Some famous problems of the theory of numbers and in particular Waring's problem. An inaugural lecture delivered before the University of Oxford by G. H. Hardy. Oxford, Clarendon Press, 1920. 8vo. 34 pp.

The particular problems with which this lecture is concerned belong to the additive theory of numbers. The general problem of the latter is stated by Hardy as follows: "Suppose that n is any positive integer, and $\alpha_1, \alpha_2, \alpha_3, \cdots$ positive integers of some special kind, squares, for example, or cubes, or perfect kth powers, or primes. We consider all possible expressions of n in the form $n = \alpha_1 + \alpha_2 + \cdots + \alpha_s$, where s may be fixed or unrestricted, the α's may or may not be necessarily distinct, and order may or may not be relevant, according to the particular problem on which we are engaged. We denote by $r(n)$ the number of representations which satisfy the conditions of the problem. Then *what can we say about* $r(n)$? Can we find an exact formula for $r(n)$, or an approximate formula valid for large values of n? In particular, is $r(n)$ *always positive*? Is it always possible, that is to say, to find at least *one* representation of n of the type required? Or, if this is not so, is it at any rate always possible when n is sufficiently large?"

The number $p(n)$ of unrestricted partitions of n into positive integral summands has been studied by many authors; the principal result of the investigation of this function by Hardy and Ramanujan has been the discovery of an approximate formula for $p(n)$ which enables them to approximate to $p(n)$ with an accuracy which is almost uncanny. Of $p(200)$, for example, the value 3,972,999,029,388 is obtained with an (additive) error of .004 by employing eight terms of their series; and the result has been verified by MacMahon, without the use of their formula, by a direct computation which occupied over a month.

The principal object of the lecture is a discussion of the problem of Waring of determining the number of representations of an integer n as a sum of s positive kth powers of integers and particularly of the (more usual) restricted form of this problem in which one seeks to show that for fixed k there exists a finite s_k independent of n such that every integer n has at least one representation as a sum of s_k non-negative kth powers. In connection with this problem there are two functions of fundamental importance, whose existence has