Department of Mathematics

MATHEMATICAL READING LIST

We have compiled this list of books mainly intended for students pursuing a degree in Mathematics; however, anyone who has an interest in mathematics can enjoy them and learn from them. The books were chosen to be accessible to a broad audience having varied degrees of experience with mathematics.

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INTRODUCTION

The range of mathematics books now available is enormous. This list just contains a few suggestions which you should find helpful. Unless otherwise noted, each of the following books should be available at Sims Memorial Library on campus. Most are also available (relatively) cheaply in paperback.

HISTORY AND GENERAL INTEREST

One of the most frequent complaints of mathematics undergraduates is that they did not realize until too late what was behind all the material they wrote down in lectures: Why was it important? What were the problems which demanded this new approach? Who did it? There is much to be learnt from a historical approach, even if it is fairly non-mathematical.

Alan Turing, the Enigma A. Hodges 1992
A great biography of Alan Turing, a pioneer of modern computing. The title has a double meaning: the man was an enigma, committing suicide in 1954 by eating a poisoned apple, and the German code that he was instrumental in cracking was generated by the Enigma machine. The book is largely nonmathematical, but there are no holds barred when it comes to describing his major achievement, now called a Turing machine, with which he demonstrated that a famous conjecture by Hilbert is false.

The Man Who Knew Infinity, R. Kanigel 1992
The life of Ramanujan, the self-taught mathematical prodigy from a village near Madras. He sent Hardy samples of his work from India, which included rediscoveries of theorems already well known in the West and other results which completely baffled Hardy. Some of his estimates for the number of ways a large integer can be expressed as the sum of integers are extraordinarily accurate, but seem to have been plucked out of thin air.

A Mathematician's Apology, G.H. Hardy 1992
Hardy was one of the best mathematicians of the first part of this century. Always an achiever (his New Year resolutions one year included proving the Riemann hypothesis, making 211 not out in the fourth test at the Oval, finding an argument for the non-existence of God which would convince the general public, and murdering Mussolini), he led the renaissance in mathematical analysis in England. Graham Greene knew of no writing (except perhaps Henry James's Introductory Essays) which conveys so clearly and with such an absence of fuss the excitement of the creative artist. There is an introduction by C.P. Snow.

Littlewood's Miscellany, Littlewood (edited by B. Bollobas) 1986
This collection, first published in 1953, contains some wonderful insights into the development and lifestyle of a great mathematician as well as numerous anecdotes, mathematical (Lion and Man is excellent) and not-so-mathematical. The latest edition contains several worthwhile additions, including a splendid lecture entitled `The Mathematician's Art of Work', (as well as various items of interest mainly to those who believe that Trinity Great Court is the center of the Universe). Thoroughly recommended.

The man who loved only numbers, Paul Hoffman 1999
An excellent biography of Paul Erdös, one of the most prolific mathematicians of all time. Erdös wrote over 1500 papers (about 10 times the normal number for a mathematician) and collaborated with 485 other mathematicians. He had no home; he just descended on colleagues with whom he wanted to work, bringing with him all his belongings in a suitcase. Apart from details of Erdös's life, there is plenty of discussion of the kind of problems (mainly number theory) that he worked on.

Hidden Figures, Margot Lee Shetterly 2016
Beginning with the pre-WWII National Advisory Committee for Aeronautics (NACA) and following both the careers of the female African American mathematicians and the contributions they made that helped America win the war, the book continues through the evolution from NACA to NASA. Many of these same women who helped in the design and testing of bombers and fighter planes went on to play a major role in America's goal to put a man in orbit and eventually land us on the Moon.
Importantly, the book also tells the parallel and tumultuous story of the fight for equality and respect faced by both women and persons of color. The women in the book faced extraordinary hurdles, especially as NACA was located at Langley in Virginia, a state that was one of the most severe in its attachment to segregation and Jim Crow laws.
As Shetterly writes, "It's a story of hope, that even among some of our country's harshest realities—legalized segregation, racial discrimination—there is evidence of the triumph of meritocracy, that each of us should be allowed to rise as far as our talent and hard work can take us."

Fermat's Enigma, Simon Singh 1997
You must read this story of Andrew Wiles's proof of Fermat's Last Theorem, including all sorts of mathematical ideas and anecdotes; there is no better introduction to the world of research mathematics. You must also see the associated BBC Horizon documentary if you get the chance. Singh's later *The Code Book* is not so interesting mathematically, but is still a very good read.

The Music of the Primes, Marcus du Sautoy 2003
This is a wide-ranging historical survey of a large chunk of mathematics with the Riemann Hypothesis acting as a thread tying everything together. The Riemann Hypothesis is one of the big unsolved problems in mathematics -- in fact, it is one of the Clay Institute million dollar problems -- though unlike Fermat's last theorem it is unlikely ever to be the subject of pub conversation. Du Sautoy's book is up to date, and attractively written. Some of the mathematics is tough but the history and storytelling paint a convincing (and appealing) picture of the world of professional mathematics.

Symmetry: a journey into the patterns of nature, Marcus Du Sautoy 2008
This book has had exceptionally good reviews (even better than Du Sautoy's Music of the Primes listed above). The title is self-explanatory. The book starts with a romp through the history and winds up with some very modern ideas. You even have the opportunity to discover a group for yourself and have it named after you.

How to Think like a Mathematician, Kevin Houston 2009
This sounds like the sort of book that elderly people think that young people should read. However, there is lots of good mathematics in it (including many interesting exercises) as well as lots of good advice. How can you resist a book the first words of which (relating to the need for accurate expression) are:
Question: How many months have 28 days?
Mathematician's answer: All of them.

The MαTH βOOK, Clifford A Pickover 2009
The subtitle is `From Pythagoras to the 57th Dimension, 250 Milestones in the History of Mathematics'. Each left hand page has a largely non-mathematical description of one of the great results in mathematics and each right hand page has a relevant illustration. There is just enough mathematical detail to allow you to understand the result and pursue it (if you fancy it), via google. The book is beautifully produced. The illustration for the page on Russell and Whitehead's Principia Mathematica, said here to be the 23rd most important non-fiction book of the 20th century, is the proposition occurring several hundred pages into the book, that $1 + 1 = 2$.

Mathematics: a very short introduction, Timothy Gowers 2002
Gowers is a Fields Medalist (the Fields medal is the mathematical equivalent of the Nobel prize), so it is not at all surprising that what he writes is worth reading. What is surprising is the ease and charm of his writing. He touches lightly many areas of mathematics, some that will be familiar (Pythagoras) and some that may not be (manifolds) and has something illuminating to say about all of them. The book is small and thin: it will fit in your pocket. You should get it.

Solving Mathematical Problems, Terence Tao 2006
Tao is another Fields Medalist. He subtitles this little book `a personal perspective' and there is probably no one better qualified to give a personal perspective on problem solving: at 13, he was the youngest ever (by some margin) gold medal winner in International Mathematical Olympiad. There are easy problems (as well as hard problems) and good insights throughout. The problems are mainly geometric and algebraic, including number theory (no calculus).

What is Mathematics? R. Courant & H. Robbins 1996 (Revised from the 1941 edition. Sims Library has only the original 1941 edition)
A new edition, revised by Ian Stewart, of a classic. It has chapters on numbers (including ∞), logic, cubics, duality, soap-films, etc. The subtitle (An elementary approach to ideas and methods) is rather optimistic: challenging would be a more appropriate adjective, though interesting or instructive would do equally well. Stewart has simply updated where appropriate -- for example, he discusses the solution to the four-color problem and the proof of Fermat's Last Theorem.

Archimedes' Revenge, P. Hoffman 1991
This is not a difficult read, but it covers some very interesting topics: for example, why democracy is mathematically unsound, Turing machines, and travelling salesmen. Remarkably, there is no chapter on chaos.

The Mathematical Experience, P.J. Davis & R. Hersh 1990
This gives a tremendous foretaste of the excitement of discovering mathematics. A classic.

Beyond Numeracy, J. A. Paulos 1991
Bite-sized essays on fractals, game-theory, countability, convergence, and much more. It is a sequel to his equally entertaining, but less technical, *Numeracy*.

Surely You're Joking Mr Feynman, R.P. Feynman 1992
Autobiographical anecdotes from one of the greatest theoretical physicists of the last century, which became an immediate best-seller. You learn about physics, about life and (most puzzling of all) about Feynman. Very amusing and entertaining.

How Not to Be Wrong: The power of mathematical thinking, Jordan Ellenberg, 2014
Ellenberg uses basic mathematical ideas to expose the hidden structure underlying many real-life situations we may encounter. He writes about the error of assuming all relationships are linear, uncertainty, the correct and incorrect interpretations of inference, expectation, geometry, and the concept of regression. The ideas are approached through real questions about where to put the armor on an airplane, Bible codes, the Baltimore stockbroker con, error-correcting codes, playing the lottery vs. winning the lottery, eugenics, smoking and lung cancer, public opinion, elections, and more. All of this is done with a good dose of wit and humor. His goal is to help the reader see that "there is structure in the world, that we can hope to understand some of it and not just gape at what our senses present to us."

Shape: The hidden geometry of information, biology, strategy, democracy, and everything else, Jordan Ellenberg, 2021
This is NOT the geometry you learned in high school. Here, Ellenberg consider how a democracy should best choose its representatives, how to stop a pandemic, how computers learn to play GO, what kids should learn in school if they really want to learn to think, and more. Entertaining, informative, and very readable.

The Art of More: How mathematics created civilization, Michael Brooks, 2021 [On order for Sims Library, June 2022]
From learning to count, tax collection, the beginnings of banking and trade, the industrial revolution, electric lights, landing men on the moon, to modern computing and information theory, Brooks explains the mathematical revolutions that drove our human history.

TOPICS IN SPECIFIC MATHEMATICAL AREAS

Students study mathematics for many reasons and at Southeastern Louisiana University we offer five concentrations in Mathematics: Business/Actuarial, Education, Industrial, Scientific Computing, and Pure. The first book in this list is for all students. The remaining books are directed towards specific concentration areas.

How to Succeed in College Mathematics, R.M. Dahlke, 2008
This book is written for the college mathematics major. There is a wealth of information, techniques and practices to help with reading, writing, and studying mathematics.

My Life as a Quant, E. Derman 2004
A non-technical, biographical introduction to financial engineering and what types of work financial engineers do.

How to Solve It, G. Polya, 1945
A study of heuristics—methods and rules used to discover and prove mathematics—from a pedagogical perspective. A classic.

Knowing and Teaching Elementary Mathematics, L Ma 1999
Liping Ma conducts a detailed analysis of the mathematical understanding among U.S. and Chinese elementary school teachers as it relates to their classroom practices. A valuable read for anyone interested in Mathematics Education.

The Princeton Companion to Applied Mathematics, ed. N. Highman, 2015
An authoritative and accessible single-volume reference book on applied mathematics. Featuring numerous entries by leading experts and organized thematically, it introduces readers to applied mathematics and its uses; explains key concepts; describes important equations, laws, and functions; looks at exciting areas of research; covers modeling and simulation; explores areas of application; and more.

Modeling Life: the mathematics of biological systems, A. Garfinkel, J. Shevtsov, Y. Gao 2017.
This book develops the mathematical tools essential for students in the life sciences to describe interacting systems and predict their behavior. From predator-prey populations in an ecosystem, to hormone regulation within the body, the natural world abounds in dynamical systems that affect us profoundly. Complex feedback relations and counter-intuitive responses are common in nature; this book develops the quantitative skills needed to explore these interactions.

Gödel, Escher, Bach: an eternal golden braid, D. Hofstedter 1979. [Available as an e-book through Sims Memorial Library.]
Part mathematics, part computer science, part music, part art, part logic, and part philosophy, this book is both challenging and entertaining.

CAREERS IN MATHEMATICS

BIG Jobs Guide: Business, Industry, and Government Careers for Mathematical Scientists, Statisticians, and Operations Researchers, R. Levy, R. Laugesen, F. Santosa, 2018.
This is a hands-on guide to pursuing a career in applied mathematics. It includes topics such as how to write a resume, where to find jobs/internships, how to market yourself, and tips for international students.

The Chicago Guide to Your Career in Science: A toolkit for students and postdocs, A. Bloomfield and E. El-Fakahany, 2008
A how-to guide for pursuing a career in science. It includes tips for conducting research, how to create a poster or conference presentation, how to write a journal article, tips for finding your first job, etc.

A Primer of Mathematical Writing, Steven G. Krantz, 1991
This book focuses on how to write in the professional mathematics environment. An excellent resource for graduate students and professionals.

Math into LaTeX: An introduction to LaTeX and AMS-LaTeX, George Grätzer, 2000
For those who will need to write (and more importantly type!) mathematical documents, this is an excellent resource to the workings of the scientific typesetting software LaTex. From the basics to the highly advanced, this book will answer your questions from typing anything from a simple equation to an entire book.

PARENTING AND WOMEN'S ISSUES IN THE SCIENCES

Motherhood: The Elephant in the Laboratory, E. Monsoon, 2008
Thirty-four female scientists share their experiences on work-life balance and raising children in a scientific career field. Their stories range from the 1970s to the 2000s.

Why So Slow? The Advancement of Women, V. Valian, 199.
Data from psychology, sociology, economics, and biology is used to create statistical documentation to discuss trends on the professional advancement of women and men.

JUST FOR FUN

Uncle Petros and Goldbach's Conjecture, Apostolos Doxiadis, 2000.
A novel, this book revolves about family, chess, Mathematics, and, of course, the Goldbach Conjecture.

The summaries of several texts in this list are taken from the *Mathematical Reading List* of Cambridge University available on-line at
https://www.maths.cam.ac.uk/sites/www.maths.cam.ac.uk/files/pre2014/undergrad/admissions/readinglist.pdf