

ing and suggestive. The general plan seems admirable ; and the student should have mastered in the end not only the usual collection of time-honored facts about conics, but a few of the well-known theorems such as Desargues's, Brianchon's, and Pascal's, as well as an introductory idea, at least, of that most important geometric concept, — the group of all projective transformations.

E. B. COWLEY.

*Tratado de las Curvas Especiales Notables.* By F. GOMES TEIXEIRA. Madrid, "Gaceta de Madrid," 1905, ix + 632 pp.

THIS volume had its inception in a prize problem proposed in 1892, and repeated in 1895, by the Royal Academy of Sciences of Madrid, requiring "An orderly list of all the curves of every kind to which definite names have been assigned, accompanying each with a succinct exposition of its form, equations and general properties, and with a statement of the books in which, or the authors by whom, it was first made known." This programme our author has closely adhered to except in one particular. To attempt to give the properties of all such curves would be extremely difficult and would make the resulting work unwieldy, he has therefore wisely limited himself to a list of over one hundred curves so selected as to include almost all of especial importance.

This treatise and Loria's work, "Spezielle algebraische und transcendente ebene Kurven," which appeared a little earlier, cover almost the same field. Both authors seem to have taken their suggestion from the theme of the Royal Academy. Teixeira, however, has followed that programme more closely. Loria's work is arranged in a more satisfactory manner and is somewhat more advanced in treatment. Teixeira's has the advantage of giving a considerable discussion of space curves.

The first two chapters (98 pages) of Teixeira's treatise are devoted to a detailed exposition of the properties of the most important cubic curves. In the third, fourth, and fifth chapters (158 pages) he treats of quartics and in the sixth chapter (68 pages) of algebraic curves of order higher than the fourth. He considers in the seventh chapter (39 pages) a number of transcendental curves, most of them of considerable physical importance. The spirals are considered in Chapter VIII (47 pages), the parabolas and hyperbolas  $y = a^{1-k}x^k$  in Chapter IX (10 pages), and the cycloidal curves in Chapter X (56

pages). Chapter XI (45 pages) is devoted to the discussion of several plane curves of lesser importance. An exposition of the properties of a number of space curves is given in Chapters XII and XIII (72 pages). These chapters are not, however, up to the standard of the rest of the book. Chapter XIV (13 pages) is devoted to polhodes and herpolhodes.

The treatment is, throughout, quite elementary, and can be followed by anyone with a knowledge of analytics and calculus. The book is not, however, suitable for a student seeking a systematic treatment of the theory of the higher curves, as its aim is the consideration of noteworthy curves and not the systematic exposition of curves in general. It is a treatise, not on curve theory, but on particular curves.

The method of exposition, whenever practicable, is as follows: the rectangular and polar equations of the curve are given, the form of the curve is derived from the equations and a figure of the curve is shown. The most interesting geometric properties of the curves are then deduced, the parametric equations — when the curve is unicursal — derived and the integrals for the length of arc and the area of the curve obtained.

The book is metrical both in viewpoint and in method. Trilinear coordinates are, however, used a few times and line coordinates several times but not in such a manner as to necessitate a previous knowledge of those subjects. It is to be regretted that the author does not enter into the projective theory at least enough to show the projective interrelations, and occasionally the projective identity, of some of the curves considered.

The content and method of the book are such as to make it especially valuable for engineers and others not specialists in geometry, but geometers also will find in it a valuable collection of information on particular curves. The Spanish text presents little difficulty to one who can read any Romance language with facility.

C. H. SISAM.

*The Scientific Papers of J. WILLARD GIBBS.* Volume 1, *Thermodynamics*, xxviii + 434 pp., with portrait; volume 2, *Dynamics, vector analysis and multiple algebra, electromagnetic theory of light, etc.*, ix + 284 pp. London, Longmans, Green, and Co., 1906. Large 8vo.

SHORTLY before the death of Professor J. Willard Gibbs he had decided to yield to requests from various sources and to