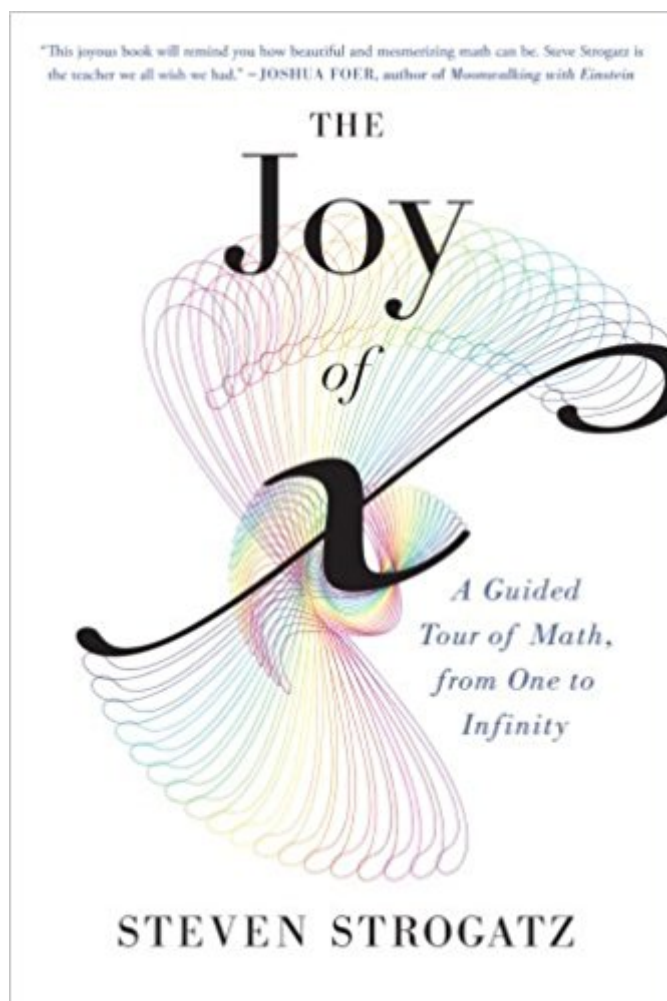


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# The Joy Of X: A Guided Tour Of Math, From One To Infinity



## Synopsis

"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*.

## Book Information

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## Customer Reviews

Guest Review by Janna Levin Janna Levin is a Professor of Astronomy and Physics at Barnard College of Columbia University. She has contributed to an understanding of black holes, the cosmology of extra dimensions, and gravitational waves in the shape of space time. She is the author of the popular-science book, *How the Universe Got Its Spots* and a novel, *A Madman Dreams of Turing Machines*, which won the PEN/Bingham prize. Janna was recently named a Guggenheim Fellow (2012). I loved this beautiful book from the first page. Mathematicians are in a peculiar predicament. Mathematical beauty is patent to them. And in the perception of that beauty is pleasure, is joy. But that pleasure is not easily shared. Mathematical beauty eludes many others, or

even most others. Steven Strogatz wants to share that joy. He sees the beauty of  $\pi$  and 0 and infinity. But he doesn't want to impose his impressions on you or to report on the view from his privileged perspective. He wants you to see it too. He doesn't want to argue that mathematics is creative and beautiful. He wants you to experience the visceral pleasure for yourself. To that end, he disassembles mathematics as a discipline, both feared and revered, and reassembles mathematics as a world, both accessible and magical. If you have never braved this grand world, put away your math anxiety, your preconceptions. This book is the most welcoming entree to mathematical thinking that I know of. If you have braved this grand world, you will find a collection of gems, new ways of inhabiting the domain. Strogatz links historical anecdotes to new insights, as though the math itself is sculptural, composed of forms that are simultaneously familiar and ethereal. The logic seems effortless so that each module snaps into its complement with a gratifying click. This book is a rebuttal to the accusation that mathematical abstraction is cold or inhuman. Mathematics is no more intrinsically cold or inhuman than language. And Strogatz lends a warmth and humanity to both. The Joy of  $x$  is, well, a joy. --This text refers to the Hardcover edition.

When Strogatz invites grade-schoolers to construct Möbius strips with scissors, crayons, and tape, he is not expecting them to discover revolutionary new mathematical principles. But he does expect them to experience the kind of intellectual joy that sustains a lifetime of mathematical inquiry. Readers share that joy by joining Strogatz on a high-spirited romp through complex numbers, standard deviations, infinite sums, differential equations, and other mathematical playgrounds. The math arrives in such delightful episodesâa hike through a snow-covered field, for example, or an excited dinner conversation over symbols scribbled on a napkinâand is so often connected to poetry, sports, and popular TV shows that even math phobes will find themselves swept up in the fun. (Who knew that The Sopranos could help us fathom calculus?) To be sure, Strogatz occasionally points well-schooled readers to the rigorous analyses identified in his endnotes. But even those reluctant to venture into deeper waters will finish this book with a new relish for mathematics as a thrilling adventure, not a dreary chore. --Bryce Christensen --This text refers to the Hardcover edition.

Struggling through several years of higher math in engineering school in the 1960s didn't engender a love of mathematics in me. It wasn't until years later that I began to value the beauty and elegance of mathematics. A big part of my appreciation came from mathematicians like Steven Strogatz who wrote about math for readers who appreciated the concepts but had no desire to wade into a

morass of complex equations. In *The Joy of x*, Strogatz has done a masterful job as our tour guide through the elements of mathematics, and he's done it without "dumbing it down" or making it just another refresher course for the subject. He presented the various mathematical elements and concepts in fresh new ways, but he clearly expected the reader to exercise their mind to understand. The reward was a new appreciation of the beauty of mathematics and for how our knowledge of the subject advanced in fits and starts over several thousand years. The book has six parts, each presenting certain elements of mathematics: Numbers, Relationships, Shapes, Change, Data, and Frontiers. These sections represent a grand tour through the history and development of mathematics, including the practical - and some whimsical - applications. Never again will I fall into the trap of bungling the answer to the classic "If three men paint three fences in three hours, how long will it take for one man to paint one fence?" (answer: 3 hours). Now I understand why a piece of paper can't be folded in half more than 7-8 times, and how a high school junior was able to beat the record using a monstrously long roll of... toilet paper! I know how Luke could guarantee himself a win over Darth Vader in a game of laser tag (hint: it involves a conic section). For young lovers, mathematics could help in finding the perfect mate (if you make a few simplistic assumptions, that is). And if the prosecution in the O.J. Simpson murder trial had understood probability and statistics, could they have gotten a conviction? As enjoyable as the first five sections of the book were, my favorite section was the last, "Frontiers," where the author covered topics including prime numbers, where I learned that no one has ever found an exact formula to find primes; group theory, which bridges the arts and sciences; topology; spherical geometry; and infinite series. This section presented some fascinating ideas. For example, group theory suggests how to get the most even wear from a mattress and confirms the old mnemonic "spin in the spring, flip in the fall." For topology, the famous Möbius strip is examined. I thought I understood the properties of a Möbius strip, but they're actually more remarkable than I would have guessed. And the most mind-blowing concept was that some infinities are larger than others. This finding, which was bitterly contested at the time, is brilliantly demonstrated with a parable named the Hilbert Hotel. I don't always read all of the footnotes or endnotes in a book, but the endnotes in *The Joy of x* are not to be missed. There are dozens of links to websites and online videos that demonstrate or expound on the concepts presented in the book. Some of these were so intriguing that I spent a couple of hours being spellbound by them. For anyone who's been disappointed by other math books written for laypersons, *The Joy of x* may be the book they've been hoping for. With keen insight, a light touch, and a bit of humor, author Steven Strogatz has written a splendid book for anyone who wants a broader understanding of mathematics. Note: I read an advance reader copy of this book provided

by the publisher through NetGalley.

It's unfortunate that math is often taught as memorization of a sequence of steps to solve a problem, without any insight or understanding of what the underlying math represents, nor realization that the underlying math was developed to solve real-world problems that are fundamental to our advancement as a society. 'The Joy of x' starts at the very basics of math and shows how each part builds on other parts. Real-world examples are given that illustrate both the need for algebra and beyond, as well as the how and why math evolved and grew. Even if you never use anything more advanced than multiplication and division, this book de-mystifies algebra and beyond, and will help move math from "a course I had to take to graduate" to a better understand of the necessity of math and how it underlies everything we do.

A few times I've seen postings on Facebook where people are proud of the fact that they "got through another day without using math". I'm amused but a little sad that they think math is unnecessary in day-to-day life. I wonder if they really didn't use math or did it without thinking of it as math. Or is it true that since they don't have a background in math they just ignore the problems in their lives where math could help. Now, I confess I was an English major and ignored math and the sciences; but I've come to understand that more math would have been helpful. Steven Strogatz shows us the basic concepts of numbers and math, building from the simple: Sesame Street characters counting fish, to the mind boggling: some infinities are larger than others. We first learn about the power of numbers when we go from calling out "fish, fish, fish" for each fish we see to grouping them together in the abstract idea of "three fish". Numbers are abstract ideas we use to stand in so we can easily measure and compare things. Once we build a set of relationship rules (addition, subtraction) we continue to develop methods of relationships. For example we build fractions as "ratios of integers - hence their technical name, rational numbers." (p 29). These rules continue to build upon one another and take us through algebra and geometry to calculus. As an example Strogatz demonstrates that adding "all the consecutive odd numbers, starting from 1: The sums above, remarkably, always turn out to be perfect squares" (p10). My biggest takeaway from the book is that when you have a hammer, everything looks like a nail. You can only use the tools in your belt to solve the problems you encounter. And worse if you do use the tools in your belt you may get the wrong answer. Or worse yet; you may have the correct tool set but use them dishonestly to misdirect people - those people like me - who didn't study enough math. An example of that is statistics, where figures lie and liars figure. Most of us have at least a passing

understanding of normal distributions (bell curves). They "can be proven to arise whenever a large number of mildly random effects of similar size, all acting independently, are added together. And many things are like that." (p 178). Many, but not all. "[P]lenty of phenomena deviate from this pattern yet still manage to follow a pattern of their own." (p 178). But we are more comfortable with the normal distributions and have the tools (the mean average) to work with them. In Power-law distributions the "modes, medians, and means do not agree because of the skewed, asymmetrical shapes of their L-curves. President Bush made use of this property when he stated that his 2003 tax cuts had saved families an average of \$1,586 each. Though that is technically correct, he was conveniently referring to the mean rebate, a figure that averaged in the whopping rebates of hundreds of thousands of dollars received by the richest 0.1 percent of the population. The tail on the far right of the income distribution is known to follow a power law, and in situations like this, the mean is a misleading statistic to use because it's far from typical. Most families, in fact got less than \$650. The median was a lot less than the mean." (p. 180) I've been intimidated by calculus but Strogatz does an effective job of making it approachable - you won't learn calculus from the book but you'll get a glimmer of understanding. If we want to find the area of a circle we start by fitting a square inside and calculate its area; then turn it into an 8 sided figure - like slices of a pizza - and calculating its area we get closer yet. And so on as the number of pie slices approaches infinity. Strogatz wraps things up with the theory of infinite sets using the illustration of the Hilbert Hotel which is always full but there is always room for one more. I can't do it justice here but he shows how the infinity of the real numbers between 0 and 1 is bigger than the infinity of whole numbers. Whaaaaat? Finally I became acquainted with the "recreational mathemusician" Vi Hart through this book. She is a video illustrator who does some marvelous work demonstrating mathematic concepts. Even if you don't read this book (which you totally should), check out Vi Hart's story of Wind and Mr. Ug; a couple of two dimensional beings who live on a transparent Möbius strip.

I thought this might be like many other books exploring the history/development of mathematics. It did do that but Strogatz does it in a way I've not read before. As a high school teacher I shared portions of this book with my senior students. Several said they wanted to read the whole book and one even purchased her own copy. Reading the book is like having a conversation with a friend about math. Those who teach and do math will appreciate the way Strogatz writes about the subject. Those who thought they didn't like math might change their mind about the subject after reading *The Joy of x*.

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