SHORTER NOTICES.

The Theory of Determinants in the Historical Order of Development. Volume II: *The period* 1841 *to* 1860. By THOMAS MUIR, Superintendent-General of Education in Cape Colony. London, Macmillan and Company, 1911. xvi + 475 pp.

THE general arrangement of the present volume is similar to that of volume I, which appeared in 1906 and was reviewed in the BULLETIN, volume 13 (1907), page 244. It is composed, mainly, of a list of books and articles which appeared during the twenty years from 1841 to 1860, and of brief remarks on their contents. A chapter is assigned to each of the following thirteen special forms: axisymmetric determinants, alternants, compound determinants, recurrents, Wronskians, Jacobians, skew determinants, orthogonants, persymmetric determinants, bigradients, Hessians, circulants, and continuants. The last chapter deals with less common forms,—including permanents, determinants with complex elements, determinants connected with anharmonic ratios, and Sylvester's unisignant.

The first two chapters of the book are devoted to determinants in general, and cover 108 pages. In the chapter on continuants the author has gone beyond the limits to which he confined himself in the other parts, by pursuing this subject up to 1870. Articles and books which relate to different forms are considered under each of the forms with which they have direct contact, and hence the same work is often listed and considered in a number of different chapters. The book closes with a list of the 87 different authors "whose writings are reported on," but there is no subject index. Such an index would have been especially useful in view of the large number of different terms employed by the various authors whose writings are considered.

It was more than thirty years ago that Muir began the collection of the material which has served as a basis for the present work, and his extensive lists of writings on determinants, which have appeared in the *Quarterly Journal of Mathematics*, volumes 18, 21, and 36, are well known. Hence one does not expect to find many omissions in a work relating to the comparatively short period considered in the present

volume. It seems, however, that a history of determinants during this period should not fail to mention Weierstrass—especially his article which appeared in 1858 in the Berliner *Berichte.** In the history of Hermitian determinants (page 449) reference should also have been made to the articles by Hermite which appeared in volume 47, page 345, and in volume 53, page 183, of *Crelle.*

What appears to the reviewer as the most serious defect in the present work results from the fact that the chronological arrangement of the articles is frequently based solely on the dates printed at the end of the articles, without any reference to the date of publication. For instance, Spottiswoode's memoir entitled "Elementary theorems relating to determinants, second edition," which appeared in *Crelle* in 1856, is classed with the papers which appeared in 1853. The unreliability of the dates at the end of articles was discussed by Eneström in the *Bibliotheca Mathematica,* volume 5 (1904), page 196; and, in this instance, Eneström seems to agree with Cantor's dictum, "da die Geschichte unwiderruflich die Veröffentlichungszeit als allein massgebend betrachten muss, wo Erstlingsrechte zu vergeben sind . . ."† It seems to the reviewer that there is a growing tendency to omit dates at the end of articles and he believes that this is desirable.

Among the few minor errors which the reviewer has noticed is one on page 206 relating to the date of an article by Bazin, entitled "Sur une question relative aux déterminants," which appeared in *Liouville,* volume 16 (1851). This article is classed in the present volume with those of 1854 and the date assigned to it is April, 1854. The number of minor errors seems, however, small; and, while the reviewer does not consider the present volume to be as complete and useful as volume I, yet it must be regarded as an important addition to the literature on determinants, and it involves a large amount of interesting information in a fairly convenient form. The fact that its author is continuing his mathematical work notwithstanding his administrative duties is an element of inspiration.

G. A. MILLER.

* Cf. Pascal's Repertorium, vol. 1 (1910), p. 66.

† Cantor, Vorlesungen über Geschichte der Mathematik, second edition, vol. 2 (1900), p. 811.