David Hilbert. Gesammelte Abhandlungen. Erster Band. *Zahlentheorie.* Berlin, Springer, 1932. xiv+539 pp.

This first volume of Hilbert's collected papers contains reprints of eleven works, one of which is the classic report on algebraic numbers of 1897, pp. 63–362. For this alone the volume will be indispensable to workers in the theory of numbers, as the French translation of some years ago was carelessly printed, and the original is not available in smaller libraries. Random sampling of the numerous formulas indicates that the printing has been accurately done.

Another great classic brings us the wonderful proof of Waring's conjecture, the last paper in the volume. Although fashion favors other proofs today, it seems safe to guess that Hilbert's proof—the first ever given—will be remembered for its perfect efficiency in attaining a prescribed goal with a maximum of skill and a minimum of effort.

It would be out of place to comment on any of the famous papers which go to make up this beautiful volume. If the work as a whole can be briefly characterized, possibly *mathematics* is sufficient. More than one sure gleam of "the light that never was on land or sea" shines in these pages.

The edition is to be completed with the publication of three more volumes, Geometry, Algebra, and the Theory of Invariants; Analysis; Miscellaneous. Workers in other fields than arithmetic will look forward to these volumes with anticipations of as keen a pleasure as the devotees of the theory of numbers will derive from this.

E. T. BELL

Cours d'Analyse. By J. Hadamard. Professé à l'École Polytechnique. Paris, Librairie Scientifique Hermann et Cie, 1930. Vol. II. vi+721 pp.

The first volume of this work appeared in two parts in 1925 and 1927, and was reviewed in volume 34 (1928) of this Bulletin. Like the prior volume, the present work is strongly oriented toward the applications and makes close contact with many important topics in theoretical physics and theoretical astronomy. Also, numerical computation is emphasized in connection with such topics as determining the approximate solution of differential equations. However, the ground work of analysis having been fully developed in volume I, it is possible for the writer, in the present volume, to touch on a much wider variety of the various theories of analysis that have been of fundamental use in the application of mathematics to its sister sciences.

The book is divided into six grand divisions whose sub-headings are as follows: Newtonian Potential Function; Calculus of Variations; Analytic Functions of a Complex Variable; Ordinary Differential Equations; Partial Differential Equations; Theory of Probabilities. The central aim of the work, namely to introduce all the important disciplines of analysis that are of wide use in the field of applications previously designated, has necessarily limited the treatment of some of the classical theories to the more elementary developments. On the other hand this same principle of selection has operated to introduce certain topics that are sometimes omitted in much more extensive treatments of the same classical theories. For example the discussion of analytic functions of a complex variable includes a brief treatment of the theory of functions of several complex variables. In the portion devoted to ordinary differential equations we find use made of some of the important ideas of the Lie theory of continuous transformation groups and an application of these notions to obtain an important result in the special theory of relativity. In the section on probability theory we find discussed certain central topics in the mathematical theory of statistics, such as frequency distributions and correlation theory.

The book is thus seen to be thoroughly modern in the best sense of that sometimes abused term. The great variety of mathematical methods that are used in various theoretical discussions in the physical sciences, and the constant shift in emphasis resulting from the rapid development of the present century in the field of physical theory makes it no light task to select from the wealth of material available the topics that are of first importance, and to give to each its proper share of attention. Hadamard has accomplished this difficult undertaking in admirable fashion. If one wished to prescribe an ideal mathematical training for a future physicist who had already in his possession the fundamentals of calculus, I do not know of any better course of study to advise than the mastery of the two volumes of this *Cours d'Analyse.*

For those familiar with other writings of Hadamard it is perhaps needless to add that from the standpoint of exposition the work lives up to the best traditions of the long series of French works appearing under the titles *Traité d'Analyse* or *Cours d'Analyse.* One cannot say more in the way of recommending a book as a path to the mastery of new domains of mathematical theory. The conscientious student of the present work will find that he has not wasted his time in overcoming unnecessary difficulties, or used it to little advantage in the study of topics of minor importance. One might alter some of the details of the book without disadvantage; but, given the aim of the writer, it is difficult to see how the general plan of the work could be appreciably improved

C. N. MOORE

Einführung in die Theorie der zähen Flüssigkeiten. By Wilhelm Müller. Leipzig, Akademische Verlagsgesellschaft, 1932. 367 pp.

Owing largely to the work of Prandtl, Oseen, and Zeilon the motion of a viscous fluid is now being studied by approximate methods of solution which require a type of mathematics quite different from that used in the classical theory. The student of hydrodynamics is faced, then, with a situation like that which has arisen in the study of radiation owing to the growth of the quantum theory, and so should welcome this scholarly, abundantly illustrated book in which the author shows a mastery of the many ramifications of his subject.

The potential problems arising in Oseen's theory of the wake are particularly interesting, and a noteworthy inference from the analysis is that the lift of Joukowsky's theory is to be supplemented by a force whose lift and drag components can both be calculated by means of integrals, over the cross-section of the wake, of expressions depending on the wake-function $X(y)$, whose gradient in a transverse direction is a measure of the vorticity. The book closes with a discussion of the stability of a steady motion of a viscous fluid and some general remarks relating to turbulence.

H. BATEMAN