crates are due to this writer, in spite of some doubt that has recently been cast upon it.

The summary which he gives of the work of the Greeks in geometry is, as would naturally be expected from him, very clear, and forms the principal portion of the work. The section on the early traces of the calculus is especially interesting, and refers of course to the contributions of Democritus, Eudoxus, and Archimedes, but without assigning the credit to Antiphon and Bryson that might be expected.

The mathematics of the Hindus is discussed with brief mention,—too brief, considering the contributions of the writers of India. The reader will not find the well-balanced judgment of the Oriental mathematics, nor the interesting information concerning its algebra, that he would expect from a perusal of the pages devoted to the work of the Greeks. The Arab contributions are somewhat more fully treated.

The medieval period in Europe is considered more at length, this being a period to which Professor Zeuthen has given much attention in his other works. Just at the present time, when Roger Bacon is much in the public eye, it is interesting to note that Professor Zeuthen dismisses him with exactly twelve words, and that these relate solely to optics.

It goes without saying that the book fills its purpose in a satisfactory manner. It gives a popular view of the progress of mathematics down to the period of the Renaissance, and is written in the pleasant style which characterizes all of the works of its distinguished author.

DAVID EUGENE SMITH.

Geometrie der Zahlen. Von HERMANN MINKOWSKI. Zweite Lieferung. 1910. viii + 15 pages. B. G. Teubner, Leipzig und Berlin.

THE first volume appeared in 1896. The preparation of the second volume was delayed by unexpected difficulties, and the author published in short articles in the journals most of the results initially intended for the second volume. These articles are accessible in the Gesammelte Abhandlungen of Minkowski, published in 1911 in two volumes, aggregating 872 pages. The present pamphlet is a continuation, bearing the same title, of the closing chapter of the first volume of Geometrie der Zahlen, and contains also a table of contents and index for the two volumes. This highly original contribution to the advanced part of the theory of numbers is already recognized to be of lasting importance. A more elementary introduction to the ideas there presented, as well as applications to algebraic numbers, are given in Minkowski's Diophantische Approximationen, which appeared in 1907 and was reviewed for the BULLETIN by the present writer, February, 1909 (volume 15, pages 251–252).

L. E. DICKSON.

Algebra of Quantics. By E. B. ELLIOTT. Second edition. Clarendon Press, Oxford, England, 1913. xvi + 416 pp.

THIS new edition of Professor Elliott's well-known work on algebraic theory presents more changes in typography than in content or method. Although the material has been considerably increased (by one eighth is the author's liberal estimate), the number of pages has been actually decreased. This has been accomplished by more compact printing, the adoption of a new method of writing fractions, and the insertion of many important equations in the body of the text instead of printing them in separate lines. These changes do not add to the appearance of the text, and surely not to the delight of the reader, to whom the outstanding equations were of great assistance in reference. The change from d to δ in writing partial derivatives strikes the eye at once. Paragraph numbers are practically unchanged.

Conservatism marks this new edition. Professor Elliott has not abandoned the English methods for German symbolism. In a majority of paragraphs there is no change, and most of the others have only slight verbal changes or an added sentence to clear up obscurities or to suggest further deductions. Chapters V and XV alone present important modifications. In Chapter V, on binary quantics, there is considerable rearrangement, and material has been added on "Invariants as functions of the differences of roots." A half dozen added pages are devoted largely to establishing the conditions under which $F(a_1, a_2, \cdots, a_p)$ can be expressed as a function of the differences of the arguments and to proving some properties of this function. The author notes that this should have been in the first edition. Chapter XV, on restricted substitutions, has undergone the most changes and contains the most new material. The half dozen paragraphs on Boolean systems for the linear form, the quadratic, the