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A Survey of Modern Algebra by Garrett Birkhoff; Saunders MacLane

Review by: L. M. Graves

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versy raging around the reviewer's *Study of Writing, The Foundations of Grammatology* (1952) shows that the principles that lie behind the origin and evolution of writing are anything but clear and simple.

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*Railroad Engineering*. Vol. 1. William W. Hay. New York: Wiley; London: Chapman & Hall, 1953. ix + 483 pp. Illus. + charts. \$7.50.

**R**ailroad Engineering is a textbook written for college courses in railroad engineering. Nevertheless, the material is presented in simple enough form to make interesting informative reading for the average layman.

As a textbook, the book presents very clearly the organization of modern railroads. The economic problems confronted by the engineer in railroad work are clearly stated. The section on motive power is presented in a manner useful to students, in that all the author's derivations are taken from the basic laws of mechanics. The major portion of the book, devoted to roadbed construction and maintenance, has its place in engineering education.

To the "uninitiated railroader" the book is of particular interest. The many problems involved in railroading are explained in clear nontechnical language. The book is very well illustrated and will be enjoyable reading for those interested in the overall story of the American railroads.

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*A Survey of Modern Algebra*, rev. ed. Garrett Birkhoff and Saunders MacLane. New York: Macmillan, 1953. xi + 472 pp. Illus. \$6.50.

**T**HIS well-known textbook has served, in the last twelve years, to introduce a great many students to the fundamental concepts of modern algebra in an extraordinarily effective way. It does this by discussing examples of mathematical systems or situations already partially familiar to the student, isolating important properties of these as postulates, and deducing some of the consequences of these postulates. These theorems are then applied to some familiar and to some less familiar examples, thus broadening the student's viewpoint without getting him lost in abstractions. The ratio of definitions to theorems and exercises is kept low. Interesting historical references appear in a number of places.

In the revised edition, chapters I to V which treat integers, integral domains, rational numbers, fields, polynomials, real numbers, and complex numbers, have been subjected to minor improvements in the way of additions, omissions, and rearrangements. A section on the Peano postulates for the positive integers has been added to chapter II. The chapter on polynomials has been placed before that on the real numbers, which seems a

better arrangement for pedagogical purposes. In addition there have been included a section on the real roots of real polynomial equations and a paragraph on the trigonometric solution of the cubic equation. To chapter V has been added a brief section giving criteria for all roots of a quadratic or a cubic equation to have positive real part.

In chapter VI on group theory, Section 2, which is an introduction to transformation groups, has been considerably expanded, so as to clarify the basic ideas and notations for the student. The authors here succumb to the prevalent disease of using the preposition "onto" as an adjective.

Chapters VII to X, entitled "Vectors and Vector Spaces," "The Algebra of Matrices," "Linear Groups," and "Determinants and Canonical Forms," respectively, have been subjected to a thorough revision and rearrangement, and have been expanded by a total of 30 pages, so that now they afford a more adequate treatment of this aspect of algebra. Matrices and their row equivalence, linear forms and the notion of dual spaces, have been introduced into chapter VII. Chapter IX contains a more complete treatment of the full linear group and some of its subgroups, and of the invariants of linear, bilinear, and quadratic forms under some of these groups. It closes with a new section on projective geometry. The new chapter X is shorter than the old, because several of the topics have been incorporated into the earlier chapters. However, some new sections on invariant subspaces and canonical forms have been added.

The last five chapters, entitled "Algebra of Classes," "Transfinite Arithmetic," "Rings and Ideals," "Algebraic Number Fields," and "Galois Theory," are little changed from the first edition. They constitute good but brief introductions to their respective topics. The bibliography has been enlarged by the inclusion of quite a number of recent books. The index has also been enlarged, and a number of the lists of exercises have been revised.

The authors are to be congratulated on having improved an already excellent text.

L. M. GRAVES

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*A Refresher Course in Mathematics*. F. J. Camm. New York: Emerson, 1953. 240 pp. Illus. \$2.95.

**T**HIS compact little book is written primarily for a reader who has already studied the subjects touched upon and wishes to be reminded of fundamental facts of arithmetic, algebra, geometry, trigonometry, and calculus. For such a reader the book contains a wealth of material: selected topics from arithmetic and algebra; essentials of mensurational trigonometry; standard areas, volumes, and physical formulas; a brief treatment of differential and integral calculus. To the definitions of terms and symbols in the text itself are added 32 pages of supplementary formulas and tables.

The author has arranged the contents on a plan he has found successful in his teaching, and he has accompanied the presentation of each mathematical concept