

suitable order properties. (7) Pascal's theorem holds only for the usual symmetric forms and in particular requires commutativity (conic sections make a fleeting appearance at this point in the book). (8) Determination of the two-sided ideals in the ring of all linear transformations, there being one for each cardinal number.

There are two generalizations which the author calls to the reader's attention. The first is to replace the vector space by a suitable kind of module over a ring; in a series of papers the author himself has carried this program nearly to completion. The second is to replace the vector space (implicitly paired to its full dual) by an arbitrary pair of dual vector spaces; here there has been substantial work by Mackey and Rickart. Further in the distance lies the project of uniting these two generalizations by studying dual modules. In yet a different direction lie the still largely mysterious rings and lattices without minimal elements, typified by von Neumann's continuous geometry. So there is much to be done; and the coming generations of young algebraists, with this book happily tucked under their arms, will find the path well laid out.

#### I. KAPLANSKY

*Calculus of variations with applications to physics and engineering.* By Robert Weinstock. New York, McGraw-Hill, 1952. 10+326 pp. \$6.50.

This book, which appears in the International Series in Pure and Applied Mathematics, has been written to fill the need for an elementary introduction to the calculus of variations, followed by extensive applications to physics and theoretical engineering. By far the greater emphasis is placed on the applications, and the list of chapter headings will show the scope: 1. Introduction; 2. Background preliminaries; 3. Introductory problems; 4. Isoperimetric problems; 5. Geometrical optics: Fermat's principle; 6. Dynamics of particles; 7. Two independent variables: the vibrating string; 8. The Sturm-Liouville eigenvalue-eigenfunction problem; 9. Several independent variables: the vibrating membrane; 10. Theory of elasticity; 11. Quantum mechanics; 12. Electrostatics.

A book with this scope should have a wide appeal at the present time, particularly among those physicists and engineers who find variational methods tricky and evasive. For the author's aim is clarity of exposition. He goes slowly at the beginning, where slowness is essential, and he provides, at the ends of the chapters, sets of exercises which should prove very useful. He is writing for those who know the concepts and techniques of a first year calculus course,