an induced law of parallelism. There is not a unique induced affine connection in a sub-space of an affinely connected space."

The book ends with a bibliography of the books and articles to which reference is made in the text. Eisenhart's previous books have been conspicuous, among other things, for their carefully prepared and useful indexes. The omission of such an index from the present work is to be regretted. With the growth of mathematical literature, it is becoming more and more inconvenient to be forced to leaf through a whole book to locate a desired bit of information.

Those wishing an introduction to the subject will find *Non-Riemannian Geometry* a useful book. A familiarity with the methods of tensor analysis is, of course, presupposed on the part of the reader. The subject matter is carefully presented and the manipulations are easy to follow. The theorems are clearly stated and are proved in a straightforward manner, a number of the proofs being original with the author. The chief defect in the book—and this seems serious in a set of colloquium lectures— is the absence of any attempt to comment upon the significance of the results or to point out possible lines for future development.

<div style="text-align: right">J. M. Thomas</div>

THREE BOOKS ON DIFFERENTIAL EQUATIONS

An Elementary Treatise on Differential Equations and their Applications.
New edition, revised and enlarged. By H. T. H. Piaggio. London,
G. Bell and Sons, 1928. 18+256+27 pp.

Gewöhnliche Differentialgleichungen. By J. Horn. Zweite, völlig umgear-
beitete Auflage. (Göschens Lehrbücherei.) Berlin, Walter de Gruyter,
1927. 8+197 pp.

Ordinary Differential Equations. By E. L. Ince. London and New York,
Longmans, Green, 1927. 8+558 pp.

Professor Piaggio's *Differential Equations* was first published in May, 1920, and was reprinted four times during the next six years. "The object of this book is to give an account of the central parts of the subject in as simple a form as possible, suitable for those with no previous knowledge of it, and yet at the same time to point out the different directions in which it may be developed." The only previous knowledge assumed is that of the differential and integral calculus. The style is admirably adapted to a text for beginners and the large number of examples with answers furnishes adequate drill material.

The usual standard forms of ordinary and partial differential equations occupy the greater part of the book: one chapter is devoted to numerical approximations and another to existence theorems. In the revised edition more examples have been included and a new chapter "Miscellaneous Methods" has been added, dealing with a number of disconnected topics, which may be regarded as in the nature of supplementary reading. The author calls particular attention to some difficulties in the theory of singular solutions, for which he is indebted to some unpublished work by Mr. H. B. Mitchell, formerly Professor at Columbia University.

Professor Horn's book is an abbreviation of his earlier work *Gewöhn-liche Differentialgleichungen beliebiger Ordnung*, which was published as volume 50 of the Sammlung Schubert and is now out of print. It may be described as an introduction to the theory of ordinary differential equations, although one of the nine chapters is devoted to standard methods of integration and another to numerical and graphical approximations. The author assumes only an elementary knowledge of the theory of functions of a complex variable and has been guided in his choice of subject matter by a desire to lead the student directly to those topics which have most useful applications in physics and astronomy.

Professor Ince's treatise represents a notable addition to mathematical literature in English. The aim of the author has been to "introduce the student into the field of ordinary differential equations and thereafter to guide him to this or that standpoint from which he may see the outlines of unexplored territory." To quote further from the preface: "For some time I have felt the need for a treatise on differential equations whose scope would embrace not merely that body of theory which may now be regarded as classical, but which should cover, in some aspects at least, the main developments which have taken place in the last quarter of a century. During this period no comprehensive treatise on the subject has been published in England, and very little work in this particular field has been carried out; while, on the other hand, both on the Continent and in America investigations of deep interest and fundamental importance have been recorded."

The book is divided sharply into two parts of about equal length. Part I deals with differential equations in the real domain and Part II in the complex domain. Beginning with elementary methods of integration, the author passes on to the existence and nature of solutions and then to an account of continuous transformation-groups. The remainder of Part I is devoted to linear differential equations in real variables. The first three chapters of Part II discuss the existence theorems and singularities of non-linear equations and these are followed by seven chapters on linear equations in complex variables.

To describe in detail the topics discussed would be to give a résumé of the important articles on differential equations which have appeared in the journals during the last twenty-five years. The book forms an excellent account of the progress during that period. Necessarily some parts of it are rather condensed and the average reader will need to have his pencil and paper at hand in order to follow the argument intelligently. However, the references to original articles and standard texts are sufficiently complete to enable one to look up readily further discussion of every major point.

As an exposition of the present state of the theory of ordinary differential equations the book deserves the highest praise.

W. R. LONGLEY