extent erroneous. So far, however, as the form of the development may be taken as implying an opinion that Lewis's theory of strict implication is from the point of view of intuitive justification better formulated as a syntax than as a logic, the reviewer finds himself in complete agreement with the author.

ALONZO CHURCH

Introduction to the Theory of Groups of Finite Order. By Robert D. Carmichael. Boston, Ginn and Co., 1937. 16+447 pp.

The fundamental place occupied by the group concept in modern mathematics and the discovery of new and important applications of the theory of groups have made it necessary for every serious student of mathematics to acquire a working knowledge of this subject. Professor Carmichael's book will find a large audience, as it is addressed to the beginner, not to specialists, and makes no claim to including the most recent discoveries in group theory. The exposition is excellent throughout. The book includes a large number of exercises of varying degrees of difficulty which will enable the learner to cultivate the subject as assiduously as he desires.

The first part of the book treats those topics which are indispensable to all works on the theory of groups: abstract groups, abelian groups, prime-power groups, permutation groups, linear groups in the field of complex numbers, and the theory of group characters. A full discussion of finite fields is followed by a treatment of linear groups in a finite field with emphasis on certain multiply transitive permutation groups whose existence is established most readily by means of linear groups. The author calls attention to certain doubly transitive groups overlooked by Burnside.

Geometers will be particularly interested in the chapters on finite geometries which contain an exposition, from the group standpoint, of the researches of Veblen and Bussey. The chapter on algebras of doubly transitive groups includes Dickson's researches on finite algebras and will appeal to mathematicians interested in linear algebras. The final chapter is devoted to tactical configurations. The latter part of the book is particularly valuable, as it includes material widely scattered throughout the literature and here collected and systematized for the first time.

LOUIS WEISNER

Höhere Algebra. II. Gleichungen höheren Grades. By Helmut Hasse. Zweite verbesserte Auflage. (Sammlung Göschen, vol. 932.) Berlin, de Gruyter, 1937. 158 pp.

The new edition is in the main the same as the first edition, giving the principal results of the Galois equation theory. The results are, however, derived under somewhat more general conditions, since the author has dropped the former limitation to perfect fields and considers separable extensions in general. There are also various minor additions and improvements. A short account of the theory of finite fields is added.

OYSTEIN ORE

An Introduction to Projective Geometry. By C. W. O'Hara and D. R. Ward. Oxford, Clarendon Press, 1937. 298 pp.

The point of view of the authors is best stated in the preface: "It cannot with truth be said that the book has been written to 'supply a long-felt want.' There seems, unfortunately, to be very little demand for the teaching of Projective Geometry in this country. In default of this excuse, therefore, the authors must fall back on another, namely, the hope that their work may do something to stimulate a demand for more wide-spread familiarity with the subject."

In the United States we have been more fortunate; during recent decades our literature has been enriched by several meritorious contributions, from various points of view. Without distinguishing between the rôles of the owl and the egg, we can also mention an eager and general demand for instruction in the subject. The reviewer is of the opinion that there is place for the book under review, both for its distinctive point of view and for the excellence of its presentation.

After a brief historical and critical introduction, the work begins with point and lines as undefined elements, and develops a logical structure in terms of incidence, without appeal to intuition. The notation is particularly well chosen, and generous lists of exercises serve as a constant check. In this first half of the book, the synthetic geometry of one and two dimensions is carried to include Pascal's theorem and poles and polars. On the whole this is well done; however, in their eagerness to avoid concepts in more than two dimensions, the authors give only an algebraic proof of Desargues' theorem on perspective triangles, and this before the good treatment of the algebraic method is started. A similar objection can be made concerning the diagonal points of a quadrilateral.

It is true that these digressions are put in fine print, and are frankly stated to be verifications only, but the context rather helps the reader to infer that they furnish more rigorous proofs. In the opinion of the reviewer the merits of the book would have been decidedly increased by leaving them out altogether until the algebraic foundations had been laid.

The second half is algebraic. It begins with the non-homogeneous mesh-gauge and develops the number system to apply to open sets, with a meaning attached to sum and product, but keeping clearly in mind that one line is not included in the scheme. The next chapter, homogeneous mesh-gauges, removes this restriction for purely descriptive properties and completes what is usually included under the title of a first course in projective geometry, both synthetic and algebraic.

The next chapter, the metric gauge, gives a satisfactory introduction to the use of metrical properties in terms of a non-singular conic, and emphasizes the restriction that elements on the metric gauge (the absolute) do not have metric properties. This is then applied to a singular conic of rank one as a point conic and rank two as line conic.

A short chapter on ternary linear transformations gives a meaning of collineations and correlations, without discussing the configurations of invariant elements. This is followed by a still shorter chapter on applications to physics, including special relativity.

The mechanical make-up of the book deserves high praise. The type is clear, the printing well done, the figures excellent, and the proofreading faultless. Dates are ordinarily associated with publication; in the case of Desargues and of Pascal that of birth is given, but the date associated with Pappus (200 B.C.) seems odd.

The reviewer hopes that the *Introduction to Projective Geometry* by O'Hara and Ward may be widely read.

VIRGIL SNYDER