The final chapter is on coordinates in one and two dimensions. It is based on the fundamental theorem that three pairs of corresponding elements fix a one-dimensional projectivity, so that the correspondent of any fourth element is uniquely determined. The idea of cross-ratio is not explicitly introduced. After defining addition and multiplication geometrically, it is shown that the rules of ordinary algebra apply. In passing from homogeneous to nonhomogeneous coordinates, the statements are frequently too inclusive; as given they include division by a vanishing coefficient. After showing that loci represented by linear equations in point coordinates are straight lines, the analytic formulation of projectivity is discussed, and also correlation. The determination of the fixed elements is not taken up except in a few particular cases.

The style is on the whole pleasing; the book is easy to read. The printing is excellent, only two typographical errors having been found. The work is provided with a full index.

VIRGIL SNYDER

Contributions to the Mechanics of Solids. (Dedicated to Stephen Timoshenko by his friends on the occasion of his sixtieth birthday anniversary.) New York, Macmillan, 1938. 277 pp.

The preface states that the idea of producing this book to commemorate the sixtieth birthday of Stephen Timoshenko, formerly professor of engineering mechanics at the University of Michigan, was conceived almost simultaneously by several of his present and past associates in colleges and industries. The book consists of a short biography of Professor Timoshenko followed by twenty-eight independent articles on various aspects of "stress and strain," written by prominent men in science and industry on both sides of the Atlantic.

Many of the articles discuss rather particularized engineering phases rather than general principles or analytical mathematics. The average technical reader will find some interesting features in such articles as "Developments in Photoelasticity" (non-mathematical), "Effect of a Flexible First Story in a Building Located on Vibrating Ground," "Dynamic Stability of Railway Trucks," "Use of Orthogonal Functions in Structural Problems," and "Hamilton's Principle and the Principle of Least Action in the Solution of Creep Problems." The above titles illustrate the range and mutual independence of the articles which constitute the book. The reviewer feels that it would have been of more interest and value to have assembled more correlated discussions of topics in the field of the mechanics of solids.

J. K. L. MACDONALD

Foundations of Logic and Mathematics. By Rudolf Carnap. (International Encyclopedia of Unified Science, vol. 1, no. 3.) Chicago, University Press, 1939. 8+71 pp.

This monograph presents in condensed form and with a minimum of formal detail the author's views concerning the relation of logistically formalized calculi to language in the ordinary sense, and concerning the application of such calculi in empirical science. It is a noteworthy contribution to philosophy of science and in particular to analysis of the relationship between pure and applied mathematics, the questions involved being made much more precise and intelligible than would otherwise be possible, through use of the methods of modern symbolic logic.

In many respects the author's views are here modified or clarified in such a way as to remove serious objections previously urged against them.

The "principle of tolerance" is explicitly restricted to uninterpreted logistic calculi and it is said that "a system of logic is not a matter of choice, but either right or wrong, if an interpretation of the logical signs is given in advance." The quoted sentence—by failing to take account of the fact that an interpretation, in advance of *some* formalization, must have a considerable element of vagueness—may even admit too much to the anti-conventionalists. The author adds, however: "It is important to be aware of the conventional components in the construction of a language system."

The purely syntactical method of the author's previous publications is here supplemented by an account of semantics. Designata are admitted not only for concrete terms but also, in some cases at least, for abstract symbols and expressions. Thus predicates are said to designate properties of things (p. 9), (declarative) sentences are allowed to designate "states of affairs" (p. 11), and "functors" are said to be signs for functions (p. 57). (The more usual terminology is "proposition" instead of "state of affairs" and "function symbol" instead of "functor.") The reviewer would prefer a still more liberal admission of abstract designata, not on any realistic ground, but on the basis that this is the most intelligible and useful way of arranging the matter—it would apparently be meaningless to ask whether abstract terms *really* have designata, but it is rather a matter of taste or convenience whether abstract designata shall be postulated.

The point brought out in §16, that a postulate set in the usual mathematical sense must be regarded as added to an underlying system of logic—which, for exactness, must be logistically formalized—is, of course, not new. But it deserves attention, because neglect of just this point has resulted in much misunderstanding concerning the significance of a set of postulates for a particular mathematical discipline.

On page 23, instead of distinguishing between finite and transfinite rules, it would seem to be better to distinguish between effective and non-effective rules. The matter is complicated by the fact that "finite" is often used in this connection substantially as a synonym of "effective." But a rule might well be non-effective without being transfinite in Carnap's sense.

In §14 there appears to be an oversimplification of the relation between logic and arithmetic, partly through failure to make explicit mention of the axiom of infinity, and partly through an unsound use of recursive definition. An example of the latter is Definition 14, which is in effect a schema providing separate definitions for $m+0$, $m+1$, $m+2$, $\cdots$. That this is no definition of the function $+$ may be seen by considering that the sentence, "For all natural numbers x and y, $x+y=y+x$," for example, remains undefined. This section (like most of the monograph) undertakes only to provide an outline statement with omission of formal detail; nevertheless it seems to the reviewer that an unfortunately misleading impression is given.

ALONZO CHURCH

Elements of the Topology of Plane Sets of Points. By M. H. A. Newman. Cambridge, University Press, 1939. 216 pp.

"This book," according to the scholarly description which appears on the jacket, "has the double purpose of providing an introduction to the methods of topology and of making accessible to analysts the simple modern technique for proving the theorems on sets of points required in the theory of functions of a complex variable [separation theorems, for example]."

There is no doubt that for non-topologists at least, many of the proofs of the Jordan separation theorem which have appeared in the literature are either dull or