remained in use as late as the seventeenth century. Von Braunmühl traces the beginning of the graphic treatment of spherical triangles back to Anaximander, but suspects that these graphic processes are much older, that they were known to the Egyptian and possibly also to the Chaldean astronomers.

The graphic method of solving spherical triangles is the oldest trigonometric *method* known to us. Ptolemaeus gives graphic processes in which *sine* is used, but curiously enough, in all trigonometric computation he employs instead *the chord of double the arc*. This anomaly finds its explanation in the fact that the Greeks treated the graphic solutions and the numerical solutions apart from each other; it remained for the Hindus and Arabs to unite the two methods and to recognize the advantage, in all cases, of using half the chord in place of the whole chord.

We have noticed no errors of importance. On page 88 the date of Alcuin's birth is given as 736. The same date occurs in Felix Müller's *Zeittafeln*, but the correct date is uncertain; it is probably 735. Snellius's baptismal name is spelled on page 70 *Willebrod*, in other places it is given correctly as *Willebrord*. FLORIAN CAJORI.

Histoire des Mathématiques. Par JACQUES BOYER. Illustrée de fac-similés de manuscrits et de portraits. Georges Carré et C. Naud, Éditeurs. Paris, 1900. 250 pp.

ON opening this book the reader is attracted by several facsimile reproductions from old mathematical books or documents and by a number of portraits of mathematicians. Thus he has before him a facsimile of part of the Egyptian Akhmim papyrus, of the title page of the Acta Eruditorum, of a page of Euclid's Elements, from a manuscript preserved in the Bibliothèque Nationale of Paris. There are nineteen portraits of mathematicians. The list comprises eleven Frenchmen, three Englishmen, two Germans, two Russians, and one Swiss. Two likenesses are of women, namely, of Mme. Du Chatelet and Mme. Kovalevski.

To write a general history of mathematics and confine it, as M. Boyer does, to the small compass of 247 pages is no easy task. Anything like completeness cannot be looked for. Perhaps all one can expect is that the information offered be accurate, that the broad movements in mathematical thought be brought before the reader and that the narrative be made attractive so as to invite more thorough study in larger treatises. In this last respect we think that

M. Boyer has done well; but in the other two his success is not always so evident.

As a rule the information is up to date and the facts are accurately presented. In the case of Mme. Kovalevski he puts us on our guard against the usual 1853 as the date of her birth, and gives it correctly as 1850. In some places the author fails to embody recent results of historical research. He mentions Argand on the graphic representation of the imaginary, but says nothing of Wessel; he does not mention Taurinus in connection with Gauss, Lobachevski and the Bolyais; the native place of Serenus is given as Antissa, but according to Heiberg it should be Antinoeia. M. Boyer refers to the question whether or not "the physical space of our experience" is that of Lobachevski and then says: "Peirce conclut par l'affirmative en se basant sur de délicates observations des parallaxes d'étoiles fixes." By the reference given in the alphabetical index this remark is attributed to Benjamin Peirce, but this is probably an error, for it was Mr. Charles S. Peirce who once maintained that he had demonstrated the above.

M. Boyer has failed to emphasize that, according to recent study of Arabic manuscripts, Nasîr Eddin and other Arabs had really developed trigonometry to a much fuller extent than was formerly supposed. We were rather surprised to find no reference whatever to such original workers in algebra as D. F. Gregory, George Peacock, and George Boole, while an eighteenth century English algebraist of lesser note is not only mentioned but also honored with a portrait. The author has signally failed in setting before the reader a view of the development of theories. For instance, nothing worthy of notice is given on the growth of the theory of limits, or the gradual extension of the number concept. No matter how inadequate the space may be for recent history, it would seem as if the broad fact should be presented that at the beginning of the nineteenth century mathematics had no adequate logical foundation, and that Gauss, Abel, and Cauchy were compelled to begin to build anew on firmer ground. The alphabetical index is inaccurate and incomplete.

Notwithstanding these defects the book will be useful in attracting students to the study of the history of mathematics and making them acquainted with the names and some of the achievements of great mathematicians.

FLORIAN CAJORI.