

CARMICHAEL'S MONOGRAPHS ON BRANCHES OF
THE THEORY OF NUMBERS.

The Theory of Numbers. By R. D. CARMICHAEL. New York, John Wiley and Sons, 1914. 8vo. 94 pages. Price \$1.
Diophantine Analysis. By R. D. CARMICHAEL. New York, John Wiley and Sons, 1915. 8vo. 6+118 pages. Price \$1.25.

THE various series of tracts or monographs on mathematics which are in course of publication in several European countries are so well known and the arguments in favor of them are so generally conceded that it is not surprising that several series of tracts have been recently begun in America. In view of the purpose of such a tract, the editor of a series naturally imposes a definite upper limit to its length. Frequently the tract relates to a very extensive field of mathematics and the problem of the selection of topics presents a serious difficulty to the author.

There is an added difficulty in the case of a tract for beginners in the theory of numbers (and the same point would apply to the case of the theory of groups): the subject is somewhat abstract and the nature of the theorems and proofs is quite different from that to which the reader is accustomed. Consequently the author of the tract on the Theory of Numbers has wisely adopted a very elementary and expansive style of presentation, even at the expense of a reduction of the number of topics treated. A like motive, combined with the desire to emphasize methods rather than results, doubtless led the author to give several proofs of Fermat's theorem and Euler's generalization, although the space used could have been utilized for the presentation of further results.

Chapter I deals (in 23 pages) with the uniqueness of factorization into primes, the greatest common divisor and least common multiple of two or more integers, the highest power of a prime which divides $n!$, and the simplest properties of prime numbers.

Chapter II devotes 7 pages to Euler's ϕ -function or indicator. Two methods of evaluating $\phi(m)$ are given in detail, and a third method is suggested.

Chapter III gives in 10 pages the formal properties of congruences, a proof that a congruence of degree n with respect