occasion. By many this is esteemed to be Halphen's chief work. Some account of it is given in the review of volumes I and II in connection with Poincaré's analysis of the memoir on pages xxx–xxxi of volume I.

Besides these two master memoirs, volume III of the *Oeuvres* contains the introductory article by C. Jordan already referred to, and two articles by Halphen closely related to the former of the two already treated. They both deal with linear differential equations of the fourth order: one is a brief note (pp. 457–461) from the COMPTES RENDUS and the other is a longer article (pp. 463–514) from the ACTA MATHEMATICA on the invariants of linear differential equations of the fourth order.

The four articles reprinted in this volume may justly be said to contain two great contributions by Halphen. The one is the memoir on twisted algebraic curves and the other is the work on linear differential equations contained in the first, third and fourth papers. These are all entirely inspired by the theory of differential invariants (to which Halphen had previously made characteristic contributions); and they are treated together by Halphen himself (vol. I, pp. 32–35) in the summary of his work prepared by him on the occasion of his candidacy before the Paris Academy in 1885.

R. D. CARMICHAEL

Graphical and Mechanical Computation. By Joseph Lipka. New York, John Wiley and Sons, 1918. ix + 264 pp.

This book is something new in American text-books. It treats two subjects of vital importance to engineering students that heretofore have found little place in the curricula of American engineering schools. The first part of the book is devoted to the graphic solution of engineering problems by means of networks of scales, various kinds of coordinate paper, the charting of equations in three variables and more particularly by means of alignment charts. The second half of the book is concerned with the question of empirical formulas for both non-periodic and periodic curves giving numerical, graphic and mechanical methods for determining the constants. For data which cannot be fitted to convenient formulas, numerical, graphic and mechanical methods are developed in the last two chapters for interpolation, differentiation and integration.

The book is rich in illustrations and applications to practical engineering problems, showing clearly the value of the graphic methods in reducing the drudgery of long computations. The three chapters on alignment charts are recommended to the student who wishes to know something of the nomographic charts of Professor M. d'Ocagne. The work is also published in two volumes.

A. R. CRATHORNE

Funktionentheorie. By Konrad Knopp. 2d edition. Berlin and Leipzig, Vereinigung wissenschaftlicher Verleger. Part I, 1918, 140 pp. Part II, 1920, 138 pp.

This "Funktionentheorie" is a completely revised edition of the work that appeared under the same title in 1913 in the Sammlung Göschen. It is issued in a form similar to the old one by the Vereinigung wissenschaftlicher Verleger which, since the war, has continued the publishing activities of several houses, among them the Göschen'sche Verlagshandlung.

The book, grouping its material around the centrally important concept of the monogenic analytic function, affords a very satisfactory brief introduction to the study of the theory of functions of a complex variable. By maintaining throughout sufficient emphasis upon the central concept, and by connecting various parts of the theory by their relation to this concept, a balance that is very desirable in a book of this kind is secured between the more and the less theoretical aspects of the subject. After a chapter on point sets, *Wege* (i.e., curves consisting of a finite number of rectifiable pieces), etc., there are taken up the integral theorems, development in series, analytic continuation and singular points. Then follow, in the second volume, short sections on entire functions, meromorphic functions and periodic functions (with brief mention of the elliptic functions); and finally a section on multiple-valued functions.

The book is clearly written, well printed, and practically free from misprints. The Cauchy integral theorem is proved for a closed *Weg* by means of approximating polygonal lines and by reducing the theorem ultimately to the case in which the area enclosed by the curve is a triangle, in a manner similar to that followed by Jordan in volume I of his *Cours d'Analyse*. A number of well-chosen exercises are distributed throughout the book.

ARNOLD DRESDEN

Réflexions sur la Métaphysique du Calcul Infinitésimal. By Lazare Carnot. I and II. Paris, Gauthier-Villars, 1921.

It is not generally known that this treatise was translated into English by William Dickson and published, with notes, in the PHILOSOPHICAL MAGAZINE of London, volumes 9 and 10, for the years 1800 and 1801. Maurice Solovine, the editor of the present edition, is mistaken when he states that J. K. Hauff's German translation (1800) and G. B. Magistrini's Italian translation (1803) antedated translation into English. To be sure, a later English version, prepared by William Robert Browell, did appear at Oxford in 1832. The various translations bear testimony to the high esteem in which the booklet was held by Carnot's contemporaries. Carnot makes no reference to English mathematicians of the eighteenth century who came after Newton; he was unacquainted with Bishop Berkeley's onslaught as found in the ANALYST. Berkeley and Carnot exerted a strong influence on the development of the philosophy of the calculus: the one by his destructive criticism, the other by his constructive efforts. Carnot lays great stress on the doctrine of the compensation of errors in infinitesimal analysis, being unaware that before him this view-point had been presented by Berkeley and others. While D'Alembert and Lhuilier were partial to the method of limits, Carnot found that method a tortuous foot-path in which it was difficult to avoid being bewildered. Mathematicians interested in the history and philosophy of the calculus will welcome this reprint of the greatly enlarged edition of 1813. It appears in the series of inexpensive editions of *Les Maîtres de la Pensée Scientifique.*

FLORIAN CAJORI