

ment lies in the introduction from the outset of vectors and matrices. The treatment of the geometry of the triangle by vectors is very elegant, as is the application of matrices to the study of orthogonal coordinate transformations and the classification of quadrics.

T. H. GRONWALL

*Methoden der Praktischen Analysis.* By Fr. A. Willers. Göschens Lehrbücherei, Band 12. Berlin and Leipzig, de Gruyter, 1928. 344 pp.

This book treats numerical, graphical, and some instrumental methods of practical analysis. While the most important is the numerical, by which an approximation to any desired degree of accuracy may be reached, the author has felt the importance of treating the less precise methods because they frequently give results which are sufficiently accurate for the purpose in hand and in other cases provide easily a first approximation to more refined results by the numerical method. Lack of space has made it necessary to limit the applications in neighboring fields and the author regrets particularly that he has had to omit almost everything from mathematical statistics.

The first chapter considers the general problems involved in calculations with approximate numbers and describes the mechanical aids to computation, particular attention being given to various special types of coordinate paper. The second chapter, which is fundamental to those which follow, develops standard methods of interpolation including numerical differentiation and integration. In the third chapter we find a treatment of approximate integration and differentiation by various formulas and types of integrating machines. The fourth chapter is devoted to methods of approximating the roots of equations, including systems of linear equations and the complex roots of algebraic equations. The last paragraph gives a brief treatment of linear difference equations. Empirical formulas and curves, particularly those involving periodic functions, are described in Chapter Five. The sixth chapter explains graphical and numerical methods for obtaining approximate solutions of ordinary differential equations.

The last four chapters are independent and each is based on Chapter Two alone. This volume is to be recommended as a convenient reference book for any one confronted by a problem the solution of which requires the approximate methods listed above.

W. R. LONGLEY

*Mathematische Existenz.* By Oskar Becker. Untersuchungen zur Logik und Ontologie mathematischer Phänomene. Halle, Niemeyer, 1927. 370 pp.

This appears as a "Sonderdruck aus: Jahrbuch für Philosophie und phänomenologische Forschung, Band VIII," and as such has a double pagination. The work is a critical, searching study of the problem of mathematical existence in its present controversial status. It should be read in connection with the recent prior articles of Hilbert, Brouwer, Weyl and others. One is plunged in the first few pages into the present conflict concerning the foundations of mathematics as championed by Brouwer for Intuitionism, and by Hilbert for Formalism. It is of significance that there is no present