

naturally to the problem of determining orbits, which has received a new and admirably clear treatment, and is now placed in its logical order as an illustration of the application of the preceding theory. Even so, the fourth chapter, which deals with attractions, seems to some extent out of place, as it interrupts the study of those parts of the subject which depend essentially on particle dynamics. An interesting chapter on the problem of three bodies leads up to the final section of the book, in which the subject of perturbations is discussed both geometrically and analytically. These two methods will scarcely appeal with equal force to the same class of student.

The book is probably better adapted to the requirements of the American than of the English student. In this country it would be assumed that a reader who was capable of really profiting by the last chapter, for example, must have a considerable mathematical equipment. One would therefore expect a more thorough treatment of some points for which room might be found by omitting some of the more elementary explanations. In America, on the other hand, there is more chance of appealing to some immature but keen student who will be induced to pursue his studies further.

Numerous examples are given, and an index. An excellent feature is to be remarked in the historical and bibliographical notes. With the dictum that Galileo was a man of greater genius than Kepler we are tempted to disagree profoundly; but when genius runs in such distinct moulds, who is to decide? H. C. P.

#### OUR BOOKSHELF.

*The Practice of Navigation and Nautical Astronomy.* By Lieut. H. Raper. Twentieth edition. Pp. xxv+934. (London: J. D. Potter, 1914.) n.p.

IT is possible to keep the most valuable educational treatise too long before the public; methods grow obsolete with lapse of time and in altered conditions, but later editors, fettered by the spell of tradition, fail to use the pruning knife with sufficient freedom. As a pioneer instructor, seventy-five years ago, Raper's work was admirable. He raised the standard of accuracy, he appreciated the necessity of systematising processes, of shortening calculations, and of ensuring correctness in working. Others occupying the more advanced outposts that he made tenable have improved on his methods, benefited by wider experience, and have aimed at greater efficiency. Of course there is nothing wrong in Raper's book; too many critical eyes have examined its principles, and too many practical hands have tested

its usefulness. But accuracy of statement is not all we look for in modern treatises. We expect to find placed at the service of the student all that has been achieved by science, analytical or practical.

Tested by such criteria, the treatise that guided admirably the navigators before the age of steam or of iron and steel built vessels is a little disappointing. In a modern book one would scarcely expect the explanation of Sumner's method of finding a ship's position at sea tucked away in an appendix or limited to a few paragraphs in the text. So far as we can see the student would not suspect that the time-honoured noon sight for latitude, and the morning or afternoon sight for longitude, are but special cases of this most powerful method. The theory of the Sumner Lines of position is so easy to understand, and at the same time is so widely applicable, that it should be made the basis upon which the whole theory of practical navigation depends. Again there is no mention of the desirability of observing time signals sent out by wireless telegraphy, and of the opportunities thus afforded for obtaining accurate Greenwich time. The practical methods suggested by Darwin for deriving improved tidal tables receive but the scantiest mention. These may be slight defects, but we think they indicate the inadvisability of attempting to accommodate an excellent book in its day to the requirements of another generation, possessing enlarged facilities and seeking more scientific instruction.

W. E. P.

*Memorabilia Mathematica, or the Philomath's Quotation Book.* By Prof. R. E. Moritz. Pp. vii+410. (New York: The Macmillan Co., 1914.) Price 12s. 6d. net.

PROF. MORITZ has brought together more than two thousand passages from the writings of mathematicians, philosophers, and others, and has grouped them under twenty heads, as well as indexed them under nearly seven hundred topics. Among the subjects of the groups of passages which make up the chapters of the book are:—the object, nature, value, and teaching of mathematics; study and research; persons and anecdotes; logic, philosophy, and science in relation to mathematics; arithmetic; algebra; geometry; the calculus and allied topics; concepts of time and space; paradoxes and curiosities. All the passages are in English, having been translated when the original extracts were in other languages. Full references are given, so that the originals can be consulted by the inquiring student when desired.

The preparation of such an extensive collection of notable utterances of some of the world's greatest thinkers must have involved enormous labour; and many writers and teachers will be grateful to the author for providing them with this anthology of mathematical philosophy. The extracts are of varying length and merit, but they are all interesting, and the grouping, as well as the index, enable selections upon particular aspects of mathe-