The book closes with a section devoted to spherical cubics. There are 152 pages, a bibliography, and a short index.

The book will find its greatest use in technical schools. Spherical trigonometry has come to be counted as one of the technical studies and taught in connection with geodetic surveying or with astronomy. It is the same with spherical analytic geometry from Dr. Heger's point of view, and the field of application is narrower.

Geometry upon the sphere is most interesting when studied as a correspondence between the sphere and some other surface — in particular, the plane. This point of view is hinted at in section 8 in explaining Gudermann's axial coordinates, but no general theory of correspondence between sphere and plane is worked out.

Dr. Heger's analytical geometry amounts to a correspondence between the sphere and the projective plane. There is another geometry upon the sphere arising from a one to one correspondence with the plane whose results are quite as useful, in their way, but which does not come within Dr. Heger's field of view.

L. WAYLAND DOWLING.

*Die Elemente der Mathematik.* Von ÉMILE BOREL, Professor an der Sorbonne zu Paris. Vom Verfasser genehmigte deutsche Ausgabe, besorgt von PAUL STÄCKEL, Professor zu Karlsruhe i. B. Erster Band: *Arithmetik und Algebra.* Mit 57 Textfiguren und 3 Tafeln. Leipzig und Berlin, B. G. Teubner, 1908. xvi + 431 pp.

This work is a German translation, or rather a "Bearbeitung," in one volume, of the three French booklets published by Borel in 1903. Borel traverses in his texts the ground to be covered in arithmetic and algebra by pupils between the ages of 14 and 17, in accordance with the courses of study laid out officially in 1902. The distinctive feature of this movement lies in the emphasis laid on graphic work, on the concept of a variable and of a function. Stäckel says in his preface to the German edition that, in view of the wide divergence of opinion as to what can be accomplished in this line with elementary pupils, the only way of arriving at an understanding and thereby at an actual realization of the contemplated reform, appears to be in showing by an example just what that reform really aims to achieve and how the subject can be developed with pupils of the ages named. Such an example is furnished in Borel's texts. As Stäckel remarks, this publication is intended only for teachers. Since the reform movement in France and Germany is essentially the same as in the United States, the book under review, coming from authors of distinction, cannot fail to be of interest to American readers.

FLORIAN CAJORI.

*A Treatise on the Mathematical Theory of Elasticity.* By A. E. H. LOVE, M.A., D.Sc., F.R.S. Second edition. Cambridge University Press, 1906. xvii + 551 pp.

THE first edition of this important work was published in two volumes in 1892 and 1893. The present edition is a new treatise which contains some extracts from the old one. The object of the book is threefold, namely, to be useful to engineers, to set forth the physical notions and analytical processes which are also used in other branches of physics, and to afford a complete picture of the present state of the science of elasticity. The book commences with an excellent historical introduction which explains the parts taken by various eminent mathematicians in establishing the theory. The first four chapters are concerned with the analysis of strain and stress, the equations of equilibrium and small motion, the expression of the stresses as functions of the strains, and the connection between the mathematical theory and technical mechanics. Chapter V opens with a useful recapitulation of the essential parts of the preceding chapters and the author proceeds to illustrate them by a number of simple examples which are needed for the subsequent development of the subject. In Chapter VI there is a discussion of the elastic constants. The 6 components of stress are linear functions of the 6 components of strain and hence depend on 36 constants. The law of conservation of energy reduces the number of constants to 21. The hypotheses of Navier and Cauchy concerning the constitution of matter (according to which bodies are regarded as made up of material points which are supposed to act on each other so that the mutual action between each pair of points is along the line joining them and is a function of the length of the line) leads to 6 relations which are called Cauchy's relations, so that the number of constants is reduced to 15. As the author remarks in the historical introduction, our views concerning the constitution of matter have changed so that the