GUNDELFINGER'S CONIC SECTIONS.

Vorlesungen aus der Analytischen Geometrie der Kegelschnitte. Von SIGMUND GUNDELFINGER. Herausgegeben Von FRIEDRICH DINGELDEY. Leipzig, Teubner, 1895. pp. 434.

AMONG recent analytic works on Conic Sections there are at least three for which one is very thankful, — the late Professor Casey's, Miss Scott's, and the one whose title appears above. The plan of this last is to systematically develop the theory by means of homogeneous coordinates, while bringing out the fact that the elementary (x, y) system is merely a case to which we can descend when so minded. This latter may seem a minor point; pedagogically it is not so, and it is certainly not well explained in many books.

The development, then, of the theory is really analytic, though one feels that the analysis is under the control of a masterly geometric insight.

The work divides into two sections and an appendix. The first section begins with the explanation of point-coordinates in all their generality. In spite of the fact that two of the three books above mentioned adopt this plan, it does seem a good method to explain these matters — at all events at first — with a special system of coordinates or "unit-point," and with the "areal" ("barycentric") system for preference, we get the full advantage of a homogeneous system, awkward factors do not appear, and if in any projective question we need an arbitrary unit-point, we have merely to show how to project the fundamental triangle so that the unit-point projects into the centroid. Evidently there is a pedagogic gain, but it is not evident that there is any loss.

We have then the fundamental expression for the distance of a point from a line; and the inference that when the point and line unite, the expression

$$u_1x_1 + u_2x_2 + u_3x_3$$

is zero, whence we have the equation of a line. It is necessary to mention such a detail so long as elementary text-books reverse the order and prove *first* that the equation of a line (p, α) is

$$x \cos \alpha + y \sin \alpha - p = 0,$$

and *second* that the left represents the distance from the line (p, α) to the point (x, y).