contribution to the teaching of algebra that has yet appeared. Teachers who know our American problem, who are well enough balanced not to be enticed into fields that are certain to resist cultivation at the present time in this country, and who are searching for sane methods of reform, should read the pages which Dr. Nunn has here written with such care and erudition, and with such force and clearness.

DAVID EUGENE SMITH.

Syllabus of Mathematics. A symposium compiled by the Committee on the Teaching of Mathematics to Students of Engineering. Published by the Society for the Promotion of Engineering Education, Ithaca, N. Y., 1912. 136 pp.

THE purpose of this syllabus is to collect those principles and methods of mathematics which should constitute the minimum mathematical equipment of the student of engineering, or "those things for which a student ought never to be obliged to refer to any book—the things which he should have constantly at his fingers' ends." The book contains separate syllabi on elementary algebra (14 pages), elementary geometry and mensuration (7 pages), plane trigonometry (19 pages), analytic geometry (28 pages), differential and integral calculus (44 pages), and complex quantities (3 pages) together with a report of the discussion of these syllabi at the Pittsburgh meeting of the Society (14 pages).

Such syllabi will be of great value to students or teachers who wish to review the essentials of elementary mathematics courses. They will especially aid those students who end courses without proper perspectives. However, some may see danger of low standards in so much stress upon the *minimum* mathematical equipment of an engineer. The ideal of the committee is hardly realized, for few engineers "know by heart" and never need to "look up in a book" all the material in these syllabi. While admitting the value of such synopses of minimum essentials, yet as pointed out in one discussion (page 126), there is also need for lists of *all* the topics and principles that should be included in mathematics courses for engineers since there is some danger of too little rather than too great mathematical equipment.

Only few illustrative problems appear. A valuable supplement would be two sets of problems; one set giving an illustrative problem corresponding to each principle; the

other set giving problems without specifying the particular principles involved. The committee is firmly of the opinion that the principal part of the engineering mathematics course should be problems worked by the students.

When the important principles of elementary algebra may be summed up in fourteen pages, it is surprising to find such universal weakness in algebra among our college students. In addition to the usual topics of algebra are found logarithms, inequalities, and the progressions. The part on exponents would be clearer to students if accompanied by translated word forms, for the full meaning of symbolic statements is often missed. Under neither algebra nor trigonometry is the distinction between equations and identities given. The operations which introduce or take out roots of an equation are not sufficiently brought out. An ingenious form for solving simultaneous linear equations is given.

Under geometry and mensuration we find properties of right and oblique triangles, angles in a circle, proportion of similar figures, area, volume and surface formulas, Cavalieri's theorem, theorems of Guldin or Pappus, and the prismoidal formula all given in seven pages.

The usual topics in trigonometry are given with commendable emphasis placed upon the sine, cosine, and tangent, thus making the other functions secondary. Line functions and graphic methods of remembering certain relations are prominent. The form of generalizing the definitions of the functions for any angle is to be commended.

Most of the part on analytic geometry is devoted to the conic sections. There is not sufficient emphasis placed upon methods of finding the equation when the locus is defined. Under neither algebra nor analytic geometry do we find sufficient treatment given to plotting and locating roots of numerical equations of higher degree; such theory as that usually given under the topic "theory of equations" in college algebra seems entirely missing. The part given to surfaces of the second degree is too condensed to be worth much. The part on the general equation of the second degree might well be condensed or even omitted in a syllabus giving only that which one "should have constantly at his fingers' ends."

The first section on the calculus is a good summary of functions and their graphic representation. In the definition of

function it would be better to emphasize the notion of *correspondence* rather than dependence. Graphs of the elementary functions are given and a short treatment of fitting functions to empirical data is included. In many places the notion of a limit is used but nowhere is limit defined. The fundamental relations of increments, derivatives and differentials are well presented. We are glad to find theorems on infinitesimals which are needed in setting up problems and which are frequently neglected when the calculus is approached from the standpoint of limits.

The part on differential equations seems too short. Integration by partial fractions is omitted. An illustrative problem would have emphasized the importance of the constant of integration. Some illustrations of the use of the definite integral are needed to make plausible their statement that "The concept of the definite integral is the most useful concept in the application of the calculus."

The promised parts on "Functions of Two or More Variables," "Numerical Computation," and on "Elementary Dynamics" have not yet appeared so far as the reviewer is aware.

ERNEST B. LYTLE.

Einführung in die höhere Mathematik. By HANS VON MANGOLDT. Vol. I: *Anfangsgründe der Infinitesimalrechnung und der analytischen Geometrie.* 1911. xiv+477 pp. Vol. II: *Differentialrechnung.* 1912. xi+566 pp. Vol. III: *Integralrechnung.* 1914. x+485 pp. Leipzig, S. Hirzel.

THE volumes before us constitute an important contribution toward the solution of a problem which is of great concern to the majority of teachers of mathematics. That problem has to do with the amount and arrangement of the mathematical methods to be included in courses for students of physics and of engineering. We are of course agreed that there must be included the analytical geometry of two and of three dimensions, differential and integral calculus. But though we realize the deficiencies of the traditional college courses in these subjects, we are not well agreed as to the remedy. There are on the one hand those who claim that the student in question need only learn when and how certain formulas should be used, on the other hand those who would teach all mathematical courses merely as if they were an