detail along with some inequalities associated with integrals, the second mean-value theorem, the usual applications to the calculation of geometric magnitudes, and the integral test for convergence. A discussion, much more rigorous than is usual in books aimed at this level, on the integral as the limit of a sum is followed by further consideration of applications from this standpoint. There is a useful commentary on double-limit processes and special functions defined by definite integrals, and the section on integration concludes with an account of numerical methods of integration and interpolation. These chapters are a fine exposition of the subject and are rich in useful results although in parts the undergraduate might feel that there is " much ado about nothing ".

In the first of three chapters on the dynamics of a particle, motion in a straight line is systematically treated according to the nature of the accelerating force; no previous knowledge of differential equations is assumed. The physical concepts which emerge on integrating the equations of motion are carefully discussed as are the physical significance of the results. Plane vectors are used in the chapter dealing with the motion of a particle in a plane and prominence is given to motion under a central force. Short historical accounts of some physical problems are a feature of this section. Systems with several degrees of freedom are considered in a chapter on plane vibrational motion. From the equations of transverse motion of a large number of particles attached to a string is deduced the partial differential equation associated with the transverse motion of a string of continuous density. The electrical analogues of dynamical problems are referred to whenever these are of interest. A systematic account of differential and difference equations follows in which an account of the algebra of operators, in particular linear differential and difference operators, is given.

A chapter on three-dimensional dynamics including rigid dynamics is preceded by an account of vector algebra with applications to three-dimensional geometry and spherical trigonometry and includes motion referred to rotating axes.

Boundary-value problems are introduced by considering the vibrating string and it is demonstrated by assuming the string to have non-uniform density that the orthonormal properties of the characteristic functions associated with the problem are not peculiar to circular functions. There is brief mention of Rayleigh's principle, and Laplace's equation and the diffusion equation are also considered but in less detail. The chapter on Fourier series and integrals is very satisfying and ends with a short sketch proof of Fourier's integral theorem.

There are also short chapters on surfaces, curves in space, and multiple integrals, and finally a short account of some variational problems.

This is something more than just another text-book. The distinguished authors have combined their separate outlooks skilfully to produce a treatise on mathematics and its application to the problems of physics and chemistry which should be satisfying to both pure mathematician and applied scientist. On the whole the choice of material and presentation are excellent and the text is adequately supplemented by examples most of which are taken from University of London examination papers. The main criticism would be that perhaps too much is expected too early of the student.

JAMES FULTON

Mathematics Dictionary, 2nd ed., edited by GLENN JAMES and ROBERT C. JAMES (D. van Nostrand Co. Inc., Princeton, N.J., 1959), 546 pp., 112s. 6d.

This dictionary, which is an enlargement and revision of a previous volume, is a valuable reference work which provides carefully formulated definitions of the basic terms used in most branches of mathematics taught to undergraduates and scholars. To search the book for some word which is not listed is a game at which any number can play but at which not many will achieve a quick success for only a few important words between *abacus* (pl. *abaci*) and *Zorn's lemma* have been omitted.

The value of the book as a reference work is enhanced by a number of Appendices such as a table of 423 integrals, a catalogue of mathematical symbols and abbreviations, arranged according to subject and, perhaps most important of all, French, German, Russian and Spanish vocabularies which enable the English-speaking reader to trace the definition of a foreign word. The first appendix is devoted to five-figure tables of logarithms and trigonometrical functions. This section also contains, surprisingly enough, tables of the present value of an annuity of one dollar per year for n years.

The main value of the volume lies, however, in the dictionary itself and there is no doubt that it will prove a valuable addition to any library of mathematical books. The authors have accomplished a very difficult task with great credit and it would be unfair to complain that a few entries might have been better presented since the vast majority of the definitions appear entirely satisfactory to the reviewer. The mathematical topics covered range from school mathematics to topology, abstract algebra, analytical dynamics, statistics, numerical analysis, the theory of games and business mathematics. To suggest how comprehensive is the coverage, we mention that the subheadings for the word *complete* are as follows: *complete annuity*, *complete field*, *complete induction*, *complete scale*, *complete space*, *topologically complete*, *complete set of functions*, *complete systems of representations for a group*, *weakly complete space*.

The volume is handsomely printed, bound and priced. D. E. RUTHERFORD

SMITH, D. E., *History of Mathematics* (Dover Publications, Inc., New York, 1958). Vol. I, xxii+570 pp.; vol. II, viii+703 pp. $2.75 each volume.

SCOTT, J. F., *A History of Mathematics* (Taylor & Francis Ltd., London, 1958), x+260 pp., 63s.

The two volumes of Professor D. E. Smith's *History of Mathematics*, written, as the preface tells us, " to provide teachers and students with a usable textbook of elementary mathematics ", originally appeared in 1923 and 1925. Now that the value to the specialist student of some knowledge of the development of his subject in its wider aspects has gained general recognition, and courses of lectures in the history of science and its special disciplines are being instituted in various universities, the present reprint of Professor Smith's book is most opportune. Of course the reader who turns to the section headed " Modern calculating machines " in the expectation of finding an up-to-the-minute account of this vast and growing field will be disappointed; but with this one exception there is nothing in the reprint that strikes one as out of date.

The historian of science, especially of mathematics, has to hold the balance between his presentation of the development of abstract ideas on one hand, and on the other of those national and personal aspects, often of great significance, without which the record would be lacking in human interest. This problem of presentation has been solved in different ways. Thus Cantor, Klein and others have skilfully contrived to interweave the two aspects in a unified treatment. Professor Smith's solution is the unusual one of writing two volumes from different standpoints. In the first volume the growth of mathematical knowledge is summarised by chronological periods, the emphasis being on individual mathematicians and their background, with not much more than a brief mention of their contributions to mathematics. In the second volume the development from the earliest times of some important topics in elementary mathematics (arithmetic, algebra, geometry, trigonometry and calculus) is traced, the emphasis being now on the mathematical ideas and their relationships. This dual method of presentation produces less overlapping than might have been expected; the two volumes complement each other perfectly, and either can be read independently of the other.