

by reason of the greater space he has allowed himself, thereby gaining enormously in comprehensiveness and lucidity. A noticeable feature of Voigt's book is the admirable bibliography of each branch of the subject; Christiansen's book has nothing of the nature of a reference for collateral reading.

Professor Magie has used for translation the German edition by Müller of the Danish original. His rendering into English is excellent, and does not slavishly follow the German text, but is free and natural.

We wish that the work of the publishers were equally deserving. The Macmillans have brought out the book in their usual elegant dress in so far as paper and type are concerned; but upon what score of economy can they be excused for the manner in which the equations are treated? One may pardon the use of the Solidus for mathematical expressions printed in the text, but surely no valid reason can be advanced for the use of the Solidus in all equations, and for the placing bodily of most of the equations in the text. The effect of a page upon the eye is dazzling and confused; and not only is eye-sight ruined, but valuable time lost, in trying to discover an equation to which reference has been made. It is to be hoped that the publishers have already come to the conclusion that this experiment in economizing in paper has not been a brilliant success.

The typographical errors which we have observed have not been numerous, and have been usually quite unimportant.

A. STANLEY MACKENZIE.

*Introduction to Infinite Series.* BY WILLIAM F. OSGOOD, PH.D., Assistant Professor of Mathematics, Harvard University. To be obtained of the Publication Agent of Harvard University, 2 University Hall, Cambridge, Mass. 8vo, 71 pp. Price, 75 cents.

A beginner is almost invariably repelled by the aridity and apparent unprofitableness of the subtle discussions that occur in the theory of infinite series. In his interests it is highly desirable that stress should be laid at first on the essential principles involved, to the neglect of such parts of the subject as belong merely to what we may call mathematical technique: *e. g.*, complicated tests of convergence. That it is possible at once to interest the reader, to make no sacrifice of thoroughness, and to arrange the material in organic connection with the other parts of mathematics is proved by Professor Osgood's short pamphlet on infinite series.

The author states in the preface that his aim is to make his path easier for the beginner by "introducing him to the theory of these series in such a way that he sees at each step precisely what the question at issue is, and never enters on the proof of a theorem till he feels that the theorem actually requires proof." In carrying out this plan he makes use of diagrams and graphical illustrations, shows where possible the *a priori* probability of the theorem in question, and draws many of his illustrations from applied mathematics.

The subject matter is arranged in 5 sections: (1) convergence, (2) series as a means of computation, (3) Taylor's theorem, (4) algebraic transformations of series, (5) continuity, integration, and differentiation of series. There is also an appendix on a fundamental theorem in limits and a table of the more elementary series. Where all is good it is difficult to single out special parts for commendation. Perhaps the most valuable characteristics are the *repeated* insistence on the importance of never forgetting that the sum of an infinite series is really the limit of a sum; the distinct formation of the theorem on the existence of a limit; the distinction between Taylor's series with the remainder and the infinite series with the accompanying remark and proofs that "it is desirable that the form should be applied much more freely than has hitherto been the custom in works on the infinitesimal calculus, both because it affords a simple means of proof in a vast variety of cases and because many proofs usually given by the aid of the latter can be simplified or rendered rigorous by the aid of the former;" and finally the treatment of continuity, etc., by graphic methods in section V. The reviewer cannot agree with Professor Osgood's statement that Taylor's theorem is proved satisfactorily in all good treatises on the differential calculus.

This pamphlet is a valuable addition to the literature on convergence of series and will be of great use to those who are called upon to teach this difficult branch of pure mathematics.

J. HARKNESS.

#### RECENT TEXT-BOOKS OF THE CALCULUS.

*Elements of the Differential and Integral Calculus with Applications.* By WILLIAM S. HALL, Professor of Technical Mathematics in Lafayette College. New York, D. Van Nostrand Company, 1897. 8vo, pp. xi+249.

This work is a conventional American text-book of the