

it these additive convergent aggregates, which may also be called irrational numbers. It is then proved that, in this enlarged domain, it is possible to extract the n th root of any natural number, and to represent the ratio of two lines, whether they are commensurable or incommensurable.

The subject matter of the rest of the volume may perhaps be sufficiently evident from the general headings of the last three lectures. They read as follows: Additive aggregates of an infinity of positive and negative rational numbers; additive aggregates of an infinity of complex numbers of the form $a + bi$; multiplicative aggregates of an infinity of numbers. The value of the volume is greatly enhanced by illustrative examples, and it may be heartily recommended even to those who are just beginning graduate work in our universities. It need scarcely be added that a clear comprehension of this theory of irrational numbers will clear up many difficulties as regards the theory of absolutely convergent series with numerical terms.

G. A. MILLER.

Magic Squares and Cubes. By W. S. ANDREWS. With Chapters by PAUL CARUS, L. S. FRIERSON, C. A. BROWNE, JR., and an Introduction by PAUL CARUS: Chicago, The Open Court Publishing Company, 1908. vi + 199 pp.

Among the Arabians magic squares were known in the ninth century of our era and about this time they played an important rôle in Arabian astrology. A special work on the subject is attributed to an Arabian mathematician named Tâbit ben Korrah who died in 901,* and H. Suter mentions several other early Arabian writers on this subject in his work entitled *Die Mathematiker und Astronomen der Araber und ihre Werke*. These facts are not in accord with the statement on page 1 of the book under review, which reads as follows: "The earliest record of a magic square is found in Chinese literature dated about 1125 A. D."

The present work is, in the main, a direct reprint of articles which appeared in the *Monist* during recent years. Its author is an electrical engineer who, during his leisure hours, "has given considerable thought to the working out in his own original way the construction of magic squares and cubes of various styles and sizes." As may be inferred from this excerpt

* *Encyclopédie des Sciences mathématiques*, t. 1, vol. 3 (1906), p. 63.