the book concludes with an Appendix, written by S. Eilenberg, axiomatising in a categorical framework the author's construction for a group of groups.

The text is not always easy reading and the reviewer must cavil at the use of the phrase " well-known principle " on p. 26. The only reference [73] is to a paper which is to appear in an unspecified journal; conceivably the reference should be [72] but there is no place of publication for this reference. The author has, however, written an illuminating account and one which forms a valuable springboard for further study in the mathematical theory of knots. R. A. RANKIN

HIRZEBRUCH, F., *Topological Methods in Algebraic Geometry*. 3rd edition with new Appendix. Translated from the 2nd German edition by R. L. E. Schwarzenberger, with an additional section by A. Borel. (Springer-Verlag, Berlin-Heidelberg-New York, 1966), xii+232 pp., DM 38.

The first edition of this book, which appeared in German in 1956, was essentially a monograph on the extension to n-dimensional algebraic manifolds of the Riemann-Roch theorem concerning the divisor classes on an algebraic curve. It was a landmark because it showed how the formidable apparatus of algebraic topology: sheaf theory, fibre spaces and cobordism, could be used to reformulate problems in algebraic geometry which had long resisted the classical methods, and to solve them.

This translation into English is also a new enlarged edition. The translator has added notes to each chapter and has written an excellent survey of the developments of the last ten years. The original work by Hirzebruch has been generalised in a number of ways, with unexpected consequences and contacts with other theories. This has considerably increased the number of people who will be interested in this book. For example, the far-reaching generalisation due to Grothendieck introduced a group of complex analytic vector bundles; similar constructions, now called Grothendieck groups, have since appeared in a purely algebraic context. Another development, due to Atiyah and Hirzebruch, has led to a powerful new cohomology theory, known as K-theory. This has had interesting contacts with operator theory, and Atiyah and Singer have been able to express the index of an elliptic differential operator in terms of topological invariants. Another generalisation of the Riemann-Roch theorem has been used to calculate the dimensions of spaces of automorphic forms.

The long introductory chapter may be recommended to anyone seeking a clear treatment of sheaves, or of vector bundles and their characteristic classes. The second chapter is a good introduction to the theory of cobordism.

The extremely clear and simple style of the original has been preserved in the translation. There is a full index and bibliography. D. J. SIMMS

MACINTYRE, SHEILA AND WITTE, EDITH, *German-English Mathematical Vocabulary*, 2nd edition (Oliver and Boyd, Edinburgh, 1966), ix+95 pp., 10s. 6d.

The first edition of this well-known reference book was published in 1956. In addition to the Vocabulary it contains a Grammatical Sketch by Lilias W. Brebner. Following Mrs MacIntyre's untimely death in 1960 the task of revision and incorporation of additional entries was completed by her co-author. Remarkably compact yet most helpful, this little dictionary gives excellent value for its very modest cost.

D. MONK

AHLFORS, L. V., *Complex Analysis*, Second edition (McGraw-Hill, New York, 1966), 317 pp., $8.95.

The first edition of this book, which appeared in 1953, has already established itself as a classic and the second edition containing additions amounting to seventy pages will be warmly welcomed by students and teachers alike. The principal changes that have been made are as follows. The section on topology has been rewritten and enlarged to include an account of metric spaces and to make brief mention of general topological spaces. Some material on conformal mapping has been added and the inclusion of the Schwarz-Christoffel transformation will add to the value of the book to students of applied mathematics. A chapter of twenty pages has been included on elliptic functions and the modular function introduced there is used later in the book along with the monodromy theorem to prove Picard's theorem. It was a defect of the first edition that hardly enough examples were provided by which the student could test his skill and discover the gaps in his understanding; this has been remedied in the present edition.

The admirable qualities of the first edition have, of course, been preserved in the revision and the book is one which every serious student of complex variable theory should possess. D. MARTIN

KLETENIK, D. V., *A Collection of Problems in Analytical Geometry* (Pergamon Press, 1966): Part I, *Analytical Geometry in the Plane*, ix + 186 pp., 18s. 6d.; Part II, *Three-dimensional Analytical Geometry*, ix + 137 pp., 15s.

These two little books contain 1261 problems on analytical geometry, with answers. Part II includes sections on vector algebra and determinants. The problems are mostly very elementary in nature, demanding straightforward calculations rather than theoretical proofs. The collection might prove useful for pupils needing much practice in routine coordinate geometry, but it can hardly be described as inspiring.

D. MONK

MAGNUS, WILHELM; KARRASS, ABRAHAM; AND SOLITAR, DONALD, *Combinatorial Group Theory* (Interscience Publishers, New York, 1966).

This book is concerned with the presentation of groups in terms of generators and defining relations, and, in particular, with free groups and free products. The adjective " combinatorial " arises from the frequent occurrence of combinatorial methods in this theory. A very clear and thorough treatment is given, and it seems certain that the book will become indispensable to mathematicians working in this area. There are numerous problems of considerable interest for the student to attempt and very full hints are given for their solution. Of particular interest to the reviewer were the frequent illustrations of the general theory chosen from the theory of the modular group and other groups of matrices. Burnside's problem and the fundamental problems of Max Dehn (of which the word problem is only one) are discussed in the later part of the book where a brief introduction is given to recent work on these very deep problems.

R. A. RANKIN

BRAUN, H., AND KOECHER, M., *Jordan-Algebren* (Springer-Verlag, Berlin-Heidelberg-New York, 1966), xiv + 357 pp., DM 48.

Jordan algebras arise in the study of subspaces of an associative algebra which are closed under the squaring operation, or more particularly, subspaces of symmetric elements in an algebra with an involution. This was the motivation for Jordan's initial work in the 1930's and it also lies behind the recent work of Vinberg in classifying homogeneous convex domains. Between these two applications a great deal of pure theory was developed and it is this theory which the authors describe here, in the first full-length book on the subject.

The authors lay—rightly—much emphasis on the quadratic transformation $P(x)$: $u \to 2(ux)x - u \, . \, x^2$ (corresponding to $u \to x \, . \, u \, . \, x$ in an associative algebra). It is defined in terms of inverses by the equation $P(x^{-1})u = u \dfrac{\partial x^{-1}}{\partial x}$. This makes it applicable to any algebra in which there are generic units (e.g. finite-dimensional

https://doi.org/10.1017/S0013091500012396 Published online by Cambridge University Press