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The Theory of Determinants in the Historical Order of Developments.

By SIR THOMAS MUIR, C.M.G. Vol. III. The Period 1861-1880. Pp. xxvi + 503. 35s. 1920. (Macmillan.)

The author is to be warmly congratulated on having brought his monumental work to within a measurable distance of completion. We who sit at home at ease, within reach of great libraries, will find it difficult to realise how far distance from the means of reference handicaps a writer and lengthens the task involved in such a work as this. On his rare visits to England he has not always been able to discover, save by multitudinous enquiries or by a happy chance, where complete or partial sets of this or that continental periodical are to be found, although the catalogue published by the Mathematical Association must have made his task the easier. To have brought up the subject through another couple of decades, and that while preoccupied by the work of the high post he holds in South Africa, in the atmosphere created during a great war, and in spite of personal loss, shows a spirit of devotion and fortitude which we cannot but admire. We learn from the preface that the last volume, bringing the record up to the end of the nineteenth century, was nearly complete in manuscript two years ago.

Those who have not had the privilege of consulting the preceding volumes must be reminded that not the least valuable part of the author's labours is in the running critical analysis of every book and memoir recorded—and that these reveal an unequalled mastery of the subject and its history. The prominence given to the subject during the period is shown by the appearance of no less than sixty text-books. Among the earliest of these is the Treatise by C. L. Dodgson, succinctly characterised as "a text-book quite unlike all its predecessors," not because it retains any of the flavour of *Alice in Wonderland*, published a couple of years before, but because "professedly its main aim is logical exactitude." The year before the same versatile writer had published a very interesting condensation-process for the evaluation of determinants, whose elements are arithmetical. Sir Thomas Muir points out that applying Dodgson's rule to a determinant with general elements the process is better understood, and we obtain the necessary justification for its use. There is not a page in the book from which the student will not have occasion to bless his stars that Sir Thomas was not content to be a mere reporter.

The Early Mathematical Manuscripts of Leibniz. Translated from the Latin Texts published by Carl Immanuel Gerhardt, with Critical and Historical Notes. By J. M. CHILD. Pp. vi + 238. 7s. 6d. net. 1920. (Open Court Publishing Co.)

It was a happy thought of the late English editor of the *Monist* to pay a tribute to the memory of Leibniz, the greatest general scholar of his time, upon the occasion of the two hundredth anniversary of his death. The translation we have here before us appeared in sections from 1916 onwards, and are here gathered together in a convenient form with a full apparatus of notes, critical and historical, bibliography, etc. No one would envy Gerhardt the task he undertook when he published in the late forties the famous collection of holographs preserved with religious care in the Royal Library of Hanover. It has been well said that no man ever wrote with more care, no man ever blotted and altered and copied more than Leibniz. In the great collection, for instance, there were cases in which he had written a letter three times over, and finally amended it so much as to be obliged to give it to his secretary to make the last copy. One would imagine that the subject of so much thought must have been of the highest importance, but this sort of thing would occur in matters of little moment. Still, Leibniz was one of those men who could find time for everything, and this may have been one of the reasons why he surpassed his greater rival in the extent and variety of his acquirements.

The late Mr. P. E. B. Jourdain's choice of Mr. Child was justified. The interest of the papers here translated largely lies in the extent to which they satisfy the quest for the earliest date at which traces are to be found of the great ideas with which the name of the writer is associated, and for the gradual

appearance of signs of the influence upon Leibniz of the mathematical ideas of Isaac Barrow. Mr. Child came fresh to his study of these papers from an exhaustive examination of the mathematical works of Newton's great predecessor. He at once recognised the obligations of the younger student to the English master. To Barrow, Leibniz owed "everything but his methods." Leibniz took up Descartes, laid him down, just as Newton laid aside *The Elements*. He resumed his study of the great Frenchman, and applied the Cartesian geometry to the theorems of Barrow; meanwhile his own notation began to develop. The operational calculus began to take form. The critical and historical notes in this volume display complete familiarity with the great controversy which raged around the notorious *Commercium Epistolicum*. Finally Mr. Child is forced to the conclusion that "Leibniz was in no way indebted to Newton for anything," and that "he was under no obligation to Barrow for his methods." The translation runs smoothly, and a useful and necessary piece of historical work has been done. The prevailing characteristic of the commentary is one of intense enthusiasm, and at times one almost feels that the writer can scarcely refrain from regarding his own hypotheses as proven facts. But on the whole there are very few slips, and the only fault that we have to find with this interesting volume lies in those places wherein his excitement and anxiety to press home his point, the author indulges in colloquialisms which are unusual in works of this type.

Euvres Completes de Christiaan Huygens. Publiées par la Société Hollandaise des Sciences. Vol. XIV. Calcul des Probabilités, Travaux de Mathématiques, 1655-1666. Pp. 556. N.p. 1920. (Nijhoff, La Haye.)

One third of this volume is given up to Huygens' work on Probabilities. The papers between 1655 and 1659 deal with problems and theorems of Arithmetic, Stereometry, and Analytical Geometry, work on the Theory of Numbers, including papers on the Pellian Equation; rectification of the parabola, quadratures of the curved surfaces of the three conoids; areas of curves, volumes of solids of revolution, centres of gravity; the cycloid; evolutes. Some of the mathematical results obtained by Huygens, and never published by himself, were added to the Commentaries of van Schooten on the *Geometria* of Descartes (1649 and 1659). These fill about sixteen pages. Finally the papers between 1661 and 1666 deal with logarithms and the logarithmic curve, quadrature of the hyperbola by logarithms with application to the height of the barometric column; the construction of the regular heptagon; constructions for tangents to algebraic curves, and for the diameter of a spherical surface; researches on cubics; calculation of the smallest number which divided by given numbers leaves given remainders. We shall be grateful to any reader who is familiar with the astronomical volumes of this collected edition for a reference to the passage where Huygens speaks of an afternoon observation as taken "après-dîner."

Elementary Algebra. By C. V. DURELL and G. W. PALMER. Part I. Pp. xxxi + 256 + xlv. With Introduction and complete set of Answers. 4s. 6d. Without Introduction, and with Answers to Questions where intermediate work is required (with perforated pages). 3s. 6d. 1920. (Bell & Sons.)

After using this little book for some months we have come to the conclusion that it is nearer the ideal book for beginners than any we have yet seen. Prominence is given to oral work, there is a reduction to a minimum of the usual "talk," the constant attention is paid throughout to the hundred and one minutiae which, if properly attended to at an early stage, lead to clearness of thinking, correctness, and even elegance of expression. All the familiar traps are here. Every master will recognise at once the good qualities of the book, and we know of nothing better to place in the hands of a private student. A boy who has worked it through will have a sound knowledge of the subject up to quadratics, and will be able to apply his powers to the problems that meet us in every-day life. There are good sets of revision papers, and, what is not often found in a book for beginners, a glossary.