Principles of Geometry. Vol. I., Foundations. By H. F. Baker. Pp. 182. 12s. 1922. (Cambridge University Press.)

This is the first of a series of volumes, the others to appear shortly, on curves and surfaces of the lower degree, up to 3 and 4, and gives "the indispensable logical preliminaries." The outstanding feature of the treatment is that idea of distance (and therefore of congruence) is not introduced, and the whole geometrical system is based on incidence and order. The full justification of this will appear when we see the properties of the commoner geometrical entities flowing as simply from this set of propositions as from the more usual assumptions. But the present volume is also of the highest interest in itself.

A theory equivalent to that of cross ratio and harmonic section is built up from the propositions of incidence, by means of perspective and the complete quadrilateral. It is shown at length that Desargues' Theorem follows from the three-dimensional assumptions, but cannot be proved from the plane propositions only (the proof is obscured by an unfortunate slip on p. 120). At the end of Chapter I., algebraic symbols are introduced, with great care, and the commutative law for multiplication is interpreted in connection with Pappus' Theorem. Chapter II. deals with the ideas of accessible and inaccessible points, based on assumptions of order, and leads very naturally to postulated points, which remove most of the restrictions of this Real Geometry. At the end of Chapter III., we have an elaborate system of sets of real elements, which can, if desired, take the place of imaginary single elements, and so justify the introduction of the latter into a purely geometrical argument. Throughout the book, any number of dimensions are contemplated.

The matter is not well displayed: the main Propositions of Incidence are huddled together in the second paragraph, and not even numbered; and quite a fair amount of eye-strain would have been saved, in reading off joins and cross-joins, by printing on p. 51 for example, $\begin{matrix} A\ N\ B' \\ B\ A'\ N' \end{matrix}$; it would have been well worth the extra space. On the other hand, we are almost entirely spared footnotes, and references are placed where they should be, in a separate Bibliographical chapter. There is an excellent table of contents and a poor index. We shall look forward with great interest to the later volumes.

H. P. H.

Plane Geometry—An Account of the More Elementary Properties of the Conic Sections, treated by the Methods of Coordinate Geometry, and of Modern Projective Geometry, with Applications to Practical Drawing. By L. B. Benny, M.A., B.A. (Lond.), F.R.A.S. Pp. 336 + vi, with five portraits. 10s. 6d. 1922. (Blackie and Son.)

To meet the needs of beginners and students of average ability many books on elementary analytical geometry have been published during the last twenty years. Here we have a work which attempts to fill a more advanced place. It is avowedly written for examination purposes, and covers the ground of pure and analytical plane geometry required for the London University B.A. and B.Sc., as well as for Part I. of the Cambridge Mathematical Tripos. The book strikes one as keeping a little too closely to the former of these schemes.

It is a difficult matter to write a good mathematical text-book of a pass standard, for the subject is in the nature of things truncated at somewhat arbitrary places, and there is difficulty in making the book a unity, for no part of the work can be rounded off and completed. What actually can be done is to pursue the elementary use of geometrical methods logically and with clearness, as far as the required pass standard admits, to show the relations between the several methods, and further to interest the reader both by suitable references to past history, and by suggestions as to advances beyond the scope of the book. The writer may even, by way of example, dip a little into one of these more advanced lines of enquiry.

Broadly speaking, the author of *Plane Geometry* has succeeded in his aim. He has given a systematic account of straight lines, circles and conics, treated both by the older and newer synthetic methods of pure geometry, and by Cartesian methods. The common bond of all is the method of projection