*Analytische Geometrie des Punktpaares, des Kegelschnittes, und der Fläche zweiter Ordnung.* Erster Teilband. By Dr. OTTO STAUDE. Leipzig and Berlin, Teubner, 1910. x + 548 pp., with 181 figures.

THIS volume is a continuation of the Analytische Geometrie des Punktes, der geraden Linie und der Ebene by the same author which was reviewed by Professor G. N. Bauer in the BULLETIN, volume 14, page 452 (June, 1908) and his concise summary applies equally well to the present volume. The treatment of the quadric surface is not completed, but is left for a third volume, to be devoted largely to intersections of surfaces of the second order. The bibliography and index will appear in the later volume.

The work aims to be a "Handbuch" and not simply "Vorlesungen." The author aims to leave no important facts concealed by attempting brevity, and as a result the reading of the book is apt to become tiresome because of detail. No effort is spared to make it convenient for ready reference. The table of contents, chapter heads, subheads, and important theorems are all so arranged as to make catch words stand out prominently. Important results are also frequently summed up in the form of tables, which are very convenient for comparison.

The book is divided into two parts of equal length. The first part deals with the point pair and the conic section. The second degree equation is treated in detail in cartesian, polar, parametric, and trilinear coordinates. Curves of the second class are treated as fully as those of the second order and line coordinates are used freely. Naturally there is little novel in this part. The classification of curves (as well as surfaces) according to "rank" is novel. A curve of the second order or class is of rank three if it has no double elements, of rank two if a single double element, and of rank one if a single infinity of double elements. Similarly an ordinary quadric surface is of rank four. This new use of the word rank does not seem necessary nor of particular advantage. The treatment of point and line involutions is of exceptional clearness. In treating class curves more use might be made of the principle of duality, and the Clebsch bordered determinant notation for the line equation of a conic could be used to advantage. The importance of the polar system with the conic as the locus of incident elements is properly emphasized. The section on confocal systems, introducing elliptic and parabolic coordinates is also extremely well presented. In the chapter on trilinear coordinates the symbolic notation of Clebsch would be much briefer than the clumsy multiple summations, and fully as intelligible to most readers. Since the author writes down the simultaneous invariant of a conic and a line, it would seem worth while to point out that for variable coordinates $u_1$, $u_2$, $u_3$ this is merely the line equation of the conic.

It is somewhat disappointing that some of the features which make Salmon's Conic Sections a valued companion are not developed. There is nothing on invariants and covariants of systems of conics which are the subject of Salmon's most fruitful chapter. The theory of reciprocal polars is not very fully developed and such ideas as radius of curvature, evolutes, etc., are not introduced.

Part II. on surfaces is developed along similar lines. The most interesting features are probably the treatment of polar properties, the early introduction of line coordinates, and above all the clear discussion of the linear complexes arising. The next volume will doubtless contain much more of interest in space geometry.

D. D. LEIB.

*Analytische Geometrie der Kegelschnitte.* By W. DETTE. Leipzig, Teubner, 1909. vi + 232 pages, with 45 figures.

THIS admirable elementary text on conic sections is worthy of examination by any teacher of that subject. Both in arrangement and in treatment, there are a number of innovations. The book is divided into three parts: the first of 94 pages is devoted entirely to theory and the study of the general equation in the form $ax^2 + 2bxy + cy^2 + 2dx + 2ey + f = 0$; the next 50 pages contain a classified list of over twelve hundred examples illustrating the text; the remaining part of the volume is devoted to answers to, and also suggestions for solving, the examples of part two.

In the text itself, the six chapter headings: the point, the right line, the ellipse, the parabola, the hyperbola, and the determination of a conic through points and lines, promise little different from the old line American text. But on the first page the author introduces the idea of relative "mass numbers" or magnitudes; that is, for any segment of a line $AB$, we say $AB = -BA$. The author calls $AB$ and $BA$ the relative "mass numbers," their absolute magnitude being the same. As soon