BOOK REVIEW

Vectors and matrices. By C. C. MacDuffee. (Carus Mathematical Monographs, no. 7.) Ithaca, N. Y., Mathematical Association of America, 1943. 11+192 pp. $2.00.

Professor MacDuffee's book is a clear and careful introduction to the theory of vector spaces and matrices. It should prove extremely useful not only to the student of mathematics, but also to the ever increasing circle of other scientists who show an interest in these fields. The more advanced undergraduate student will have no difficulty reading the book. The material is given in easy, almost leisurely steps. The book sets out from familiar facts, formulating the well known aspects in a new manner, gradually approaching new ideas, and almost inadvertently the reader will have become familiarized with the more abstract ways of mathematical thinking. There is, of course, another way of reaching the same aim: to push the reader into the cold waters of mathematical abstraction right away and let him swim around as well as he can. The student who follows Professor MacDuffee's book will not experience a sudden shock of this kind. Unless he ventures out into the last chapter prematurely (and in a footnote he is given permission to do so if he desires), he will learn about the more abstract concepts such as groups with operators, endomorphisms, and rings of endomorphisms only after he has digested the more "concrete" theories of vectors and matrices.

The book starts with a treatment of linear equations. Determinants are avoided at this stage. The author feels that determinants have been vastly overrated and that most parts of the theory of linear equations can be developed much better without determinants. This is a view with which at least most algebraists will concur. Fifty years ago it was a sign of a progressive attitude in a book to use determinants; to-day it is a sign of progressive thinking to avoid determinants as far as possible.

In the second chapter, vector spaces are defined and matrices are introduced, first in a rather formal manner. The reader is made familiar with the concept of rank which is at once made useful for the theory of linear equations. Determinants can now be approached in the next chapter. The author emphasizes the fact that the idea of matrix precedes that of determinant and suggests that to discuss determinants without matrices is like having the feline grin without the Cheshire cat. Determinants are studied as polynomials $d(X)$ in the