teachers might well note. The applications considered are the ordinary ones,—measurement of the earth, astronomical problems, determining one's position at sea, and the like. The last chapter is a discussion of the work of Möbius on spherical triangles whose sides or angles may be greater than 180°, and of the still further extensions of Study. Any reader of this volume will be impressed with the possibilities of a course in trigonometry.

D. D. LEIB.

Théorie des Nombres. Par E. CAHEN. Tome premier: *Le premier Dégré.* Paris, A. Hermann et Fils, 1914. xii + 408 pp.

THE first ei-ht chapters contain an exposition, mainly following the ideas of Helmholtz, of the definition and properties of integers, the four fundamental operations, divisibility, greatest common divisor and least common multiple, and the theory of fractions. Chapter 9 deals with diophantine equations in one and two unknown quantities, and the euclidean algorithm. Chapters 10 to 12 contain an exhaustive treatment of diophantine equations in any number of unknown quantities, and systems of such equations, preceded by an exposition of the corresponding algebraic theories (determinants and systems of linear equations). Chapters 13 to 16 give the theory of linear substitutions and linear and bilinear forms, the number theoretic case, where the coefficients are integers, being always preceded by an exposition of the corresponding algebraic case, where the coefficients are arbitrary. Chapter 17 is concerned with linear congruences, and chapters 18 to 20 contain the fundamentals of the algebra of matrices, followed by the corresponding number theoretic propositions for matrices with integers as elements. The three last chapters give the decomposition of an integer into prime factors, the properties of Euler's function $\varphi(n)$ and some other number theoretic functions, and some remarks on linear congruences with prime modulus.

Misprints are rather numerous, though seldom misleading, and it is difficult to see why the name of Frobenius should be persistently misspelled; one may also well take exception to the narrow and unusual definition of number theory proposed in the introduction. But these are minor criticisms, and the volume should prove of great value as a text-book, since the exposition is remarkably clear and easy to follow, and illustrated by numerous and well-chosen numerical examples and exercises. Several topics, for instance the arithmetical reduction of bilinear forms, are presented here in a more lucid and accessible form than in any other work known to the reviewer.

T. H. GRONWALL.

Lecons sur la Théorie générale des Surfaces et les Applications géométriques du Calcul infinitésimal. Par GASTON DARBOUX. Première partie: *Généralités. Coordonnées curvilignes. Surfaces minima.* Deuxième édition, revue et augmentée. Paris, Gauthier-Villars, 1914. vii + 618 pp.

AFTER having been out of print for some time, the first volume of Darboux's classical treatise now appears in a second edition. Since the general features of this admirable work are undoubtedly familiar to the majority of the BULLETIN'S readers, it will be sufficient to mention, in this review, the new matter added in the second edition and taken mostly from Darboux's own papers in the *Bulletin des Sciences mathématiques* and the *Comptes rendus*.

In Book I, Chapters 5 and 6 deal with the kinematics of motions dependent on any number of parameters, and the integration of the corresponding total differential equations for the direction cosines. Chapter 7, dealing with the special case of two parameters, brings some new developments regarding the Plücker conoid. Chapter 10 gives a new solution, which is both elementary and elegant, of a problem first proposed and solved by Sophus Lie: to determine all surfaces which can be generated in more than one way by the translation of a rigid curve. It seems, however, to have escaped the notice of the distinguished author that a similar solution has been previously given by Scheffers ("Das Abelsche Theorem und das Liesche Theorem über Translationsflächen," *Acta Mathematica*, volume 28 (1904), pages 65–91).

In Book II, there has been added to Chapter 1 a study of a special conjugate system formed by plane curves, which leads to a class of surfaces applicable on quadric surfaces and discovered by Peterson. Chapter 4 contains an exposition of Gauss's method for the conformal representation of the terrestrial ellipsoid on a sphere, as well as a solution of a problem