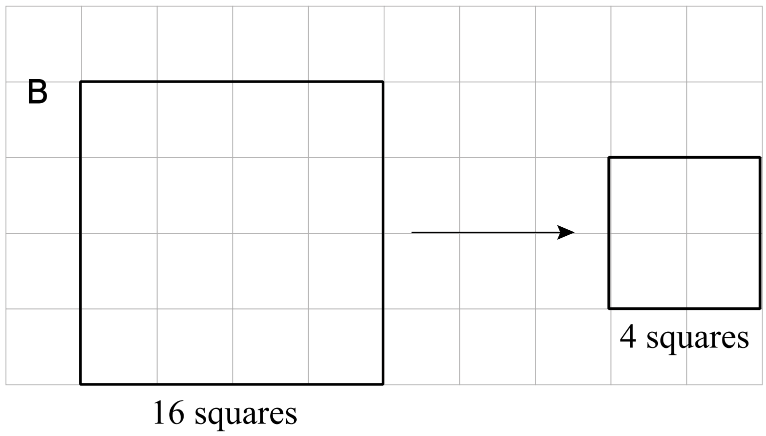
Activity 30.3

Learner's Book page 394

1. a– d)



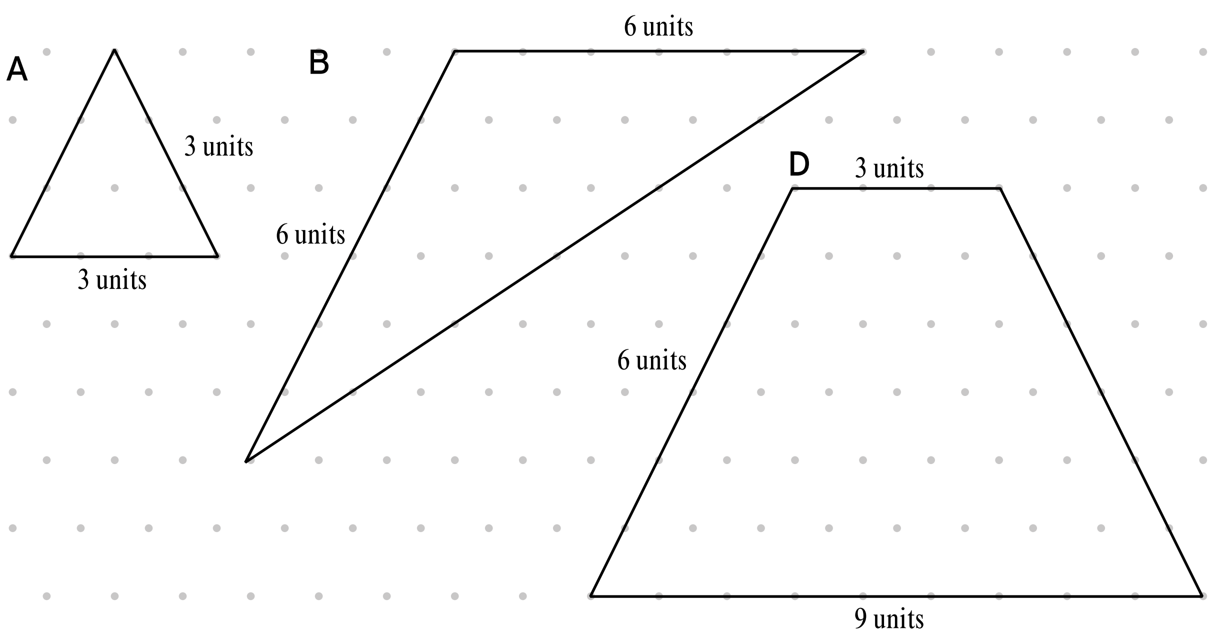
2. a–d)

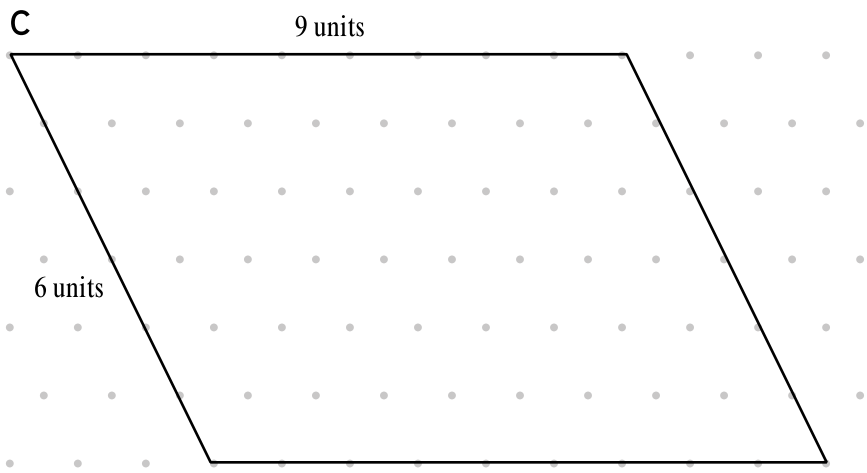


Revision

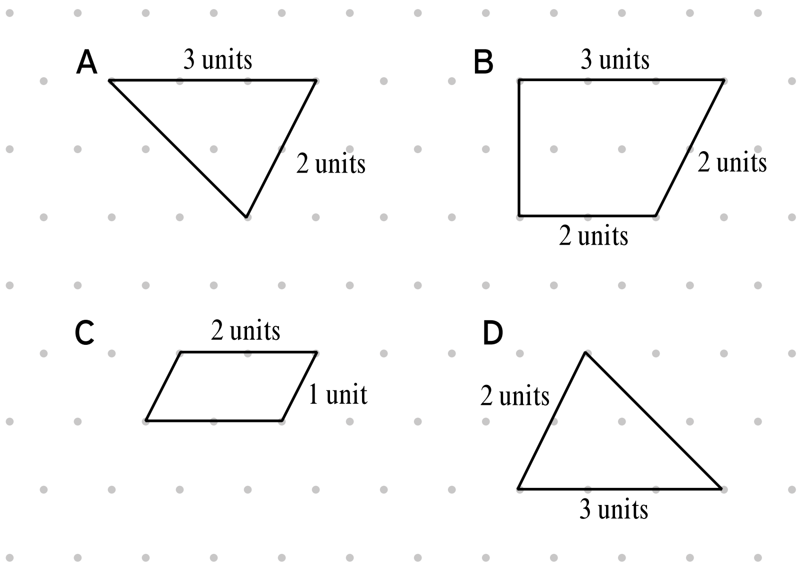
Learner's Book page 394

1.



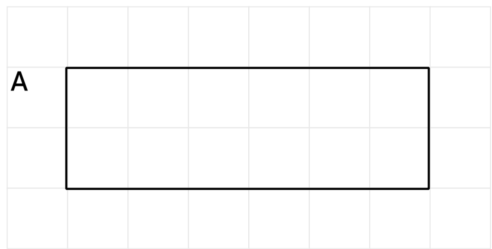


2.



3. **a)** 3 squares

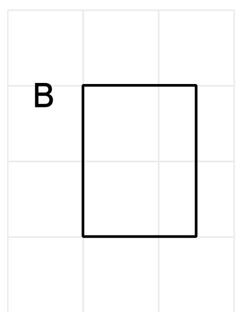
b)



c) 12 squares

d) 12 squares

e)



f) 3 squares

Investigation
Learner's Book page 394

Let the learners work on dotted paper to help them with this investigation. They can use any shape, but the simplest one is a square that measures 1 cm × 1 cm. They can first enlarge the square by a factor of 2, then count the number of squares in the enlarged square. Then they can enlarge the original square by a factor of 3 and then by a factor of 4, and so on, each time writing down the area of the enlarged square. The learners will then realise the following:

- The area of the polygon will increase by 9 times if it is enlarged by a factor 3.
- The area of the polygon will increase by 16 times if it is enlarged by a factor 4.
- The area of the polygon will increase by 25 times if it is enlarged by a factor 5.

Remedial activities

Let the learners first work with triangles and squares only, each with all sides measuring 1 cm, or 1 unit.

Let them enlarge the 1 cm × 1 cm × 1 cm triangle by various increasing factors each time, that is, by 2, 3, 4, 5 and 6. Then let them do the same with the square of sides 1 cm. Once the learners can do this, move on to triangles with sides of bigger units, but still make all the sides the same length.

Do the same with squares. Only once the learners are able to easily do these enlargements, let them work with triangles whose sides are not all the same length, and with other quadrilaterals.

Extension activities

Give the learners cardboard cut-outs of shapes that have been correctly reduced and enlarged. Let the learners fit the shapes into one another. They will notice that all the angles of the original shape and the shape that has been enlarged or reduced are exactly the same.

Then give the learners examples of shapes that have not been correctly enlarged or reduced. They will notice how the enlarged or reduced shape distorts from the original shape. They will find that the shapes will not fit correctly into each other.

Location and directions

Learner's Book page 396

The learners should be familiar with how to use alpha-numeric grids, as they have worked with alpha-numeric grids from Grade 4 already. In this chapter, the learners further practise locating items in a grid that uses alpha-numeric grid references.

They also use grid references on maps to locate positions of objects. Furthermore, the learners practise following directions to trace routes on a map, as well as giving directions to describe moving from place to place on a map.

Unit 31 Objects on a grid

Revise how a grid works. Remind the learners that the columns and rows of a grid are labelled, and that each block in the grid uses the labels of the column and the row in which it is.

MENTAL MATHS Learner's Book page 396

Learners' own work

Activity 31.1

Learner's Book page 396

1. This activity checks whether the learners know how the blocks in an alpha-numeric grid fit together.

Assessment points

- Do the learners know how the blocks in an alpha-numeric grid are named?
- Are they able to locate objects in a grid that uses alpha-numeric references?

Unit 32 Working with maps

Learner's Book page 397

Maps are drawings that show places as if we are looking at them from above (like a bird in the sky looking down at the land). We often use grid blocks on a map because they help us to find places on the map.

Activity 32.1

Learner's Book page 397

In this unit, the learners work with maps that use an alpha-numeric grid. They must locate places and describe place locations. They also trace paths or routes on the map and then give directions for different routes on maps.

1. **a)** A3: hospital
   b) B2: school A
2. C5, B4, B5, B6, A5, A6
3. A6
4. B1 and C1
5. B2; C1 and C2; C4; C5; C6; C6 and B6.

Activity 32.2

Learner's Book page 398

1. There are different routes. The following one is the shortest: From the school in Short Road, turn left into Victoria Road. Travel all the way up Victoria Road until you see the hospital in front of you.
2. There are different routes. Here is one. From the field, take a right turn into Victoria Road. Take the first left turn into Steed Road. You will find the school on your right.
3. There are different routes. Here is one. From the post office, walk northwards up Francis Road. Turn left into Willow Road. Turn right into Victoria Road. Take the first right turn into 5th Avenue. Take the first left turn into Walters Road. You will find the place of worship on your right.
4. **a)** Learners' own work
   b) Let the learners check that a partner points to the correct place.

Assessment points

- How easily are the learners able to describe and locate places on a map using a grid?
- Are they able to follow directions to trace a path on the map?
- How well are they able to give directions to describe how to travel between places?

Revision

Learner's Book page 398

1. **a)** A4: place of worship
   b) D1: primary school
2. D1, D2, D3 and D4
3. B1, B2 and B3
4. Let the learners work in pairs to check that their partners are pointing out the route correctly.
5. There are different routes. Here is one. From the primary school, walk southwards down Dolphin Way. At the end of the road, turn right into Kelp Way. Go past Whale Road on your right and Eel Road on your left. You will find the high school on your right.

6. There are different routes. Here is one.
   From the police station walk left into Kelp Way. Take the first right into Dolphin Way. Follow Dolphin Way as it curves to the left. Go past Whale Road on your left. You will find the library on your right.

Assignment

Learner's Book page 399

The learners will need a map of your school's area. It will be good to use a map that has been printed in a local street atlas, but you could also let the learners use a map that you have drawn. Check that learners are able to:

- read the grid references
- use the grid references to locate places on the map
- say in which grid blocks places on the map are found
- read the names of the roads on the map
- give directions to describe how to travel from place to place on the map.

Remedial activities

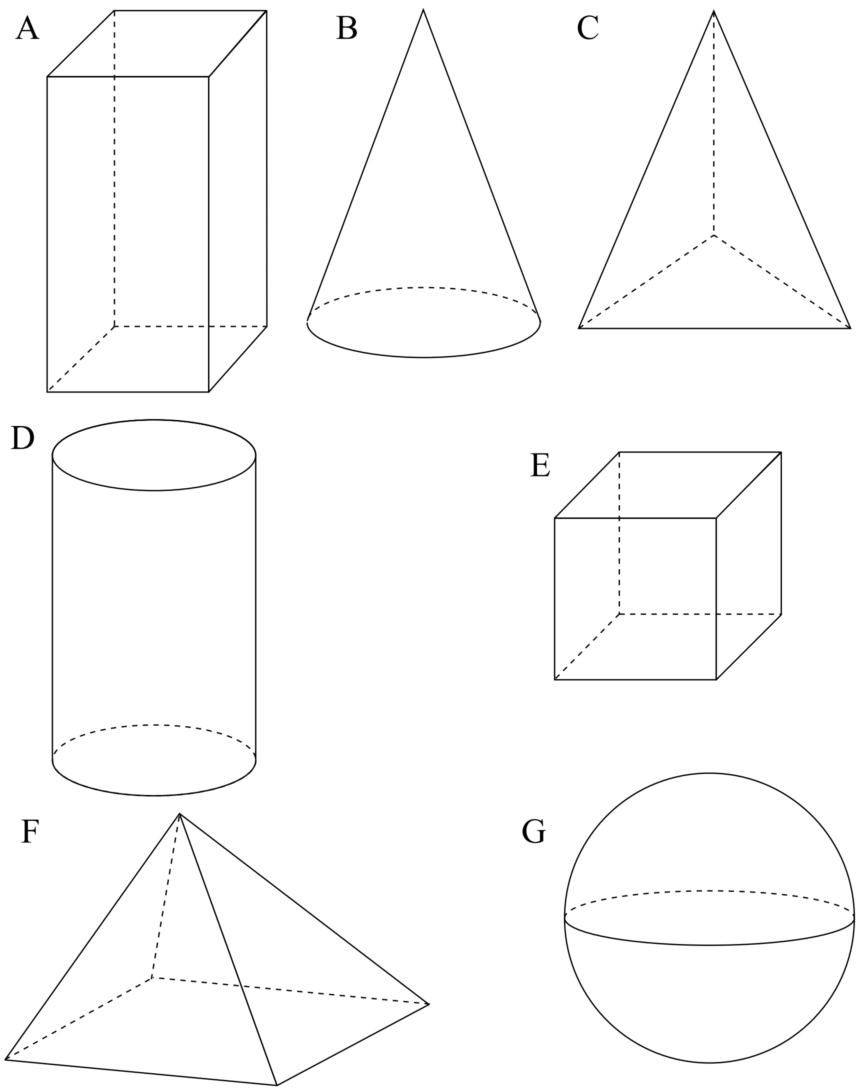
- Let the learners point out directions on a map, i.e. north, south, east and west, as these may help them to follow or give directions more easily. Remind them that most maps show the direction north, so they will be able to work out the other directions from there. Also explain that maps that do not show where north is usually have north towards the top of the map.
- Let the learners imagine standing in a particular grid block on a map. Let them say which direction they are facing, or which other place on the map they are facing. Let them practise saying what other features are on their left, right, in front of them or behind them. Let them pretend to stay in the same spot, but to turn in another direction. Let them practise saying which features are on their left, right, in front of them or behind them now.
- Get maps of your own area for the learners to read so that they can more easily visualise the area and how the map represents reality.

Extension activities

- Find real atlases and street maps for the learners to practise their map-reading skills. Real atlases and street maps show much more detail, but the principles are the same. Learners may find that these maps use double-digit numbers or two letters to reference a row or column. Again, the principles are the same as when they look at simpler maps, so encourage the learners to try reading more complex maps.
- Let the learners practise finding places on a map by using the index of an atlas. Here, they will need to find the page number and the grid reference of the place they are looking for.

Assessment 4.6 Properties of 3-D objects, transformations, and location and directions

1. Look at the 3-D objects below.



a) Which objects have at least one curved surface?

b) Which objects have only flat faces?

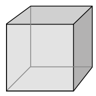
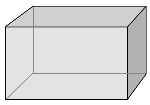
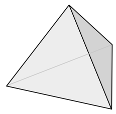
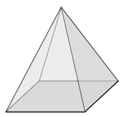
c) Find each of these 3-D objects.
- sphere
- cylinder
- cone
- prism
- pyramid

d) Which prism is a cube?

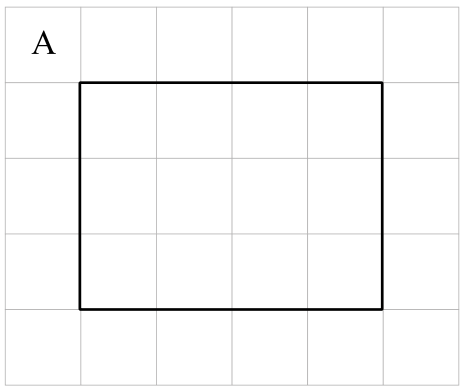
e) Which prism is a rectangular prism?

f) Which pyramid is a tetrahedron?

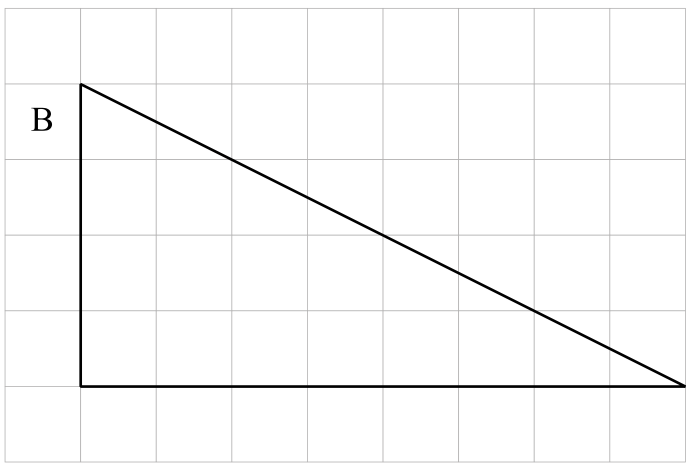
2. Copy the table below. Instead of drawing the 3-D object, write its name in the first column. Then complete the table to describe the number of faces, shapes of faces, number of edges and number of vertices of each shape.

3-D object	Number of faces	Shapes of faces	Number of edges	Number of vertices
				
				
				
				

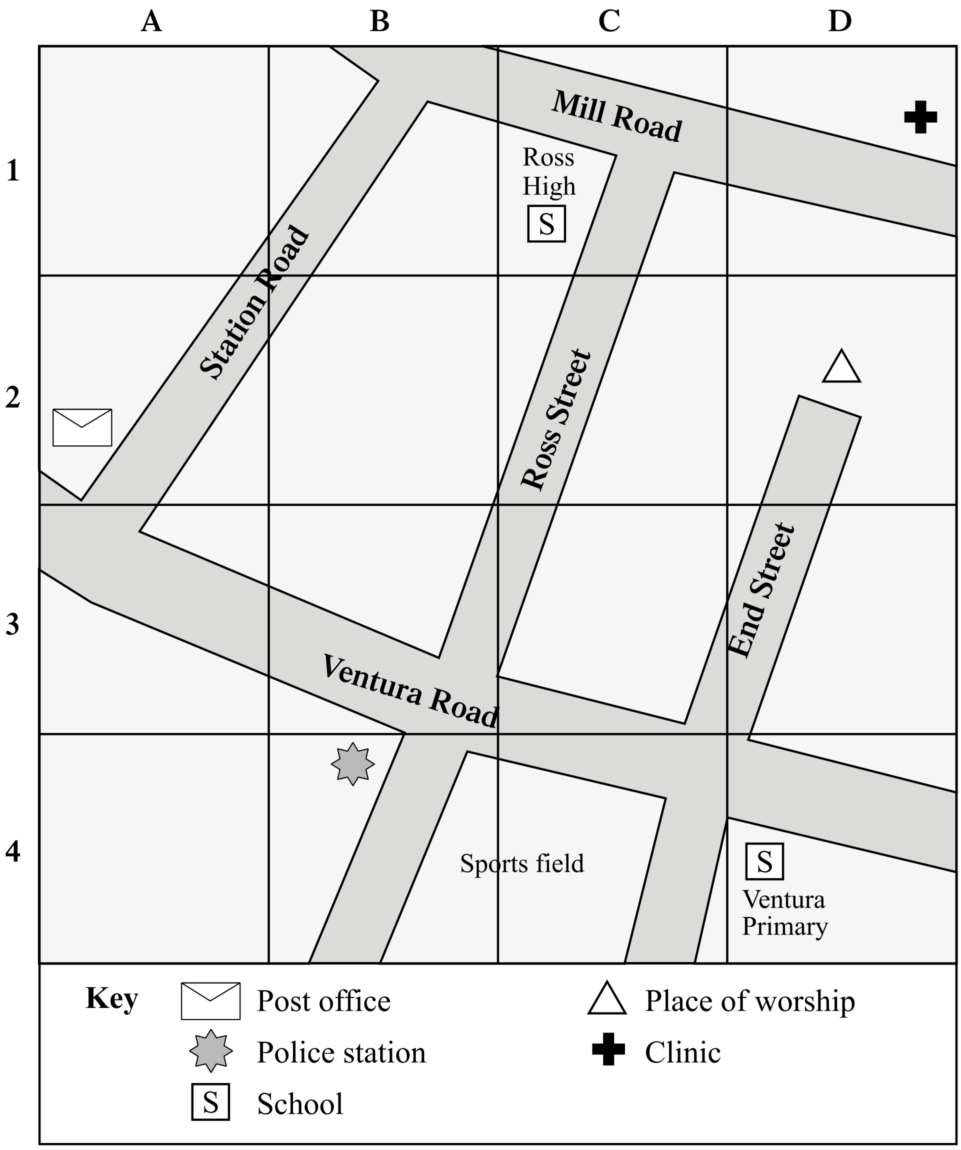
3. a) Write down the area of shape A below.
   b) Enlarge shape A to twice its size.
   c) Write down the area of the enlarged shape.



4. a) Write down the area of shape B.
   b) Reduce shape B to half its size.
   c) Write down the area of the reduced shape.



5. Look at the map below.



a) Which place would you find in these blocks?
- A2
- D4
- D1
- B4

b) Name one block in which you can look for these places:
- place of worship
- police station
- Mill Road
- Station Road

c) Point out the following route on the map:
From the clinic, turn west into Mill Road. Turn left into Ross Street. Turn left into Ventura Road. Cross End Street. Then you will find Ventura Primary School on your right.

d) Give directions to travel from the police station to the clinic.

e) Give directions to travel from the post office to the place of worship.

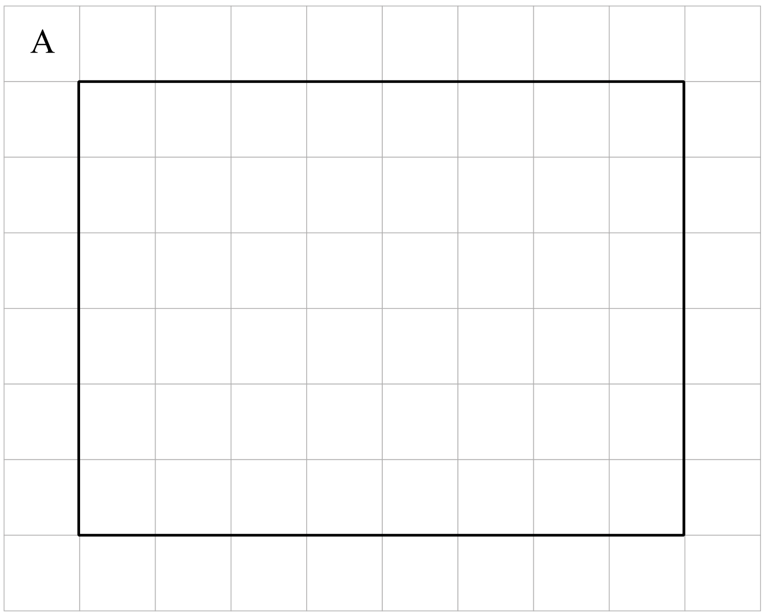
1. a) B, D, G
   b) A, C, E, F
   c)
   - Sphere → G
   - Cylinder → D
   - Cone → B
   - Prism → A or E
   - Pyramid → C or F

   d) E
   e) A
   f) C

2. Completed table

3-D object	Number of faces	Shapes of faces	Number of edges	Number of vertices
Cube	6	Squares	12	8
Rectangular prism	6	Rectangles or rectangles and squares	12	8
Tetrahedron	4	Triangles	6	4
Square-based pyramid	5	Triangles and a square	8	5

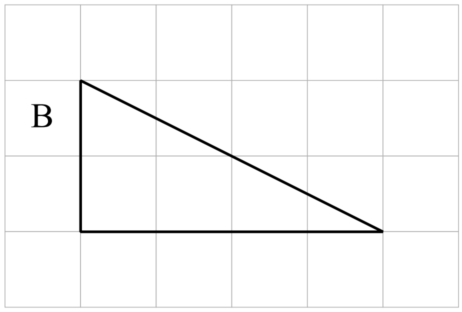
3. **a)** 12 squares
   b)



   c) 48 squares

4. a) 16 squares

b)



c) 4 squares

5. a)
- A2 → post office
- D4 → Ventura Primary School
- D1 → clinic
- B4 → sports field

b)
- Place of worship → D2
- Police station → B4
- Mill Road → C1 (or B1 or D1)
- Station Road → A2 (or B1 or B2)

c) Ensure that the learners are able to trace the route correctly.

d) There are different options. Here is one:
From the police station, cross Ventura Road and walk up Ross Street. Turn right into Mill Road. Walk a while and you will find the clinic on your left.

e) There are different options. Here is one:
From the post office in A2, take a left turn into Ventura Road. Go past Ross Street and pass the sport field. Then turn left into End Street. You will find the place of worship in front of you at the end of the road.

Probability

Learner's Book page 400

In this section, the learners continue to identify possible outcomes, carry out experiments and record actual outcomes. No new concepts are introduced in Grade 6 that the learners have not learned in Grades 4 and 5. However, in this grade, the learners are expected to be able to carry out experiments consisting of up to 50 trials.

Unit 33 Possible outcomes

Remind the learners what *probability* means. Also remind them what *possible outcomes* are and how these are different to *actual outcomes*.

Activity 33.1

Learner's Book page 401

Three possible outcomes

Activity 33.2

Learner's Book page 401

1. Possible outcomes:
a red ball
a white ball
a purple ball

2. **a)** 2 possible outcomes
b) Possible outcomes:
King of diamonds
Ace of diamonds

3. **a)** 4 possible outcomes
b) Possible outcomes:
2; 4; 6; 8

4. **a)** 6 possible outcomes
b) Possible outcomes:
1; 2; 3; 4; 5; 6

5. **a)** 6 possible outcomes
b) Possible outcomes:
a triangle
a square
a diamond
a hexagon
a pentagon
a circle

Assessment points

- How well can the learners list possible outcomes of an event?
- Can they tell the difference between possible outcomes and actual outcomes?

Unit 34 Recording actual outcomes

Learner's Book page 402

The learners should be very familiar with tally tables by now. Remind them how to use a tally table to record the outcomes of their experiments.

MENTAL MATHS

Learner's Book page 403

Learners play the game.

Activity 34.1

Learner's Book page 403

Learners' own work.
Ensure that the learners know how to draw up suitable tally tables and can accurately record the outcomes of the repeated events. Let them work in pairs initially if they are not confident at doing the experiments on their own. If learners have difficulty keeping track of how many times they have tossed the coin, rolled the die, and so on, you can organise the activity in a synchronised way by calling out the instruction 'Toss the coin 1', 'Toss the coin 2', and so on – every learner then does this, records the result, and waits for your next instruction.

Activity 34.2

Learner's Book page 403

Learners' own work.

Assessment points

- Can the learners list possible outcomes of events?
- Can they draw up a suitable tally table to record the outcomes of the events?
- Can they accurately record the results or actual outcomes of their trials?
- Are they able to compare the frequency of actual outcomes for the series of trials they perform?

Revision

Learner's Book page 404

1. **a)** 50 times **b)** Yellow
2. The learners' tally table should include the information below:

Possible outcomes	Tallies of actual outcomes	Number of each actual outcome
One		
Two		
Three		
Four		
Five		
Six		

2. The learners' tally table should include the information below:

Possible outcomes	Tallies of actual outcomes	Number of each actual outcome
Heads		
Tails		

Remedial activities

- If the learners still struggle with how to use tally marks, give them more practice. Let them work in pairs or small groups, where each learner asks another to write a number using tally marks. Let them check one another's work.
- Let the learners work with a number of events where the possible outcomes are only two, for example: tossing a coin, choosing one of two objects from a bag, choosing one of two cards, and spinning a spinner where the possible outcomes are only one of two. Let them first repeat the event three or four times and analyse the results. Then they can move on to repeat the event up to 20 times, then up to 50 times. Only then move on to events where there are three, four, five or six possible outcomes.
- Let the learners describe the events they performed and how they went about carrying out the events and recording their outcomes. This verbalisation helps learners to think clearly and logically, and therefore gain a better understanding of the concepts.

Extension activities

- Let the learners experiment with repeating trials up to 60 times. They can record the actual outcomes, and say which outcome occurred most often. Then let them try to predict what their results would be if they were to repeat the experiment.
- Let the learners work with events in which there are combinations of outcomes. For example, let them choose two balls from a bag that contains a blue ball, a white ball and a red ball. They would list the possible outcomes and actual outcomes in a table such as the one on the next page.

Possible outcomes	Tallies of actual outcomes	Number of each actual outcome
Blue ball and white ball		
Blue ball and red ball		
White ball and red ball		

1. a) Write down the two possible outcomes of tossing a coin.
   b) Write down the possible outcomes of rolling a six-sided dice.
   c) Write down the possible outcomes of spinning a spinner that has a white side, a pink side, a yellow side, a red side and a purple side.

2. Marcia did an experiment. She spun a spinner a number of times and recorded each actual outcome.

Possible outcomes	Tallies	Number of actual outcomes
Red	~~||||~~ ~~||||~~ ~~||||~~ |	16
Blue	~~||||~~ ~~||||~~ ~~||||~~ ||	17
Green	~~||||~~ ||||	9
Orange	~~||||~~ ~~||||~~ |||	13

   a) How many times did the spinner land on red?
   b) How many times did the spinner land on orange?
   c) How many times did Marcia spin the spinner altogether?
   d) Do you think Marcia will get exactly the same results if she repeats this experiment?

3. Do the same experiment that Marcia did in question 2. Compare your results with Marcia's. How were the outcomes the same or different?

4. Roll a dice 50 times and record your actual outcomes.
   a) Draw a tally table that lists all the possible outcomes of the event.
   b) Roll the dice 50 times and record each outcome.
   c) Which number was the most common outcome?
   d) Which number was the least common outcome?
   e) Write two sentences that describe your results.

1. **a)** Heads or tails
   b) 1, 2, 3, 4, 5 or 6
   c) White, pink, yellow, red or purple
2. **a)** 16 times
   b) 13 times
   c) 55 times
   d) Probably not
3. Let the learners do the experiment on their own. They should know that they must draw a tally table to record their outcomes. They should state which outcome occurred most often and least often. Then they should compare their results with the outcomes shown in the table above.
4. The learners should be able to carry out the trial and record the outcomes clearly. They have had a lot of practice in doing trials such as these.

5. Resources

Mental maths grid

Mental calculations							
Name:							
	Task 1	**Task 2**	**Task 3**	**Task 4**	**Task 5**	**Task 6**	**Task 7**
Number							
Shade the blocks below to show your progress.							
10							
9							
8							
7							
6							
5							
4							
3							
2							
1							

Reflection

What do I do well?

....

....

....

What can I do better next time?

....

....

....

One-minute addition and subtraction

1. 7 + 9 =	
2. 17 + 19 =	
3. 8 + 6 =	
4. 80 + 60 =	
5. 4 + 7 =	
6. 24 + 7 =	
7. 6 + 9 =	
8. 6 + 39 =	
9. 9 + 5 =	
10. 19 + 25 =	
11. 16 – 7 =	
12. 36 – 7 =	
13. 15 – 8 =	
14. 45 – 18 =	
15. 13 – 6 =	
16. 23 – 16 =	
17. 19 – 11 =	
18. 59 – 11 =	
19. 20 – 9 =	
20. 50 – 9 =	

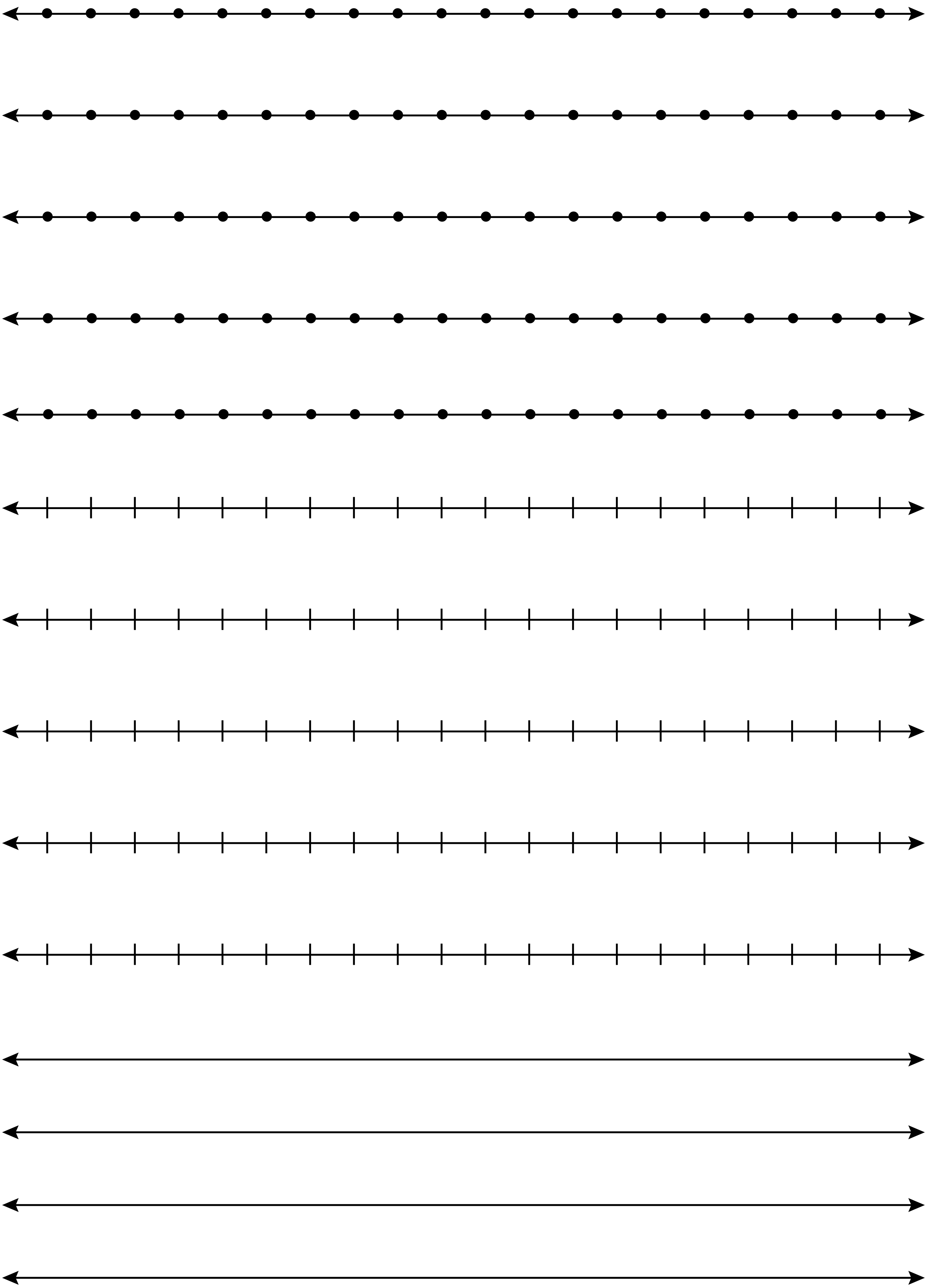
Questionnaire for Data handling

Questionnaire		
Tick the 'yes' or 'no' box for each question.	Yes	No
1.		
2.		
3.		
4.		
5.		

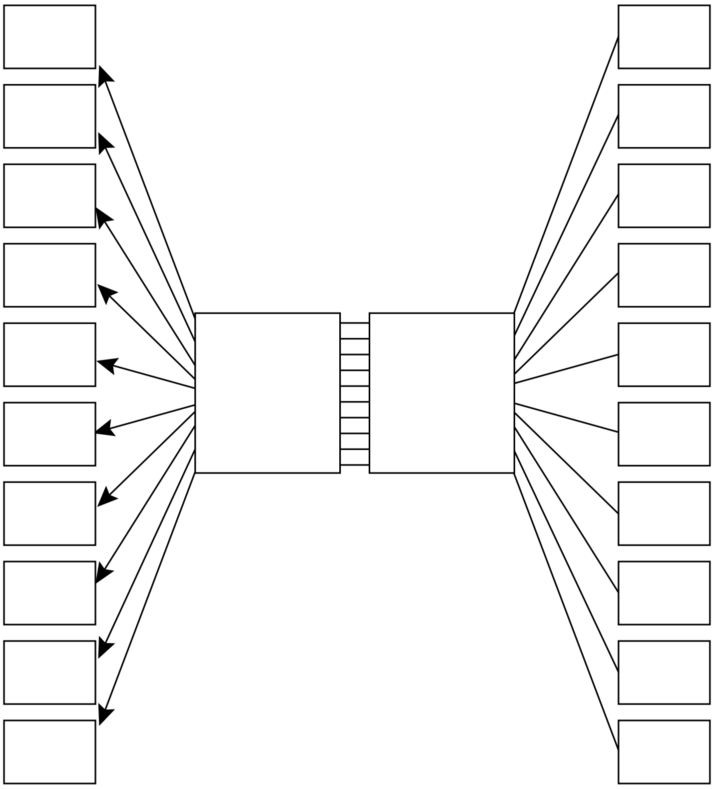
Questionnaire		
Tick the 'yes' or 'no' box for each question.	Yes	No
1.		
2.		
3.		
4.		
5.		

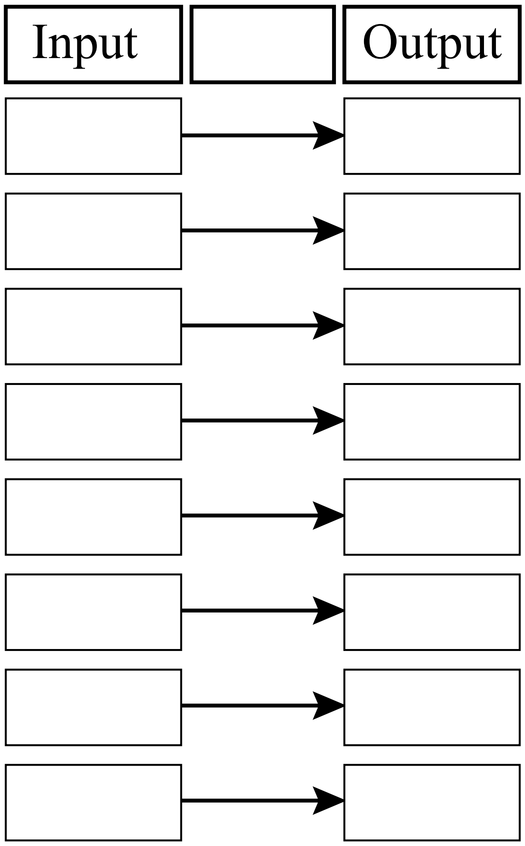
Questionnaire		
Tick the 'yes' or 'no' box for each question.	Yes	No
1.		
2.		
3.		
4.		
5.		

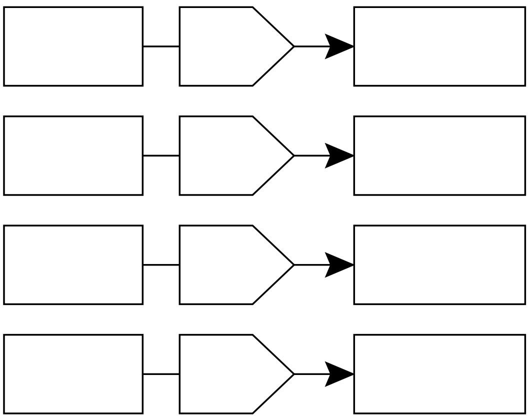
Number lines

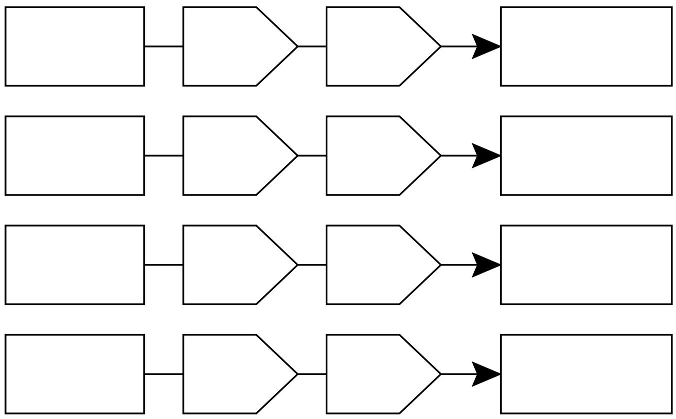


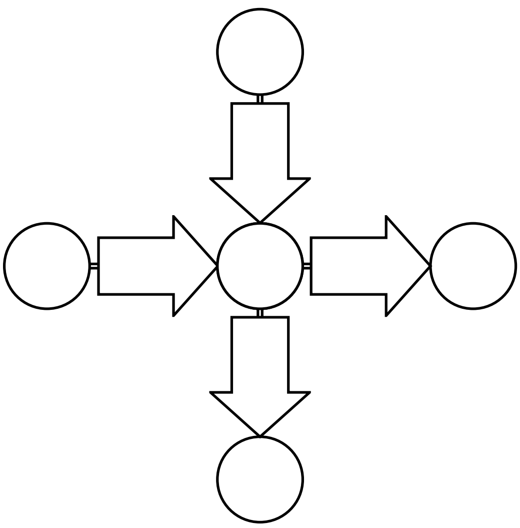
Flow charts

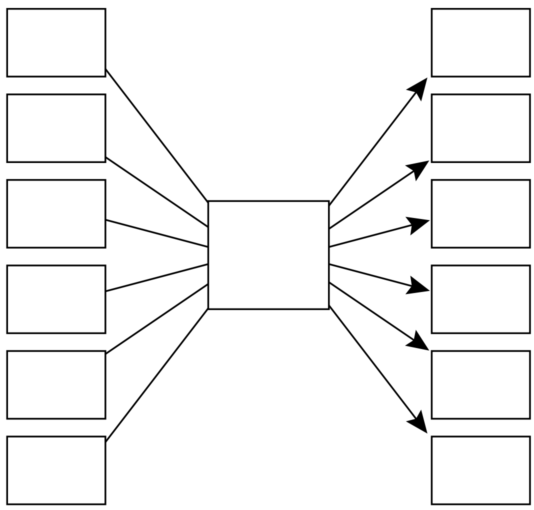




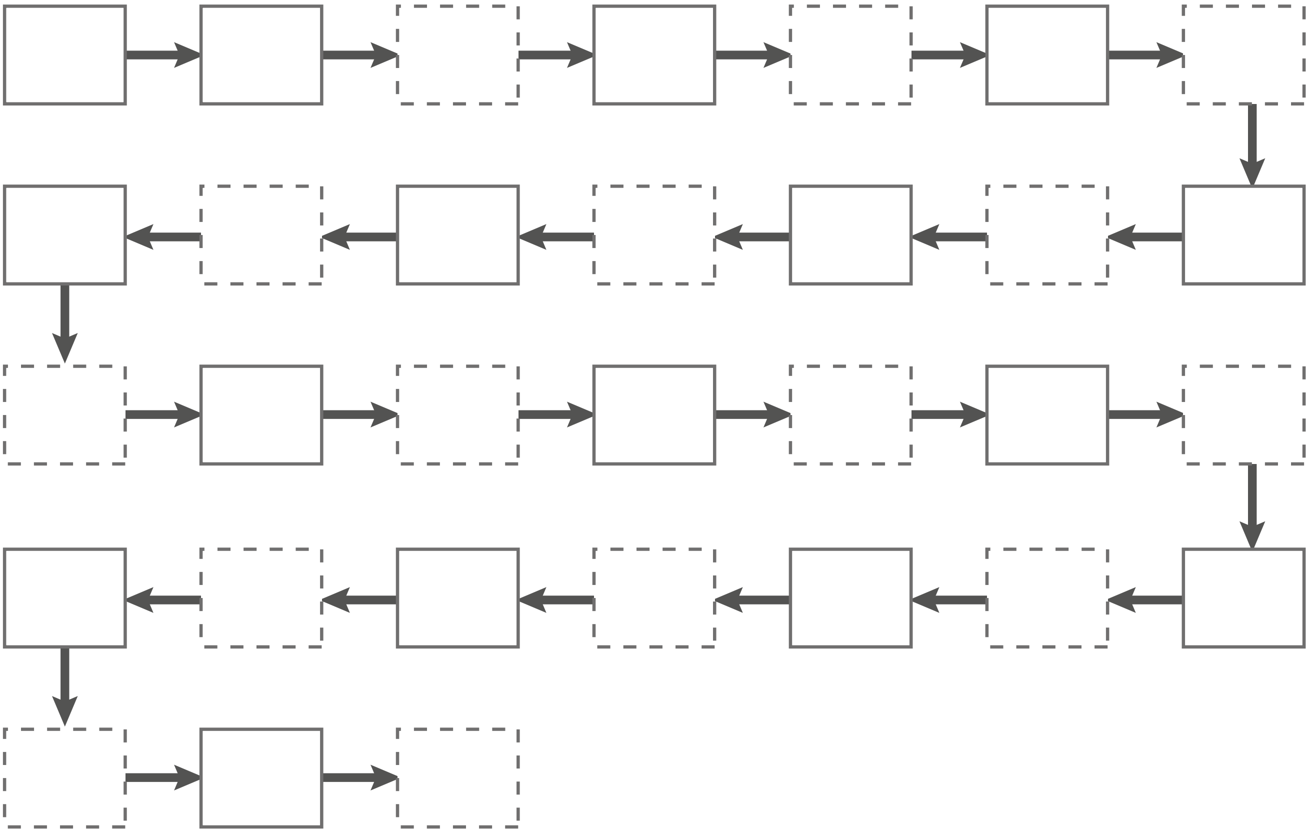


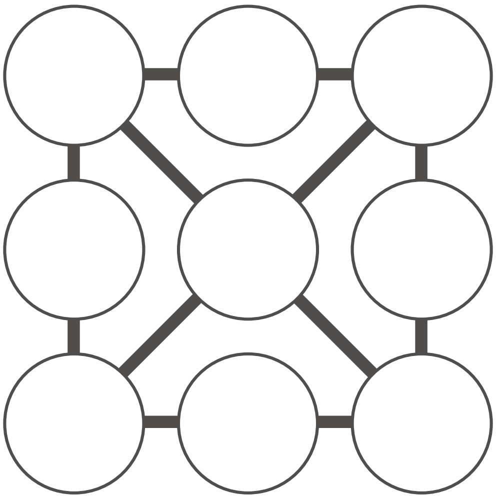


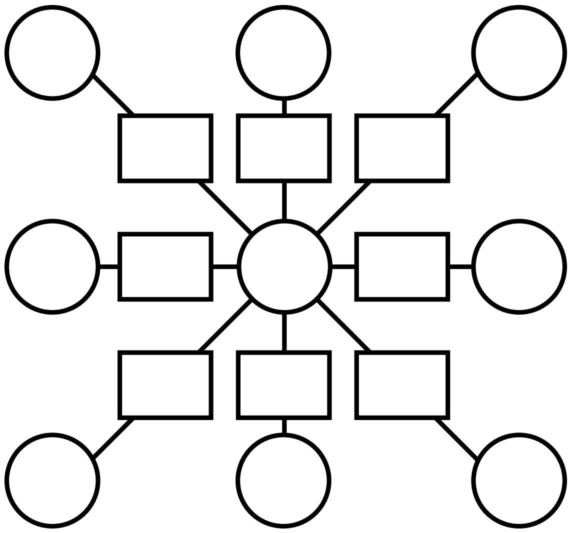


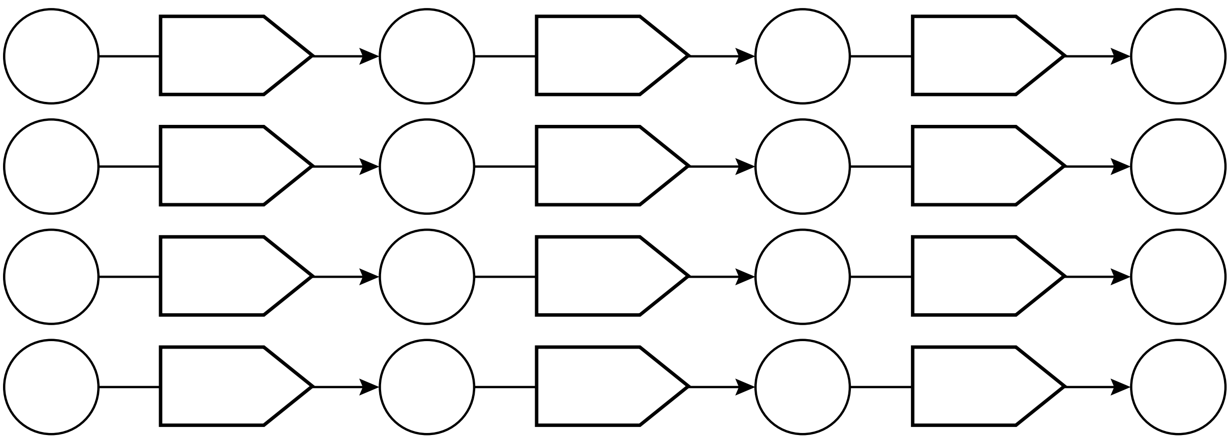


Number chains and calculation diagrams

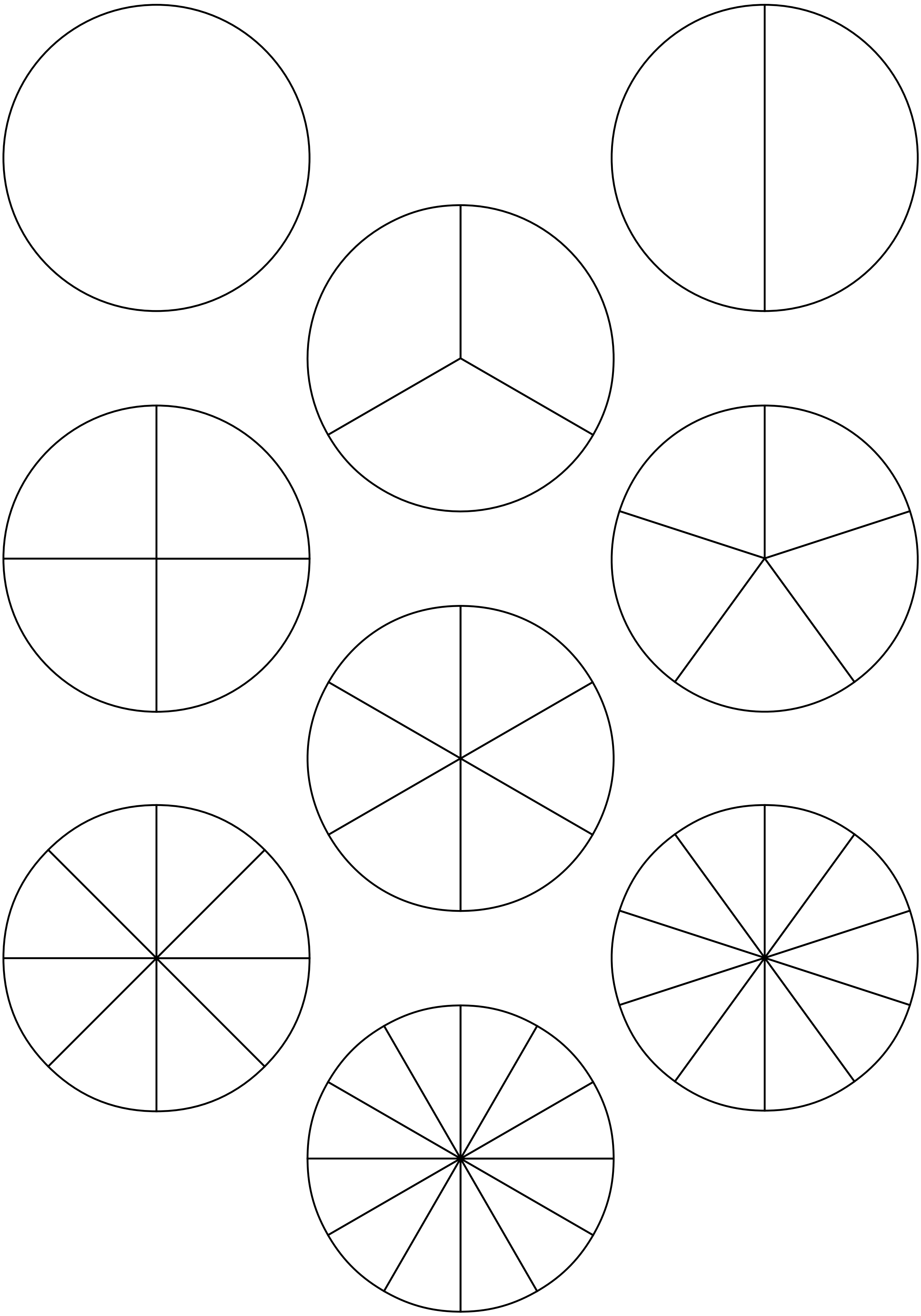








Fraction circles



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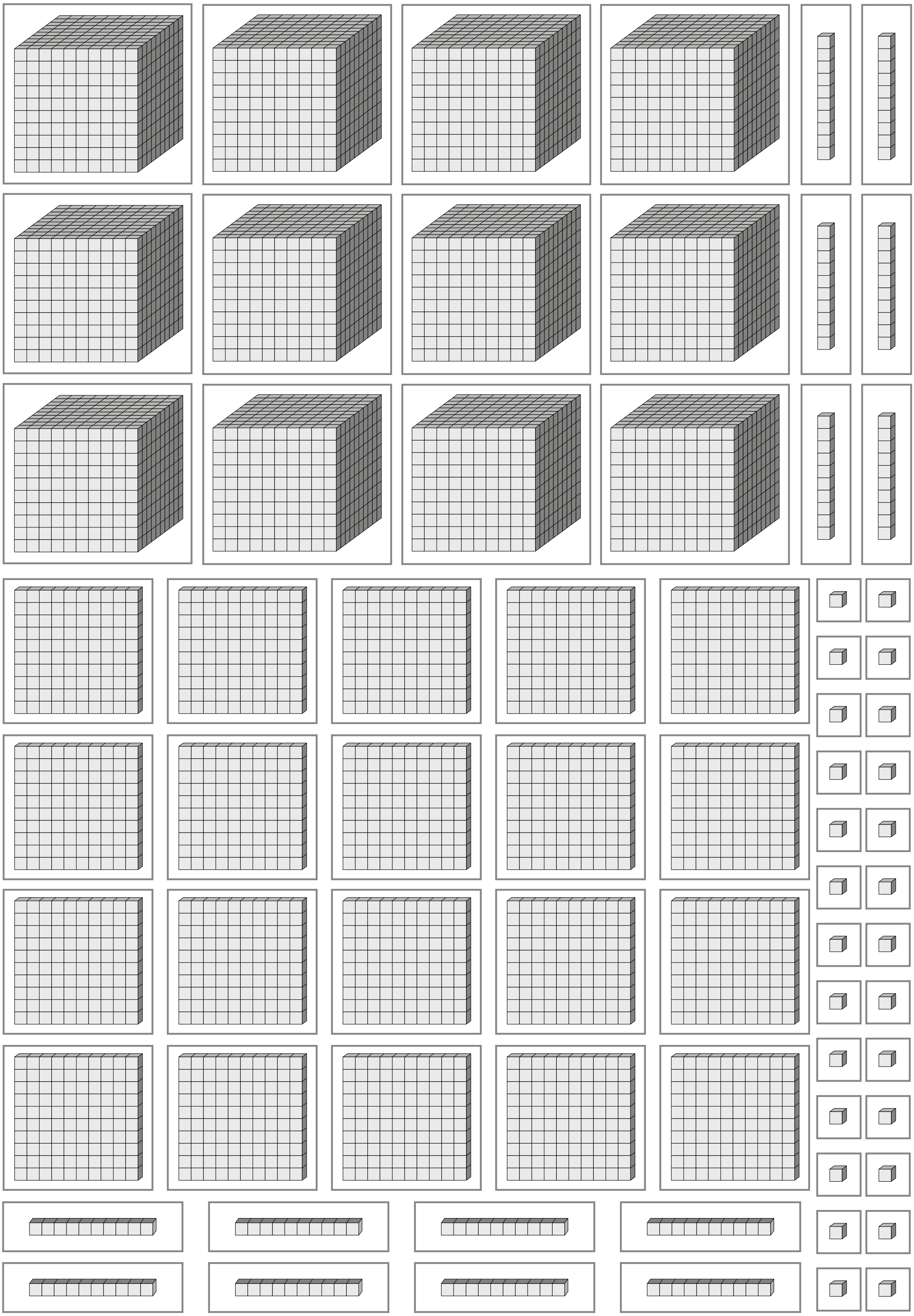
Flard cards

10000	1000
20000	2000
30000	3000
40000	4000
50000	5000
60000	6000
70000	7000
80000	8000
90000	9000

Flard cards

100	10	1
200	20	2
300	30	3
400	40	4
500	50	5
600	60	6
700	70	7
800	80	8
900	90	9

Dienes blocks



Number grid

200 grid

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130
131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170
171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190
191	192	193	194	195	196	197	198	199	200

Number grids

99 grid

0	1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29
30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47	48	49
50	51	52	53	54	55	56	57	58	59
60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99

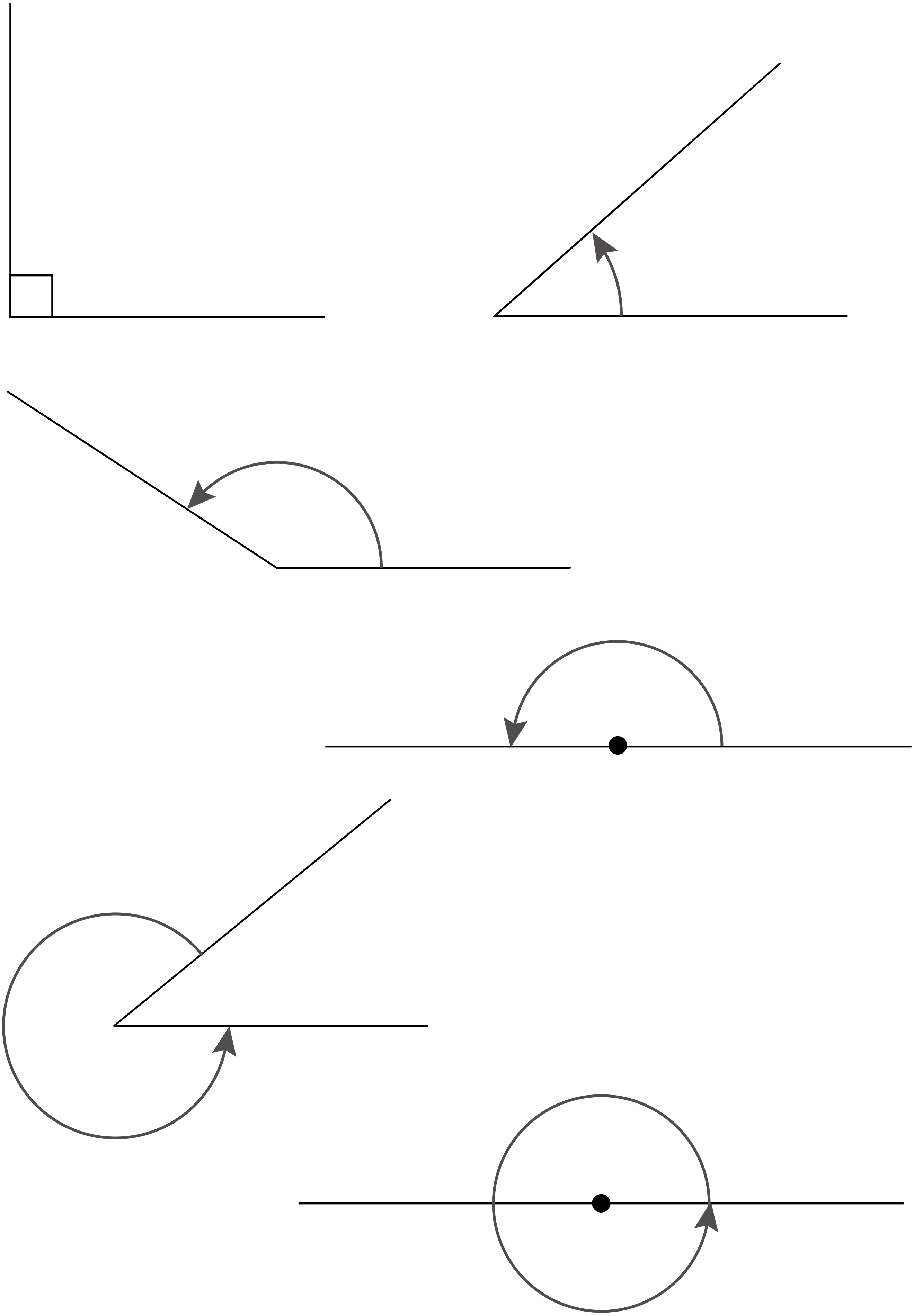
100 grid

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

109-grid

0	1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29
30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47	48	49
50	51	52	53	54	55	56	57	58	59
60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99
100	101	102	103	104	105	106	107	108	109

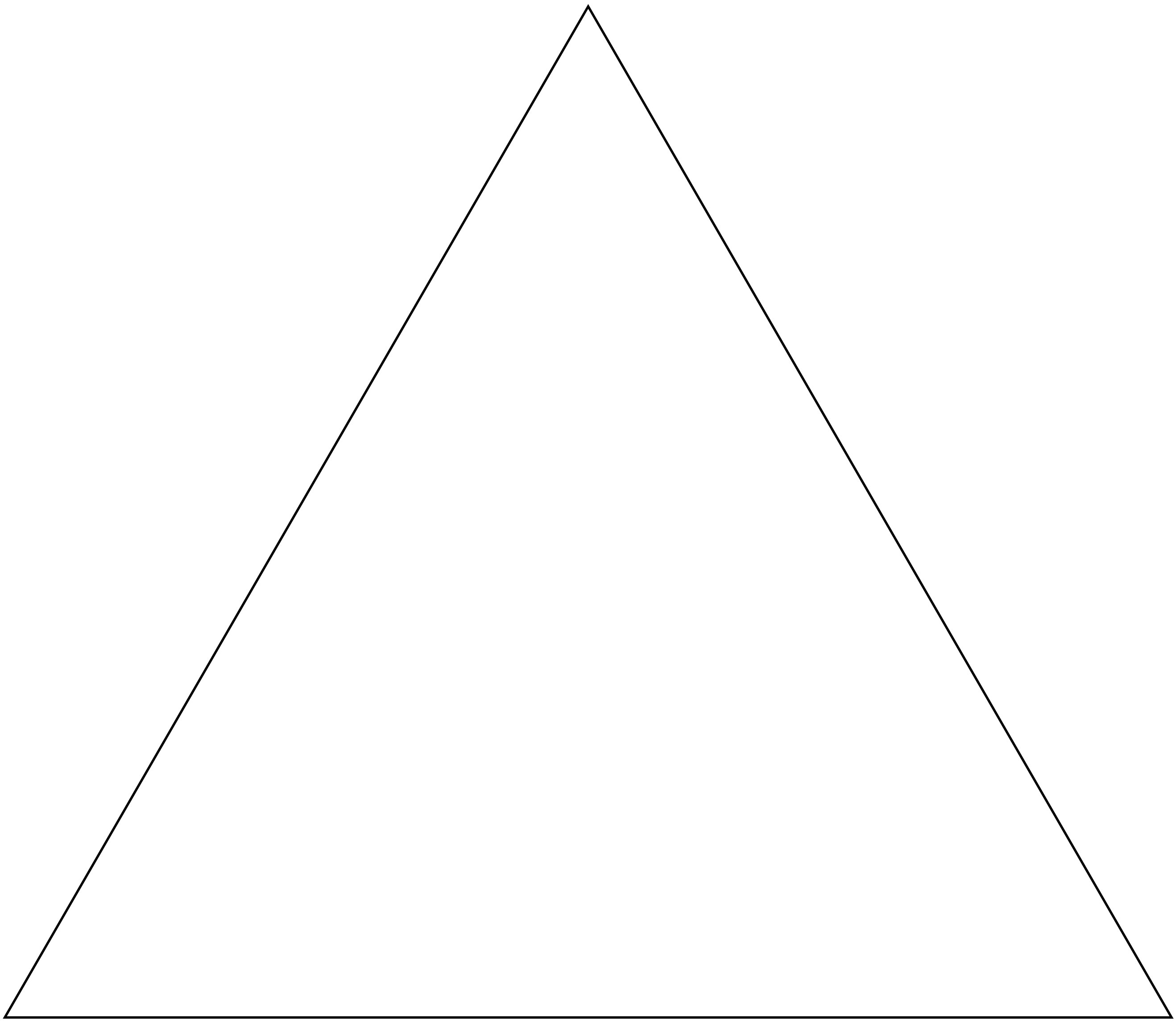
Angles



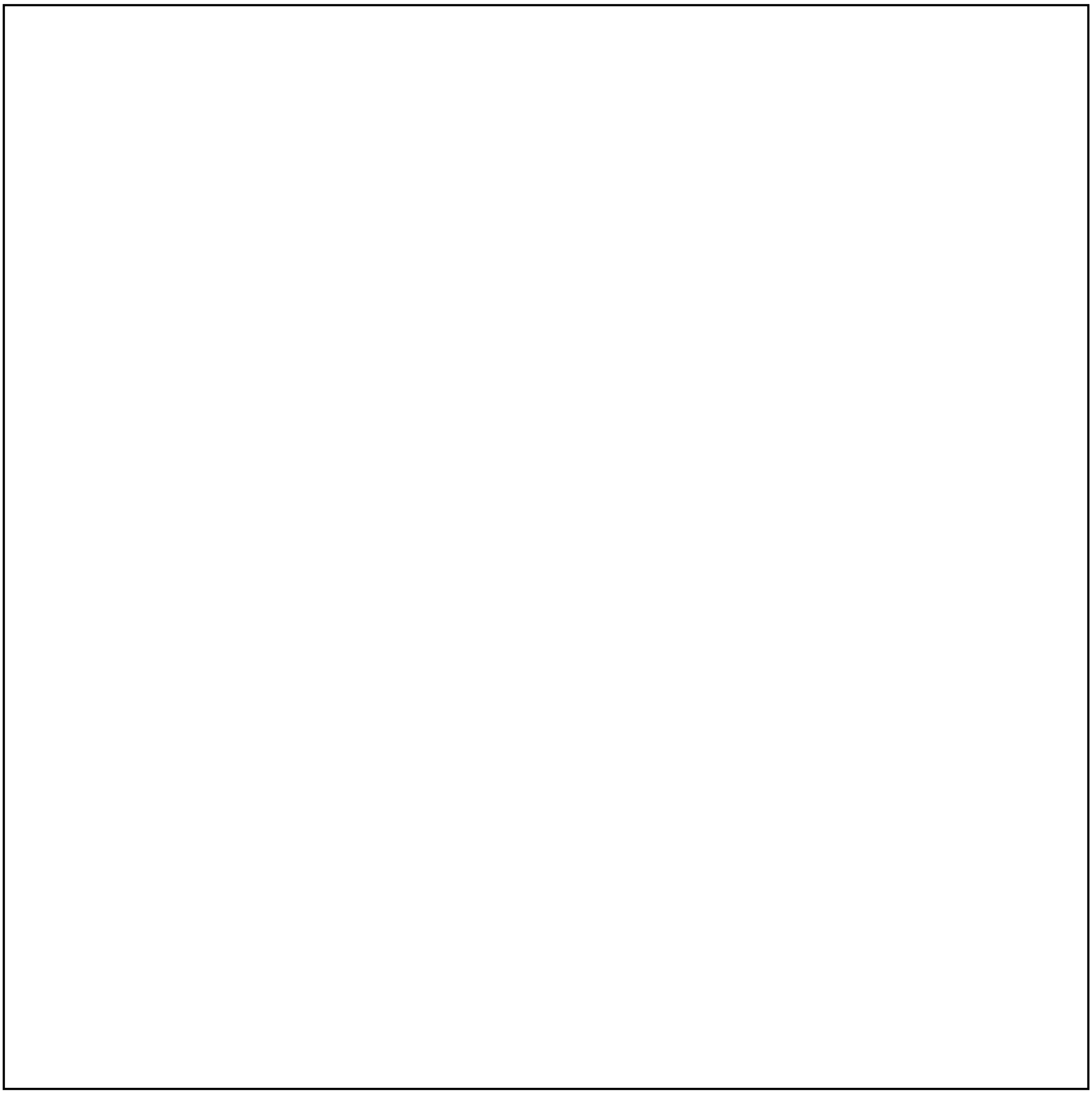
Angle names

acute angle	obtuse angle
acute angle	obtuse angle
acute angle	obtuse angle
right angle	straight angle
right angle	straight angle
right angle	straight angle
reflex angle	revolution
reflex angle	revolution
reflex angle	revolution

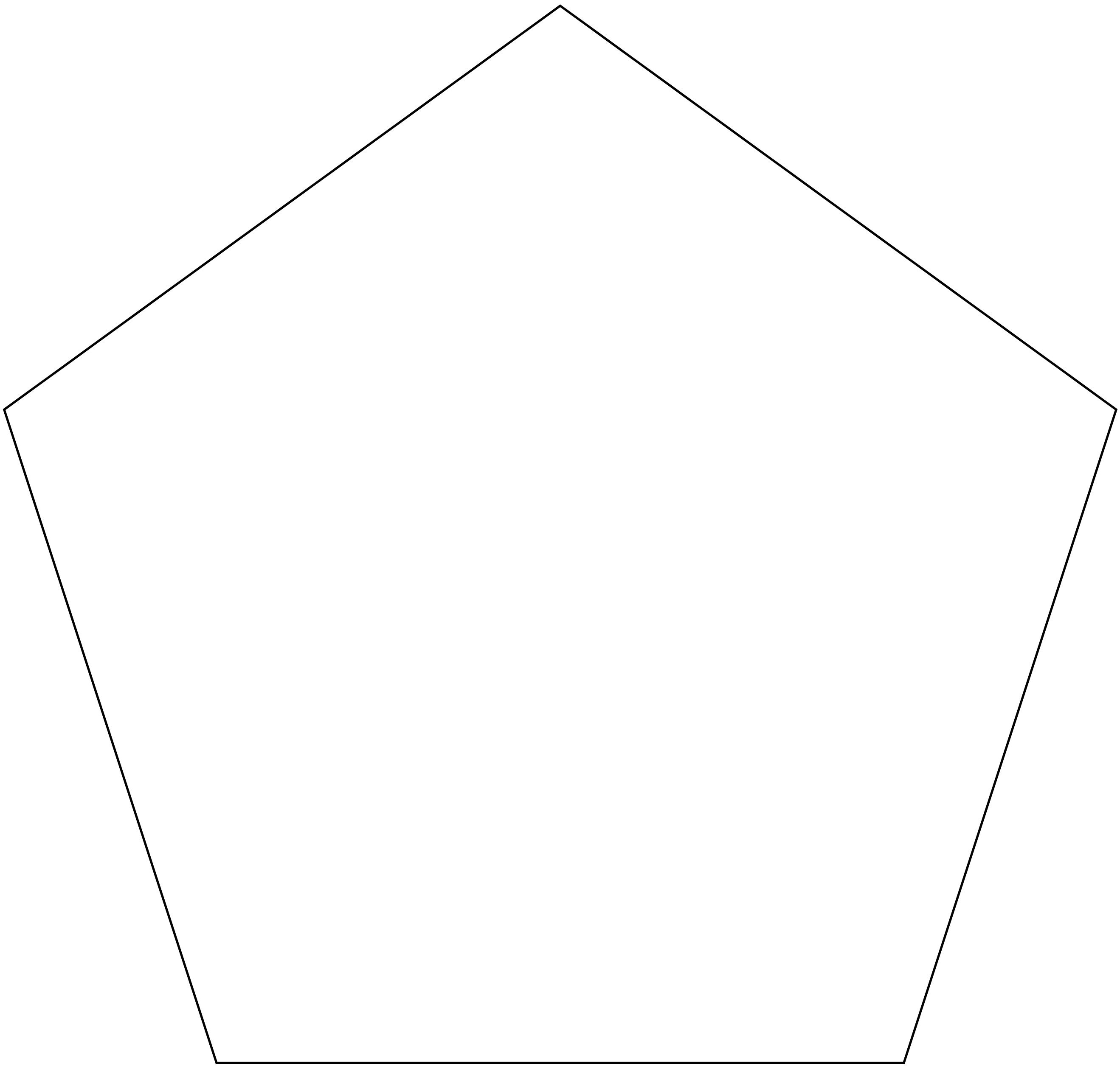
Shapes: equilateral triangle



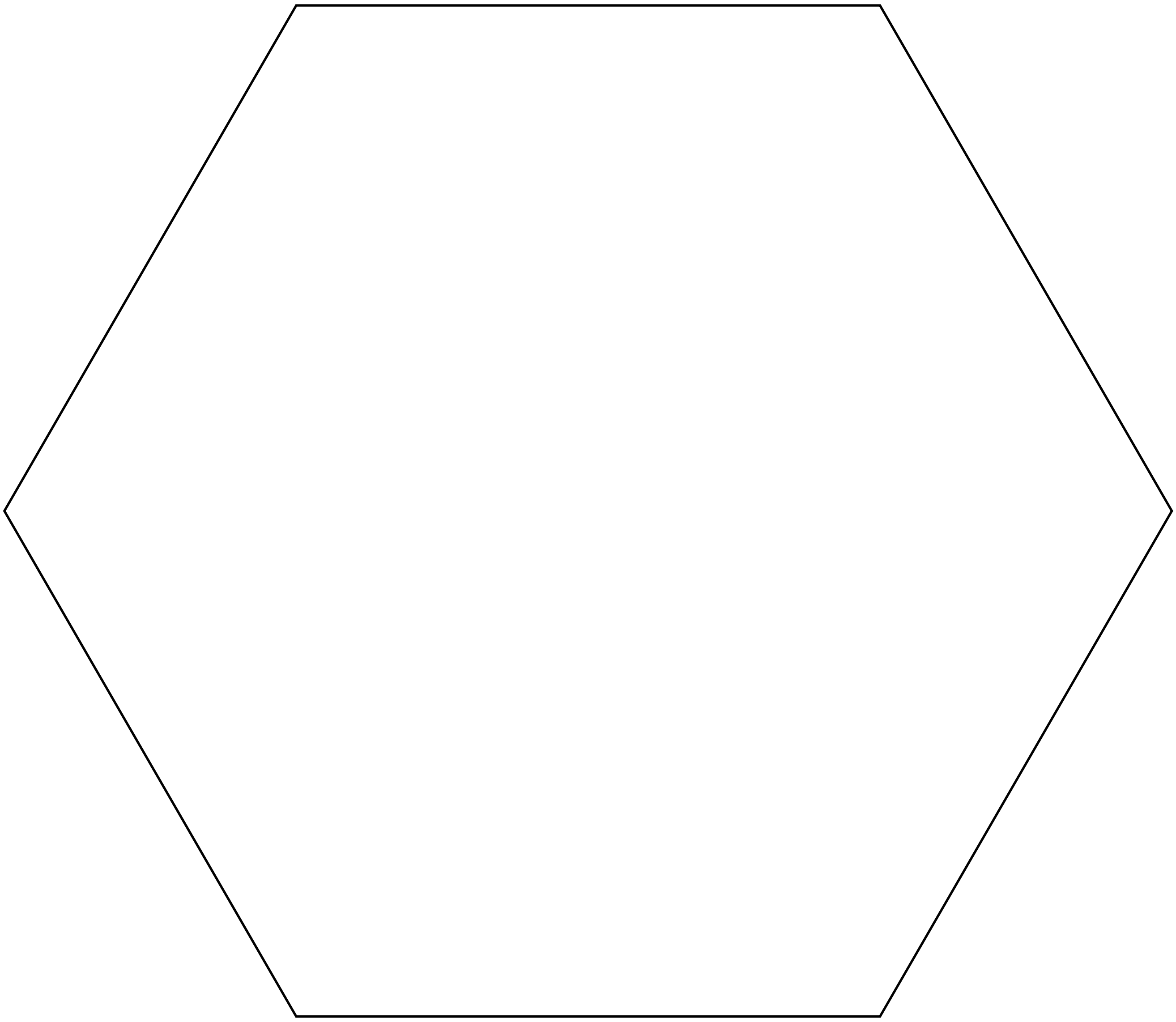
Shapes: square



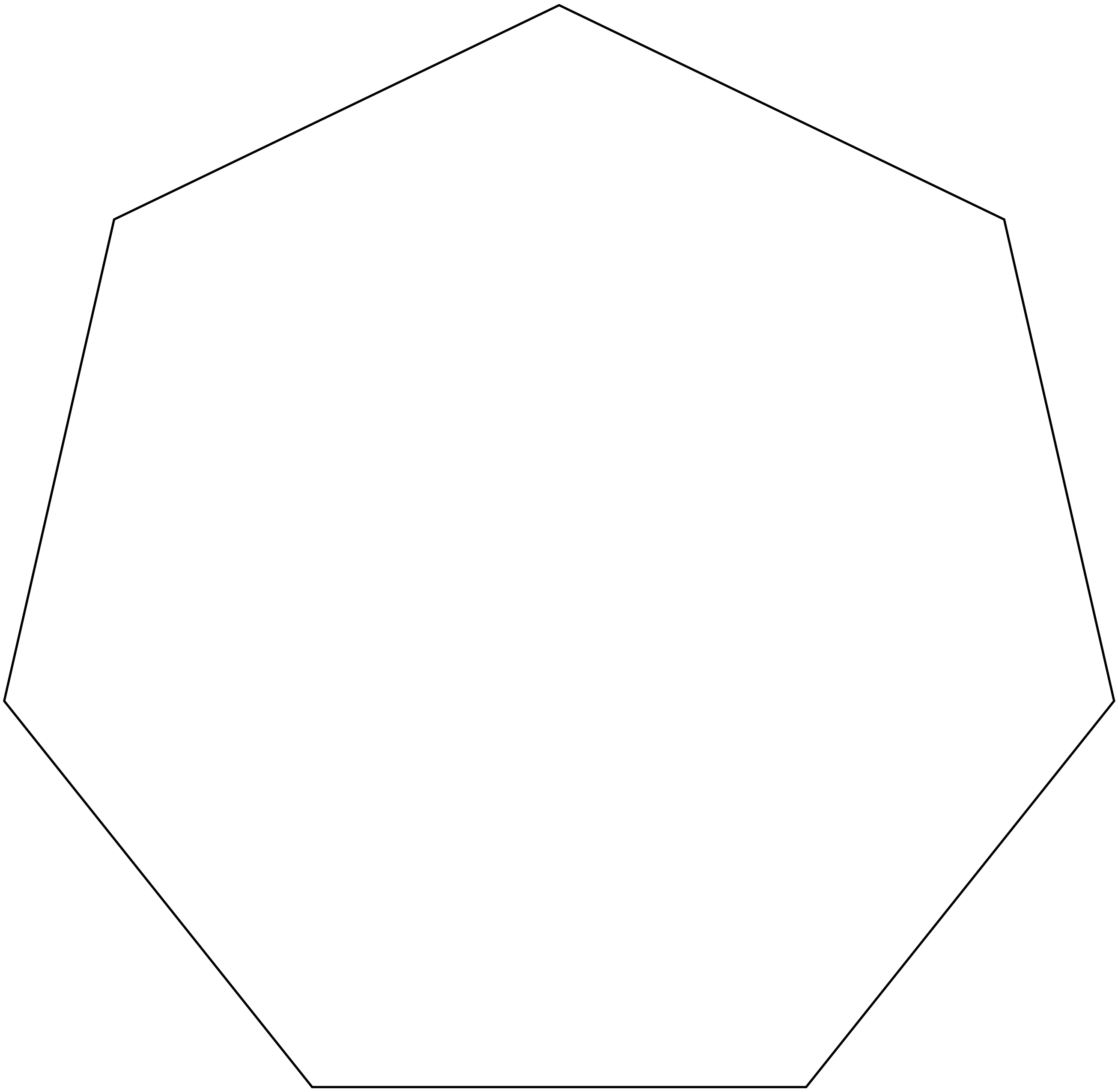
Shapes: pentagon



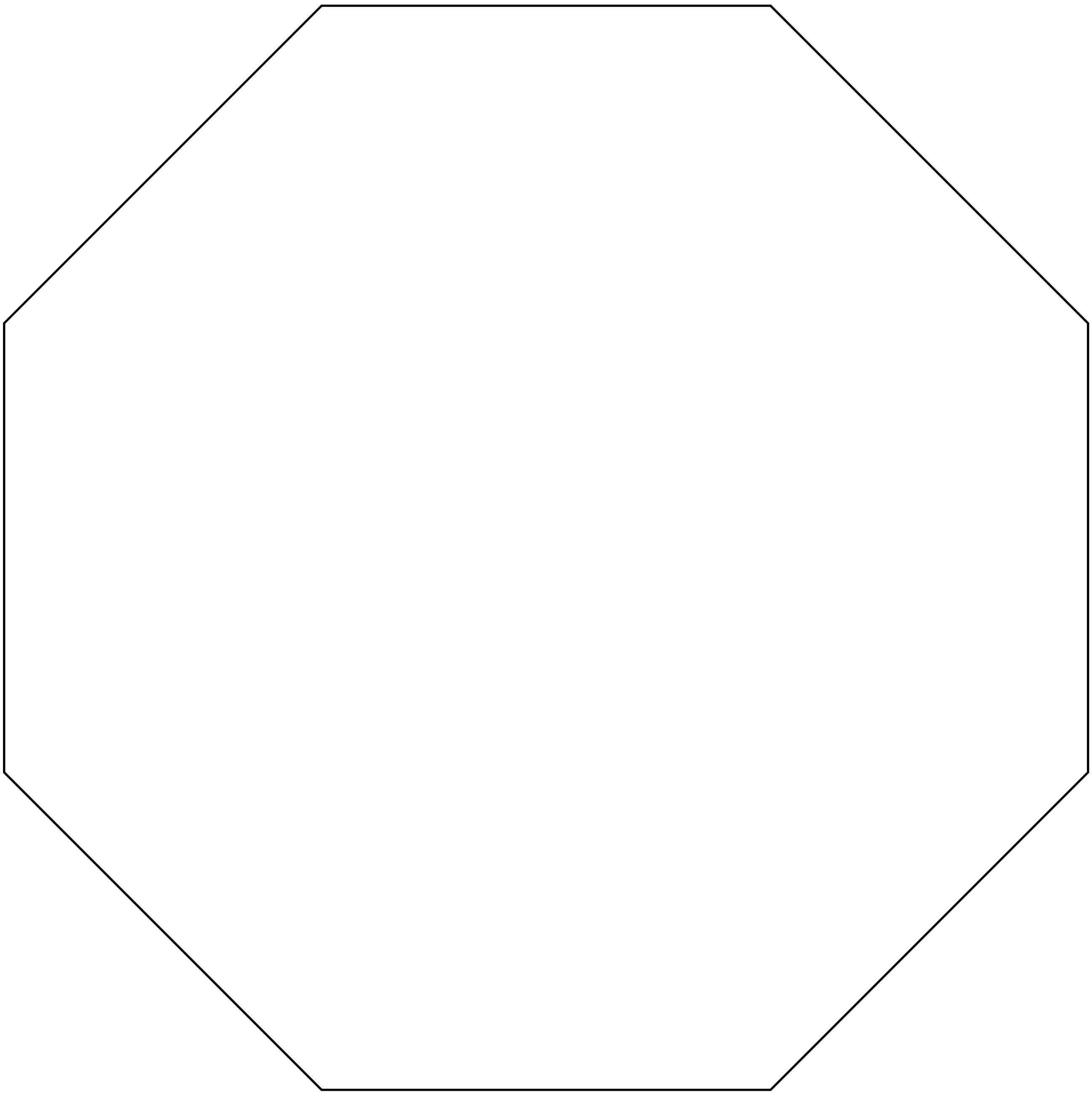
Shapes: hexagon



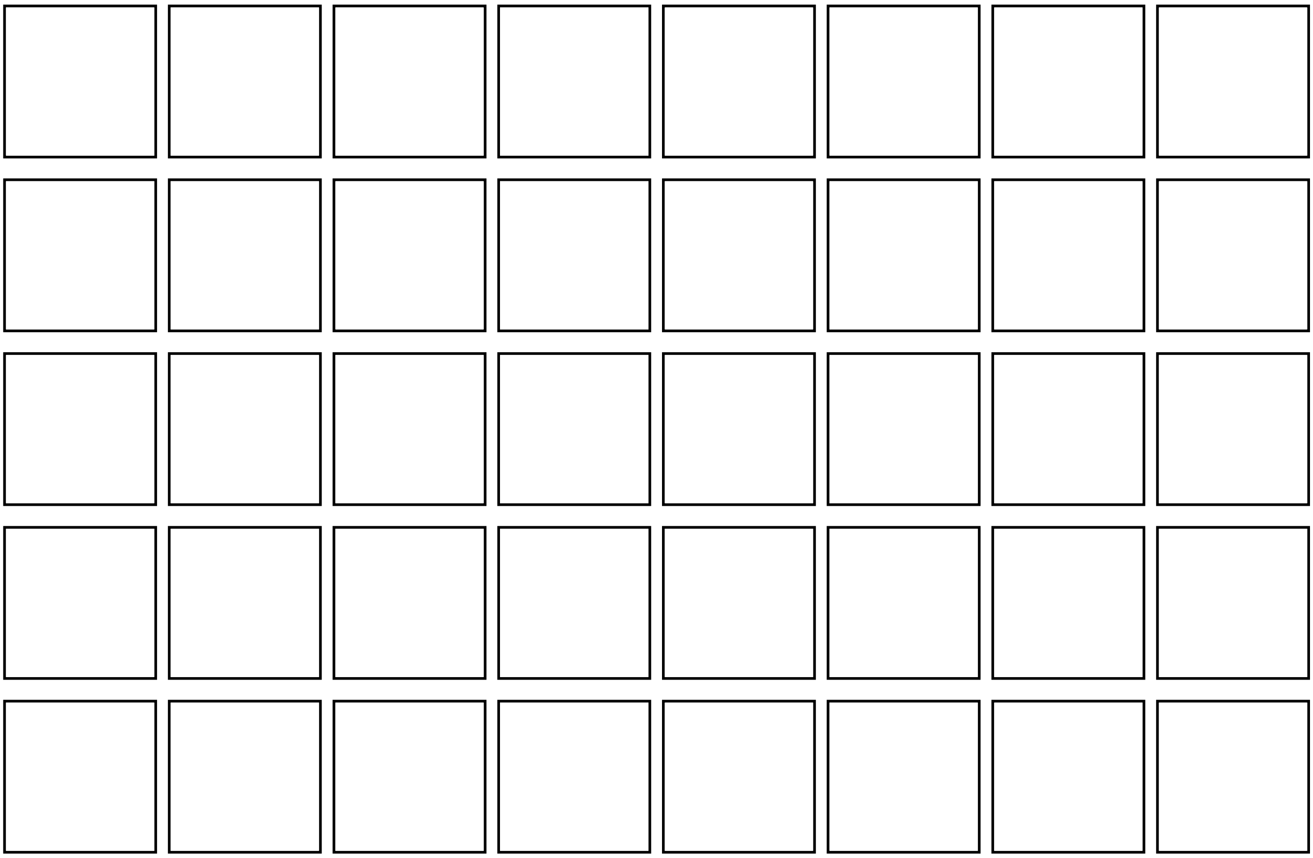
Shapes: heptagon



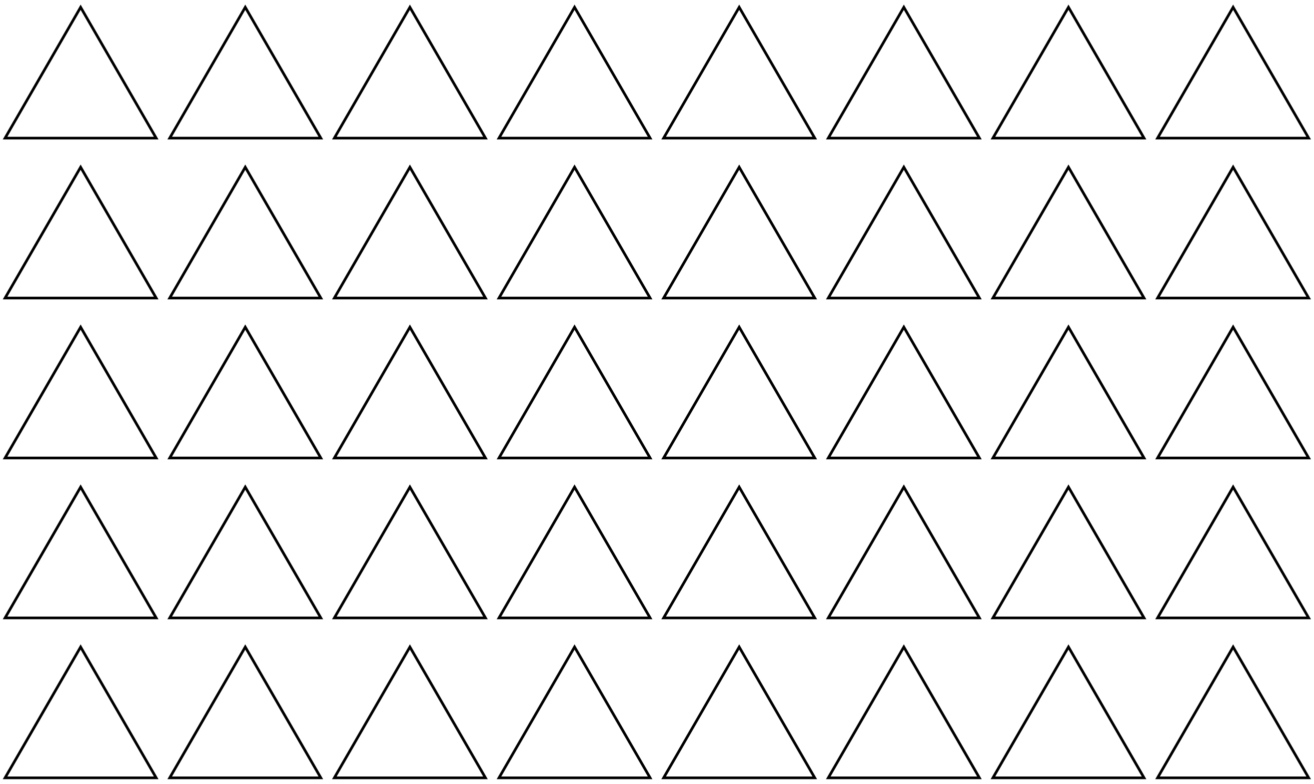
Shapes: octagon



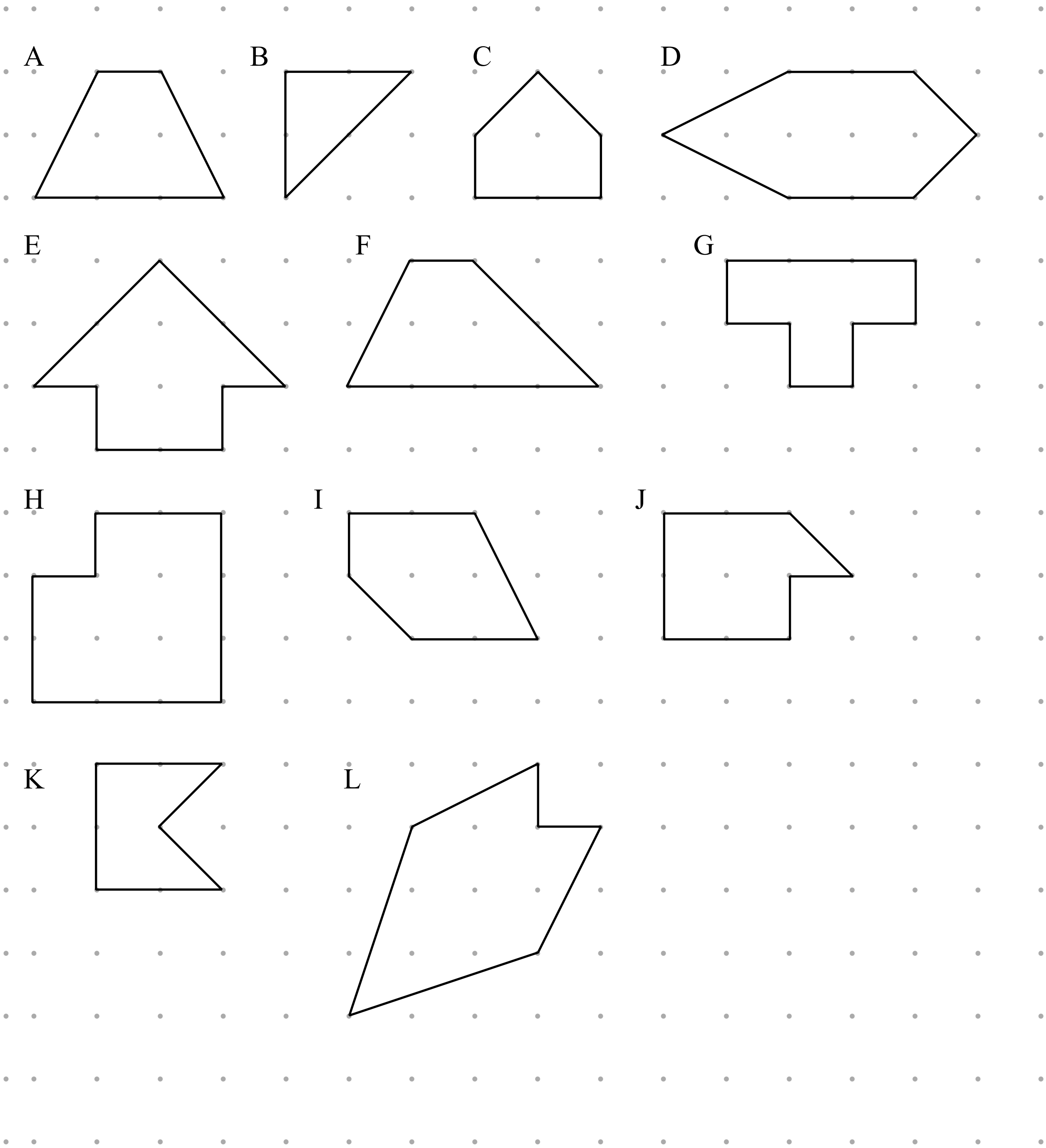
Shapes: 2 cm squares



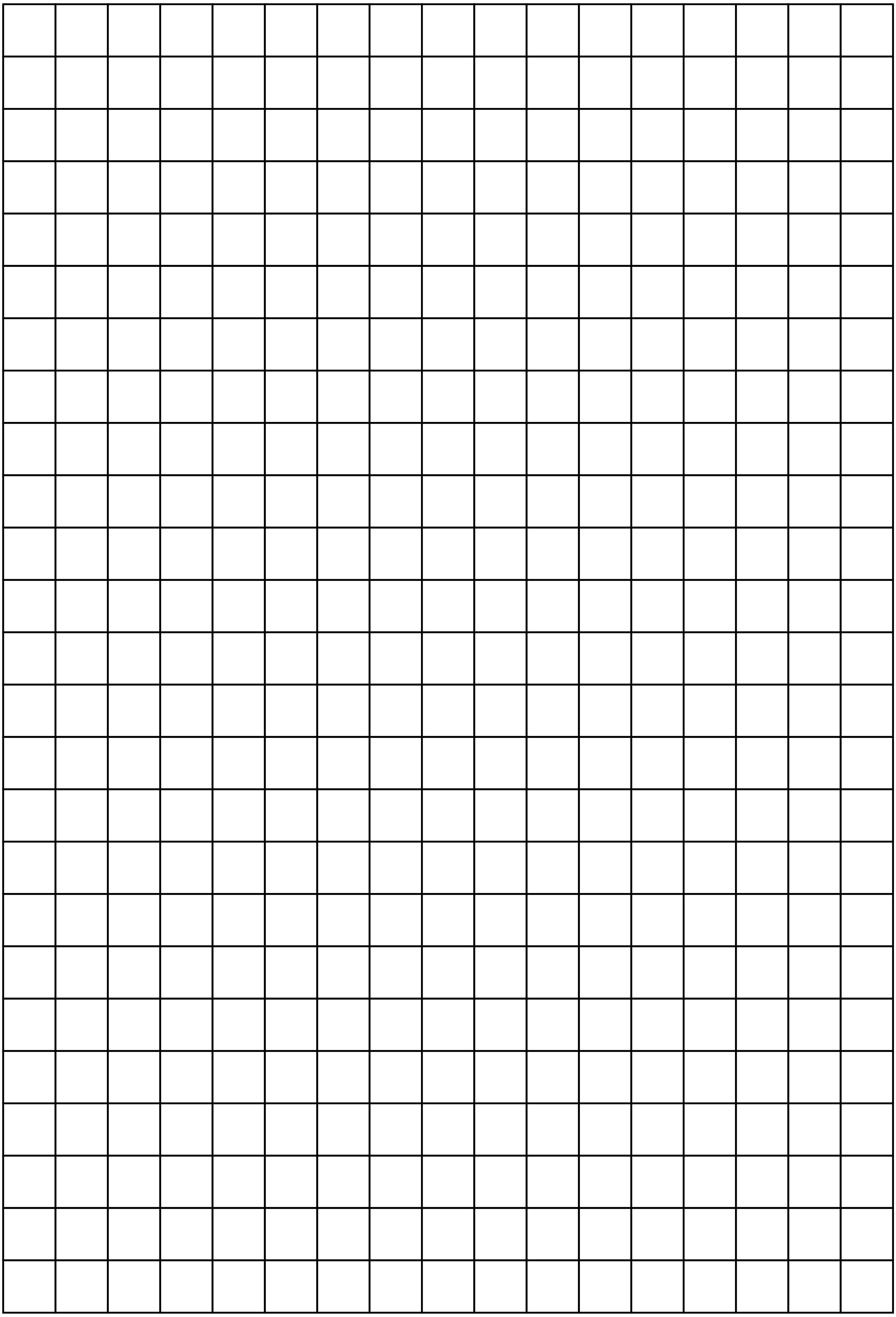
Shapes: 2 cm equilateral triangles



Symmetry: lines

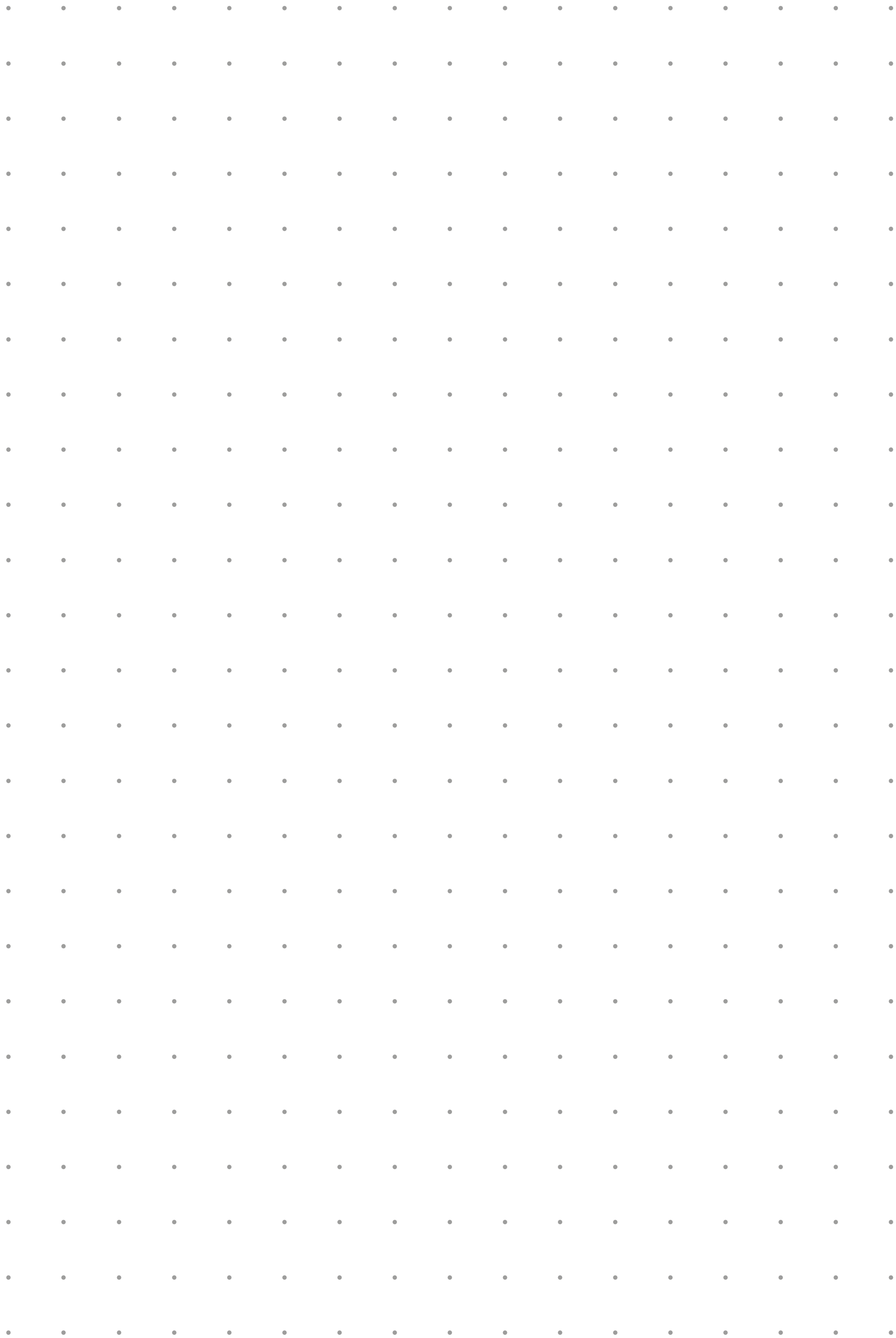


Square grid: 1 cm × 1 cm



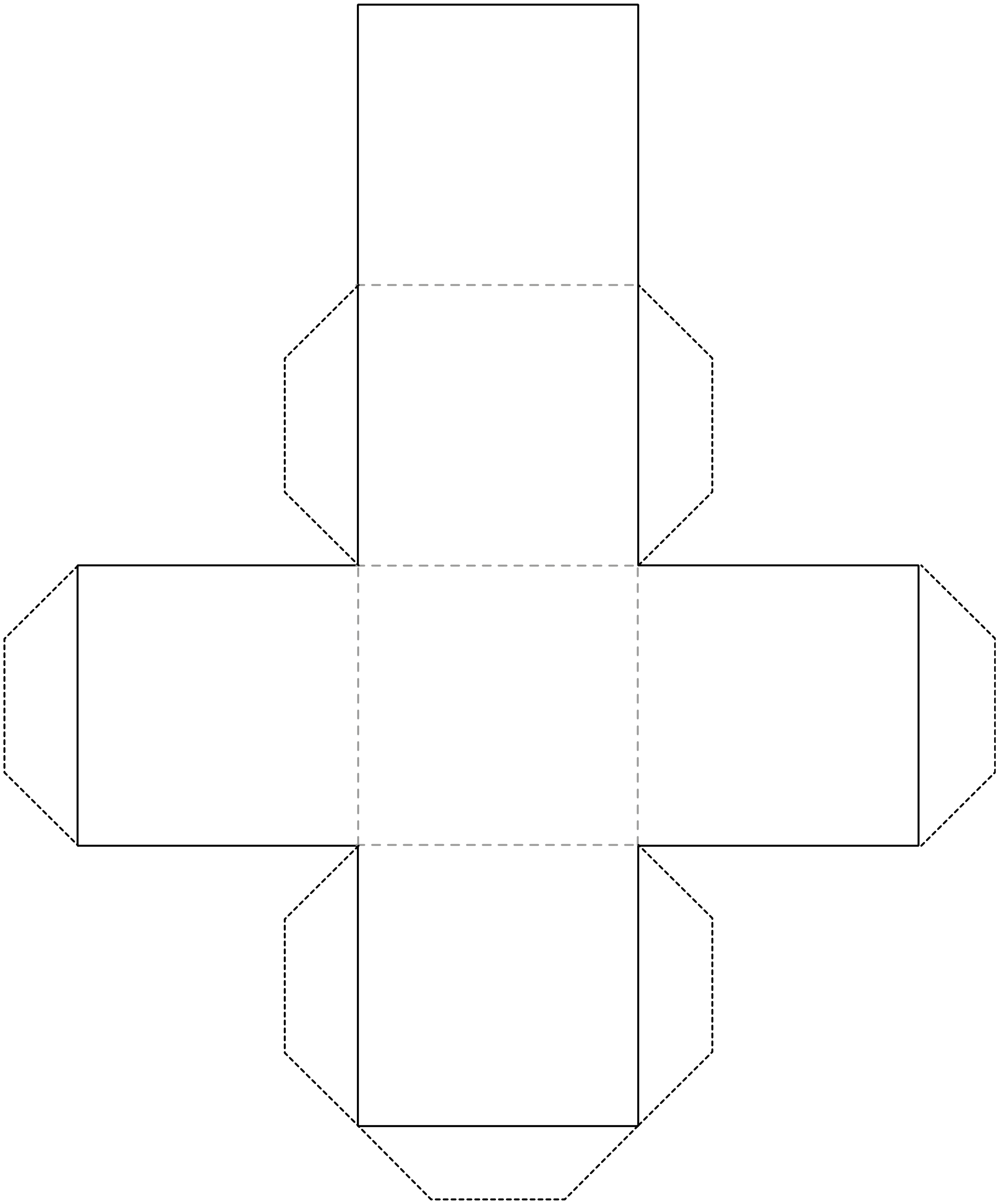
Square grid: 2 cm × 2 cm

Square dotted grid

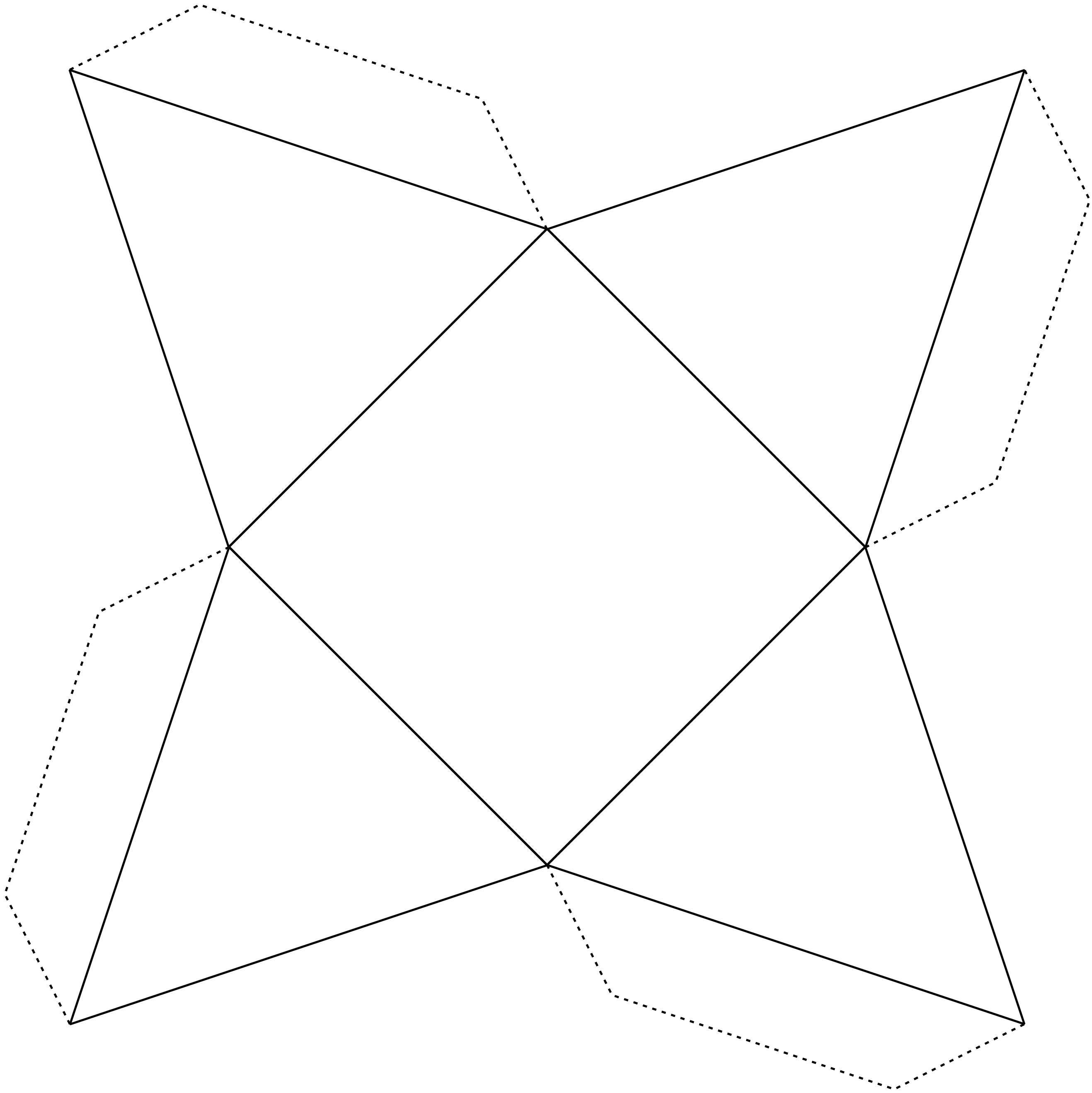


Triangular dotted grid

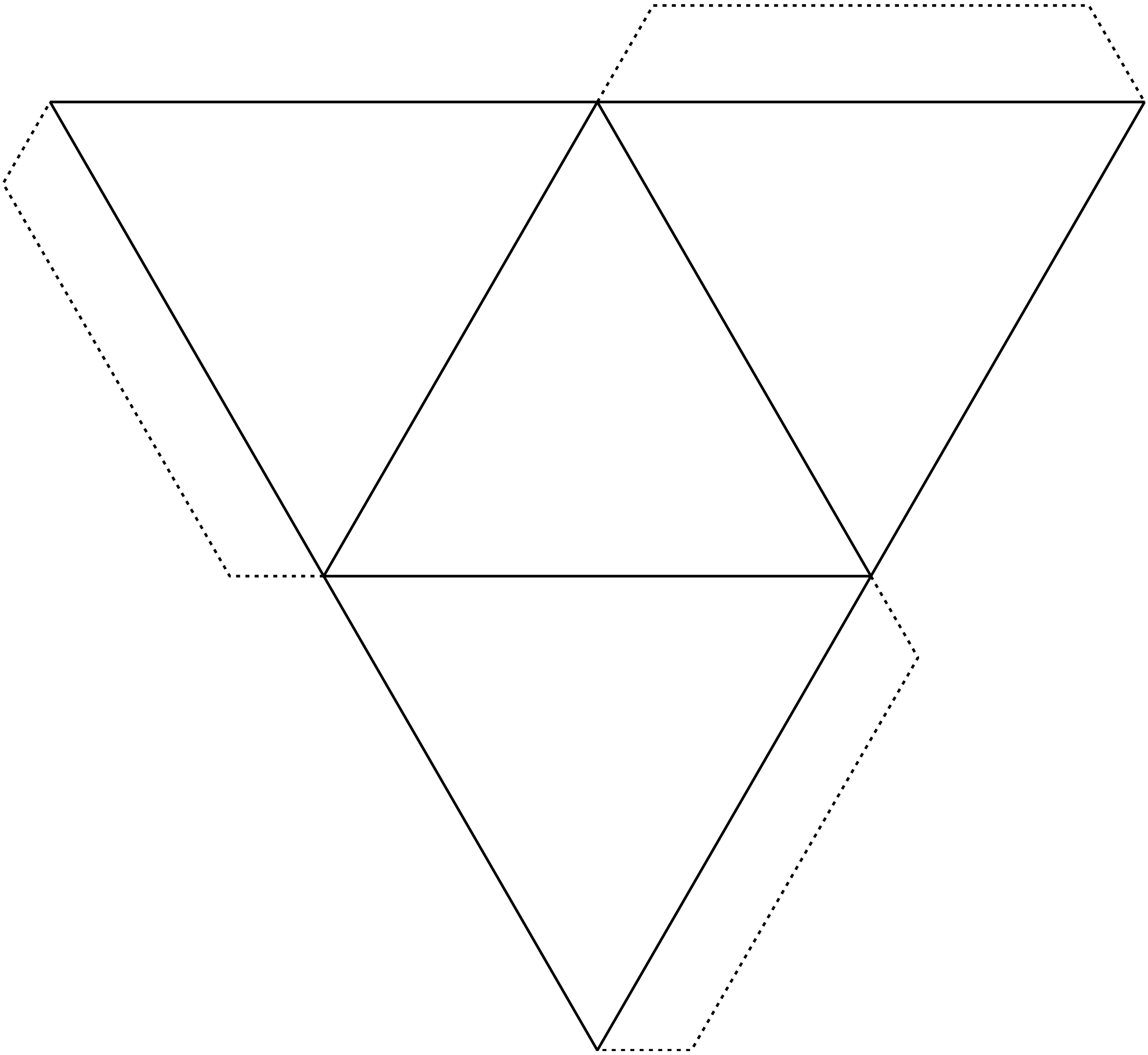
Net for a cube



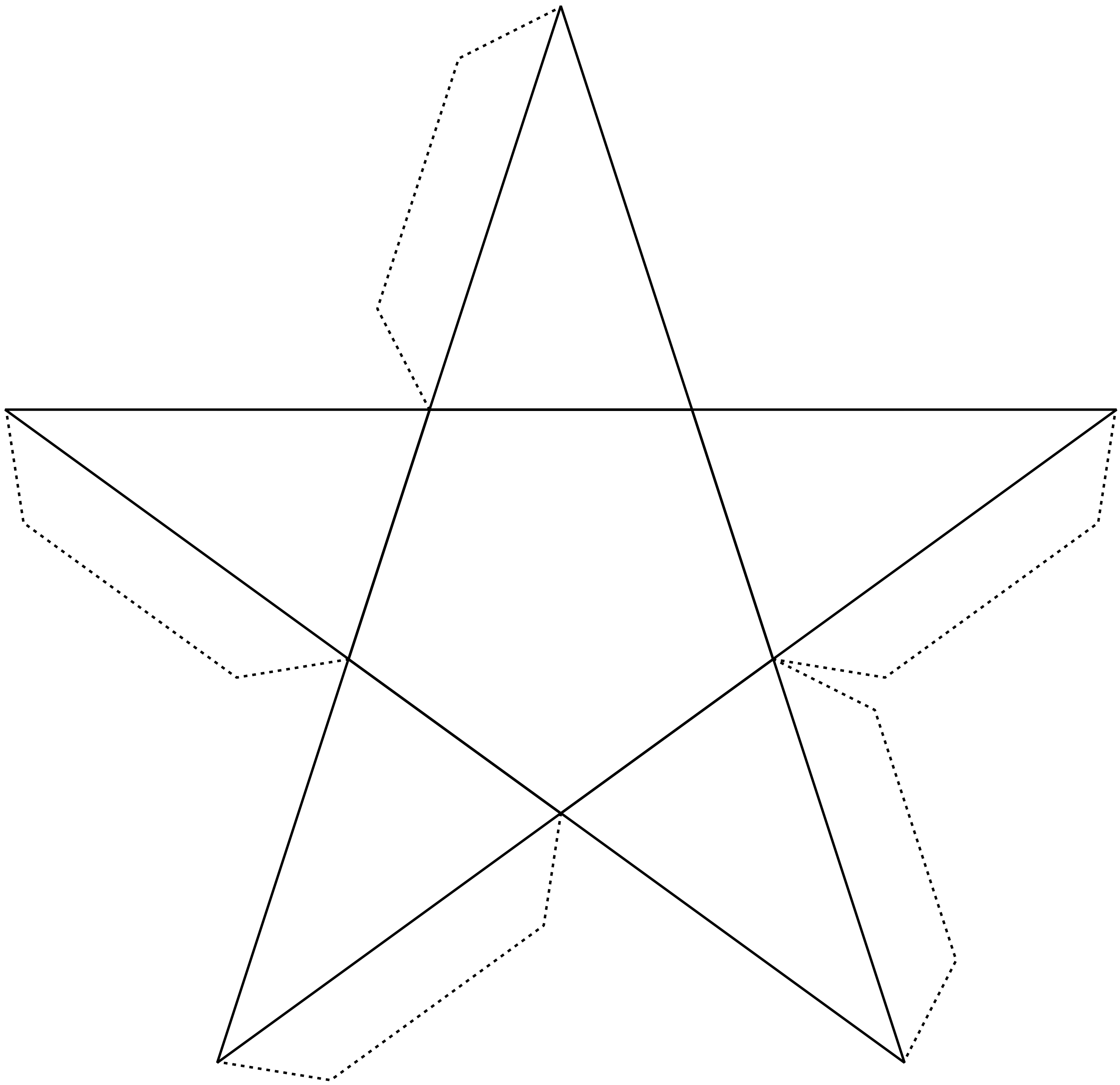
Net for a square-based pyramid



Net for a triangular-based pyramid (tetrahedron)



Net for a pentagonal-based pyramid



I have … (1)

Distribute the pack of cards in the class. If there are more cards than learners, give some learners each two cards. If there are too few cards, some learners can play in pairs and share a card. The first player reads his or her card. The learner who has the card with the answer, reads his or her card. The game continues until the chain ends with the first player answering the last question.

I have 0. Who has 19 more?	I have 19. Who has this plus 1 multiplied by 2?	I have 40. Who has 10 fewer?	I have 54. Who has this plus 6?	I have 10. Who has 17 more?	I have 14. Who has half of this multiplied by 3?	I have 21. Who has 10 more?	I have 30. Who has this divided by 6?	I have 27. Who has double this?	I have 5. Who has this plus 1, multiplied by 3?
I have 60. Who has this minus 15?	I have 45. Who has this plus 13?	I have 13. Who has double this?	I have 26. Who has 10 more?	I have 36. Who has half of this plus 6?	I have 24. Who has double this?	I have 48. Who has this minus 9?	I have 37. Who has 9 more?	I have 46. Who has 1 fewer divided by 5?	I have 18. Who has 2 more?
I have 20.Who has double this plus 1?	I have 41. Who as 2 fewer?	I have 39. Who has 5 fewer?	I have 34. Who has 1 more?	I have 35. Who has this minus 2?	I have 33. Who has twice as much?	I have 66. Who has this minus 60, plus 5?	I have 11. Who has 6 more?	I have 17. Who has 3 fewer?	I have 31. Who has this minus 1, divided by 3?
I have 8. Who has 4 more?	I have 12. Who has half of this?	I have 6. Who as 1 fewer, divided by 5?	I have 1. Who has this multiplied by 9?	I have 9. Who has this plus 3, divided by 4?	I have 3. Who has double this plus 4?	I have 10. Who has a dozen more?	I have 22. Who has this divided by 11?	I have 2. Who has this minus 2, multiplied by 6?	I have 9. Who has 87 more divided by 2?

I have ... (2)

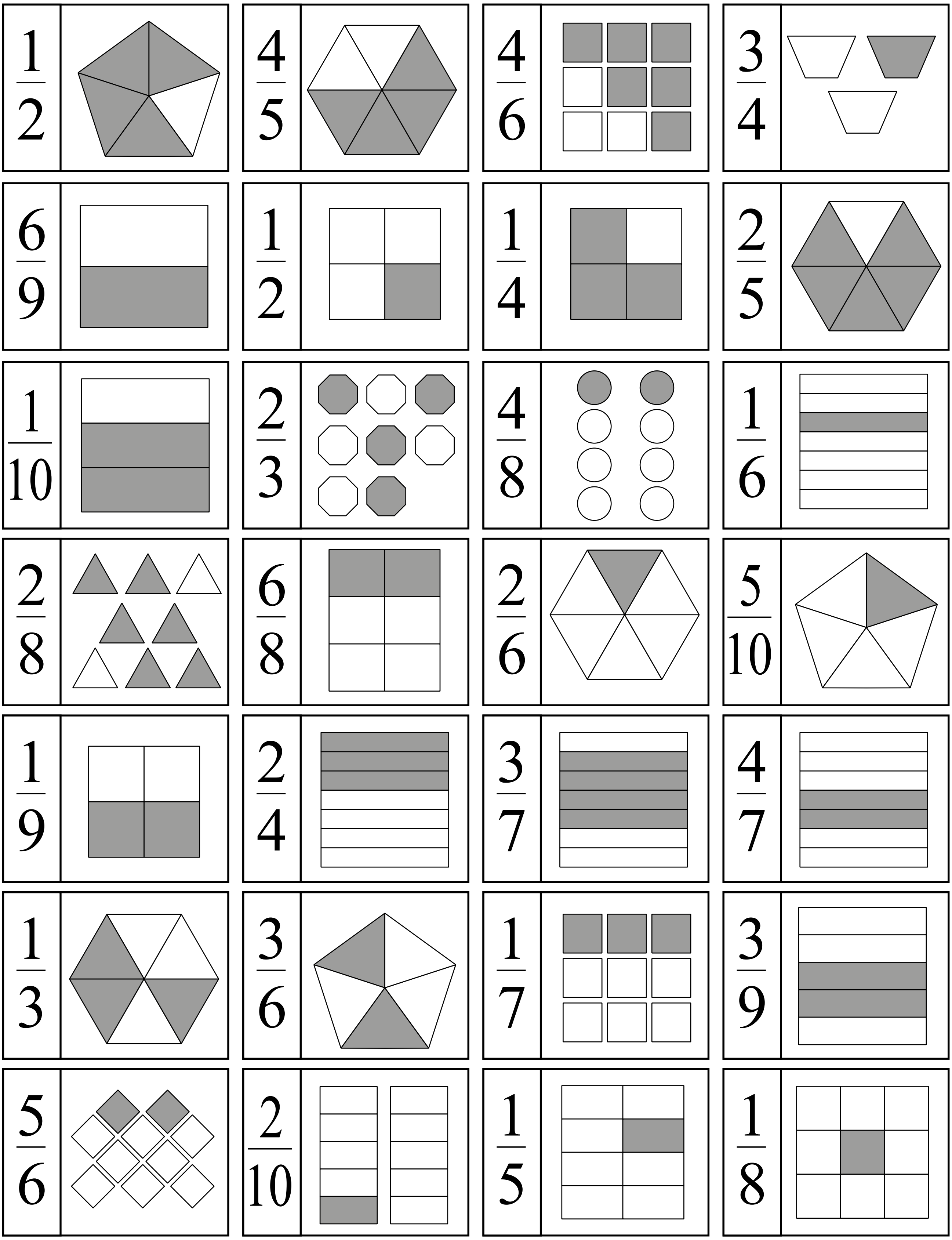
I have 8. Who has 4 more?	I have 12. Who has half of this?	I have 45. Who has 8 more?	I have 18. Who has 7 more?
I have 6.Who has 1 fewer, plus 5?	I have 10. Who has double this?	I have 53. Who has 7 fewer?	I have 51. Who has 2 fewer?
I have 20. Who has this, plus 3, minus 6?	I have 17. Who has this plus 10?	I have 46. Who has half of this plus 6?	I have 25. Who has double this plus 1?
I have 27. Who has 5 fewer?	I have 22. Who has double this?	I have 29. Who has 40 more?	I have 49. Who has 7 fewer?
I have 44. Who has this, plus 4?	I have 48. Who has half of this?	I have 69. Who has this minus 10?	I have 140. Who has this minus 50?
I have 24. Who has this minus 8?	I have 16. Who has 9 fewer?	I have 59. Who has 11 more?	I have 90. Who has this minus 15?
I have 7. Who has this plus 8?	I have 15. Who has double this minus 12?	I have 70. Who has double this?	I have 75. Who has 40 fewer?
I have 42. Who has 20 more?	I have 50. Who has twice as much?	I have 62. Who has this minus 12?	I have 100. Who has this, minus 60, plus 5?
I have 35. Who has this minus 12?	I have 23. Who has 9 fewer?	I have 14. Who has double this?	I have 28. Who has 9 fewer?
I have 19. Who has this minus 10?	I have 9. Who has 4 more?	I have 13. Who has double this?	I have 26. Who has half of this minus 5?

Fraction snap

$\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$\frac{3}{4}$
$1\frac{2}{3}$	$\frac{1}{3}$	$\frac{2}{4}$	$1\frac{2}{4}$
$\frac{2}{2}$	$\frac{3}{3}$	$1\frac{2}{6}$	$1\frac{4}{6}$
$\frac{4}{4}$	$\frac{5}{5}$	$1\frac{3}{5}$	$\frac{2}{5}$
$1\frac{3}{6}$	$\frac{3}{6}$	$1\frac{3}{8}$	$\frac{5}{8}$
$1\frac{1}{7}$	$\frac{6}{7}$	$1\frac{7}{10}$	$\frac{3}{10}$

Fraction dominoes: Enlarge and copy onto stiff card

This game is for two, three, four or more players. Play it like dominoes that you play with 28 cards. Each players gets the same number of cards (seven each if there are four players). The player who has two-sevenths starts playing. The next player has to match the fraction symbol four-fifths to the diagram next to two-sevenths. If the next player does not have the matching card, he or she knocks and loses a round. The first player who has played all his or her cards, wins. The rest of the players continue playing until they have played all their cards.



Bingo games and answer sheets

Addition Bingo

5 + 5	0 + 6	6 + 6	15 + 7	7 + 9
8 + 8	6 + 7	17 + 9	9 + 9	5 + 8
5 + 6	8 + 9	5 + 9	15 + 5	6 + 8
7 + 7	16 6	18 + 8	5 + 7	19 + 9
15 + 6	18 + 9	16 + 7	7 + 0	0 + 8

Addition Bingo answer sheet

10	6	12	22	16
16	13	28	18	13
11	17	14	20	14
14	22	26	12	28
21	27	23	7	8

Subtraction Bingo

10 – 5	16 – 0	13 – 5	15 – 6	17 – 7
15 – 8	17 – 9	20 – 9	12 – 5	10 – 9
16 – 7	13 – 4	10 – 6	15 – 9	13 – 9
10 – 8	15 – 7	20 – 8	17 – 8	16 – 6
20 – 7	18 – 9	12 – 9	13 – 8	10 – 0

Subtraction Bingo answer sheet

5	16	8	9	10
7	8	11	7	1
9	9	4	6	4
2	8	12	9	10
13	9	3	5	10

Multiplication Bingo

10 × 6	7 × 8	3 × 9	4 × 8	5 × 7
7 × 7	9 × 6	8 × 5	10 × 4	3 × 8
4 × 5	8 × 9	6 × 7	3 × 5	9 × 9
3 × 6	5 × 4	0 × 8	6 × 6	9 × 7
4 × 0	1 × 6	6 × 4	8 × 8	9 × 5

Multiplication Bingo answer sheet

60	56	27	32	35
49	54	40	40	24
20	72	42	15	81
18	20	0	36	63
0	6	24	64	45

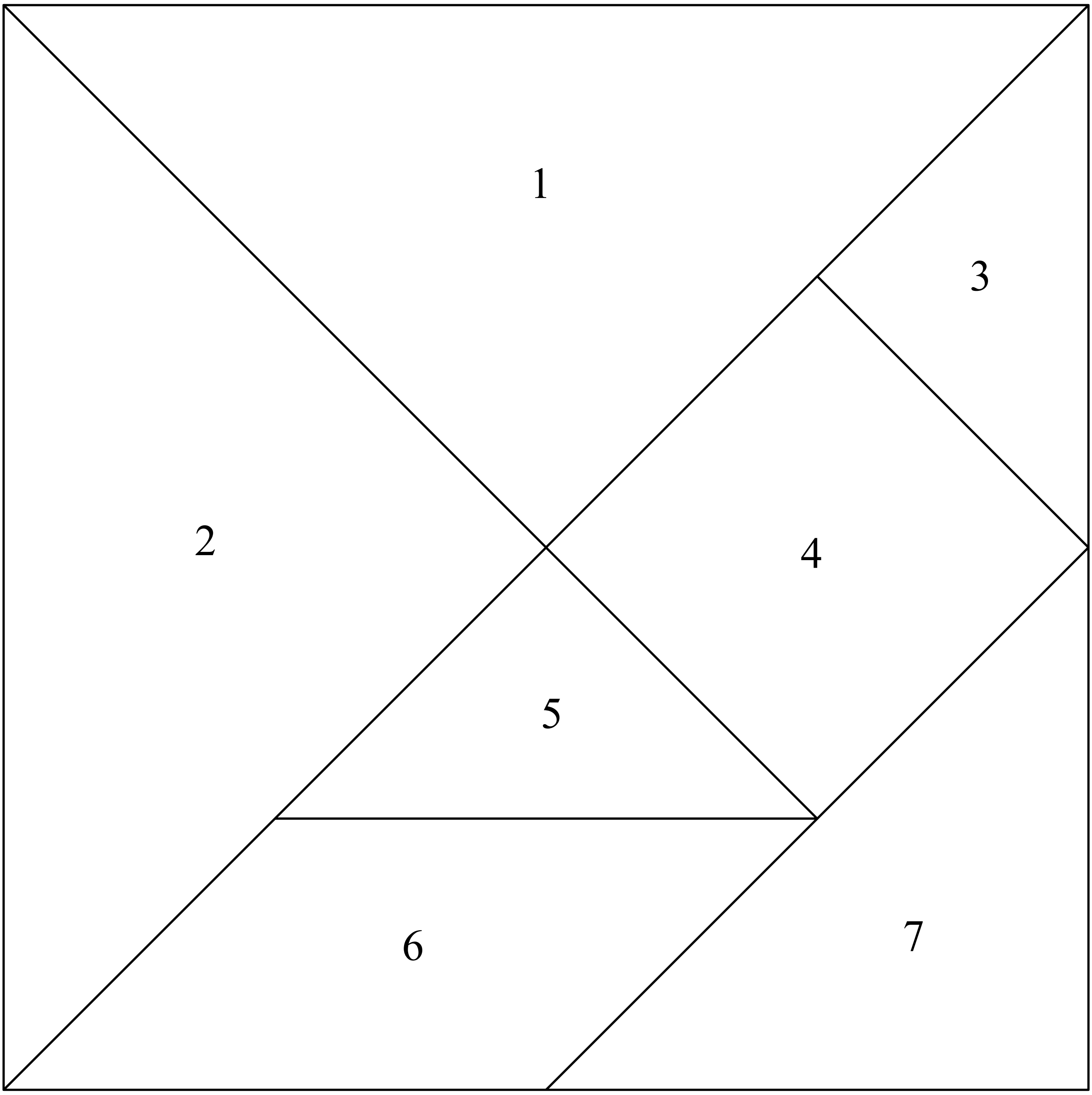
Division Bingo

5 ÷ 5	50 ÷ 10	24 ÷ 6	27 ÷ 9	44 ÷ 11
48 ÷ 8	56 ÷ 7	36 ÷ 6	121 ÷ 11	28 ÷ 9
44 ÷ 4	18 ÷ 6	12 ÷ 12	66 ÷ 11	72 ÷ 8
35 ÷ 7	64 ÷ 8	90 ÷ 10	42 ÷ 7	45 ÷ 5
14 ÷ 2	12 ÷ 4	84 ÷ 12	63 ÷ 7	108 ÷ 9

Division Bingo answer sheet

1	5	4	3	4
6	8	6	11	4
11	3	1	6	9
5	8	9	6	9
7	3	7	9	12

Tangram



6. Documents

Add your own documents and notes, for example the CAPS document for Intermediate Phase Mathematics, here.

Grade 6

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- stimulating Mental Maths activities for all relevant topics
- examples based on learners' own experiences.

The innovative Teacher's Guide includes:

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- teaching tips to guide teaching of the topics in the learner material
- worked out answers for all activities in the Learner's Book
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