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Review

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disappear in a second edition. The next volume will deal with equations, which according to the parameter involved represent either algebraical or transcendental curves—parabolas and hyperbolas of any order, cycloidal curves, and the like. Two chapters will be devoted to *gauche* curves, and one to the theory of Poinso't's polhode and herpolhode. The book will be a perfect storehouse of material for examination questions on the applications of the calculus to analytical geometry.

**Cœuvres de Charles Hermite, publiées sous les Auspices de l'Académie des Sciences.** Par EMILE PICARD. Vol. II. Pp. 520. (Gauthier-Villars, 1908.)

As in the first volume, M. Picard has arranged the contents in chronological order. The memoirs date from 1858 to 1872. In 1856 Hermite had been admitted to the Institute, and six years later a chair was created for him at the Ecole Normale. As we all know he was afterwards appointed through the influence of Pasteur to the Ecole Polytechnique, and eventually, in 1869, succeeded Duhamel as Professor of Analysis at the Sorbonne. The memoirs in the present volume are the outcome of his labours during the years when perhaps his fertility was greatest. Fifteen years before, he had written to Jacobi, a letter of a few pages, which placed him, then barely twenty years of age, among the finest analysts of Europe. The letter, it may be added, dealt with a question in connection with hyper-elliptical functions. His special interests for the next twenty years lay in the domain of pure number and, in spite of the inconveniences attending physical frailty, his power of invention was now at its highest. He took his place with Sylvester and Cayley in the creation of the theory of algebraical forms, he wrote his great memoir on the equation of the fifth degree, and he discovered the properties of the modular function, and the nature of modular equations, with their application to the theory of elliptic functions. M. Bourget has borne the lion's share in the editing of the memoir on the equation of the fifth degree for the present volume, having fully revised and checked the whole of the calculations. Many other questions of absorbing interest are dealt with in the present volume, and are striking enough if merely as illustrating the width of Hermite's attainment and the elegance of his methods. We hope that as soon as the last of these volumes is published, this worthy monument to one of the greatest names on the roll of French mathematicians will be crowned by at least a selection from his correspondence. For in the letters he wrote and received we would see adequately reflected the mathematical life of Europe almost from the times of Gauss, Cauchy, Jacobi and Dirichlet to that fatal day when stern Death laid his icy finger on one of the best and purest of men. We had almost forgotten to add that an additional interest attaches to Vol. iv., in that it contains an excellent portrait of Hermite at the age of fifty or thereabouts.

**Vorlesungen über Geschichte der Mathematik.** By MORITZ CANTOR. Vol. I. Third Edition. Pp. vi, 941. (From the earliest times to 1200 B.C.) Vol. II. Pp. vi, 1113. (1759-1799.)

It is fifteen years since the second edition of the first volume of Cantor's *Vorlesungen* made its appearance, and last year a third edition was called for. After the completion of Vol. iii., which brought this monumental work up to 1758, the author felt that the time had come when the claims of advancing years were strong enough to force him to leave the completion of his *magnum opus* to others. He must have felt that he had not lived in vain and that an historical school worthy of German traditions had grown up around him, when, inspired by his example and enthusiasm, men were found able and eager to continue his great work under his direction. We are unfortunate in that the health of the aged savant has prevented him from giving that full personal supervision which is so essential in securing a general unity of treatment when the mathematical labours of half a century are divided among so many hands, however individually competent they may be. And when we say that no less than nine monographs by nine men constitute this fourth volume, it is not surprising to find, that although there is less diversity of treatment than might

be expected, yet the volume is not what it would have been had Cantor been able to continue his colossal task. As it is, he had intended to append to this portion of the work a general treatment of the progress of mathematics during the latter part of the eighteenth century. We are, however, disappointed at the absence of what would of course have been a masterly survey of the development of ideas in that period, and greatly regret that the plan had to be abandoned. The greatest mathematical historiographer found himself compelled to be content with a chronological index. Even so, it is one of the most useful features in the book. His *Überblick* gives a mass of information in a couple of dozen pages, fortified with ample cross references to the sections of this volume. Dr. Günther was entrusted with the purely historical section. Under this heading we have accounts of works dealing with the history of the subject, monographs on its various branches, dictionaries, and editions of the works of classical authors. Arithmetic, the Theory of Equations, and the Theory of Numbers fell to the lot of Fl. Cajori. Netto of Giessen writes on Permutations and Combinations, the Theory of Probability, and on Imaginary Series. Elementary Geometry, Mensuration, etc., and the doctrine of parallels as it stood in this period are undertaken by Bobynin. The additions to Trigonometry made by Euler and his contemporaries, with what is called Polygonometry, Polyhedrometry and Cyclometry are adequately dealt with by Braunnmühl. Analytical Geometry of the Plane and Space is admirably handled by Kommerell, while Gino Loria is quite at home in his treatment of Perspective and the golden age of Descriptive Geometry. The calculus forms, as might be expected, one of the longest of the monographs, forming about one-fifth of the book. This was Vivanti's share in the work, while Differential Equations and the Calculus of Variations fell to C. R. Wallner. When we remember that we have now got to the days when most of the Bernoullis, Bezout, Condorcet, d'Alembert, Arbogast, Euler, Lagrange, Lambert, Laplace, Carnot, Legendre, Monge, etc., were alive, it may be surmised that the mathematician will find this volume as full of good things as the proverbial egg is of meat. And so it is.

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#### ERRATA.

P. 323, l. 3 up, should read—"The correspondence of single operands to the sets of operands or of sets . . ."

P. 325. The last sentence should read—"By a cube root of one ought strictly to be meant *any* treposition, and not *only* such an expression as  $\frac{-1+\sqrt{-3}}{2}$ ."

P. 326. In paragraphs 3, 4, 5, for  $ux$  read  $ux^p$ .

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#### BOOKS, ETC., RECEIVED.

*The Progress Report of the Indian Mathematical Club.* No. 7. Oct. 15. 1908.  
*On the Cardioid.* R. P. PARANJPEE. *The Nine-Point Circle.* M. T. NARANIENGAR. *Questions and Solutions.*

*American Journal of Mathematics.* Edited by F. MORLEY. Vol. XXX. No. 4. Oct. 1908.

*On a Group of Transformations which occurs in the Problem of Several Bodies.* E. O. LOVETT.  
*Normal Curves of Genus 6, and their Groups of Birational Transformation.* V. SNYDER. *On the Range of Birational Transformation of Curves of Genus greater than the Canonical Form.* V. SNYDER.  
*A Set of Assumptions for Projection Geometry.* O. VIBLEN and J. W. YOUNG. *On the Pantastroid.* R. P. STEPHENS. *A Table of the Values of m corresponding to given Values of Euler's  $\phi$ -function of m up to  $\phi(m)=1000$ .*

*Die Elemente der Mathematik.* By E. BOREL. Translated by P. STÄCKEL. Vol. I. *Arithmetik und Algebra.* Pp. xvi, 431. 8 m. 60. 1908. (Teubner, Leipzig.)