SCIENTIFIC BOOKS

RECENT BOOKS ON MATHEMATICS

Memorabilia Mathematica or The Philomath's Quotation-book. By ROBERT EDOUARD MORITZ, Ph.D., Ph.N.D., Professor of Mathematics in the University of Washington. New York, The Macmillan Company. 1914. Pp. vii + 410.

Analytical Geometry of Space. By VIRGIL SNYDER, Ph.D., Professor of Mathematics at Cornell University, and C. H. SISAM, Ph.D., Assistant Professor of Mathematics at the University of Illinois. New York, Henry Holt and Company. 1914. Pp. xi + 285.

Analytic Geometry and Principles of Algebra. By ALEXANDER ZIWET, Professor of Mathematics, the University of Michigan, and LOUIS ALLEN HOPKINS, Instructor in Mathematics, the University of Michigan. New York, The Macmillan Company. 1913. Pp. viii + 369.

Higher Algebra. By HERBERT E. HAWKES, Ph.D., Professor of Mathematics in Columbia University. Boston, Ginn and Company. Pp. iv + 222.

Industrial Mathematics. By HORACE WILMAR MARSH, Head of Department of Mathematics, School of Science and Technology, Pratt Institute, with the collaboration of ANNIE GRISWOLD FORDYCE MARSH. New York, John Wiley and Sons. 1913. Pp. viii + 477.

Trigonometry. By ALFRED MONROE KENYON, Professor of Mathematics, Purdue University, and LOUIS INGOLD, Assistant Professor of Mathematics, the University of Missouri. Edited by EARL RAYMOND HEDRICK. New York, the Macmillan Company. 1913. Pp. xi + 132 + xvii + 124.

Trigonometry for Schools and Colleges. By FREDERIC ANDEREGG, A.M., Professor of Mathematics in Oberlin College, and EDWARD DRAKE ROE, JR., Ph.D., Professor of Mathematics in Syracuse University. Boston, Ginn and Company. Pp. viii + 108.

Advanced Algebra. By Jos. V. COLLINS, Ph.D., Professor of Mathematics, State Normal School, Stevens Point, Wisconsin. New York, American Book Company. 1913. Pp. x + 342.

The Algebra of Logic. By LOUIS COUTURAT. Authorized translation by LYDIA GILLINGHAM ROBINSON, B.A., with a Preface by PHILIP E. B. JOURDAIN, M.A. (Cantab.). 1914. Chicago and London: The Open Court Publishing Company. Pp. xiv + 98.

A History of Japanese Mathematics. By DAVID EUGENE SMITH and YOSHIO MIKAMI. Chicago, The Open Court Publishing Company. 1914. Pp. v + 288.

Thousands of readers will be grateful to the author and the publishers for a work that is so beautiful, both physically and spiritually, as the "Memorabilia." The ideal that requires us to dispense entirely with authority and to hold no beliefs and form no judgments not based on evidence examined by ourselves is not attainable. If it were, it would not be an ideal. In the future it will be necessary, as it has been in the past, for all men and women to depend for the most part upon borrowed estimates. Even if it were not, we should still value as such the opinions of others, especially when expressed in worthy and lasting form. In view of such considerations such an undertaking as that of Professor Moritz is amply justified and especially so because this work of his is the first of its kind in the English language. Nor has he, except in the case of "a small number of famous utterances," duplicated Rebiere's "Mathématiques et Mathematiciens" or the "Scherz und Ernst in der Mathematik" of Ahrens. We have here more than a thousand utterances of more than three hundred authors regarding the nature and value of mathematics. The quotations vary in length from a line to several scores of lines, and all of them are in English. In the case of borrowed translations, the translator's name is given. At the end of each passage there are given the author's name and the source of the extract. An attempt to group the material under heads has resulted in dividing the volume into twenty-one chapters. Moreover, the final index refers to nearly seven hundred topics. The list of authors,

which represents all historic times, includes not only mathematicians but students of natural science, poets, philosophers, statesmen, theologians and historians. In respect of fame these range from the obscure to the world-renowned. Various criteria were used for determining the admissibility of passages, as eminence of the author, fitness of content, felicity of expression. Even Shakespeare contributes three passages and Goethe ten. One of these is: "Mathematics, like dialectics, is an organ of the inner higher sense; in its execution it is an art like eloquence. Both alike care nothing for the content, to both nothing is of value but the form." Gauss contributes 10 passages, Poincaré 5, Plato 9, Emerson 2, Euripides 1, Descartes 11, Newton 7, Leibnitz 8, Laplace 13, Daniel Webster 1, Pliny 1, Dante 2, and so on. It is difficult to imagine that any teacher, student or scholar could fail to find instruction and delight in this book of gems.

Professors Snyder and Sisam's book will meet the demand of those who desire a larger knowledge of the analytical geometry of three dimensions than is afforded by the usual first-course books on analytical geometry and who find such works as those of Salmon and Frost too extensive. The first eight chapters present the usual matter but the remaining six chapters of about 180 pages will serve admirably as a basis for an undergraduate advanced elective in the subject; the main topics here treated being tetrahedral coordinates, quadratic surfaces in tetrahedral coordinates, linear systems of quadrics, transformations of space, curves and surfaces in tetrahedral coordinates, and differential geometry of curves and surfaces. There is appended a list of answers to the exercises. Graduate students should come with such preparation as this book yields.

Among the commendable features of Ziwet and Hopkins's book are the treatment of algebraic topics usually presupposed by or studied simultaneously with first lessons on analytical geometry, the early introduction of the use of determinants, the emphasis upon the straight line and the circle as preliminary loci, the attention given to the plotting of polynomials before attacking the conics, and the employment of the notion of the derivative of polynomials. The doctrine of poles and polars is presented only in relation to the circle. The concept of a vector is introduced in connection with applications to mechanics. The elements of the geometry of space occupy 78 pages. Portions that may be omitted are in small type. Answers are given.

Professor Hawkes's book opens with a chapter of 22 pages devoted to a review extending through linear equations in two variables. Functions and their graphs occupy the next chapter (14 pages). Recognizing that a student who would proceed to analytical geometry, the calculus or the theory of higher equations must gain a thorough knowledge of the quadratic equation, the author has devoted a chapter of 27 pages to this important subject. It is handled admirably. A very brief presentation of inequalities is followed by an excellent chapter on complex numbers. There follows a chapter of 75 pages dealing with elements of the theory of the general equation in one unknown. A notable feature is the presentation of Horner's method. The notion of derivative of a polynomial is introduced. Permutations, combinations and probability claim ten pages, followed by the elements of determinant theory. Then follow chapters on partial fractions, logarithms and infinite series. The book closes with some short tables, and a good index. The work is notably successful in its endeavor to make theory and practise reciprocally helpful.

Mr. Marsh's thick volume contains a mass of information designed to enable "industrial" folk to use mathematics without really studying the subject beyond the initial steps. It begins with arithmetic. After much useful direction in a great variety of mensurations, the solution of simple equations is reached on page 354. Mathematical theory is present in only infinitesimal amounts, sometimes of higher order, whilst practise swells toward the infinite. The reader is told how to do things, even how to solve triangles by use of logarithmic tables. The work will help many who are very ignorant of mathematical science. One

of its possible services is that of awakening in the reader a desire to understand the ghostly theory that lurks behind the practician's rules. I shall never forget how unhappy I was made when a boy by having to learn by heart and to use the rule for computing the area of a triangle in terms of its sides before looking into a geometry and what a burden was rolled off when in subsequent years I learned to deduce the rule. Industrial folk will not find it easy to circumvent the necessity of understanding something of the science they would use. The way of the transgressor is hard.

Among the more notable features of Professor Kenyon and Professor Ingold's "Trigonometry" are the prominence given to the solution of triangles, first by geometric methods, then gradually by means of the trigonometric functions and logarithms; the use of composition and resolution of forces to show the significance of large angles and of addition formulæ; the hinging of the treatment on a minimum of theoretical considerations; the very large number and variety of exercises and applications; the omission of DeMoivre's theorem and of infinite series; the presence of a rather extensive chapter on spherical trigonometry, and the inclusion of 124 pages of convenient tables.

The attractiveness of the admirable little volume of Professors Anderegg and Roe is due partly to its smallness. The smallness is due in some measure to conciseness but mainly to omission of tables, model arithmetical solutions, a list of answers and an index. A large part of the book deals with spherical trigonometry. It is shown that plane trigonometry is a special case of spherical. It is evident that the authors are fascinated with the theory of the subject, and their treatment of it looks up toward higher analysis rather than merely down to practical uses and computation.

As we open Professor Collins's "Advanced Algebra" it is pleasant to be greeted by a genial likeness of Sylvester and, as we pass on, to encounter the pictures of Tartaglia, Cauchy and Gauss, with brief accounts of them. A first-year course is presupposed. The book falls into three parts, devoted respectively to a review, to the remaining topics of elementary algebra, and to such college topics as general equation theory, probability, determinants and infinite series. The author's aim has been to equip the student to meet either of the two algebra standards of the College Entrance Board and to carry him well into college topics.

Many students of modern logic will welcome Miss Robinson's excellent English translation of Dr. Couturat's well-known "L'Algèbre de la logique." This edition is distinctly enhanced by the preface prepared by Mr. Jourdain. Here and now are not the place and time to review the content of a work of which the original French edition was published in 1905. Suffice it to say that it consists of the elements of the classic logic of exclusion and inclusion presented in algebraic garb and that the algebra of logic is not to be confounded with what is known as the logic of mathematics.

From the mathematical public thanks are due Professor Smith, Mr. Mikami and the Open Court Publishing Company for their "History of Japanese Mathematics." Owing to the wellnigh complete insulation of the Japanese until recently from the western world, this first English account of their mathematical work is a real romance in the austere things of the human spirit—almost as fascinating as would be a message from Mars. We confess to having read every line of it with eager and increasing interest. Not only will all liberal students and teachers of mathematics wish to read it but it is rich in material for psychologists, historians and other scientific students. In particular may anthropologists find in it evidence both for and against the thesis that similarity or dissimilarity of circumstances determines similarity or dissimilarity of intellectual developments. Even if space allowed it would be a kind of injustice to delineate the content of this volume here and so deprive the reader of it of the pleasure of meeting its surprises first-hand. Suffice it to say that the numerous beautiful photographic illustrations (made by Mr. L. L. Lock)

are themselves well worth the price of the volume.

Cassius J. Keyser

A Dictionary of Applied Chemistry. By Sir Edward Thorpe. Longmans, Green & Company. 5 vols., 800 pp. each. Price $13.50.

Samuel Johnson, to use his words, "noting whatever might be of use to ascertain or illustrate any word or phrase, accumulated in time the materials of a dictionary." A proper dictionary of chemistry might then well be a collection of whatever information might be of use in ascertaining and illustrating words and phrases of chemical usage. Some such broad foundation was used in the dictionary at hand.

Thorpe's "Dictionary of Applied Chemistry," first published in 1890, has ever since been such a well-known dictionary that a review of this new and enlarged edition need concern only the completeness of the accumulations since then. It is clear that no other English work contains so much information of chemical nature. As it also gives the main references to literature on many subjects, it is difficult to conceive of any improvement which the chemist might fairly expect. There are now five volumes, as against three in 1898. Emerson's reference to dictionaries, in his essay on Books, is particularly fitting when shorn of any points of irony: "Neither is a dictionary a bad book to read. There is no cant in it, no excess of explanation, and it is full of suggestions—the raw material of possible poems and histories." This has all seemed very pertinent to me in reading the "illustrations" of some of the chemical words. "Absorption spectra and chemical composition" has charm and rhythm that must be poetry to every real chemist. The brief accounts of such perennially youthful patriarchs as iron, tungsten, boron, etc., are free from "cant" and "excess," and are powerful new history. The Frash process, by which practically all the sulphur in the United States is now produced, is a very interesting story and particularly to those who know only of the Sicilian sulphur of the older books.

Hardly a single chemical element has been "dead" since the publication of the first edition of this Dictionary, and therefore they all had their history rewritten. Then almost no hydrogen was technically applied, no oxygen manufactured, no aluminum sold. Silicon, tantalum, argon and radium were all practically unheard of.

A great deal had to be written to "illustrate" the words of modern applied chemistry, novelties of the recent period: cryoscopy, cyanamid, monel metal, metallography, etc. This has been well done, and usually by experts. Who, for example, could better describe carbon bisulphide than our own E. R. Taylor, who makes about all that is used in America? The oils, fats, waxes, etc., have been cared for by Lewkowitsch, water by Frankland, potash by Lunge, radioactivity by Bragg, cellulose by Cross, and paper by Bevan, dyes by Perkin, and acetylene by Lewes. Thus scores of the most prominent chemists of all nations have aided the work.

A few more of the indicators used to determine that the work has been brought up to date may well be mentioned. The ancient and interesting "suffoni" are now partly displaced by California mines of colemanite as a source of boric acid. Cement is now burned in rotating kilns of 150 feet length. Oxyhydrogen and oxyacetylene metal cutting are well described. Chemical affinity, equilibria and catalysis are living subjects evidently still being studied at the time of going to press, and they are made comprehensive by articles of breadth. Bordet's and Ehrlich's different views of the interaction of toxins and antitoxins are disclosed. The Claude and the Linde air liquefaction processes and the liquefaction work on hydrogen and helium by Travers and Olszewski are fully described. Four different uses of the word ferrite are described, which ought to militate a little against the use of this word for any other newly discovered material.

Chemical analysis is treated in 100 pages as compared with 57 of the 1898 edition: Azo colors in 38 pages, as against 28; carbohydrates, 24 as against 4; naphthalene, 102, in place of 65; ozone 8 against 2½; rust and corrosion of iron 11 against 2½; spectrum analysis 30