

## Mathematics For The Non Mathematician Dover Books On Mathematics

A non-mathematician explores mathematical terrain, reporting accessibly and engagingly on topics from Sudoku to probability. Brian Hayes wants to convince us that mathematics is too important and too much fun to be left to the mathematicians. Foolproof, and Other Mathematical Meditations is his entertaining and accessible exploration of mathematical terrain both far-flung and nearby, bringing readers tidings of mathematical topics from Markov chains to Sudoku. Hayes, a non-mathematician, argues that mathematics is not only an essential tool for understanding the world but also a world unto itself, filled with objects and patterns that transcend earthly reality. In a series of essays, Hayes sets off to explore this exotic terrain, and takes the reader with him. Math has a bad reputation: dull, difficult, detached from daily life. As a talking Barbie doll opined, "Math class is tough." But Hayes makes math seem fun. Whether he's tracing the genealogy of a well-worn anecdote about a famous mathematical prodigy, or speculating about what would happen to a lost ball in the  $n$ th dimension, or explaining that there are such things as quasirandom numbers, Hayes wants readers to share his enthusiasm. That's why he imagines a cinematic treatment of the discovery of the Riemann zeta function ("The year: 1972. The scene: Afternoon tea in Fuld Hall at the Institute for Advanced Study in Princeton, New Jersey"), explains that there is math in Sudoku after all, and describes better-than-average averages. Even when some of these essays involve a hike up the learning curve, the view from the top is worth it.

Twenty-three mathematical masterpieces for exploration and enlightenment How can a shape have more than one dimension but fewer than two? What is the best way to elect public officials when more than two candidates are vying for the office? Is it possible for a highly accurate medical test to give mostly incorrect results? Can you tile your floor with regular pentagons? How can you use only the first digit of sales numbers to determine if your accountant is lying? Can mathematics give insights into free will?

Edward Scheinerman, an accomplished mathematician and enthusiastic educator, answers all these questions and more in this book, a collection of mathematical masterworks. In bite-sized chapters that require only high school algebra, he invites readers to try their hands at solving mathematical puzzles and provides an engaging and friendly tour of numbers, shapes, and uncertainty. The result is an unforgettable introduction to the fundamentals and pleasures of thinking mathematically.

Explores sets and relations, the natural number sequence and its generalization, extension of natural numbers to real numbers, logic, informal axiomatic mathematics, Boolean algebras, informal axiomatic set theory, several algebraic theories, and 1st-order theories.

Tries to refine the philosophy of mathematics to reflect what mathematicians really do, and argues that mathematics must be understood in a social context.

In this must-have for anyone who wants to better understand their love life, a mathematician pulls back the curtain and reveals the hidden patterns—from dating sites to divorce, sex to marriage—behind the rituals of love. The roller coaster of romance is hard to quantify; defining how lovers might feel from a set of simple equations is impossible. But that doesn't mean that mathematics isn't a crucial tool for understanding love. Love, like most things in life, is full of patterns. And mathematics is ultimately the study of patterns—from predicting the weather to the fluctuations of the stock market, the movement of planets or the growth of cities. These patterns twist and turn and warp and evolve just as the rituals of love do. In *The Mathematics of Love*, Dr. Hannah Fry takes the reader on a fascinating journey through the patterns that define our love lives, applying mathematical formulas to the most common yet complex questions pertaining to love: What's the chance of finding love? What's the probability that it will last? How do online dating algorithms work, exactly? Can game theory help us decide who to approach in a bar? At what point in your dating life should you settle down? From evaluating the best strategies for online dating to defining the nebulous concept of beauty, Dr. Fry proves—with great insight, wit, and fun—that math is a surprisingly useful tool to negotiate the complicated, often baffling, sometimes infuriating, always interesting, mysteries of love.

Longlisted for the National Book Award New York Times Bestseller A former Wall Street quant sounds an alarm on the mathematical models that pervade modern life -- and threaten to rip apart our social fabric We live in the age of the algorithm. Increasingly, the decisions that affect our lives--where we go to school, whether we get a car loan, how much we pay for health insurance--are being made not by humans, but by mathematical models. In theory, this should lead to greater fairness: Everyone is judged according to the same rules, and bias is eliminated. But as Cathy O'Neil reveals in this urgent and necessary book, the opposite is true. The models being used today are opaque, unregulated, and uncontestable, even when they're wrong. Most troubling, they reinforce discrimination: If a poor student can't get a loan because a lending model deems him too risky (by virtue of his zip code), he's then cut off from the kind of education that could pull him out of poverty, and a vicious spiral ensues. Models are propping up the lucky and punishing the downtrodden, creating a "toxic cocktail for democracy." Welcome to the dark side of Big Data. Tracing the arc of a person's life, O'Neil exposes the black box models that shape our future, both as individuals and as a society. These "weapons of math destruction" score teachers and students, sort resumes, grant (or deny) loans, evaluate workers, target voters, set parole, and monitor our health. O'Neil calls on modelers to take more responsibility for their algorithms and on policy makers to regulate their use. But in the end, it's up to us to become more savvy about the models that govern our lives. This important book empowers us to ask the tough questions, uncover the truth, and demand change. -- Longlist for National Book Award (Non-Fiction) -- Goodreads, semi-finalist for the 2016 Goodreads Choice Awards (Science and Technology) -- Kirkus, Best Books of 2016 -- New York Times, 100 Notable Books of 2016 (Non-Fiction) -- The Guardian, Best Books of 2016 -- WBUR's "On Point," Best Books of 2016: Staff Picks -- Boston Globe, Best Books of 2016, Non-Fiction

When do the hands of a clock coincide? How likely is it that two children in the same class will share a birthday? Should you play Roulette or the Lottery? How do we calculate the volume of a doughnut? Why does the android Data in Star Trek lose at poker? What is Fibonacci's Rabbit Problem? Many things in the world have a mathematical side to them, as revealed by the puzzles and questions in this book. It is written for anyone who is curious about mathematics and would like a simple and entertaining account of what it can do. Peter Higgins provides clear explanations of the more mysterious features of childhood mathematics as well as novelties and connections to prove that mathematics can be enjoyable and full of surprises.

Practical, scientific, philosophical, and artistic problems have caused men to investigate mathematics. But there is one other motive which is as strong as any of these — the search for beauty. Mathematics is an art, and as such affords the pleasures which all the arts afford." In this erudite, entertaining college-level text, Morris Kline, Professor Emeritus of Mathematics at New York University, provides the liberal arts student with a detailed treatment of mathematics in a cultural and historical context. The book can also act as a self-study vehicle for advanced high school students and laymen. Professor Kline begins with an overview,

tracing the development of mathematics to the ancient Greeks, and following its evolution through the Middle Ages and the Renaissance to the present day. Subsequent chapters focus on specific subject areas, such as "Logic and Mathematics," "Number: The Fundamental Concept," "Parametric Equations and Curvilinear Motion," "The Differential Calculus," and "The Theory of Probability." Each of these sections offers a step-by-step explanation of concepts and then tests the student's understanding with exercises and problems. At the same time, these concepts are linked to pure and applied science, engineering, philosophy, the social sciences or even the arts. In one section, Professor Kline discusses non-Euclidean geometry, ranking it with evolution as one of the "two concepts which have most profoundly revolutionized our intellectual development since the nineteenth century." His lucid treatment of this difficult subject starts in the 1800s with the pioneering work of Gauss, Lobachevsky, Bolyai and Riemann, and moves forward to the theory of relativity, explaining the mathematical, scientific and philosophical aspects of this pivotal breakthrough. Mathematics for the Nonmathematician exemplifies Morris Kline's rare ability to simplify complex subjects for the nonspecialist.

SHORTLISTED FOR THE 2017 ROYAL SOCIETY SCIENCE BOOK PRIZE Even small children know there are infinitely many whole numbers - start counting and you'll never reach the end. But there are also infinitely many decimal numbers between zero and one. Are these two types of infinity the same? Are they larger or smaller than each other? Can we even talk about 'larger' and 'smaller' when we talk about infinity? In *Beyond Infinity*, international maths sensation Eugenia Cheng reveals the inner workings of infinity. What happens when a new guest arrives at your infinite hotel - but you already have an infinite number of guests? How does infinity give Zeno's tortoise the edge in a paradoxical foot-race with Achilles? And can we really make an infinite number of cookies from a finite amount of cookie dough? Wielding an armoury of inventive, intuitive metaphor, Cheng draws beginners and enthusiasts alike into the heart of this mysterious, powerful concept to reveal fundamental truths about mathematics, all the way from the infinitely large down to the infinitely small.

In this "provocative" book (New York Times), a contrarian physicist argues that her field's modern obsession with beauty has given us wonderful math but bad science. Whether pondering black holes or predicting discoveries at CERN, physicists believe the best theories are beautiful, natural, and elegant, and this standard separates popular theories from disposable ones. This is why, Sabine Hossenfelder argues, we have not seen a major breakthrough in the foundations of physics for more than four decades. The belief in beauty has become so dogmatic that it now conflicts with scientific objectivity: observation has been unable to confirm mindboggling theories, like supersymmetry or grand unification, invented by physicists based on aesthetic criteria. Worse, these "too good to not be true" theories are actually untestable and they have left the field in a cul-de-sac. To escape, physicists must rethink their methods. Only by embracing reality as it is can science discover the truth.

Möbius bagels, Euclid's flourless chocolate cake and apple pi - this is maths, but not as you know it. In *How to Bake Pi*, mathematical crusader and star baker Eugenia Cheng has rustled up a batch of delicious culinary insights into everything from simple numeracy to category theory ('the mathematics of mathematics'), via Fermat, Poincaré and Riemann. Maths is much more than simultaneous equations and  $\pi^2$ : it is an incredibly powerful tool for thinking about the world around us. And once you learn how to think mathematically, you'll never think about anything - cakes, custard, bagels or doughnuts; not to mention fruit crumble, kitchen clutter and Yorkshire puddings - the same way again. Stuffed with moreish puzzles and topped with a generous dusting of wit and charm, *How to Bake Pi* is a foolproof recipe for a mathematical feast.

Index and answers included.

A hilarious reeducation in mathematics—full of joy, jokes, and stick figures—that sheds light on the countless practical and wonderful ways that math structures and shapes our world. In *Math With Bad Drawings*, Ben Orlin reveals to us what math actually is; its myriad uses, its strange symbols, and the wild leaps of logic and faith that define the usually impenetrable work of the mathematician. Truth and knowledge come in multiple forms: colorful drawings, encouraging jokes, and the stories and insights of an empathetic teacher who believes that math should belong to everyone. Orlin shows us how to think like a mathematician by teaching us a brand-new game of tic-tac-toe, how to understand an economic crisis by rolling a pair of dice, and the mathematical headache that ensues when attempting to build a spherical Death Star. Every discussion in the book is illustrated with Orlin's trademark "bad drawings," which convey his message and insights with perfect pitch and clarity. With 24 chapters covering topics from the electoral college to human genetics to the reasons not to trust statistics, *Math with Bad Drawings* is a life-changing book for the math-estranged and math-enamored alike.

An introduction to category theory as a rigorous, flexible, and coherent modeling language that can be used across the sciences. Category theory was invented in the 1940s to unify and synthesize different areas in mathematics, and it has proven remarkably successful in enabling powerful communication between disparate fields and subfields within mathematics. This book shows that category theory can be useful outside of mathematics as a rigorous, flexible, and coherent modeling language throughout the sciences. Information is inherently dynamic; the same ideas can be organized and reorganized in countless ways, and the ability to translate between such organizational structures is becoming increasingly important in the sciences. Category theory offers a unifying framework for information modeling that can facilitate the translation of knowledge between disciplines. Written in an engaging and straightforward style, and assuming little background in mathematics, the book is rigorous but accessible to non-mathematicians. Using databases as an entry to category theory, it begins with sets and functions, then introduces the reader to notions that are fundamental in mathematics: monoids, groups, orders, and graphs—categories in disguise. After explaining the "big three" concepts of category theory—categories, functors, and natural transformations—the book covers other topics, including limits, colimits, functor categories, sheaves, monads, and operads. The book explains category theory by examples and exercises rather than focusing on theorems and proofs. It includes more than 300 exercises, with solutions. *Category Theory for the Sciences* is intended to create a bridge between the vast array of mathematical concepts used by mathematicians and the models and frameworks of such scientific disciplines as computation, neuroscience, and physics.

Bestselling author and astrophysicist Mario Livio examines the lives and theories of history's greatest mathematicians to ask how—if mathematics is an abstract construction of the human mind—it can so perfectly explain the physical world. Nobel Laureate Eugene Wigner once wondered about "the unreasonable effectiveness of mathematics" in the formulation of the laws of nature. *Is God a Mathematician?* investigates why mathematics is as powerful as it is. From ancient times to the present, scientists and philosophers have marveled at how such a seemingly abstract discipline could so perfectly explain the natural world. More than that—mathematics has often made predictions, for example, about subatomic particles or cosmic phenomena that were unknown at the time, but later were proven to be true. Is mathematics ultimately invented or discovered? If, as Einstein insisted, mathematics

is “a product of human thought that is independent of experience,” how can it so accurately describe and even predict the world around us? Physicist and author Mario Livio brilliantly explores mathematical ideas from Pythagoras to the present day as he shows us how intriguing questions and ingenious answers have led to ever deeper insights into our world. This fascinating book will interest anyone curious about the human mind, the scientific world, and the relationship between them.

This book takes a novel view of mathematics, arguing that it is a branch of human language. Looking through this lens, it traces the evolution of math from the first tally sticks, through the invention of number systems, up to modern computer science. Along the way it shows that, like all language, the real key to math is human intuition. This book has something for everybody: math-phobes hoping to come to terms with an intimidating subject, mathematicians looking for insight into their trade, educators trying to make math accessible, and laymen who want to understand the role of numbers in human societies.

“Delightful . . . easily digestible chapters include plenty of helpful examples and illustrations. You'll never forget the Pythagorean theorem again!”—Scientific American Many people take math in high school and promptly forget much of it. But math plays a part in all of our lives all of the time, whether we know it or not. In *The Joy of x*, Steven Strogatz expands on his hit New York Times series to explain the big ideas of math gently and clearly, with wit, insight, and brilliant illustrations. Whether he is illuminating how often you should flip your mattress to get the maximum lifespan from it, explaining just how Google searches the internet, or determining how many people you should date before settling down, Strogatz shows how math connects to every aspect of life. Discussing pop culture, medicine, law, philosophy, art, and business, Strogatz is the math teacher you wish you'd had. Whether you aced integral calculus or aren't sure what an integer is, you'll find profound wisdom and persistent delight in *The Joy of x*.

With wit and clarity, the authors progress from simple arithmetic to calculus and non-Euclidean geometry. Their subjects: geometry, plane and fancy; puzzles that made mathematical history; tantalizing paradoxes; more. Includes 169 figures.

Lockhart's *Mathematician's Lament* outlined how we introduce math to students in the wrong way. *Measurement* explains how math should be done. With plain English and pictures, he makes complex ideas about shape and motion intuitive and graspable, and offers a solution to math phobia by introducing us to math as an artful way of thinking and living.

“Witty, compelling, and just plain fun to read . . .” —Evelyn Lamb, *Scientific American* The Freakonomics of math—a math-world superstar unveils the hidden beauty and logic of the world and puts its power in our hands The math we learn in school can seem like a dull set of rules, laid down by the ancients and not to be questioned. In *How Not to Be Wrong*, Jordan Ellenberg shows us how terribly limiting this view is: Math isn't confined to abstract incidents that never occur in real life, but rather touches everything we do—the whole world is shot through with it. Math allows us to see the hidden structures underneath the messy and chaotic surface of our world. It's a science of not being wrong, hammered out by centuries of hard work and argument. Armed with the tools of mathematics, we can see through to the true meaning of information we take for granted: How early should you get to the airport? What does “public opinion” really represent? Why do tall parents have shorter children? Who really won Florida in 2000? And how likely are you, really, to develop cancer? *How Not to Be Wrong* presents the surprising revelations behind all of these questions and many more, using the mathematician's method of analyzing life and exposing the hard-won insights of the academic community to the layman—minus the jargon. Ellenberg chases mathematical threads through a vast range of time and space, from the everyday to the cosmic, encountering, among other things, baseball, Reaganomics, daring lottery schemes, Voltaire, the replicability crisis in psychology, Italian Renaissance painting, artificial languages, the development of non-Euclidean geometry, the coming obesity apocalypse, Antonin Scalia's views on crime and punishment, the psychology of slime molds, what Facebook can and can't figure out about you, and the existence of God. Ellenberg pulls from history as well as from the latest theoretical developments to provide those not trained in math with the knowledge they need. Math, as Ellenberg says, is “an atomic-powered prosthesis that you attach to your common sense, vastly multiplying its reach and strength.” With the tools of mathematics in hand, you can understand the world in a deeper, more meaningful way. *How Not to Be Wrong* will show you how.

Stimulating account of development of mathematics from arithmetic, algebra, geometry and trigonometry, to calculus, differential equations, and non-Euclidean geometries. Also describes how math is used in optics, astronomy, and other phenomena.

The fundamental mathematical tools needed to understand machine learning include linear algebra, analytic geometry, matrix decompositions, vector calculus, optimization, probability and statistics. These topics are traditionally taught in disparate courses, making it hard for data science or computer science students, or professionals, to efficiently learn the mathematics. This self-contained textbook bridges the gap between mathematical and machine learning texts, introducing the mathematical concepts with a minimum of prerequisites. It uses these concepts to derive four central machine learning methods: linear regression, principal component analysis, Gaussian mixture models and support vector machines. For students and others with a mathematical background, these derivations provide a starting point to machine learning texts. For those learning the mathematics for the first time, the methods help build intuition and practical experience with applying mathematical concepts. Every chapter includes worked examples and exercises to test understanding. Programming tutorials are offered on the book's web site.

Refuting the accepted belief that mathematics is exact and infallible, the author examines the development of conflicting concepts of mathematics and their implications for the physical, applied, social, and computer sciences

Winner of the 1983 National Book Award! "...a perfectly marvelous book about the Queen of Sciences, from which one will get a real feeling for what mathematicians do and who they are. The exposition is clear and full of wit and humor..." - *The New Yorker* (1983 National Book Award edition) Mathematics has been a human activity for thousands of years. Yet only a few people from the vast population of users are professional mathematicians, who create, teach, foster, and apply it in a variety of situations. The authors of this book believe that it should be possible for these professional mathematicians to explain to non-professionals what they do, what they say they are doing, and why the world should support them at it. They also believe that mathematics should be taught to non-mathematics majors in such a way as to instill an appreciation of the power and beauty of mathematics. Many people from around the world have told the authors that they have done precisely that with the first edition and they have encouraged publication of this revised edition complete with exercises for helping students to demonstrate their understanding. This edition of the book should find a new generation of general readers and students who would like to know what mathematics is all about. It will prove invaluable as a course text for a general mathematics appreciation course, one in which the student can combine an appreciation for the esthetics with some satisfying and revealing applications. The text is ideal for 1) a GE course for Liberal Arts students 2) a Capstone course for perspective teachers 3) a writing course for mathematics teachers. A wealth of customizable online course materials for the book can be obtained from Elena Anne Marchisotto (elena.marchisotto@csun.edu) upon request.

Accessible but rigorous, this outstanding text encompasses all of the topics covered by a typical course in elementary abstract algebra. Its easy-to-read treatment offers an intuitive approach, featuring informal discussions followed by thematically arranged exercises. This second edition features additional exercises to improve student familiarity with applications. 1990 edition.

"One of the most careful and intensive among the introductory texts that can be used with a wide range of students. It builds remarkably sophisticated technical skills, a good sense of the nature of a formal system, and a solid and extensive

background for more advanced work in logic. . . . The emphasis throughout is on natural deduction derivations, and the text's deductive systems are its greatest strength. Lemmon's unusual procedure of presenting derivations before truth tables is very effective." --Sarah Stebbins, *The Journal of Symbolic Logic*

Briefly discusses the traditional mathematics formerly taught in American schools and views the language and weaknesses of the modern math curriculum

Erudite and entertaining overview follows development of mathematics from ancient Greeks to present. Topics include logic and mathematics, the fundamental concept, differential calculus, probability theory, much more. Exercises and problems.

The aim of this volume is to explain the differences between research-level mathematics and the maths taught at school. Most differences are philosophical and the first few chapters are about general aspects of mathematical thought. A discussion of fundamental mathematical principles from algebra to elementary calculus designed to promote constructive mathematical reasoning.

In this charming volume, a noted English mathematician uses humor and anecdote to illuminate the concepts of groups, sets, subsets, topology, Boolean algebra, and other mathematical subjects. 200 illustrations.

An awesome, globe-spanning, and *New York Times* best-selling journey through the beauty and power of mathematics. What if you had to take an art class in which you were only taught how to paint a fence? What if you were never shown the paintings of van Gogh and Picasso, weren't even told they existed? Alas, this is how math is taught, and so for most of us it becomes the intellectual equivalent of watching paint dry. In *Love and Math*, renowned mathematician Edward Frenkel reveals a side of math we've never seen, suffused with all the beauty and elegance of a work of art. In this heartfelt and passionate book, Frenkel shows that mathematics, far from occupying a specialist niche, goes to the heart of all matter, uniting us across cultures, time, and space. *Love and Math* tells two intertwined stories: of the wonders of mathematics and of one young man's journey learning and living it. Having braved a discriminatory educational system to become one of the twenty-first century's leading mathematicians, Frenkel now works on one of the biggest ideas to come out of math in the last 50 years: the Langlands Program. Considered by many to be a Grand Unified Theory of mathematics, the Langlands Program enables researchers to translate findings from one field to another so that they can solve problems, such as Fermat's last theorem, that had seemed intractable before. At its core, *Love and Math* is a story about accessing a new way of thinking, which can enrich our lives and empower us to better understand the world and our place in it. It is an invitation to discover the magic hidden universe of mathematics.

Mathematics for the Nonmathematician Courier Corporation

According to the great mathematician Paul Erdős, 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.

Which mathematician elaborated a crucial concept the night before he died in a duel? Who funded his maths and medical career through gambling and chess? Who learned maths from her wallpaper? Ian Stewart presents the extraordinary lives and amazing discoveries of twenty-five of history's greatest mathematicians from Archimedes and Liu Hui to Benoit Mandelbrot and William Thurston. His subjects are the inspiring individuals from all over the world who have made crucial contributions to mathematics. They include the rediscovered geniuses Srinivasa Ramanujan and Emmy Noether, alongside the towering figures of Muhammad al-Khwarizmi (inventor of the algorithm), Pierre de Fermat, Isaac Newton, Carl Friedrich Gauss, Nikolai Ivanovich Lobachevsky, Bernhard Reimann (precursor to Einstein), Henri Poincaré, Ada Lovelace (arguably the first computer programmer), Kurt Gödel and Alan Turing. Ian Stewart's vivid accounts are fascinating in themselves and, taken together, cohere into a riveting history of key steps in the development of mathematics.

Considers how our ideas about mathematics shape our individual and cultural relationship to the field. Where and how do we, as a culture, get our ideas about mathematics and about who can engage with mathematical knowledge? Sara N. Hottinger uses a cultural studies approach to address how our ideas about mathematics shape our individual and cultural relationship to the field. She considers four locations in which representations of mathematics contribute to our cultural understanding of mathematics: mathematics textbooks, the history of mathematics, portraits of mathematicians, and the field of ethnomathematics. Hottinger examines how these discourses shape mathematical subjectivity by limiting the way some groups—including women and people of color—are able to see themselves as practitioners of math. *Inventing the Mathematician* provides a blueprint for how to engage in a deconstructive project, revealing the limited and problematic nature of the normative construction of mathematical subjectivity.

This book gives a remarkably fine account of the influences mathematics has exerted on the development of philosophy, the physical sciences, religion, and the arts in Western life.

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