

*Einführung in die Axiomatik der Algebra.* By H. Beck. Berlin, Walter de Gruyter, 1926. 194 pp.

This book is a presentation from the view point of formal logic, of the fundamental operations and theorems of algebra. Chapter one discusses the usual axioms of algebra and the immediately resulting theorems. Articles ten and eleven of this chapter deal in particular with natural numbers. The next four chapters define the usual algebraic operations for point sets, vectors and matrices, and discuss the validity of the axioms of Chapter one in the fields of these elements. It should not be surprising that these axioms do not all hold. For, although two axioms may be alike in form, they are different axioms if they deal with different elements, unless of course they only state relations between properties common to both sets of elements. For example the statement, p. 19, that  $A_2$  failing and  $I_4$  holding for point-sets implies the independence of these axioms, has no significance. This merely shows that the point-set analogs of  $A_2$  and  $I_4$  are inconsistent. Notwithstanding this criticism, the reviewer considers these chapters a worthwhile paralleling of these various algebras.

Chapters six to ten inclusive treat in a brief and attractive way the theory of linear equations, linear vector forms, linear and quadratic forms, and matrices and determinants. Chapter eleven gives a brief axiomatic introduction to the theory of finite groups. The last chapter discusses the genetic structure of algebra upon the basis of Peano's five axioms. The treatment is condensed, well organized and very readable.

GLENN JAMES

*Beyond the Electron.* By Sir J. J. Thomson. Cambridge University Press, 1928. 43 pp.

The contents of this highly interesting booklet is a lecture given at Girton College and includes mathematical appendices bearing on points involved. The incentive was obtained from the experiments of the author's son, Professor G. P. Thomson, showing that a moving electron is always accompanied by a series of waves; a result also obtained from the experiments of Davisson and Germer. Because of these experiments the old idea that an electron is merely a charged particle must be given up. In his characteristically lucid manner, Sir Joseph goes step by step in forming pictures of two physical things: the transmission of energy and the propagation of waves and presents ultimately a view of the electron with a dual structure, "one part of this structure, that where the energy is located, being built up of a number of lines of electric force, while the other part is a train of waves in resonance with the electron and which determine the path along which it travels."

In view of the attempts of physicists to reconcile phenomena explainable in some cases by the undulatory theory and in other cases by the corpuscular conceptions of the physical entities: light, X-rays, electrons, etc., the booklet should prove of great interest to mathematicians and physicists alike.

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