

## A Mathematicians Apology

This collection of essays inverts the way we see the Cold War by looking at the conflict from the perspective of the so-called developing world, rather than of the superpowers, through the birth and first decades of India's life as a postcolonial nation. Contributors draw on a wide array of new material, from recently opened archival sources to literature and film, and meld approaches from diplomatic history to development studies to explain the choices India made and to frame decisions by its policy makers. Together, the essays demonstrate how India became a powerful symbol of decolonization and an advocate of non-alignment, disarmament, and global governance as it stood between the United States and the Soviet Union, actively fostering dialogue and attempting to forge friendships without entering into formal alliances. Sweeping in its scope yet nuanced in its analysis, this is the authoritative account of India and the Cold War. Contributors: Priya Chacko, Anton Harder, Syed Akbar Hyder, Raminder Kaur, Rohan Mukherjee, Swapna Kona Nayudu, Pallavi Raghavan, Srinath Raghavan, Rahul Sagar, and Waheguru Pal Singh Sidhu.

G. H. Hardy (1877-1947) ranks among the great mathematicians of the twentieth century. He did essential research in number theory and analysis, held professorships at Cambridge and Oxford, wrote important textbooks as well as the classic *A Mathematician's Apology*, and famously collaborated with J. E. Littlewood and Srinivasa Ramanujan. Hardy was a colorful character with remarkable expository skills. This book is a feast of G. H. Hardy's writing. There are selections of his mathematical papers, his book reviews, his tributes to departed colleagues. Some articles are serious, whereas others display a wry sense of humor. And there are recollections by those who knew Hardy, along with biographical and mathematical pieces written explicitly for this collection. Fans of Hardy should find much here to like. And for those unfamiliar with his work, *The G. H. Hardy Reader* provides an introduction to this extraordinary individual.

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.

To many outsiders, mathematicians appear to think like computers, grimly grinding away with a strict formal logic and moving methodically--even algorithmically--from one black-and-white deduction to another. Yet mathematicians often describe their most important breakthroughs as creative, intuitive responses to ambiguity, contradiction, and paradox. A unique examination of this less-familiar aspect of

mathematics, *How Mathematicians Think* reveals that mathematics is a profoundly creative activity and not just a body of formalized rules and results. Nonlogical qualities, William Byers shows, play an essential role in mathematics. Ambiguities, contradictions, and paradoxes can arise when ideas developed in different contexts come into contact. Uncertainties and conflicts do not impede but rather spur the development of mathematics. Creativity often means bringing apparently incompatible perspectives together as complementary aspects of a new, more subtle theory. The secret of mathematics is not to be found only in its logical structure. The creative dimensions of mathematical work have great implications for our notions of mathematical and scientific truth, and *How Mathematicians Think* provides a novel approach to many fundamental questions. Is mathematics objectively true? Is it discovered or invented? And is there such a thing as a "final" scientific theory? Ultimately, *How Mathematicians Think* shows that the nature of mathematical thinking can teach us a great deal about the human condition itself.

In 2010, French mathematician Cédric Villani received the Fields Medal, the most coveted prize in mathematics, in recognition of a proof which he devised with his close collaborator Clément Mouhot to explain one of the most surprising theories in classical physics. *Birth of a Theorem* is Villani's own account of the years leading up to the award. It invites readers inside the mind of a great mathematician as he wrestles with the most important work of his career. But you don't have to understand nonlinear Landau damping to love *Birth of a Theorem*. It doesn't simplify or overexplain; rather, it invites readers into collaboration. Villani's diaries, emails, and musings enmesh you in the process of discovery. You join him in unproductive lulls and late-night breakthroughs. You're privy to the dining-hall conversations at the world's greatest research institutions. Villani shares his favorite songs, his love of manga, and the imaginative stories he tells his children. In mathematics, as in any creative work, it is the thinker's whole life that propels discovery—and with *Birth of a Theorem*, Cédric Villani welcomes you into his.

An entertaining history of mathematics as chronicled through fifty short biographies. Mathematics today is the fruit of centuries of brilliant insights by men and women whose personalities and life experiences were often as extraordinary as their mathematical achievements. This entertaining history of mathematics chronicles those achievements through fifty short biographies that bring these great thinkers to life while making their contributions understandable to readers with little math background. Among the fascinating characters profiled are Isaac Newton (1642-1727), the founder of classical physics and infinitesimal calculus—he frequently quarreled with fellow scientists and was obsessed by alchemy and arcane Bible interpretation; Sophie Germain (1776 - 1831), who studied secretly at the Ecole Polytechnique in Paris, using the name of a previously enrolled male student—she is remembered for her work on Fermat's Last Theorem and on elasticity theory; Emmy Noether (1882 - 1935), whom Albert Einstein described as the most important woman in the history of mathematics—she made important contributions to abstract algebra and in physics she clarified the connection between conservation laws and symmetry; and Srinivasa Ramanujan (1887-1920), who came from humble origins in India and had almost no formal training, yet made substantial contributions to mathematical analysis, number theory, infinite series, and continued fractions. The unusual behavior and life circumstances of these and many other intriguing personalities make for fascinating reading and a highly enjoyable introduction to mathematics.

The true story that inspired the 2020 film. The autobiography of mathematician Stanislaw Ulam, one of the great scientific minds of the twentieth century, tells a story rich with amazingly prophetic speculations and peppered with lively anecdotes. As a member of the Los Alamos National Laboratory from 1944 on, Ulam helped to precipitate some of the most dramatic changes of the postwar world. He was among the first to use and advocate computers for scientific research, originated ideas for the nuclear propulsion of space vehicles, and

made fundamental contributions to many of today's most challenging mathematical projects. With his wide-ranging interests, Ulam never emphasized the importance of his contributions to the research that resulted in the hydrogen bomb. Now Daniel Hirsch and William Mathews reveal the true story of Ulam's pivotal role in the making of the "Super," in their historical introduction to this behind-the-scenes look at the minds and ideas that ushered in the nuclear age. An epilogue by Françoise Ulam and Jan Mycielski sheds new light on Ulam's character and mathematical originality.

"The son of a prominent Japanese mathematician who came to the United States after World War II, Ken Ono was raised on a diet of high expectations and little praise. Rebelling against his pressure-cooker of a life, Ken determined to drop out of high school to follow his own path. To obtain his father's approval, he invoked the biography of the famous Indian mathematical prodigy Srinivasa Ramanujan, whom his father revered, who had twice flunked out of college because of his single-minded devotion to mathematics. Ono describes his rocky path through college and graduate school, interweaving Ramanujan's story with his own and telling how at key moments, he was inspired by Ramanujan and guided by mentors who encouraged him to pursue his interest in exploring Ramanujan's mathematical legacy. Picking up where others left off, beginning with the great English mathematician G.H. Hardy, who brought Ramanujan to Cambridge in 1914, Ono has devoted his mathematical career to understanding how in his short life, Ramanujan was able to discover so many deep mathematical truths, which Ramanujan believed had been sent to him as visions from a Hindu goddess. And it was Ramanujan who was ultimately the source of reconciliation between Ono and his parents. Ono's search for Ramanujan ranges over three continents and crosses paths with mathematicians whose lives span the globe and the entire twentieth century and beyond. Along the way, Ken made many fascinating discoveries. The most important and surprising one of all was his own humanity."

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.

*The Calculus of Friendship* is the story of an extraordinary connection between a teacher and a student, as chronicled through more than thirty years of letters between them. What makes their relationship unique is that it is based almost

entirely on a shared love of calculus. For them, calculus is more than a branch of mathematics; it is a game they love playing together, a constant when all else is in flux. The teacher goes from the prime of his career to retirement, competes in whitewater kayaking at the international level, and loses a son. The student matures from high school math whiz to Ivy League professor, suffers the sudden death of a parent, and blunders into a marriage destined to fail. Yet through it all they take refuge in the haven of calculus--until a day comes when calculus is no longer enough. Like calculus itself, *The Calculus of Friendship* is an exploration of change. It's about the transformation that takes place in a student's heart, as he and his teacher reverse roles, as they age, as they are buffeted by life itself. Written by a renowned teacher and communicator of mathematics, *The Calculus of Friendship* is warm, intimate, and deeply moving. The most inspiring ideas of calculus, differential equations, and chaos theory are explained through metaphors, images, and anecdotes in a way that all readers will find beautiful, and even poignant. Math enthusiasts, from high school students to professionals, will delight in the offbeat problems and lucid explanations in the letters. For anyone whose life has been changed by a mentor, *The Calculus of Friendship* will be an unforgettable journey.

A biography of the Indian mathematician Srinivasa Ramanujan. The book gives a detailed account of his upbringing in India, his mathematical achievements, and his mathematical collaboration with English mathematician G. H. Hardy. The book also reviews the life of Hardy and the academic culture of Cambridge University during the early twentieth century. There are few textbooks of mathematics as well-known as Hardy's *Pure Mathematics*. Since its publication in 1908, this classic book has inspired successive generations of budding mathematicians at the beginning of their undergraduate courses. In its pages, Hardy combines the enthusiasm of the missionary with the rigour of the purist in his exposition of the fundamental ideas of the differential and integral calculus, of the properties of infinite series and of other topics involving the notion of limit. Celebrating 100 years in print with Cambridge, this edition includes a Foreword by T. W. Körner, describing the huge influence the book has had on the teaching and development of mathematics worldwide. Hardy's presentation of mathematical analysis is as valid today as when first written: students will find that his economical and energetic style of presentation is one that modern authors rarely come close to.

A Fields medalist recounts his lifelong transnational effort to uncover the geometric shape—the Calabi-Yau manifold—that may store the hidden dimensions of our universe. Harvard geometer and Fields medalist Shing-Tung Yau has provided a mathematical foundation for string theory, offered new insights into black holes, and mathematically demonstrated the stability of our universe. In this autobiography, Yau reflects on his improbable journey to becoming one of the world's most distinguished mathematicians. Beginning with an impoverished childhood in China and Hong Kong, Yau takes readers through his doctoral studies at Berkeley during the height of the Vietnam War protests, his Fields Medal-winning

proof of the Calabi conjecture, his return to China, and his pioneering work in geometric analysis. This new branch of geometry, which Yau built up with his friends and colleagues, has paved the way for solutions to several important and previously intransigent problems. With complicated ideas explained for a broad audience, this book offers readers not only insights into the life of an eminent mathematician, but also an accessible way to understand advanced and highly abstract concepts in mathematics and theoretical physics.

An excellent undergraduate text examines sets and structures, limit and continuity in  $\mathbb{R}^n$ , measure and integration, differentiable mappings, sequences and series, applications of improper integrals, more. Problems with tips and solutions for some.

Mathematics as a Science of Patterns expounds a system of ideas about the nature of mathematics which Michael Resnik has been elaborating for a number of years. In calling mathematics a science he implies that it has a factual subject-matter and that mathematical knowledge is on a par with other scientific knowledge; in calling it a science of patterns he expresses his commitment to a structuralist philosophy of mathematics. He links this to a defence of realism about the metaphysics of mathematics--the view that mathematics is about things that really exist.

In August 1859 Bernhard Riemann, a little-known 32-year old mathematician, presented a paper to the Berlin Academy titled: "On the Number of Prime Numbers Less Than a Given Quantity." In the middle of that paper, Riemann made an incidental remark "a guess, a hypothesis. What he tossed out to the assembled mathematicians that day has proven to be almost cruelly compelling to countless scholars in the ensuing years. Today, after 150 years of careful research and exhaustive study, the question remains. Is the hypothesis true or false? Riemann's basic inquiry, the primary topic of his paper, concerned a straightforward but nevertheless important matter of arithmetic "defining a precise formula to track and identify the occurrence of prime numbers. But it is that incidental remark "the Riemann Hypothesis" that is the truly astonishing legacy of his 1859 paper. Because Riemann was able to see beyond the pattern of the primes to discern traces of something mysterious and mathematically elegant shrouded in the shadows "subtle variations in the distribution of those prime numbers. Brilliant for its clarity, astounding for its potential consequences, the Hypothesis took on enormous importance in mathematics. Indeed, the successful solution to this puzzle would herald a revolution in prime number theory. Proving or disproving it became the greatest challenge of the age. It has become clear that the Riemann Hypothesis, whose resolution seems to hang tantalizingly just beyond our grasp, holds the key to a variety of scientific and mathematical investigations. The making and breaking of modern codes, which depend on the properties of the prime numbers, have roots in the Hypothesis. In a series of extraordinary developments during the 1970s, it emerged that even the physics of the atomic nucleus is connected in ways not yet fully understood to this strange conundrum.



Hunting down the solution to the Riemann Hypothesis has become an obsession for many – the veritable "great white whale" of mathematical research. Yet despite determined efforts by generations of mathematicians, the Riemann Hypothesis defies resolution. Alternating passages of extraordinarily lucid mathematical exposition with chapters of elegantly composed biography and history, *Prime Obsession* is a fascinating and fluent account of an epic mathematical mystery that continues to challenge and excite the world. Posited a century and a half ago, the Riemann Hypothesis is an intellectual feast for the cognoscenti and the curious alike. Not just a story of numbers and calculations, *Prime Obsession* is the engrossing tale of a relentless hunt for an elusive proof – and those who have been consumed by it.

This seminal, multidisciplinary book shows how mathematics can be used to study the first principles of DNA. Most importantly, it enriches the so-called "Chargaff's grammar of biology" by providing the conceptual theoretical framework necessary to generalize Chargaff's rules. Starting with a simple example of DNA mathematical modeling where human nucleotide frequencies are associated to the Fibonacci sequence and the Golden Ratio through an optimization problem, its breakthrough is showing that the reverse, complement and reverse-complement operators defined over oligonucleotides induce a natural set partition of DNA words of fixed-size. These equivalence classes, when organized into a matrix form, reveal hidden patterns within the DNA sequence of every living organism. Intended for undergraduate and graduate students both in mathematics and in life sciences, it is also a valuable resource for researchers interested in studying invariant genomic properties.

It is amazing that the usual reply to being introduced to a mathematician is a stumbling apology about how bad someone is at mathematics, no matter how good they may be in reality. The problem is that we have come to view mathematics as an arcane branch of knowledge that only a few can aspire to understand or grasp. The sense of separation between those who have the knowledge and those who do not, is present even amongst academics where many of the same skills and research practices exist - intuition, the use of symbolic structures and the use of intuition and insight. The more worrying aspect of this separation is the ever declining numbers of students choosing mathematics as part of their curriculum beyond the stage when it is mandatory. Even worse, it would seem that the mathematics community has created a discriminatory environment that deters many students from continuing beyond secondary and tertiary education. Exit interviews with graduates show a stark rejection of their previously chosen subject. What about mathematicians themselves - how do they see themselves? Do male and female mathematicians come to know their mathematics in different ways, do they tackle different problems with varying results for their status in the research community? Does the pervasive labelling that mathematics is a male domain arise because of a lack of role models for women or through its highly competitive, hierarchical nature? Are the negative labels often associated with mathematics, i. e. Based on the remarkable true story of G. H. Hardy and Srinivasa Ramanujan, and populated with such luminaries such as D. H. Lawrence, Bertrand Russell, and Ludwig Wittgenstein, *The Indian Clerk* takes this extraordinary slice of history and transforms it into an emotional and spellbinding story about the fragility of human connection and our need to find order in the world. A literary

masterpiece, it appeared on four bestseller lists, including the Los Angeles Times, and received dazzling reviews from every major publication in the country.

G. H. Hardy was one of this century's finest mathematical thinkers, renowned among his contemporaries as a 'real mathematician ... the purest of the pure'. He was also, as C. P. Snow recounts in his Foreword, 'unorthodox, eccentric, radical, ready to talk about anything'. This 'apology', written in 1940, offers a brilliant and engaging account of mathematics as very much more than a science; when it was first published, Graham Greene hailed it alongside Henry James's notebooks as 'the best account of what it was like to be a creative artist'. C. P. Snow's Foreword gives sympathetic and witty insights into Hardy's life, with its rich store of anecdotes concerning his collaboration with the brilliant Indian mathematician Ramanujan, his idiosyncrasies, and his passion for cricket. This is a unique account of the fascination of mathematics and of one of its most compelling exponents in modern times. "One of the best critiques of current mathematics education I have ever seen."—Keith Devlin, math columnist on NPR's Morning Edition A brilliant research mathematician who has devoted his career to teaching kids reveals math to be creative and beautiful and rejects standard anxiety-producing teaching methods. Witty and accessible, Paul Lockhart's controversial approach will provoke spirited debate among educators and parents alike and it will alter the way we think about math forever. Paul Lockhart, has taught mathematics at Brown University and UC Santa Cruz. Since 2000, he has dedicated himself to K-12 level students at St. Ann's School in Brooklyn, New York.

Academic life in Cambridge especially in Trinity College is viewed through the eyes of one of its greatest figures. Most of Prof. Littlewood's earlier work is presented along with a wealth of new material.

Opening another drawer in his Cabinet of Curiosities, renowned mathematics professor Ian Stewart presents a new medley of games, paradoxes, and riddles in Professor Stewart's Hoard of Mathematical Treasures. With wit and aplomb, Stewart mingles casual puzzles with grander forays into ancient and modern mathematical thought. Amongst a host of arcane and astonishing facts about every kind of number from irrational and imaginary to complex and cuneiform, we learn: – How to organize chaos – How matter balances anti-matter – How to turn a sphere inside out (without creasing it) – How to calculate pi by observing the stars – ...and why you can't comb a hairy ball. Along the way Stewart offers the reader tantalizing glimpses of the mathematics underlying life and the universe. Mind-stretching, enlightening, and endlessly amusing, Professor Stewart's Hoard of Mathematical Treasures will stimulate, delight, and enthrall.

2017 Reprint of 1941 Edition. Full facsimile of the original edition, not reproduced with Optical Recognition software. G. H. Hardy was one of this century's finest mathematical thinkers, renowned among his contemporaries as a 'real mathematician ... the purest of the pure'. This 'Apology', written in 1940, offers a brilliant and engaging account of mathematics as very much more than a science; when it was first published, Graham Greene hailed it alongside Henry James's notebooks as 'the best account of what it was like to be a creative artist'. One of the main themes of the book is the beauty that mathematics possesses, which Hardy compares to painting and poetry. For Hardy, the most beautiful mathematics was that which had no practical applications in the

outside world (pure mathematics) and, particularly, his own special field of number theory.

"As gripping as a good thriller." --The Washington Post Unpack the science of secrecy and discover the methods behind cryptography--the encoding and decoding of information--in this clear and easy-to-understand young adult adaptation of the national bestseller that's perfect for this age of WikiLeaks, the Sony hack, and other events that reveal the extent to which our technology is never quite as secure as we want to believe. Coders and codebreakers alike will be fascinated by history's most mesmerizing stories of intrigue and cunning--from Julius Caesar and his Caesar cipher to the Allies' use of the Enigma machine to decode German messages during World War II. Accessible, compelling, and timely, *The Code Book* is sure to make readers see the past--and the future--in a whole new way. "Singh's power of explaining complex ideas is as dazzling as ever." --The Guardian

An undergraduate textbook devoted exclusively to relationships between mathematics and art, *Viewpoints* is ideally suited for math-for-liberal-arts courses and mathematics courses for fine arts majors. The textbook contains a wide variety of classroom-tested activities and problems, a series of essays by contemporary artists written especially for the book, and a plethora of pedagogical and learning opportunities for instructors and students. *Viewpoints* focuses on two mathematical areas: perspective related to drawing man-made forms and fractal geometry related to drawing natural forms. Investigating facets of the three-dimensional world in order to understand mathematical concepts behind the art, the textbook explores art topics including comic, anamorphic, and classical art, as well as photography, while presenting such mathematical ideas as proportion, ratio, self-similarity, exponents, and logarithms. Straightforward problems and rewarding solutions empower students to make accurate, sophisticated drawings. Personal essays and short biographies by contemporary artists are interspersed between chapters and are accompanied by images of their work. These fine artists--who include mathematicians and scientists--examine how mathematics influences their art. Accessible to students of all levels, *Viewpoints* encourages experimentation and collaboration, and captures the essence of artistic and mathematical creation and discovery. Classroom-tested activities and problem solving Accessible problems that move beyond regular art school curriculum Multiple solutions of varying difficulty and applicability Appropriate for students of all mathematics and art levels Original and exclusive essays by contemporary artists Forthcoming: Instructor's manual (available only to teachers)

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"One of the themes of the book is how to have a fulfilling professional life. In order to achieve this goal, Krantz discusses keeping a vigorous scholarly program going and finding new challenges, as well as dealing with the everyday tasks of research, teaching, and administration." "In short, this is a survival manual for the professional mathematician - both in academics and in industry and government agencies. It is a sequel to the author's *A Mathematician's Survival Guide*."--BOOK JACKET.

Uncle Petros is a family joke. An ageing recluse, he lives alone in a suburb of Athens, playing chess and tending to his garden. If you didn't know better, you'd surely think he was one of life's failures. But his young nephew suspects otherwise. For Uncle Petros, he discovers, was once a celebrated mathematician, brilliant and foolhardy enough to stake everything on solving a problem that had defied all attempts at proof for nearly three centuries - Goldbach's Conjecture. His quest brings him into contact with some of the century's greatest mathematicians, including the Indian prodigy Ramanujan and the young Alan Turing. But his struggle is lonely and single-minded, and by the end it has apparently destroyed his life. Until that is a final encounter with his nephew opens up to Petros, once more, the deep mysterious beauty of mathematics. *Uncle Petros and Goldbach's Conjecture* is an inspiring novel of intellectual adventure, proud genius, the exhilaration of pure mathematics - and the rivalry and antagonism which torment those who pursue impossible goals.

A fascinating mixture of poetry and mathematics in which each bespeaks the other. This is as passionate a book as it is erudite. Sarah Glaz moves naturally between the visceral world of strong emotions and the mathematical world of Commutative Rings.

Winner of the 2008 Olivier Award for Best New Play "With touching emotion and unnerving disquietude, *A Disappearing Number* forces the spectator to consider the fact of love, death and belonging, within the space of his or her own personal universe."—*New Statesman*

This arsenal of tips and techniques eases new students into undergraduate mathematics, unlocking the world of definitions, theorems, and proofs.

The biography of a mathematical genius. Paul Erdos was the most prolific pure mathematician in history and, arguably, the

strangest too. 'A mathematical genius of the first order, Paul Erdos was totally obsessed with his subject -- he thought and wrote mathematics for nineteen hours a day until he died. He travelled constantly, living out of a plastic bag and had no interest in food, sex, companionship, art -- all that is usually indispensable to a human life. Paul Hoffman, in this marvellous biography, gives us a vivid and strangely moving portrait of this singular creature, one that brings out not only Erdos's genius and his oddness, but his warmth and sense of fun, the joyfulness of his strange life.' Oliver Sacks For six decades Erdos had no job, no hobbies, no wife, no home; he never learnt to cook, do laundry, drive a car and died a virgin. Instead he travelled the world with his mother in tow, arriving at the doorstep of esteemed mathematicians declaring 'My brain is open'. He travelled until his death at 83, racing across four continents to prove as many theorems as possible, fuelled by a diet of espresso and amphetamines. With more than 1,500 papers written or co-written,

Originally published in 1927, this book presents the collected papers of the renowned Indian mathematician Srinivasa Ramanujan (1887-1920), with editorial contributions from G. H. Hardy (1877-1947). Detailed notes are incorporated throughout and appendices are also included. This book will be of value to anyone with an interest in the works of Ramanujan and the history of mathematics.

When you are a young mathematician, graduate school marks the first step toward a career in mathematics. During this period, you will make important decisions which will affect the rest of your career. Here now is a detailed guide to help you navigate graduate school and the years that follow. In his inimitable and forthright style, Steven Krantz addresses the major issues of graduate school, including choosing a program, passing the qualifying exams, finding an advisor, writing a thesis, and getting your first job. As with his earlier guide, *How to Teach Mathematics*, he avoids generalities, giving clear advice on how to handle real situations. The book also contains a description of the basic elements of a mathematical education, as well as a glossary and appendices on the structure of a typical department and university and the standard academic ranks. Steven G. Krantz is an accomplished mathematician and an award-winning author. He has published 130 research articles and 45 books. He has worked in many different types of mathematics departments, supervised both masters and doctoral students, and is currently the Chair of the Mathematics Department at Washington University in St. Louis.

A Mathematician's Apology Cambridge University Press

A Study Guide for G. H. Hardy's "A Mathematician's Apology," excerpted from Gale's acclaimed *Nonfiction Classics for Students*. This concise study guide includes plot summary; character analysis; author biography; study questions; historical context; suggestions for further reading; and much more. For any literature project, trust *Nonfiction Classics for Students* for all of your research needs.

All the matter and light we can see in the universe makes up a trivial 5 per cent of everything. The rest is hidden. This could be the biggest puzzle that science has ever faced. Since the 1970s, astronomers have been aware that galaxies have far too little matter in them to account for the way they spin around: they should fly apart, but something concealed holds them together. That

'something' is dark matter – invisible material in five times the quantity of the familiar stuff of stars and planets. By the 1990s we also knew that the expansion of the universe was accelerating. Something, named dark energy, is pushing it to expand faster and faster. Across the universe, this requires enough energy that the equivalent mass would be nearly fourteen times greater than all the visible material in existence. Brian Clegg explains this major conundrum in modern science and looks at how scientists are beginning to find solutions to it.

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