Cours de Géométrie Analytique. By Georges Bouligand, with a preface by
E. Cartan. Paris, Librairie Vuibert, 1919. vii + 421 pp.

This book constitutes a second course in the Cartesian geometry of the
plane and of space, freely interspersed with essentials of modern geometry.
After a concise development of rectangular and oblique coordinates and
their application to straight lines and planes, the infinite and the imaginary
elements are introduced. With the basis for projective geometry in
complex space or for any of its sub-geometries thus developed, the author
proceeds to consider some general questions. He first treats miscellaneous
elementary properties of real curves and surfaces in real space. He then
passes on to the discussion of projective and affine properties of algebraic
curves and surfaces in complex space, developing the ideas of the order of
a curve or a surface and that of one of its points, proving Bezout's theorem,
and devoting some attention to asymptotes and to unicursal curves.
After a brief discussion of loci comes the next major topic, that of trans-
formations. Rigid motions, reflections, and transformations of similitude
are discussed, followed by affine and projective transformations; cross
ratio is introduced and the projective generation of conics and quadrics
developed, involutions are given proper attention and Desargues' theorem
is proved; finally comes the geometry of inversion.

An important phase of this chapter is the stress laid on the distinction
between metric, affine, and projective geometries. Indeed, if the reviewer
were to single out any one motive governing the plan of the book, it would
be this motive. Latent but still decisive in the beginning, when once
introduced it maintains predominance.

One further general concept, that of tangential coordinates, is developed,
and the author then attacks the theory of curves and surfaces of the second
order. With the general equation as the point of departure in each case,
the usual questions of classification, normal forms, various geometric
definitions (of the conics), rulings and circular sections (of the quadrics),
tangential equations, poles and polars, diameters, etc., are discussed; a
separate chapter treats geometrically the intersection of two quadrics.

A supplement of some sixty pages covers the geometrical applications
of determinants, the classification of conics and quadrics on·an analytic
basis, the determination of conics and quadrics under given conditions,
pencils of conics and quadrics, and an introduction to the theory of
invariants.

The differential calculus is freely applied and a modicum of differential
geometry developed. Certain subjècts, whose detailed analytic treatments
are regarded, perhaps unfortunately, by most American geometers as
belonging to analysis, are carefully treated: the implicit function theorem
in connection with a plane curve defined by an implicit equation, and a
thorough analytic theory of envelopes in connection with line coordinates.
On the other hand, the principle of duality is barely mentioned and, though
polar reciprocation with respect to the sphere, $x^2 + y^2 + z^2 + 1 = 0$, is
freely used, the theory of reciprocal polars in general is lightly passed over
and that of general correlations not mentioned.

All in all, however, the author is to be congratulated on his choice of

material; only essentially important topics are treated and these carefully and fully. There are no exercises per se, but the author leaves much in the text to the student and furnishes frequent suggestions for further study. The methods followed are for the most part analytic, but are inspired by a keen geometric insight. The proofs and deductions are concise, rigorous, facile, and in some cases, novel.

The author has followed an established custom in the descriptive, rather than logical, introduction of imaginary elements. This has led here, as frequently, to a lack of proper respect for the eccentricities of the complex domain, resulting in some unguarded, if not inaccurate, statements. It is to be hoped that the time is not far distant, when geometers who feel themselves forced into the complex domain will accord to it a logical and rigorous foundation.

The book makes delightful reading. It should prove of value to advanced students and to teachers of Cartesian and modern geometry in this country.

W. C. Graustein

Applied Calculus. By F. F. P. Bisacre. Glasgow and Bombay, Blackie and Son, Ltd., 1921. xiv + 446 pp.

It is not in general the policy of the Bulletin to review elementary textbooks on the calculus. In the present instance, however, it seems desirable to make an exception and to give a brief notice to Mr. Bisacre's text. It differs in several particulars from the usual elementary textbook. Its avowed intention is to provide an introductory course in the calculus for the use of students in the natural and applied science whose knowledge of mathematics is slight. The author does not presuppose anything beyond elementary algebra, trigonometry, geometry and graphs. In particular no previous course in analytic geometry is presupposed. The first part of the text as far as its selection of material is concerned does not differ very greatly from the ordinary textbook. It is, however, distinguished by a remarkable vividness of presentation. The author uses a quotation from the *Merchant of Venice,* for example, to illustrate the notion of units and large and small quantities, in particular the notion of allowable error, etc. In the latter part of the text, the selection of material, however, differs widely from the conventional. There is a chapter of thirty-two pages on problems in electricity and magnetism, a chapter of twenty-one pages on problems in chemical dynamics and a chapter of sixty-five pages on problems in thermodynamics. The treatment is remarkably accurate and rigorous considering its elementary character. Its interest is further enhanced by biographical notes and portraits of mathematicians who have contributed to the development of the calculus and to the physical theories covered.

It is doubtful whether the book could be advantageously used in courses on the calculus in this country and yet it is not at all clear that some schools of applied science or technology might not find it distinctly available in their work.

J. W. Young