Numerical Mathematical Analysis. By J. B. Scarborough. Baltimore, The Johns Hopkins Press, 1930. xiv+416 pp.

Mathematics has been defined as the science of avoiding computation, and in many fields of pure mathematics the ideal is to achieve results by reasoning which involves no computation. In recent years numerical mathematics has grown rapidly in connection with statistics, biology, and other sciences, and computation is a necessary consequence. It is in the fields of applied mathematics where numerical results are demanded that it becomes most desirable to avoid unnecessary and inaccurate computation. The object of Professor Scarborough's book "is to set forth in systematic manner and as clearly as possible the most important principles, methods, and processes used for obtaining numerical results; and also methods and means for estimating the accuracy of such results."

The book is not a treatise on computation in the sense of convenient forms and efficient arrangements. These are usually highly specialized and the fundamental principles with which the book deals are not so specialized. Notations peculiar to certain subjects have been avoided and the treatment has been made as elementary as is consistent with soundness. Assuming only a knowledge of elementary calculus, the author has succeeded in giving an excellent presentation of his material. Specialists in some of the topics may disagree with the choice of material and may regret the omission of a few methods like that of divided differences in the standard formulas of interpolation, but the author has made his choice with a definite view in mind. He has "tried everywhere to clear up the difficulties before the student meets them, so that no teacher or other source of information will be needed."

This ideal in the matter of explanation is particularly laudable in a work of this character because its greatest usefulness will be as a reference book when one needs to use methods which are not very familiar to him. After an exposition of the theory underlying a formula, the reader is shown how to use it and its limitations are carefully pointed out. The book would serve well as a classroom text. At the present time no large number of students pursue such a course, but an increasing number of mathematicians and scientists are performing work for which the methods here treated are essential. Since it seems likely that the book will be most widely used for individual study without the guidance of a teacher, its value would be increased if answers were given to most of the problems.

The following list of chapter headings will indicate the contents. 1. The accuracy of approximate calculations. 2. Interpolation (Newton's formulas). 3. Interpolation (central-difference formulas). 4. Interpolation (Lagrange's formula. Inverse interpolation). 5. The accuracy of interpolation formulas. 6. Interpolation with two independent variables. Trigonometric interpolation. 7. Numerical differentiation and integration. 8. The accuracy of quadrature formulas. 9. The solution of numerical algebraic and transcendental equations. 10. Graeffe's root-squaring method for solving algebraic equations. 11. The numerical solution of differential equations (method of successive approximations). 12. Convergence and accuracy of the iteration process. 13. Other methods for the numerical solution of differential equations (J. C. Adams, Runge-