Differentialrechnung. By A. Witting. Berlin and Leipzig, de Gruyter, 1931. 191 pp.

This volume is Number 87 of the Sammlung Göschen and replaces the earlier one on differential calculus. It covers essentially the same ground as a half year introductory course in American colleges, with about the same degree of rigor and the same applications. The 185 exercises in the text are drill problems to which answers are given. This book maintains the high standard of printing and appears in the same convenient pocket size and durable linen binding as other recent volumes of this collection.

W. R. LONGLEY

Projective und Nichteuklidische Geometrie. By F. Schilling. Leipzig and Berlin, B. G. Teubner. Volume I, xi+212 pp.; Volume II, xi+216 pp.

The principal object of Professor Schilling's treatise is to lay the foundations and derive the important features of projective geometry in a systematic manner independent of euclidean metrics, and to establish non-euclidean geometry upon a projective basis as it had been accomplished before by his illustrious teacher Felix Klein. The result is a very broad and thoroughgoing treatment of the whole subject which the student can use with much profit. In the first volume Schilling makes the passage from the synthetic to the abstract analytic formulation in a very illuminating manner by means of the dyadic number system involved in Möbius' harmonic quadrangle construction. This is undoubtedly the simplest and fastest method of approach in the establishment of a system of projective coordinates. It seems to the reviewer that Schilling's treatment could be still more simplified by making use of the fact that every real rational or irrational number can be represented as a dyadic number. Thus by a continuity axiom and eventual limiting process every number or point is obtained in the constructive scheme.

In the study of collineations particular attention is given to those that leave a fixed conic invariant. The purpose of this is of course to prepare the way for non-euclidean geometry in the second volume. One also finds a very interesting section on the birational mapping of the projective plane upon a closed surface without singularities in a limited portion of space.

Volume II contains a very satisfactory exposition of non-euclidean geometry from a projective stand-point in which the groups of movements in the three types of geometry (including euclidean) assume a fundamental role. Schilling does not of course fail to show the connection of the projective standpoint with that of Riemann's "Habilitationsschrift." He also gives an ample treatment of non-euclidean trigonometry, so that altogether the book forms a welcome addition to the projective treatment of the subject.

The reviewer has noticed very few errors. On page 3, volume II, theorem 2. "Eindeutigkeitsaxiom" of *plane* movements contains an inaccuracy. In Fig. 1, it is obvious that the shaded sides cannot be assigned arbitrarily as corresponding, as would be possible by the statement in the text. The typography and general make up of the books are excellent.

Their value is furthermore increased by a large number of literary references and comments.

A. EMCH