Review

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though it is dressed up so as to look like a piece of commonplace Algebra or Trigonometry.

It is a matter of the greatest surprise that Bow's notation for force-diagrams of framed structures has not been universally adopted in foreign text-books. The confusion produced by the multiplication of arrow heads in the bars of the roof truss on p. 204 seems almost hopeless. The stress-diagram as given by Stephan for this roof is here reproduced, and for comparison the same diagram with Bow's notation. Comment seems superfluous. The struts and

Roof Truss with Stress-diagram.—Bow's Notation.

ties are distinguished by positive and negative signs placed beside the bars of the frame. Stephan, on the other hand, uses thick lines in the force-diagram to denote the struts. If the force-diagram is actually to be used for the measurement of the stresses, this can only lead to faulty results. There would not be the same objection to indicating the corresponding bars of the frame-diagram by thick lines, and, in some ways, this is preferable to using the more usual positive and negative signs. This, however, might be criticised on the score that a bar might be a strut for one system of loading and a tie for another system.

About 200 examples are worked out in the text, many of them showing a pleasing originality and freshness which is sadly to seek in our ordinary school text-books. Nearly all the examples are accompanied by clear diagrams, in which the direction of the acting forces and, in many cases, also the linear dimensions and angles are also given. These diagrams are invaluable: they make mistakes arising from ambiguous or cumbrous expression in the wording of the question almost impossible.

On page 221 is given a graphical Time-table for the trains that run between Furstenwalde and Guben by way of Frankfort (on the Oder), a distance of about 80 kilometres. It is well known that these graphical time-tables are largely employed in railway offices for interpolating special trains and for many other purposes. A great deal of information and instruction may be obtained from the inspection of such a time-table.

The book is one which it is a delight to handle and read, as the print is large and the diagrams excellent. We look forward to the second part, which is to treat of the Mechanics of Liquids, with considerable interest.

R. M. MILNE.

Über eine zeitgemässe Umgestaltung des Mathematischen Unterrichts an den höheren Schulen. By F. KLEIN. Pp. 82. 1904. (Teubner.)

This is a set of five addresses delivered at the Easter vacation course for mathematical and physical schoolmasters at Göttingen in 1904, supplemented by

reprints of four earlier papers. The author pleads hard for the early introduction of the notation of the calculus into the school curriculum. The principles of the calculus have long ago been admitted into the school course, and it is illogical (to say the least of it) to obtain the critical values of a function by "Schellbach's rule" and to discriminate between maxima and minima by "Fermat's rule," when the methods are those of the calculus pure and simple. If a mathematical pupil becomes gradually familiar with the calculus at an early stage of his career, he will not have to experience a "revolution of ideas" later on. Pupils who are to study law, medicine, chemistry, etc., instead of mathematics at the University need the proposed reform still more urgently. They have no time to continue their mathematical studies at the University, and so under the present system are for ever excluded from the more important mathematical developments of their subject. Their only hope is to read some abridged treatise of the *Calculus for Chemists* type, which they can never really understand, since they have had no suitable training at school.

Other reforms are suggested; artificial problems should be excluded, the graphical illustration of simple functions should be taught early, more stress should be laid on the applications of mathematics (especially to physics), and so on. The practical difficulties involved in the change are given a fair discussion, but this part of the book will naturally be of less interest to English readers. H. H.

Plane Trigonometry. By JAMES M. TAYLOR. Pp. 171. 3s. 6d. 1904. (Boston: The Athenæum Press.)

The chief merit of this book is the large number of examples of the "heights and distances" type. These are first introduced at the very beginning of the book, and are well calculated to stimulate a pupil's interest in the subject. Circular measure is postponed till after the solution of oblique triangles, and is followed by a discussion of graphs, limits, complex numbers, etc., which is too brief to be of any value. "Csc A," "Center," "quality of a line" have a rather curious appearance to English eyes. H. H.

Theoretical Geometry for Beginners. Part IV. By C. H. ALLCOCK. Pp. 224. 1s. 6d. 1904. (Macmillan & Co.)

The first half of this book covers Euclid VI., and is well illustrated by an abundant supply of examples of varying difficulty. The latter half supplies a very interesting introduction to the theory of harmonic ranges, poles and polars with respect to a circle, centres of similitude, inversion, maxima and minima treated geometrically, and envelopes. The theory of ranges other than harmonic would be a welcome addition to future editions; the book is sufficiently attractive to make the reader wish for more. H. H.

Elementary Trigonometry. By C. H. P. MAYO. Pp. 204. 1904. (Longmans, Green & Co.)

This book is divided into a practical and a theoretical section. The former begins with a definition of sine, cosine, and tangent applicable to angles of any magnitude and a table of these functions for acute angles. This table is at once applied to the finding of heights and distances and to the solution of oblique triangles by splitting them up into two right-angled triangles. The second section begins with the definition of cosecant, secant, and cotangent, and ends with circular measure and the obtaining of the trigonometrical functions of 30° , 45° , etc. It is a pity that so little stress is laid on the more usual methods of solving triangles. H. H.

Elementary Plane Geometry. By V. M. TURNBULL. Pp. 136. 2s. (Blackie & Son.)

This excellent text-book is based on the report of the Cambridge Syndicate (1903), and is intended for students who have already been through a preliminary course of experimental work. The proofs given are clear and concise, but rigorous: e.g. Euclid I. 5 is proved by folding about the bisector of the vertical angle, but it is first shown that this bisector exists. The whole book is illustrated by a plentiful and well-chosen supply of practical and theoretical exercises. The proofs of the theorems alone are given, the proofs of the constructions being left

to the pupil. The ground covered is that of Euclid I. to VI.; the theorems of Euclid II. are rightly considered as illustrating algebraic formulæ, not as proved by those formulæ. H. H.

Elementary Pure Geometry, with Mensuration. By E. BUDDEN, M.A., B.Sc. (Chambers.) 1904.

Mr. Budden's book is full of interest, but the method of treatment is probably too condensed for due assimilation by a beginner. Moreover, in some cases the proofs are incomplete, thus in obtaining the locus of points (in a plane) equidistant from two given points he proves that all points on the perpendicular bisector satisfy the condition, but does not show that points not on that line fail to satisfy the condition. This same neglect of the second of the two conditions for a complete locus occurs elsewhere, and spoils the logic of proof based on such loci.

Nevertheless, for older students who wish to have all their geometrical mathematics comprised in a single book, and who are able to correct such slips on their own account, the book is likely to be very useful. It is most comprehensive, including the substance of Euclidean Plane and Solid Geometry with extensions to centres of similitude, antiparallels, etc., elementary trigonometry to solution of triangles, harmonic and anharmonic ratios, and other concepts of modern geometry, geometry of conic sections, and mensuration of solids.

The printing is clear, and the collection of examples excellent, and although some of the earlier proofs may be found fault with on the score of rigorousness, the terse vigour of the proofs in general is most remarkable, and in this respect the book will be found invaluable. Mr. Budden's treatment of "ratio" is worthy of minute consideration, as it appears to cover the case of incommensurables with easy naturalness. The book should be in every mathematical library.

A. LODGE.

Mathematical Problem Papers. By E. M. RADFORD. Pp. 203. 1904. (Cambridge University Press.)

This is a collection of one hundred problem papers, each consisting of twelve questions, intended for the use of candidates for entrance scholarships at Cambridge. A large number of the problems are original and the rest have been compiled from various University and College examination papers "other than entrance scholarship papers," so that the work does not enter into competition with the well-known volumes of scholarship papers issued by the University Press.

Indeed what must strike anyone looking through this collection is the unfamiliarity of the great bulk of the questions. Occasionally one comes across a question from the *Educational Times* (lxxxvi., 3), or the *Gazette* (xlix., 7), or Roberts' *Dynamics* (viii., 11), or Besant's *Dynamics* (xlii., 11), or an old Tripos question (xlix., 11). For the most part, however, the old, tried friends of one's youth have quietly dropped out, and their places are filled by strangers of a later generation and of the most uncompromising aspect. Though, of course, there are scattered here and there a few easy questions, the papers, which are graduated in degree of difficulty, proceed from ordinary flagellation to chastisement with scorpions. One might safely predict that any scholarship candidate who had been nurtured upon, and could assimilate, such strong diet as is here provided, would not only be absolutely certain of success, but could also count upon a respectable place in the Tripos. It might be possible to work steadily through the first half of the book (one paper a week) in the year before going up to Cambridge, and to finish the other half during the first year of residence. This, of itself, would almost prove a sufficient problem equipment for the first four days of the Tripos.

The geometrical questions are sometimes peculiar statements of old properties. For instance (xl., 8) "Prove that all parabolas with a given self-conjugate triangle touch four fixed straight lines." The author has evidently followed recent work in the *Gazette* when he gives (xciii., 1) "Prove that the operations of inversion with respect to two circles are commutative only when the circles cut orthogonally." One of H. E. Dudeney's puzzles appears in (xlix., 1) "Given two points in a plane find a compass construction for the mid-point of their join." This little study in stigmatic geometry will well repay attention.