



Review

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tion, distribution, congruence, and continuity, with the "axiom of parallels." The only spatial axioms are Nos. 3-7 in group I., all the rest are either linear or "planar." They show us more than ever the truth of the saying of M. Poincaré: all axioms are but definitions in disguise. But in the present case the disguise is easily pierced. After demonstrating by means of these weapons a particular case of Pascal's Theorem, and the ordinary laws for the theory of plane areas, we come to Desargue's theorem on the intersection of the joins of the homologous vertices of triangles whose homologous sides are parallel. We are shown that it is impossible to prove this theorem without the aid of either the axioms of congruence or of spatial axioms. From a new segmentary calculus based on this theorem we are led to the equation of a straight line, and ultimately to the construction of a Geometry of space. In the German edition the author does not deal with the possibility of discussing a Geometry without the axiom of parallels, or with points as elements coupled with the idea of groups of displacements as in Sophus Lie's "*travaux fondamentaux et féconds*." But a few interesting remarks on the subject have been added to this translation, and of these Prof. Halsted has made use in his review of Manning's Non-Euclidean Geometry, in the *Gazette*, No. 29, p. 94.

(14) The handsome volumes of M. Gournerie on Descriptive Geometry take us back to the days of Chasles and Poncelet. The first edition appeared in three parts from 1860 to 1864. Poncelet alludes to it in his *Traité des propriétés progressives des figures* as the most complete, the most accurate, and "le plus rationnel" of any work on this subject that had as yet appeared. Chasles became its sponsor in a very practical way, by speaking highly of it before the *Académie des Sciences*. The third edition of the third part has been edited by Professor Lebon, of the Lycée Charlemagne, who succeeded the author in his chair in the *Conservatoire des Arts et des Métiers*, and who is, moreover, the author of a large work on the same subject. Among the more interesting features of the part which has just appeared, we may mention the simple and elegant presentation of the theory of Curvature of Surfaces. In this, as well as in the proof of Euler's formula giving the curvature of a normal section, the infinitesimal calculus is not used, the author founding his treatment on Bertrand's Theorem (Salmon, *Geom. of Three Dim.*, p. 265, note). We find Meunier's Theorem (*loc. cit.*, p. 256) applied to the construction of the radii of curvature and the osculating planes of a curve given by its projections. The author follows Dupin's treatment of the lines of curvature of surfaces of the second order. M. Lebon brings the book up to date by notes historical and illustrative.

Differential and Integral Calculus. By E. W. NICHOLS. Pp. xii., 394. 7s. 6d. 1900. (Heath, Boston.)

This is essentially a book for beginners, by which we mean that the author has laboured to present his subject in the clearest and simplest manner, removing "all obscurities and mysteries," and smoothing the path of the student generally. Accordingly there is more explanatory matter than is generally to be found in a book for "the undergraduate courses of our best Universities, colleges, and technical schools." In some ways a book of this type is very useful to the tyro, especially if he be a private student. But there is always the danger that in removing every statement that may cause the student to exercise his wits, we are losing an opportunity of stimulating his attention and cultivating a valuable faculty. Mr. Nichols is to be commended for the skilful way in which the geometrical, mechanical, and electrical applications are worked in throughout the book. The historical notes are concise and to the point. Some twenty pages are given to differential equations. The volume is well bound and printed, and the author's boast that he gives the reader a "clear and open" page is amply justified.

Differential and Integral Calculus for Beginners. By E. EDSEER. Pp. vi. 253. 2s. 6d. 1901. (Nelson.)

Yet another Calculus "adapted to the use of Students of Physics and Mechanics," "shorn of all extraneous difficulties," providing the "physical student with a valuable engine of research," the student finding "no difficulties which cannot be overcome by application and perseverance"! Assuming on

the part of the reader only an elementary knowledge of Algebra and Geometry, the author proceeds at once to initiate him into the mysteries of co-ordinate geometry and of circular and potential functions. The proofs of trigonometrical formulæ required are relegated to an appendix. The differentiation of simple and complex functions occupy pp. 27-53; then follow two chapters on maxima and minima and expansions of functions. Two chapters on integration lead up to applications to geometrical, mechanical, and physical problems. Double and triple integrations and easy differential equations bring the book to a close. The treatment is throughout clear and simple; in fact, many of the problems are worked out with almost unnecessary detail of development. For instance, the moment of inertia of an ellipsoid drags through $2\frac{1}{2}$ pages, and requires neither "application" nor "perseverance" to follow its course. But, no doubt, this is quite necessary with students whose mathematical equipment is limited in character. We notice a curious mistake on page 101. Here the author brings the mean ordinate to $y = a \sin bx$ into relation with the maximum of alternating electric currents. He seems to think that "the maximum current is a little greater than $1\frac{1}{2}$ times the average current." A reference to Everett (Deschanel, part iii., p. 176) will show that this cannot be true. Has the author confused square root of mean square into mathematical mean?

The Elements of Hydrostatics. By S. L. LONEY, M.A. Pp. x. 248. 4s. 6d. (Cambridge University Press.)

The peculiar characteristics of Mr. Loney's works are so familiar to most teachers that it is unnecessary to dwell on them here. Suffice it to say that the *Hydrostatics* is no exception to the rule. The chapter on Centres of Pressure strikes us as more complete than is usually the case in an elementary work. The valves in the Condenser (p. 180) might be more convincing. Why not have substituted for this picture a simple machine in daily use such as the bicycle pump? (cf. Greenhill's *Hydrostatics*, p. 374). The sections dealing with curves of buoyancy and tensions of vessels are as simple as is necessary for ordinary students. We think that some definite reasons should be given why the theory of Hydrostatics here laid down should be even remotely applicable to other than the "perfect liquid," and that, in general, more illustrative matter is advisable referring to the machines in daily use. It is really remarkable how differently a student works at theories which have obvious practical applications. We *must* be wrong if we neglect any method likely to convince the pupil of the practical value and relevance of his investigations.

Eléments de Mathématiques Supérieures à l'usage des Physiciens, Chimistes et Ingénieurs, et des élèves des Facultés des Sciences. By H. VOGT. Pp. vii., 619. 10 fr. 1901. (Nony, Paris.)

Nancy is one of the few Universities in Europe where the study of Physics and Chemistry is so well organised that students can avail themselves of the services of a Professor of Mathematics to unveil those mysteries of his science which are indispensable to their course of instruction. This book contains about fifty chapters, each about the length of a lecture, beginning with equations containing two unknowns, and ending with linear differential equations. From easy determinants, the binomial theorem, surds and indices, the author proceeds to the discussion of the doctrine of series, prefacing his remarks on series by generalities on limits. The usual rules on convergence, etc., are followed by a detailed account of method of approximation to the sum of a series. Logarithms and the exponential theorem complete the section devoted to Algebra, with the exception of the few notes on elimination and series at the end of the book. Analytical Geometry is introduced by general ideas on units, etc., the examples being derived from Geometry, Mechanics, and Physics. Then come co-ordinates and the representation of lines and surfaces by means of equations. Elementary Differential Calculus with its geometrical applications leads up to the Integral, which is carried as far as the theorems of Ostrogradsky, Stokes, and Green. The book closes with some two hundred exercises on all the sections. This rapid summary will give an idea of the ground covered by these lectures, and as they have been "professed" by the author for several years, they no doubt represent the minimum that is required by those who wish to have at their disposal in the shortest possible period a mathematical armoury for prac-