The book is a collection of problems intended to be useful in the student's future work. The use of such problems the author believes will also correlate the several mathematical subjects among themselves as well as with physics.

The problems are grouped under the following heads: measurement and approximate number, vernier and micrometer calipers, work and power, lever and beams, specific gravity, geometrical constructions with algebraic applications, the use of squared paper, functionality, maximum and minimum values, algebraic solution of geometry problems, logarithms, the slide rule, angle functions, variation, exercises in solid geometry, heat, electricity, and logarithmic paper. In the appendix are tables of unit equivalents, four-place logarithms, and a bibliography of problem sources.

Some problems require the student to obtain his own data by measuring, weighing, etc. Many problems contain two sets of numbers, one set leading to integral results and one involving fractions. The part on numerical calculation and approximation deserves special mention. Necessary definitions and a minimum of theory precede each set of problems. This collection is just such a set of problems as live teachers wish to have at hand for frequent selection of those which may be *real* for their students.

ERNEST B. LYTLE.

Handbuch der angewandten Mathematik. Herausgegeben von H. E. TIMERDING. Berlin and Leipzig, B. G. Teubner.

Vol. 1. *Praktische Analysis.* Von H. v. SANDEN. 1914. 185 pages.

Vol. 2. *Darstellende Geometrie.* Von J. HJELMSLEV. 1914. 320 pages.

ONE or two decades ago there was considerable agitation to have mathematics taught to technical students by engineers rather than by professional mathematicians. The reaction against this tendency, in which the Perry movement played an important part, has been decisive and possibly extreme. Now every reputable technical school in Europe and America has its mathematics taught according to mathematical standards by men trained as mathematicians.

But the engineers had a legitimate grievance; the theoretically trained man was too frequently unable to apply his knowledge to concrete problems. The reason the Perry move-

ment failed was that the theoretical side was largely replaced by empirical procedures, thus making it impossible for the student to take the initiative. All he could do was to follow blindly the rule of thumb.

The present trend seems more much hopeful of a final solution of the difficulty; it consists of an attempt on the part of the mathematician to bridge over the gap by supplementing the theoretic solution with a systematic development of the graphical and numerical work that shall be at once economically feasible, yet sufficiently accurate for the problem at hand. Professor Timerding, the editor, is certainly qualified to speak as a mathematician; his experience at the technical school at Brunswick has enabled him to learn the needs of the engineer, hence we can expect the handbook to contain something worth while. The first volume is prepared by Dr. von Sanden, of the University of Göttingen. Both the book and its author developed under the immediate influence of Professor Runge, while the emphasis given to graphical skill shows the effects of Schilling's activity in the organization of the geometric institute.

The first chapter is concerned with arrangement of numerical calculation; it admonishes against the use of detached notes, and urges to keep every step of each calculation in tabulated form; it points out that a numerical error should show up in an unwarranted roughness in the graphical representation. The theory and the use of the slide-rule are developed in great detail. The treatment of this chapter is fairly typical of the whole plan. The theory is presented with sufficient rigor to satisfy the most exacting critic, yet its application to a wide range of numerical processes is so minutely explained that a reader with patience may soon become skilled in its use. Calculating machines are then treated in the same way. The planimeter, integraph, and harmonic analyzer are simply mentioned.

The chapter on Horner's method is almost exactly the same as the corresponding chapter in an American algebra; almost the same can be said about the chapter on interpolation. In mechanical quadrature, the usual treatment of the trapezoidal rule and Simpson's rule is followed by the more comprehensive method of Gauss.

The second half of the book is devoted more particularly to graphical differentiation and integration, as developed in

Professor Runge's Columbia University Lectures. The remainder in Taylor's series, the forms of trigonometric series, and of series in harmonic functions are treated at length. The discussion of systems of simultaneous equations by means of successive elimination, by least squares, and by the method of Gräffe, emphasize the fact that the ordinary expression of a root as the quotient of two determinants has but little value for numerical purposes. The last two chapters are concerned with the graphical and numerical solution of ordinary differential equations of the first and second orders. The book is supplied with a list of references for further study. The table of contents and clearly arranged subject matter make an index unnecessary.

While there was a distinct need for such a book as that of Dr. von Sanden, especially in Germany, it is necessary to look rather more carefully to discover the need of a new treatise on descriptive geometry. But when we recall that the series of books is to form a handbook for the teacher, to supply the missing step between theory and practice, the purpose is easily seen. The book begins with an unusually long discussion of orthogonal projection on a single plane; numerous applications are given, and the reader becomes familiar with this one dominant process. The next chapter of less than twenty pages is devoted to the double projection of rectilinear figures. It contains all the essential features of the methods of descriptive geometry, as applied to straight lines and planes. Then follows a short introduction to axonometry and cavalier projection. The elements of projective geometry, including homology and the cross-ratio theorems of Pappus and of Desargues, are fully treated, and a fairly full metrical theory of conics is added.

The part on plane curves includes tangent, normal, radius of curvature, evolute, with applications to envelopes, roulettes, and cyclic curves. It is more purely geometric and emphasizes the graphical properties more than most recent books on the subject.

Surfaces of revolution are considered almost exclusively from the standpoint of double projection. A chapter of twenty pages is given to the study of quadric surfaces; it includes center, diametral planes, contour, rectilinear generators, circular sections, and stereographic projection. The study of the space curve begins with the simple arc. The

projection along a bisecant and along a tangent are clearly explained, also from a point in the osculating plane. Cones and developables, together with their curves of intersection, ruled surfaces and helicoids complete the volume.

The presentation is too concise for a first reading, but the volume is not meant for this purpose. It is rather for the teacher who already knows something of the various methods and wishes to know their mutual relations. At the end of each chapter a generous list of books and monographs is given which add greatly to the value of the book. It is a curious fact that not a single American work is mentioned.

VIRGIL SNYDER.

NOTES.

THE December number (volume 16, number 2) of the *Annals of Mathematics* contains the following papers: "A substitute for Duhamel's theorem," by G. A. BLISS; "The points of inflexion of a plane cubic curve," by L. E. DICKSON; "Properties of four confocal parabolas whose vertical tangents form a square," by C. M. HERBERT; "Some remarks on conformal representation," by T. H. GRONWALL; "On the maximum modulus of an analytic function," by T. H. GRONWALL; "Note on the simple difference equation," by J. H. M. WEDDERBURN; "Note on the rank of a symmetrical matrix. II," by J. H. M. WEDDERBURN.

AT the Philadelphia meeting of the American association for the advancement of science Professor W. W. CAMPBELL was elected president, and Dr. L. O. HOWARD was reëlected permanent secretary for a term of five years. Professor A. O. LEUSCHNER was elected vice-president of Section A. The Association will hold a summer meeting at San Francisco, August 2–7, and a winter meeting at Columbus, Ohio, next December. A convocation week meeting will be held in New York City in 1916–1917.

THE Paris academy of sciences announces the following prize problems. The Bordin prize (3,000 fr.) for 1915 for a noteworthy contribution to the theory of curves of constant torsion, in particular of algebraic curves, with special emphasis