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THE FIRST RESOURCE FOR MATHEMATICS

Sethuraman, B.

Proofs and ideas. A prelude to advanced mathematics. (English) Zbl 1492.00008

AMS/MAA Textbooks 68. Providence, RI: MAA Press/American Mathematical Society (AMS) (ISBN 978-1-4704-6514-8/pbk; 978-1-4704-6761-6/ebook). xiii, 334 p. (2022).

The main purpose of this book is to help students make the transition from a computational type of mathematics (i.e., memorizing techniques and formulas to solve drilling exercises following an algorithm), towards a more abstract and creative way of understanding the underlying mathematical ideas. The book is not a standard sequence of subjects in a classical arithmetic, calculus, or algebra course and it is not written in a Bourbaki style (a sequence of definitions, theorems, proofs). The first chapters treat a number of mathematical notions and principles (pigeonhole principle, logic of mathematical statements, combinatorics, sets, cardinality, functions and equivalence relations, proof techniques) while subsequent chapters correspond to more traditional chapters of a mathematics course (prime factorization, limits of sequences and series, completeness of the real numbers, groups and symmetry, introduction to graphs). It is well suited for self-study, but several possible selections of the chapters are suggested to set up courses of varying lengths. No special prerequisites are needed besides a basic mathematical formation and a certain desire to move to a higher mathematical level. The readers are not pampered. For example, in an introductory chapter, the binary arithmetic of even and odd numbers is presented via equivalence classes $\mathbb{Z}/2\mathbb{Z}$, so that it allows direct extension to a more general modular arithmetic with integers and polynomials. This illustrates how abstraction of a simple idea leads to a much more general setting. Every chapter introduces the concepts, definitions, and properties interlaced with exercises, and it is extended with a section containing further exercises. The latter can be somewhat challenging when introducing further generalizations. No solution section is provided.

Reviewer: Adhemar Bultheel (Leuven)

MSC:

00A08 Recreational mathematics
97-01 Introductory exposition (textbooks, tutorial papers, etc.) pertaining to mathematics education
97E50 Reasoning and proving in the mathematics classroom

Keywords:

abstraction; proofs; combinatorics; sets; number systems; analysis; limit; symmetry; groups; graphs

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