Fundamentals of Mathematics, Vol. 1: Foundations of Mathematics: The Real Number System and Algebra

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Fundamentals of Mathematics represents a new kind of mathematical publication. While excellent technical treatises have been written about specialized fields, they provide little help for the nonspecialist; and other books, some of them semipopular in nature, give an overview of mathematics while omitting some necessary details. *Fundamentals of Mathematics* strikes a unique balance, presenting an irreproachable treatment of specialized fields and at the same time providing a very clear view of their interrelations, a feature of great value to students, instructors, and those who use mathematics in applied and scientific endeavors. Moreover, as noted in a review of the German edition in *Mathematical Reviews*, the work is "designed to acquaint [the student] with modern viewpoints and developments. The articles are well illustrated and supplied with references to the literature, both current and 'classical.'"

The outstanding pedagogical quality of this work was made possible only by the unique method by which it was written. There are, in general, two authors for each chapter: one a university researcher, the other a teacher of long experience in the German educational system. (In a few cases, more than two authors have collaborated.) And the whole book has been coordinated in repeated conferences, involving altogether about 150 authors and coordinators.

Volume I opens with a section on mathematical foundations. It covers such topics as axiomatization, the concept of an algorithm, proofs, the theory of sets, the theory of relations, Boolean algebra, and antinomies. The closing section, on the real number system and algebra, takes up natural numbers, groups, linear algebra, polynomials, rings and ideals, the theory of numbers, algebraic extensions of a fields, complex numbers and quaternions, lattices, the theory of structure, and Zorn's lemma.

Volume II begins with eight chapters on the foundations of geometry, followed by eight others on its analytic treatment. The latter include discussions of affine and Euclidean geometry, algebraic geometry, the Erlanger Program and higher geometry, group theory approaches, differential geometry, convex figures, and aspects of topology.

Volume III, on analysis, covers convergence, functions, integral and measure, fundamental concepts of probability theory, alternating differential forms, complex numbers and variables, points at infinity, ordinary and partial differential equations, difference equations and definite integrals, functional analysis, real functions, and analytic number theory. An important concluding chapter examines "The Changing Structure of Modern Mathematics."

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