polation, published in 1923. They furnish a practical reference book on interpolation with equal and with unequal intervals, central difference formulas and applications. These four chapters are followed by a short one on Chio's method of computing the numerical value of a determinant.

The chapter on the numerical solution of algebraic and transcendental equations describes, illustrates and compares the more important methods. One might wonder if the value of an up to date calculating machine is fully appreciated at the Laboratory. The computation of the successive values satisfying a difference equation is especially well adapted for machine computation, and the successive values of S_p (the sum of the pth powers of the roots of an equation) can be ground out with uncanny readiness by one who has had a little experience. Then, using Bernoulli's method, the quotient S_{p+1}/S_p can be obtained to as many decimals as may be desired. The computing machine is also invaluable in constructing tables of differences.

There are also chapters on Numerical Integration, Normal Frequency Distributions, Least Squares, Fourier Analysis, Smoothing of Data, Correlation, Search for Periodicity and the Solution of Differential Equations. These subjects are all given with satisfying clearness and detail with plenty of examples, and sample solutions. The whole book presents evidence on every page of sound scholarship and good practical judgement. The authors call attention to the opportunities for research in the subject of numerical mathematics. "There is an evident need for new and improved methods of dealing with many of the problems discussed in the later chapters".

D. N. LEHMER

Les Lieux Géométriques en Mathématiques Spéciales avec Application du Principe de Correspondance et de la Théorie des Charactéristiques à 1,400 Problèmes de Lieux et d'Enveloppes. By T. Lemoyne. Paris, Vuibert, 1923. 146 pp.

This little pamphlet summarizes Chasles' theory of characteristics together with the extensions which the author (with Brocard) developed in volume I of *Courbes Géométriques Remarquables,* and gives 1400 problems by way of illustration. It will be recalled that the characteristics μ, ν of a system of conics refer to the number of conics which pass through an arbitrary point, and are tangent to an arbitrary line, respectively. The characteristics of 170 systems of conics, and of 41 systems of circles are listed. Fundamental theorems give formulas for the order or class of many loci or envelopes connected with these systems in the form $\alpha\mu + \beta\nu$. Chasles gave 32 such fundamental theorems for the values of α and β; Lemoyne adds about 50 more, either with proofs or with references to the *Courbes Géométriques*

Remarquables, an important addition being to certain specializations where Chasles' formulas are inapplicable. The author is then in a position to state, not to be sure 80 times 170 results, for not every fundamental theorem and listed entry of characteristics may be paired, but perhaps 10,000 results (problems). Of these he actually gives about 1400. For two or three theorems he feels compelled to go practically through the 170 entries. Otherwise it is fair to say that he has chosen pretty much at random among those cases where the order or class is low. In some cases the order or class may be extremely large. Thus the locus of the vertices of conics tangent to three given conics and to a given line is a curve of order 1000. But the author does not gloat over these millics.

Lack of system seriously impairs the value of this book. The table of characteristics is extremely awkward for reference; failure to number the entries seems inexcusable. If the reader will number these he will find slips in 100, 102, 133, 134, 135, and 159. Among the problems there are obvious slips in 47, 148-152, 206, 248, 250, 690, 900, 1168, and 1291, while 605, 606, 607 are repetitions of 597, 598, 599, and 1141—except for a non-significant variation in punctuation—of 1121. There are unnecessary and irritating changes in notation, such as the use, in problem 1288, of D to denote both an asymptotic direction and an arbitrary line, while other capital letters stand for points. On the other hand, the enumerative results in these problems have all been checked and have been found correct.

B. H. Brown

Aufgabensammlung zur Funktionentheorie. By Konrad Knopp. Berlin and Leipzig, Walter de Gruyter. 1923. 135 pp. I. Teil: *Aufgaben zur elementaren Funktionentheorie.* Sammlung Göschen.

This little book contains an excellent collection of problems on the elementary theory of complex functions. They are listed by chapters under six headings, fundamental concepts, sequences of numbers and infinite series, functions of a complex variable, integral theorems, developments in series, conformal mapping. Each of these chapters is further divided into two or three sections.

It has been said that if we could have excellent sets of problems published separately from texts, the task of text-book writers would be greatly simplified and they could concentrate on the presentation of their subject alone. The problems in this book could be a companion to any text which might be written on the subject of the theory of functions of a complex variable, covering the field of a single variable.

H. J. Ettlinger