

Mathematics A Very Short Introduction Timothy Gowers

Algebra marked the beginning of modern mathematics, moving it beyond arithmetic, which involves calculations featuring given numbers, to problems where some quantities are unknown. Now, it stands as a pillar of mathematics, underpinning the quantitative sciences, both social and physical. This Very Short Introduction explains algebra from scratch. Over the course of ten logical chapters, Higgins offers a step by step approach for readers keen on developing their understanding of algebra. Using theory and example, he renews the reader's acquaintance with school mathematics, before taking them progressively further and deeper into the subject. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

How many possible sudoku puzzles are there? In the lottery, what is the chance that two winning balls have consecutive numbers? Who invented Pascal's triangle? (it was not Pascal) Combinatorics, the branch of mathematics concerned with selecting,

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arranging, and listing or counting collections of objects, works to answer all these questions. Dating back some 3000 years, and initially consisting mainly of the study of permutations and combinations, its scope has broadened to include topics such as graph theory, partitions of numbers, block designs, design of codes, and latin squares. In this Very Short Introduction Robin Wilson gives an overview of the field and its applications in mathematics and computer theory, considering problems from the shortest routes covering certain stops to the minimum number of colours needed to colour a map with different colours for neighbouring countries. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

Newton's contributions to an understanding of the heavens and the earth are considered to be unparalleled. This very short introduction explains his scientific theories, and uses Newton's unpublished writings to paint a picture of an extremely complex man whose beliefs had a huge impact on Europe's political, intellectual, and religious landscape.

Identity has become one of the most widely used terms today, appearing in many different contexts. Anything and everything has an identity, and identity crises have

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become almost equally pervasive. Yet 'identity' is extremely versatile, meaning different things to different people and in different scientific disciplines. To many its meaning seems self-evident, since its various uses share common features, so often the term is used without a definition of what, exactly, is meant by it. This provokes the core question: What exactly is identity? In this Very Short Introduction Florian Coulmas provides a survey of the many faces of the concept of identity, and discusses its significance and varied meanings in the fields of philosophy, sociology, and psychology, as well as politics and law. Tracing our concern with identity to its deep roots in Europe's intellectual history, individualism, and the felt need to draw borderlines, Coulmas identifies the most important features used to mark off individual and collective identities, and demonstrates why they are deemed important. He concludes with a glimpse at the many ways in which literature has engaged with problems of identity throughout history. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

Born of the desire to understand the workings of motions of the heavenly bodies, trigonometry gave the ancient Greeks the ability to predict their futures. Most of what we see of the subject in school comes from these heavenly origins; 15th century

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astronomer Regiomontanus called it "the foot of the ladder to the stars." In this Very Short Introduction Glen Van Brummelen shows how trigonometry connects mathematics to science, and has today become an indispensable tool in predicting cyclic patterns like animal populations and ocean tides. Its historical journey through major cultures such as medieval India and the Islamic World has taken it through disciplines such as geography and even religious practice. Trigonometry has also been a major player in the most startling mathematical developments of the modern world. Its interactions with the concept of infinity led to Taylor and Fourier series, some of the most practical tools of modern science. The birth of complex numbers led to a shocking union of exponential and trigonometric functions, creating the most beautiful formulas and powerful modelling tools in science. Finally, as Van Brummelen shows, trigonometry allows us to explore the strange new worlds of non-Euclidean geometries, opening up bizarre possibilities for the shape of space itself. And indeed, one of those new geometries - spherical - takes us full circle back to ancient Greek astronomers and European navigators, who first used it to chart their ways across the heavens and the earth. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

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The aim of this book is to explain, carefully but not technically, the differences between advanced, research-level mathematics, and the sort of mathematics we learn at school. The most fundamental differences are philosophical, and readers of this book will emerge with a clearer understanding of paradoxical-sounding concepts such as infinity, curved space, and imaginary numbers. The first few chapters are about general aspects of mathematical thought. These are followed by discussions of more specific topics, and the book closes with a chapter answering common sociological questions about the mathematical community (such as "Is it true that mathematicians burn out at the age of 25?")

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In this Very Short Introduction, Jacqueline Stedall explores the rich historical and cultural diversity of mathematical endeavour from the distant past to the present day, using illustrative case studies drawn from a range of times and places; including early imperial China, the medieval Islamic world, and nineteenth-century Britain.

Infinity is an intriguing topic, with connections to religion, philosophy, metaphysics, logic, and physics as well as mathematics. Its history goes back to ancient times, with especially important contributions from Euclid, Aristotle, Eudoxus, and Archimedes. The

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infinitely large (infinite) is intimately related to the infinitely small (infinitesimal). Cosmologists consider sweeping questions about whether space and time are infinite. Philosophers and mathematicians ranging from Zeno to Russell have posed numerous paradoxes about infinity and infinitesimals. Many vital areas of mathematics rest upon some version of infinity. The most obvious, and the first context in which major new techniques depended on formulating infinite processes, is calculus. But there are many others, for example Fourier analysis and fractals. In this Very Short Introduction, Ian Stewart discusses infinity in mathematics while also drawing in the various other aspects of infinity and explaining some of the major problems and insights arising from this concept. He argues that working with infinity is not just an abstract, intellectual exercise but that it is instead a concept with important practical everyday applications, and considers how mathematicians use infinity and infinitesimals to answer questions or supply techniques that do not appear to involve the infinite.

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How is a subway map different from other maps? What makes a knot knotted? What makes the Mbius strip one-sided? These are questions of topology, the mathematical

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study of properties preserved by twisting or stretching objects. In the 20th century topology became as broad and fundamental as algebra and geometry, with important implications for science, especially physics. In this Very Short Introduction Richard Earl gives a sense of the more visual elements of topology (looking at surfaces) as well as covering the formal definition of continuity. Considering some of the eye-opening examples that led mathematicians to recognize a need for studying topology, he pays homage to the historical people, problems, and surprises that have propelled the growth of this field. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

100 years ago, Einstein's theory of relativity shattered the world of physics. Our comforting Newtonian ideas of space and time were replaced by bizarre and counterintuitive conclusions: if you move at high speed, time slows down, space squashes up and you get heavier; travel fast enough and you could weigh as much as a jumbo jet, be squashed thinner than a CD without feeling a thing - and live for ever. And that was just the Special Theory. With the General Theory came even stranger ideas of curved space-time, and changed our understanding

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of gravity and the cosmos. This authoritative and entertaining Very Short Introduction makes the theory of relativity accessible and understandable. Using very little mathematics, Russell Stannard explains the important concepts of relativity, from $E=mc^2$ to black holes, and explores the theory's impact on science and on our understanding of the universe. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

The Earth contains a vast array of minerals, many with highly complex arrangements of atoms of several elements. David Vaughan explores the structure of minerals, the conditions under which they form and transform, their properties, and their interaction with microbes, as well as their importance in human health.

Mathematics is a fundamental human activity that can be practised and understood in a multitude of ways; indeed, mathematical ideas themselves are far from being fixed, but are adapted and changed by their passage across periods and cultures. In this Very Short Introduction, Jacqueline Stedall explores

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the rich historical and cultural diversity of mathematical endeavour from the distant past to the present day. Arranged thematically, to exemplify the varied contexts in which people have learned, used, and handed on mathematics, she also includes illustrative case studies drawn from a range of times and places, including early imperial China, the medieval Islamic world, and nineteenth-century Britain. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable. Modern statistics is very different from the dry and dusty discipline of the popular imagination. In its place is an exciting subject which uses deep theory and powerful software tools to shed light and enable understanding. And it sheds this light on all aspects of our lives, enabling astronomers to explore the origins of the universe, archaeologists to investigate ancient civilisations, governments to understand how to benefit and improve society, and businesses to learn how best to provide goods and services. Aimed at readers with no prior mathematical knowledge, this Very Short Introduction explores and explains how statistics work, and how we can decipher them. ABOUT THE SERIES: The Very Short

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Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

Physics, the fundamental science of matter and energy, encompasses all levels of nature from the subatomic to the cosmic, and underlies much of the technology around us. Understanding the physics of our universe is an essential aspect of humanity's quest to understand our environment and our place within it. Doing physics enables us to explore the interaction between environment and human society, and can help us to work towards the future sustainability of the planet. This Very Short Introduction provides an overview of how this pervasive science came to be and how it works: who funds it, how physicists are trained and how they think, and how physics supports the technology we all use. Sidney Perkowitz presents the theories and outcomes of pure and applied physics from ideas of the Greek natural philosophers to modern quantum mechanics, cosmology, digital electronics and energy production. Considering its most consequential experiments, including recent results in elementary particles, gravitational waves and materials science, he also discusses outside the lab, the

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effects of physics on society, culture, and humanity's vision of its place in the universe. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

Now a vital part of modern economies, the rapid growth of the finance industry in recent decades is largely due to the development of mathematical methods such as the theory of arbitrage. Asset valuation, credit trading, and fund management, now depend on these mathematical tools. Mark Davis explains the theories and their applications.

Mathematics is playing an increasingly important role in society and the sciences, enhancing our ability to use models and handle data. While pure mathematics is mostly interested in abstract structures, applied mathematics sits at the interface between this abstract world and the world in which we live. This area of mathematics takes its nourishment from society and science and, in turn, provides a unified way to understand problems arising in diverse fields. This Very Short Introduction presents a compact yet comprehensive view of the field of applied mathematics, and explores its relationships with (pure) mathematics,

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science, and engineering. Explaining the nature of applied mathematics, Alain Goriely discusses its early achievements in physics and engineering, and its development as a separate field after World War II. Using historical examples, current applications, and challenges, Goriely illustrates the particular role that mathematics plays in the modern sciences today and its far-reaching potential.

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Every atom of our bodies has been part of a star. Our very own star, the Sun, is crucial to the development and sustainability of life on Earth. This Very Short Introduction presents a modern, authoritative examination of how stars live, producing all the chemical elements beyond helium, and how they die, sometimes spectacularly, to end as remnants such as black holes. Andrew King shows how understanding the stars is key to understanding the galaxies they inhabit, and thus the history of our entire Universe, as well as the existence of planets like our own. King presents a fascinating exploration of the science of stars, from the mechanisms that allow stars to form and the processes that allow

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them to shine, as well as the results of their inevitable death. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

In recent years the finance industry has mushroomed to become an important part of modern economies, and many science and engineering graduates have joined the industry as quantitative analysts, with mathematical and computational skills that are needed to solve complex problems of asset valuation and risk management. An important parallel story exists of scientific endeavour. Between 1965-1995, insightful ideas in economics about asset valuation were turned into a mathematical 'theory of arbitrage', an enterprise whose first achievement was the famous 1973 Black-Scholes formula, followed by extensive investigations using all the resources of modern analysis and probability. The growth of the finance industry proceeded hand-in-hand with these developments. Now new challenges arise to deal with the fallout from the 2008 financial crisis and to take advantage of new technology, which has revolutionized the practice of trading. This Very Short Introduction introduces readers with no previous background in

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this area to arbitrage theory and why it works the way it does. Illuminating pricing theory, Mark Davis explains its applications to interest rates, credit trading, fund management and risk management. He concludes with a survey of the most pressing issues in mathematical finance today. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

With over 140 million copies in print, and serving as the principal proselytizing tool of one of the world's fastest growing faiths, the Book of Mormon is undoubtedly one of the most influential religious texts produced in the western world. Written by Terryl Givens, a leading authority on Mormonism, this compact volume offers the only concise, accessible introduction to this extraordinary work. Givens examines the Book of Mormon first and foremost in terms of the claims that its narrators make for its historical genesis, its purpose as a sacred text, and its meaning for an audience which shifts over the course of the history it unfolds. The author traces five governing themes in particular--revelation, Christ, Zion, scripture, and covenant--and analyzes the Book's central doctrines and

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teachings. Some of these resonate with familiar nineteenth-century religious preoccupations; others consist of radical and unexpected takes on topics from the fall of Man to Christ's mortal ministries and the meaning of atonement. Givens also provides samples of a cast of characters that number in the hundreds, and analyzes representative passages from a work that encompasses tragedy, poetry, sermons, visions, family histories and military chronicles. Finally, this introduction surveys the contested origins and production of a work held by millions to be scripture, and reviews the scholarly debates that address questions of the record's historicity. Here then is an accessible guide to what is, by any measure, an indispensable key to understanding Mormonism. But it is also an introduction to a compelling and complex text that is too often overshadowed by the controversies that surround it. About the Series: Combining authority with wit, accessibility, and style, Very Short Introductions offer an introduction to some of life's most interesting topics. Written by experts for the newcomer, they demonstrate the finest contemporary thinking about the central problems and issues in hundreds of key topics, from philosophy to Freud, quantum theory to Islam.

You cannot hide from radioactivity. Even the book you are holding is slightly radioactive, but there are more serious risks. Radioactivity - the breakdown of

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unstable atomic nuclei, releasing radiation - is a fundamental process in nature. It is a process that has been harnessed to provide wide and important applications in science, medicine, industry, and energy production. But it remains much misunderstood - and feared, perhaps because nuclear radiation cannot be detected by human senses, and can undoubtedly do great harm if appropriate precautions are not taken. In recent times there have been increasing concerns about nuclear terrorism. The traces of radioactive atoms in rocks have allowed us to understand the nature and history of the Earth, in particular to date events in that history. Radioactive dating has been used for a variety of purposes, from determining the age of the first hominids to the dating of the Turin Shroud. The discovery of radioactivity has improved our survival kit, but also gave us the chance to reach a new level of awareness on the history of our species and its environmental impacts. In this Very Short Introduction, Claudio Tuniz explains the nature of radioactivity and discuss its role in nature. Describing radioactivity in the stars and in the Earth, he also looks at its wide range of applications in biomedicine and in science, as well as the mechanisms of nuclear fission and fusion, and the harnessing of nuclear power. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way

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Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable. Chaos exists in systems all around us. Even the simplest system of cause and effect can be subject to chaos, denying us accurate predictions of its behaviour, and sometimes giving rise to astonishing structures of large-scale order. Our growing understanding of Chaos Theory is having fascinating applications in the real world - from technology to global warming, politics, human behaviour, and even gambling on the stock market. Leonard Smith shows that we all have an intuitive understanding of chaotic systems. He uses accessible maths and physics (replacing complex equations with simple examples like pendulums, railway lines, and tossing coins) to explain the theory, and points to numerous examples in philosophy and literature (Edgar Allen Poe, Chang-Tzu, Arthur Conan Doyle) that illuminate the problems. The beauty of fractal patterns and their relation to chaos, as well as the history of chaos, and its uses in the real world and implications for the philosophy of science are all discussed in this Very Short Introduction. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new

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In the 1800s mathematicians introduced a formal theory of symmetry: group theory. Now a branch of abstract algebra, this subject first arose in the theory of equations. Symmetry is an immensely important concept in mathematics and throughout the sciences, and its applications range across the entire subject. Symmetry governs the structure of crystals, innumerable types of pattern formation, how systems change their state as parameters vary; and fundamental physics is governed by symmetries in the laws of nature. It is highly visual, with applications that include animal markings, locomotion, evolutionary biology, elastic buckling, waves, the shape of the Earth, and the form of galaxies. In this Very Short Introduction, Ian Stewart demonstrates its deep implications, and shows how it plays a major role in the current search to unify relativity and quantum theory. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable. Logic is often perceived as having little to do with the rest of philosophy, and

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even less to do with real life. Graham Priest explores the philosophical roots of the subject, explaining how modern formal logic addresses many issues. Number theory is the branch of mathematics primarily concerned with the counting numbers, especially primes. It dates back to the ancient Greeks, but today it has great practical importance in cryptography, from credit card security to national defence. This book introduces the main areas of number theory, and some of its most interesting problems.

Games are everywhere: Drivers maneuvering in heavy traffic are playing a driving game. Bargain hunters bidding on eBay are playing an auctioning game. The supermarket's price for corn flakes is decided by playing an economic game. This Very Short Introduction offers a succinct tour of the fascinating world of game theory, a ground-breaking field that analyzes how to play games in a rational way. Ken Binmore, a renowned game theorist, explains the theory in a way that is both entertaining and non-mathematical yet also deeply insightful, revealing how game theory can shed light on everything from social gatherings, to ethical decision-making, to successful card-playing strategies, to calculating the sex ratio among bees. With mini-biographies of many fascinating, and occasionally eccentric, founders of the subject--including John Nash, subject of the movie *A Beautiful Mind*--this book offers a concise overview of a cutting-edge

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field that has seen spectacular successes in evolutionary biology and economics, and is beginning to revolutionize other disciplines from psychology to political science. About the Series: Oxford's Very Short Introductions offers concise and original introductions to a wide range of subjects--from Islam to Sociology, Politics to Classics, and Literary Theory to History. Not simply a textbook of definitions, each volume provides trenchant and provocative--yet always balanced and complete--discussions of the central issues in a given topic. Every Very Short Introduction gives a readable evolution of the subject in question, demonstrating how it has developed and influenced society. Whatever the area of study, whatever the topic that fascinates the reader, the series has a handy and affordable guide that will likely prove indispensable.

Measurement is a fundamental concept that underpins almost every aspect of the modern world. It is central to the sciences, social sciences, medicine, and economics, but it affects everyday life. We measure everything - from the distance of far-off galaxies to the temperature of the air, levels of risk, political majorities, taxes, blood pressure, IQ, and weight. The history of measurement goes back to the ancient world, and its story has been one of gradual standardization. Today there are different types of measurement, levels of accuracy, and systems of units, applied in different contexts. Measurement

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involves notions of variability, accuracy, reliability, and error, and challenges such as the measurement of extreme values. In this Very Short Introduction, David Hand explains the common mathematical framework underlying all measurement, the main approaches to measurement, and the challenges involved. Following a brief historical account of measurement, he discusses measurement as used in the physical sciences and engineering, the life sciences and medicine, the social and behavioural sciences, economics, business, and public policy. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable. The proposal that the impact of humanity on the planet has left a distinct footprint, even on the scale of geological time, has recently gained much ground. Global climate change, shifting global cycles of the weather, widespread pollution, radioactive fallout, plastic accumulation, species invasions, the mass extinction of species - these are just some of the many indicators that we will leave a lasting record in rock, the scientific basis for recognizing new time intervals in Earth's history. The Anthropocene, as the proposed new epoch has

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been named, is regularly in the news. Even with such robust evidence, the proposal to formally recognize our current time as the Anthropocene remains controversial both inside and outside the scholarly world, kindling intense debates. The reason is clear. The Anthropocene represents far more than just another interval of geologic time. Instead, the Anthropocene has emerged as a powerful new narrative, a concept through which age-old questions about the meaning of nature and even the nature of humanity are being revisited and radically revised. This Very Short Introduction explains the science behind the Anthropocene and the many proposals about when to mark its beginning: the nuclear tests of the 1950s? The beginnings of agriculture? The origins of humans as a species? Erle Ellis considers the many ways that the Anthropocene's "evolving paradigm" is reshaping the sciences, stimulating the humanities, and foregrounding the politics of life on a planet transformed by humans. The Anthropocene remains a work in progress. Is this the story of an unprecedented planetary disaster? Or of newfound wisdom and redemption? Ellis offers an insightful discussion of our role in shaping the planet, and how this will influence our future on many fronts. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a

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new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

A short introduction ideal for students learning category theory for the first time. About the philosophy of René Descartes.

In this Very Short Introduction Peter M. Higgins presents an overview of the number types featured in modern science and mathematics. Providing a non-technical account, he explores the evolution of the modern number system, examines the fascinating role of primes, and explains their role in contemporary cryptography.

Systems biology came about as growing numbers of engineers and scientists from other fields created algorithms which supported the analysis of biological data in incredible quantities. Whereas biologists of the past had been forced to study one item or aspect at a time, due to technical and biological limitations, it suddenly became possible to study biological phenomena within their natural contexts. This interdisciplinary field offers a holistic approach to interpreting these processes, and has been responsible for some of the most important developments in the science of human health and environmental sustainability. This Very Short Introduction outlines the exciting processes and possibilities in

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the new field of systems biology. Eberhard O. Voit describes how it enabled us to learn how intricately the expression of every gene is controlled, how signaling systems keep organisms running smoothly, and how complicated even the simplest cells are. He explores what this field is about, why it is needed, and how it will affect our understanding of life, particularly in the areas of personalized medicine, drug development, food and energy production, and sustainable stewardship of our environments. Throughout he considers how new tools are being provided from the fields of mathematics, computer science, engineering, physics, and chemistry to grasp the complexity of the countless interacting processes in cells which would overwhelm the cognitive and analytical capabilities of the human mind. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

Since long before computers were even thought of, data has been collected and organized by diverse cultures across the world. Once access to the Internet became a reality for large swathes of the world's population, the amount of data

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generated each day became huge, and continues to grow exponentially. It includes all our uploaded documents, video, and photos, all our social media traffic, our online shopping, even the GPS data from our cars. "Big Data" represents a qualitative change, not simply a quantitative one. The term refers both to the new technologies involved, and to the way it can be used by business and government. Dawn E. Holmes uses a variety of case studies to explain how data is stored, analyzed, and exploited by a variety of bodies from big companies to organizations concerned with disease control. Big data is transforming the way businesses operate, and the way medical research can be carried out. At the same time, it raises important ethical issues; Holmes discusses cases such as the Snowden affair, data security, and domestic smart devices which can be hijacked by hackers. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

Quantum Theory is the most revolutionary discovery in physics since Newton. This book gives a lucid, exciting, and accessible account of the surprising and

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counterintuitive ideas that shape our understanding of the sub-atomic world. It does not disguise the problems of interpretation that still remain unsettled 75 years after the initial discoveries. The main text makes no use of equations, but there is a Mathematical Appendix for those desiring stronger fare. Uncertainty, probabilistic physics, complementarity, the problematic character of measurement, and decoherence are among the many topics discussed. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

Making good decisions under conditions of uncertainty - which is the norm - requires a sound appreciation of the way random chance works. As analysis and modelling of most aspects of the world, and all measurement, are necessarily imprecise and involve uncertainties of varying degrees, the understanding and management of probabilities is central to much work in the sciences and economics. In this Very Short Introduction, John Haigh introduces the ideas of probability and different philosophical approaches to probability, and gives a brief account of the history of development of probability theory, from Galileo and

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Pascal to Bayes, Laplace, Poisson, and Markov. He describes the basic probability distributions, and goes on to discuss a wide range of applications in science, economics, and a variety of other contexts such as games and betting. He concludes with an intriguing discussion of coincidences and some curious paradoxes. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable. 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. Many are familiar with the beauty and ubiquity of fractal forms within nature. Unlike the study of smooth forms such as spheres, fractal geometry describes more familiar shapes and patterns, such as the complex contours of coastlines, the outlines of clouds, and the branching of trees. In this Very Short Introduction, Kenneth Falconer looks at the roots of the 'fractal revolution' that occurred in mathematics in the 20th century, presents the 'new geometry' of fractals, explains the basic concepts, and explores the wide range of applications in science, and

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in aspects of economics. This is essential introductory reading for students of mathematics and science, and those interested in popular science and mathematics. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

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