

Thomas Heath to say that the care shown by each, in the editing of the classics to which their names attach, is on a par with that shown by the other. Certainly we have not had any such work done before in this country in the editing of any Greek mathematical text, and the thanks and appreciation of Professor Archibald's colleagues will go out to him in abundant measure for his excellent contribution to the literature of the subject.

Not the least of the commendable features of the edition under review is the bibliography of works relating to the division of figures. How complete this is it is difficult to say, since one would have to go through a large amount of material, as has evidently been done in this case, to determine just where to find points of contact with the "De Divisionibus." At any rate the list is a very helpful one and adds materially to the value of the work.

The publishers have allowed the printing of a copious index of names, and have issued the work in the dignified form which always characterizes the output of the Cambridge University Press.

DAVID EUGENE SMITH.

Analytic Geometry. By H. B. PHILLIPS. New York, John Wiley and Sons, 1915. vii+197 pp.

IN the preface of this book the author expresses the belief that for engineering students "a short course in analytic geometry is essential"; and "he has, therefore, written this text to supply a course that will equip the student for work in calculus and engineering without burdening him with a mass of detail useful only to the student of mathematics for its own sake." At first glance the comparatively small number of pages would seem to promise such a short course. But a closer examination led the present writer to the opinion that the apparent brevity was achieved by condensation, and that it would require as much time to cover these 197 pages as to cover say 300 pages of many other texts. Except for the omission of some of the special properties of the conics, it did not seem quite obvious that the student's burden of a mass of detail was conspicuously lightened.

On the other hand, the author at times assumes a clearness of mathematical vision and a facility in technique on the part of the student which would be eminently desirable, but

which we fail to find in a majority of our college students. For instance, after learning (page 94) that "a curve is symmetrical with respect to the origin if all the terms in its equation are of even degree or if all are of odd degree," we find the following example (I quote the text exactly):

" $y = x^3 - 3x^2 + 3x + 1$. This equation can be written

$$y - 2 = (x - 1)^3.$$

The expressions $y - 2$ and $x - 1$ are the coordinates of a point $P(x, y)$ relative to the lines $y = 2$, $x = 1$ used as axes. Since the equation contains only odd powers of $y - 2$ and $x - 1$, the curve is symmetrical with respect to the point $(1, 2)$." This occurs 50 pages earlier than the treatment of transformations to parallel axes. At such points the ordinary student will certainly need the help of the teacher. However, many teachers will find this no objection to the book, but will prefer to use a text which leaves to the teacher some further function than the assigning of lessons and the conducting of recitations. Teachers with ideas of their own are sometimes hampered by a text too liberal in its explanations.

The first chapter, on algebraic principles, furnishes a good review of those parts of algebra which are most necessary for what follows. One is pleased to find a discussion of inequalities and of homogeneous linear equations. In the second chapter, introducing rectangular coordinates, there are six excellent pages on vectors. The straight line and circle are treated in chapter three, which is short but would seem to furnish the student with the necessary working equipment. A very good feature is the clear exposition of the geometrical significance of the sign of the expression $Ax + By + C$; but it is to be regretted that the idea was not used to the best advantage later; as, for instance, in connection with the distance formula $(Ax_1 + By_1 + C) / \pm \sqrt{A^2 + B^2}$, and the definition of the hyperbola.

After a somewhat unusual treatment of the conics in chapter four, one finds a very interesting chapter on graphs and empirical equations. In addition to the usual curve drawing, the problem of fitting a curve to a number of given pairs of values of the variables is discussed, with a number of exercises drawn from mechanics, electricity, chemistry, etc. Chapters six, seven, and eight are devoted respectively to polar coordinates, parametric representation, and transformations. The

chapter on parametric representation, with the development of the equations of the cycloidal and other curves, is one of the excellent features of the book. The last three chapters present very briefly the first elements of the analytic geometry of space, treating the plane, straight line, sphere, cylindrical surfaces, surfaces of revolution, and the different quadric surfaces in their simplest positions. The helix is discussed in a very short paragraph on parametric equations of space curves.

The author's treatment of conics should have special mention. The ellipse, parabola, and hyperbola are defined as follows:

"If a circle is deformed in such a way that the distances of its points from a fixed diameter are all changed in the same ratio, the resulting curve is called an ellipse.

"Let LK , RS be perpendicular lines and MP , NP perpendiculars from any point P to them. If a is constant and NP considered positive when P is on one side of RS , negative when on the other, the locus of points P such that

$$MP^2 = a \cdot NP$$

is called a parabola.

"Let KL and RS be two straight lines intersecting in C , PM and PN the perpendiculars from any point P to these lines. Let MP be considered positive when P is on one side of KL , negative when on the other side. Similarly, let NP be positive when P is on one side of RS , negative when on the other side. A hyperbola is the locus of points P such that the product

$$MP \cdot NP = \text{constant.}"$$

The general definition of a conic, and the classification with respect to the eccentricity are given later in the chapter on polar coordinates. There is no question here of correctness or incorrectness, but merely one of taste and expediency. Many teachers would prefer that the conics should be first introduced by a general definition; and many others, willing to use independent definitions of the three types, would prefer other definitions than those which the author has seen fit to use. Immediately following the definition of the parabola we read: "A parabola is thus a locus of points the squares of whose distances from one of two perpendicular lines are proportional to their distances from the other. The complete locus of

such points is two parabolas, one on each side of RS ." A similar statement follows the definition of the hyperbola. Is it not unfortunate to speak of a locus which is not a complete locus?

The definition of equivalence of sets of equations (page 3) is somewhat vague; and it hardly seems wise to say that the equation $(x + y)(x - 2y) = 0$ is equivalent to the two equations $x + y = 0$ and $x - 2y = 0$, even though the sense in which this is meant is immediately explained.

The statement (page 15) that "a set of homogeneous equations can often be solved for the ratios of the variables when there are not enough equations to determine the exact values" might seem to imply that the "exact" values could be determined if there were enough equations.

In chapter five there is a paragraph on "infinite values" which reminds one of the school algebras of the last generation. It seemed to the present writer to be a really serious defect in what is in many respects an excellent book.

The mechanical features of the book are attractive, the figures (with a few exceptions) are accurate, and the typographical work is free from errors.

WALTER B. CARVER.

A Budget of Paradoxes. By AUGUSTUS DE MORGAN. Reprinted, with the author's additions, from the *Athenæum*. Second edition, edited by DAVID EUGENE SMITH. Two volumes, I, viii+402 pp.; II, 387 pp. Chicago, The Open Court Publishing Co., 1915. Price, \$3.50 per volume.

THE first edition of this interesting work by Augustus De Morgan (1806-1871) appeared in 1872, after the author's death, under the editorship of his widow, Sophia De Morgan. Some ten years later Mrs. De Morgan wrote a "Memoir of Augustus De Morgan," which is worthy of mention in connection with the "Budget of Paradoxes." De Morgan's articles which constitute the present work appeared from time to time, in the years from 1863 (Oct. 10) to 1866 (Dec. 1), in the London *Athenæum*. From other facts which we have concerning the life of De Morgan it appears that some of the popular writing which he did, for encyclopedias and for journals, was stimulated by financial pressure; at this distance we can properly rejoice at the conditions which fostered the growth of the present work.