lows each chapter will be found useful and the bibliography appended seems adequate.

The last chapter of the book is devoted to the gamma function and the auxiliary functions of Prym. It is condensed from La function gamma: Theorie, Histoire, Bibliographie of our author, and although the available analytic processes are necessarily restricted, the proofs are elegant and compact.

M. B. PORTER.

Höhere Analysis für Ingenieure. Von Dr. JOHN PERRY. Autorisierte deutsche Bearbeitung von Dr. ROBERT FRICKE und FRITZ SÜCHTING. Leipzig, B. G. Teubner, 1903. 8vo., viii + 423 pp.

IT is interesting to note in what numbers the last few years have produced treatises on the differential and integral calculus which have for their aim the fulfilment of the needs of some special class of students. For instance, there are for students of physics the elaborate treatise of Boussinesq and the smaller book by H. A. Lorentz, for chemists the work of Nernst and Schoenfliess recently translated into English by Young and Linebarger, for students of political economy a small primer by Irving Fisher, and for engineers the work of Perry. The question naturally arises whether so much subdivision in the study of calculus is necessary. It will prove a matter of serious inconvenience if each specialist must have a special course and a special book to suit his needs. There can be little doubt that the present tendency to this subdivision is due partly to the fact that mathematicians are apt to wish too selfishly to make their elementary courses strictly mathematical instead of practical, and in this respect we hope they will mend. A great part of the difficulty, however, is due to the inertness of the students of special branches, who wish to learn so much and only so much of calculus as appears to them necessary for their immediate needs. The short-sightedness of this attitude renders it dangerous. To-day many a chemist or economist, whose elementary education was finished a decade ago, complains of experiencing inconveniences because he did not study calculus. Perhaps before twenty-five years are past those who now are trying to learn as little of it as possible will be wishing that they had not tried to economize so much. In the earlier years of instruction time is not so precious as later, symbolic processes fix themselves more readily upon the mind which later will be occupied more with thought. Thus a student who leaves his undergraduate course without a thorough knowledge of the purely formal manipulation of mathematics seldom can make good his loss.

It seems to us that one who studies Professor Perry's book will run just this risk of acquiring an insufficient formal knowledge of calculus. The author states that "the young engineer cannot be practiced too thoroughly in the mere simplification of algebraic and trigonometric relations, including those which contain complex quantities." The statement applies as well to the calculus and casts considerable doubt upon the efficacy of the author's arrangement of his book, in which he leaves such simple rules of operation as the differentiation of a sum, product, or quotient of two functions or of a function of a function, until the last chapter (p. 305) to be classed under the title, "More difficult exercises and theorems." To whom the work will be valuable is hard to say. So full is it of applications to mechanics, electricity and magnetism, thermodynamics, and elasticity as to be practically unintelligible to one who has not had considerable training as an engineer; and so little stress does it lay on the formal side of calculus that even the engineer, far from obtaining a working knowledge of the subject, would do well if he learned so much as "not to be afraid of calculus when he saw it."

We pass over the surprisingly few offenses against accuracy in demonstrations and definitions and turn our attention to a few features which might advantageously be copied in other elementary text-books on calculus. The first is the omission of indeterminate forms $0/0$, ∞/∞, $0 \cdot \infty$, etc., of which the rigorous treatment is a matter of considerable difficulty. It is doubtful if students even understand what they are doing when they differentiate numerator and denominator until they find a determinate result. The whole subject may well be postponed until after treating the algebraic operations upon series. Secondly the introduction of the simpler differential equations and the methods of integrating them affords a pleasant and valuable change from the lengthy treatment of the formal integration of a rational function or a function rational in the domain $(x, \sqrt{ax^2 + bx + c})$ with which most text-books insist on tormenting the students notwithstanding that a table of integrals like Professor B. O. Peirce's serves every purpose. Meanwhile, despite the fact that almost every application of calculus involves a differential equation, the students remain unable to treat even the equation of harmonic motion and completely ignorant of the necessity and significance of "determining the arbitrary constants." Thirdly the author introduces Fourier's series long before he reaches the chapter on "more difficult exercises and theorems" in which he first states the rule for differentiating a product. Curious as this arrangement may seem, we wish to use it to call attention to the value and the possibility of early introducing the expansion of a function into a Fourier's series. Mathematicians as a rule are so preoccupied with contemplating the difficulties encountered in proving the expansibility of an arbitrary function into a Fourier's series that their students study calculus three hours a week for two full years, one hundred and eighty lessons, without hearing of any such series. Yet so valuable are these series in physics and astronomy that they might well be introduced, even crudely, as Professor Perry introduces them, early in the study of calculus. The actual determination of the coefficients in a case of the simpler functions is not difficult and furnishes a practical problem in integration.

Such are some of the advantages and disadvantages of Professor Perry's *Calculus for Engineers*. We can heartily recommend to any teacher the perusal of this book. In many places he will find his eyes opening to ways in which the treatment of difficulties, unsuspected and unappreciated by the student, may be replaced by questions of practical use and interest without endangering the career of any possible future pure mathematician. It will be only by a rational compromise on both sides that the inconvenience of the present tendency to different courses and different books for each class of specialists can be avoided without harm to any.

E. B. WILSON.

Leçons sur les Fonctions Méromorphes. Par ÉMILE BOREL. Recueillies et rédigées par LUDOVIC ZORETTI. Paris, Gauthier-Villars, 1903. 8vo., vi + 122 pp.

THE Leçons sur les Fonctions Méromorphes is a natural sequel to the author's Leçons sur les Fonctions Entières which appeared about three years ago. The results are in great part mere generalizations, to the case of functions possessing poles, of the results earlier obtained for functions possessing no singularities in the finite region of the complex plane. Considerable