and normals, integration, etc. This is followed by Chapter XIII on Applications of integration which is exceptionally well written. The fundamental idea of the summation process of the integral calculus is given in the clearest manner. On page 268, line 10, a lower limit has been omitted and at the bottom of the same page the letter A stands for a point, while on the next page (line 8) it mysteriously becomes an area.

Passing from the best-written chapter in the book we come to the poorest, namely Chapter XIV, on Space geometry. In this chapter the authors have made many inaccurate statements. For example on page 310 we find: "Find the equation of the sphere formed by revolving the circle $x^2 + z^2 = a^2$ about OX as an axis." Now $x^2 + z^2 = a^2$ represents a cylinder and not a circle. The authors evidently meant the circle $x^2 + z^2 = a^2$, $y = 0$. The proof of the distance formula from a plane to a point is also incorrect, for it assumes that the plane cuts the z-axis. The same trouble exists on page 63 in the proof for the distance formula from a line to a point; there it is assumed that the line cuts the y-axis.

The chapter on space geometry is followed by chapters on Partial differentiation, Multiple integrals, Infinite series and a short course in Differential equations.

Many fine examples are worked out in the text and many more are given in the exercises, the total number of which is 2,000. These exercises are to be found only in long lists placed at the end of each chapter. The book is well adapted for use in a course covering both analytics and calculus.

F. M. MORGAN.

Introduction to the Calculus of Variations. By W. E. BYERLY. Cambridge, Harvard University Press, 1917. 8vo. 48 pp. Cloth. Price 75 cents.

THIS little book is the first of a series of "Mathematical Tracts for Physicists." It indicates in admirably clear style the solution of a number of examples involving some of the fundamental ideas of the calculus of variations. As the subject owed its origin to the attempt to solve a rather narrow class of problems in maxima and minima, the eight pages of the Introduction are mainly taken up with a discussion of three simple examples: the shortest line, the curve of quickest descent, the minimum surface of revolution.

The integrals of the Lagrange equations arising in connection with the second and third of these examples are given in the second chapter (pages 9–22) which is entitled: "Variations. Notation and nomenclature. Illustrative problems." We find here also a second solution of the two-dimensional shortest line problem (polar coordinates), and a solution of the problem of the geodesic line joining two given points on the surface of a sphere. Section 10 is devoted to isoperimetrical problems. The seven examples that are given for solution involve slight developments of the text.

In Chapter III (pages 23–28), on "Problems involving several dependent variables," Hamilton's principle and its application are considered. Chapter IV (pages 29–33) on "Multiple integrals" contains (1) the derivation of the differential equation of minimal surfaces, and, by means of Hamilton's principle, (2) the derivation of the differential equation for small transverse oscillations of a stretched elastic string.

"Variation of limits" and the "Principle of least action" are the topics of the last chapter. In each of the last three chapters are examples to be solved.

No references to the literature of the subject are to be found in the tract.

R. C. ARCHIBALD.

Science and the Nation. Essays by Cambridge Graduates with an Introduction by the Right Hon. Lord Moulton. Edited by A. C. SEWARD. Cambridge, at the University Press, 1917. 22 + 328 pages. Price 5 shillings. (G. P. Putnam's Sons, New York. Price $1.50.)

"IT is widely believed that technical education stands for efficiency and prosperity, but pure science is regarded as something apart—a purely academic subject. It was with a view to demonstrate the fallacy of this distinction that the present volume was suggested," writes Mr. Seward.

The volume contains thirteen chapters each written by a specialist of note. The first four chapters, occupying about one third of the volume, are headed as follows: "The national importance of chemistry" by W. J. Pope; "Physical research and the way of its application" by W. H. Bragg; "The modern science of metals, pure and applied" by W. Rosenhain; "Mathematics in relation to pure and applied science" by E. W. Hobson.