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How to Prove It American Mathematical Soc. This elementary presentation exposes readers to both the process of rigor and the rewards inherent in taking an axiomatic approach to the study of functions of a real variable. The aim is to challenge and improve mathematical intuition

rather than to verify it. The philosophy of this book is to focus attention on questions which give analysis its inherent fascination. Each chapter begins with the discussion of some motivating examples and concludes with a series of questions.

Understanding Analysis World Scientific

"Proof" has been and remains one of the concepts which characterises mathematics. Covering basic propositional and predicate logic as well as discussing axiom systems and formal proofs, the book seeks to explain what mathematicians understand by proofs and how they are communicated. The authors explore the principle techniques of direct and indirect proof including induction, existence and uniqueness proofs, proof by contradiction, constructive and non-constructive proofs, etc. Many examples from analysis and modern algebra are included. The exceptionally clear style and presentation ensures that the book will be useful and enjoyable to those studying and interested in the notion of mathematical "proof."

100% Mathematical Proof Cambridge University Press

Ross Honsberger was born in Toronto, Canada, in 1929 and attended the University of Toronto. After more than a decade of teaching mathematics in Toronto, he took advantage of a sabbatical leave to continue his studies at the University of Waterloo, Canada. He joined the faculty in 1964 (Department of Combinatorics and Optimization) and has been there ever since. He is married, the father of three, and grandfather of three. He has published seven bestselling books with the Mathematical Association of America. Here is a selection of reviews of Ross Honsberger's

books: The reviewer found this little book a joy to read ... the text is laced with historical notes and lively anecdotes and the proofs are models of lucid, uncluttered reasoning. (about Mathematical Gems I) P. Hagis, Jr., in Mathematical Reviews This book is designed to appeal to high school teachers and undergraduates particularly, but should find a much wider audience. The clarity of exposition and the care taken with all aspects of explanations, diagrams and notation is of a very high standard. (about Mathematical Gems II) K. E. Hirst, in Mathematical Reviews All (i.e., the articles in Mathematical Gems III) are written in the very clear style that characterizes the two previous volumes, and there is bound to be something here that will appeal to anyone, both student and teacher alike. For instructors, Mathematical Gems III is useful as a source of thematic ideas around which to build classroom lectures ... Mathematical Gems III is to be warmly recommended, and we look forward to the appearance of a fourth volume in the series. Joseph B. Dence, Mathematics and Computer Education These delightful little books contain between them 27 short essays on topics from geometry, combinatorics, graph theory, and number theory. The essays are independent, and can be read in any order ... overall these are serious books presenting pretty mathematics with elegant proofs. These books deserve a place in the library of every teacher of mathematics as a valuable resource. Further, as much of the material would not be beyond upper secondary students, inclusion in school libraries may be felt desirable too (about Mathematical Gems I and II) Paul Scott, in The Australian Mathematics Teacher

Real Analysis

Springer Science & Business Media

This undergraduate text teaches students what

constitutes an acceptable proof, and it develops their ability to do proofs of routine problems as well as those requiring creative insights. 1990 edition.

Bicycle Or Unicycle?

Waveland Press

The best problems selected from over 25 years of the Problem of the Week at Macalester College.

Mathematical Writing Courier Corporation

A Bridge to Abstract Mathematics will prepare the mathematical novice to explore the universe of abstract mathematics. Mathematics is a science that concerns theorems that must be proved within the constraints of a logical system of axioms and definitions rather than theories that must be tested, revised, and retested. Readers will learn how to read mathematics beyond popular computational calculus courses. Moreover, readers will learn how to construct their own proofs. The book is intended as the primary text for an introductory course in proving theorems, as well as for self-study or as a reference. Throughout the text, some pieces (usually proofs) are left as exercises. Part V gives hints to help students find good approaches to the exercises. Part I introduces the language of mathematics and the methods of proof. The mathematical content of Parts II through IV were chosen so as not to seriously overlap the standard mathematics major. In Part II, students study sets, functions, equivalence and order relations, and cardinality. Part III concerns algebra. The goal is to prove that the real numbers form the unique, up to isomorphism, ordered field with the least upper bound. In the process, we construct the real numbers starting with the natural numbers. Students will be prepared for an abstract linear algebra or modern algebra course. Part IV studies analysis. Continuity

and differentiation are considered in the context of time scales (nonempty, closed subsets of the real numbers). Students will be prepared for advanced calculus and general topology courses. There is a lot of room for instructors to skip and choose topics from among those that are presented.

How to Prove It John Wiley & Son Limited This treatment covers the mechanics of writing proofs, the area and circumference of circles, and complex numbers and their application to real numbers. 1998 edition.

Which Way Did the Bicycle Go? Wiley-Blackwell Written by two prominent figures in the field, this comprehensive text provides a remarkably student-friendly approach. Its sound yet accessible treatment emphasizes the history of graph theory and offers unique examples and lucid proofs. 2004 edition.

Mathematical Logic for Computer Science Springer Looking for a head start in your undergraduate degree in mathematics? Maybe you've already started your degree and feel bewildered by the subject you previously loved? Don't panic! This friendly companion will ease your transition to real mathematical thinking. Working through the book you will develop an arsenal of techniques to help you unlock the meaning of definitions, theorems and proofs, solve problems, and write mathematics effectively. All the major methods of proof - direct method, cases, induction, contradiction and contrapositive - are featured. Concrete examples are used throughout, and you'll get plenty of practice on topics common to many courses such as divisors, Euclidean algorithms, modular arithmetic, equivalence relations, and injectivity and surjectivity of functions. The material has been

tested by real students over many years so all the essentials are covered. With over 300 exercises to help you test your progress, you'll soon learn how to think like a mathematician.

An Introduction to Abstract Mathematics

Springer Science & Business Media

Many students have trouble the first time they take a mathematics course in which proofs play a significant role. This new edition of Velleman's successful text will prepare students to make the transition from solving problems to proving theorems by teaching them the techniques needed to read and write proofs. The book begins with the basic concepts of logic and set theory, to familiarize students with the language of mathematics and how it is interpreted. These concepts are used as the basis for a step-by-step breakdown of the most important techniques used in constructing proofs. The author shows how complex proofs are built up from these smaller steps, using detailed 'scratch work' sections to expose the machinery of proofs about the natural numbers, relations, functions, and infinite sets. To give students the opportunity to construct their own proofs, this new edition contains over 200 new exercises, selected solutions, and an introduction to Proof Designer software. No background beyond standard high school mathematics is assumed. This book will be useful to anyone interested in logic and proofs: computer scientists, philosophers, linguists, and of course mathematicians.

A Logical Introduction to Proof

Springer Science & Business Media

The aim of this book is to help students write mathematics better. Throughout it are large exercise sets well-integrated with the text and varying

appropriately from easy to hard. Basic issues are treated, and attention is given to small issues like not placing a mathematical symbol directly after a punctuation mark. And it provides many examples of what students should think and what they should write and how these two are often not the same.

American Mathematical Soc.

This is a textbook for an introductory combinatorics course that can take up one or two semesters. An extensive list of problems, ranging from routine exercises to research questions, is included. In each section, there are also exercises that contain material not explicitly discussed in the preceding text, so as to provide instructors with extra choices if they want to shift the emphasis of their course. Just as with the first edition, the new edition walks the reader through the classic parts of combinatorial enumeration and graph theory, while also discussing some recent progress in the area: on the one hand, providing material that will help students learn the basic techniques, and on the other hand, showing that some questions at the forefront of research are comprehensible and accessible for the talented and hard-working undergraduate. The basic topics discussed are: the twelvefold way, cycles in permutations, the formula of inclusion and exclusion, the notion of graphs and trees, matchings and Eulerian and Hamiltonian cycles. The selected advanced topics are: Ramsey theory, pattern avoidance, the probabilistic method, partially ordered sets, and algorithms and complexity. As the goal of the book is to encourage students to learn more combinatorics, every effort has been made to provide them with a not only useful, but also enjoyable and engaging reading.

Journey into Mathematics

American Mathematical Soc.

This book provides an accessible, critical introduction to the

three main approaches that dominated work in the philosophy of mathematics during the twentieth century: logicism, intuitionism and formalism.

How to Prove It

Courier Dover Publications

While most texts on real analysis are content to assume the real numbers, or to treat them only briefly, this text makes a serious study of the real number system and the issues it brings to light. Analysis needs the real numbers to model the line, and to support the concepts of continuity and measure. But these seemingly simple requirements lead to deep issues of set theory—uncountability, the axiom of choice, and large cardinals. In fact, virtually all the concepts of infinite set theory are needed for a proper understanding of the real numbers, and hence of analysis itself. By focusing on the set-theoretic aspects of analysis, this text makes the best of two worlds: it combines a down-to-earth introduction to set theory with an exposition of the essence of analysis—the study of infinite processes on the real numbers. It is intended for senior undergraduates, but it will also be attractive to graduate students and professional mathematicians who, until now, have been content to "assume" the real numbers. Its prerequisites are calculus and basic mathematics. Mathematical history is woven into the text, explaining how the concepts of real number and infinity developed to meet the needs of analysis from ancient times to the late twentieth century. This rich presentation of history, along with a background of proofs, examples, exercises, and explanatory remarks, will help motivate the reader. The material covered includes classic topics from both set theory and real analysis courses, such as countable and uncountable sets, countable ordinals, the continuum problem, the Cantor – Schröder – Bernstein theorem, continuous functions, uniform convergence,

Zorn's lemma, Borel sets, Baire functions, Lebesgue measure, and Riemann integrable functions.

Philosophies of Mathematics

Oxford University Press

Bond and Keane explicate the elements of logical, mathematical argument to elucidate the meaning and importance of mathematical rigor. With definitions of concepts at their disposal, students learn the rules of logical inference, read and understand proofs of theorems, and write their own proofs all while becoming familiar with the grammar of mathematics and its style. In addition, they will develop an appreciation of the different methods of proof (contradiction, induction), the value of a proof, and the beauty of an elegant argument. The authors emphasize that mathematics is an ongoing, vibrant disciplineits long, fascinating history continually intersects with territory still uncharted and questions still in need of answers. The authors extensive background in teaching mathematics shines through in this balanced, explicit, and engaging text, designed as a primer for higher- level mathematics courses. They elegantly demonstrate process and application and recognize the byproducts of both the achievements and the missteps of past thinkers. Chapters 1-5 introduce the fundamentals of abstract mathematics and chapters 6-8 apply the ideas and techniques, placing the earlier material in a real context. Readers interest is continually piqued by the use of clear explanations, practical examples, discussion and discovery exercises, and historical comments.

How to Prove It
Springer Science & Business Media
This is a mathematics textbook with theorems and proofs. The choice of topics has been guided by the needs of computer science students. The method of semantic tableaux provides an elegant way to teach logic that is both theoretically sound and yet sufficiently elementary for undergraduates. In order to provide a balanced treatment of logic, tableaux are related to deductive proof systems. The book presents various logical systems and contains exercises. Still further, Prolog source code is available on an accompanying Web site. The author is an Associate Professor at the Department of Science Teaching, Weizmann Institute of Science.

Tools of the Trade
Cambridge University Press
Helps students transition from problem solving to proving theorems, with a new chapter on number theory and over 150 new exercises.

Proofs and Fundamentals
Academic Press
This book eases students into the rigors of university mathematics. The emphasis is on understanding and constructing proofs and writing clear mathematics. The author achieves this by exploring set theory, combinatorics, and number theory, topics that include many fundamental ideas and may not be a part of a young mathematician's toolkit. This material illustrates how familiar ideas can be formulated rigorously, provides examples demonstrating a wide range of basic methods of proof, and includes some of the all-time-great classic proofs. The book presents mathematics as a continually developing subject. Material meeting the needs of readers from a wide range of backgrounds is included. The over 250 problems include questions to

interest and challenge the most able student but also plenty of routine exercises to help familiarize the reader with the basic ideas.

Foundations for Moral Relativism Cambridge University Press

According to the great mathematician Paul Erd ö s, God maintains perfect mathematical proofs in The Book. This book presents the authors candidates for such "perfect proofs," those which contain brilliant ideas, clever connections, and wonderful observations, bringing new insight and surprising perspectives to problems from number theory, geometry, analysis, combinatorics, and graph theory. As a result, this book will be fun reading for anyone with an interest in mathematics.

Calculus: A Rigorous First Course Wiley

This book is an introduction to the language and standard proof methods of mathematics. It is a bridge from the computational courses (such as calculus or differential equations) that students typically encounter in their first year of college to a more abstract outlook. It lays a foundation for more theoretical courses such as topology, analysis and abstract algebra. Although it may be more meaningful to the student who has had some calculus, there is really no prerequisite other than a measure of mathematical maturity.