

Math List

May 26, 2022

Abstract

Here's the courses for undergrad and the books I have used and have been recommended throughout my mathematical journey. This list was first developed in 2018, when I had acquired a taste for Physics in HS, then prospered when I realized Physics was dumb. The list has been/is edited to save money, given I prefer physical copies, and be as comprehensive as possible, such that it is more than sufficient for a college course and math knowledge in general, and at the same time as small as possible; so, being concise is the main goal for this list; and the hope is that every subject/book in the list is disjoint from one another. I also am not a book connoisseur, so it's not like these are the best books possible, these come from a chain of recommendations, and readings I have found myself. So I may/have change(d) the list at various moments if I find something more concise and to the point. But as of the creation of this LaTeX doc (12/01/20), this list is more than enough, once again, for any university, including Ivy, as of now; in fact, a lot of their courses/books are dog shit in comparison, I would say, and will die on a hill by.

Also, note for people at the "Basics" level, it's better not to skip around subjects and be lost for a month, than to do the proper prerequisites beforehand (trust me). I also want to add that to afford some of these overpriced books, I use slugbooks.com

List without exposition: <https://www.overleaf.com/read/gnwynqhjgwbt>

Basics:

- "Basic Mathematics"- Serge Lang
- Calculus 1,2,3 (By Ron Larson - Calculus: Early Transcendental Functions)(For additional practice, try to do all these tests and learn from your mistakes: <https://tinyurl.com/y5b8g3b2>)
- Linear algebra ("Linear Algebra"-Kenneth Hoffman/Ray Kunze)
- Differential equations(ODE) ("Ordinary Differential Equations (Dover Books)" - Morris)¹

¹See the last page

It Branches off into(Intermediate/Undergrad math)(No order unless noted):

- Real Analysis ("Principles of Mathematical Analysis"- Rudin)- If Rudin is too hard, a good "Ice breaker" is to do the Set Theory & Topology book in the list first, this book doesn't require you to do real analysis before, and it helped me understand Rudin more- (Written abt. 2019).

- Set Theory/Topology ("Set Theory"- Daniel W.Cunningham & ("Topology"- Munkres with "Topology"- K Jänich (*KJänich is really optional, but they're just a good pair, just read it online(Libgen) after Munkres, it's short & sweet*)))

- Complex Analysis ("Complex Analysis" - Stein)- requires Analysis, very fast & more difficult than a standard Complex Analysis book.

- Algebra ("Algebra"- Serge Lang)- If you don't like algebra, try T. Hungerford's "Algebra" and its exercises; excellent book, but I added Lang instead because it's more comprehensive, but I also prefer this.

- Differential Geometry/Manifolds ("Introduction to Manifolds"-Loring W.Tu, then(&) "Differential Geometry" - Loring Tu)-requires topology and analysis

- Algebraic Topology ("Algebraic Topology" - Allen Hatcher)-requires topology, & really, really basic algebra. You can just skip the subject entirely, and use wiki if needed, if you don't want to finish college. It's dense enough so that you can just learn it on the go

After that it can just be anything any order and the subjects become more distinct from one another, these are more optional (Intermediate math: Addendum):

- More Set Theory ("Set Theory"- Thomas Jech)

- Mathematical Logic ("Mathematical Logic"- Thomas, Flum, & Ebbinghaus)

- Graph theory ("Graph Theory"- Adrian Bondy)- analysis needed

- Measure Theory/Functional Analysis ("Real and Complex Analysis"- W. Rudin with <https://tinyurl.com/w2yftw> (*Read online with Rudin, the text and formatting makes it easy, so it's doable, it's a very soft and nice book, like K Jänich (no homo).*)) -Real Analysis and P.S Topology suggested/required

- More Functional Analysis ("A Course in Functional Analysis"- Jon Conway)- Real Analysis required

- Model Theory ("Model Theory: An Introduction" by David Marker)- Logic and basic Algebra suggested/required

Graduate Mathematics:

- More Differential Geometry ("A Comprehensive Introduction to Differential Geometry" (*Some Volumes*)- M. Spivak & "Riemannian geometry and geometric analysis"- Jost, Jürgen)
- Category theory ("Categories for the Working Mathematician" by Saunders Mac Lane)
- Representation Theory ("Introduction to Lie Algebras and Representation Theory"- J.E. Humphreys, then "Representation Theory: A First Course"- J. Harris/Fulton (*If you want to go conservative with your money and shelf space: just chose Harris*))
- Algebraic Geometry/Complex Algebraic Geometry ("Algebraic Geometry: A first course"-Joe Harris, then "The Geometry of Schemes"- David Eisenbud/Harris & "Algebraic Geometry"-Hartshorne, then "A Second Course in Algebraic Geometry"-Harris/Eisenbud, then "Etale Cohomology Theory"- Lei fu)
- Differential Topology ("Differential Forms in Algebraic Topology" by Raoul Bott, & "Differential Topology" by C.T.C Wall)
- Homotopy Theory ("Elements of Homotopy Theory" - George W.Whitehead)
- Geometric Topology ("An Introduction to Geometric Topology"- Bruno Martelli & "Introduction to Vassiliev Knot Invariants"- S. Chmutov)

Books that I acknowledge exist and are ok, but you shouldn't care to read/buy, so stfu about them to me; they may be good, but cover an infinitesimal amount of the subject, or I just don't care:

"Differential Topology"- Victor Guillemin/Allan Pollack, "Commutative Algebra"- Atiyah, "Algebra"- D&F, "Principles of Mathematical Logic"- Hilbert, most annals made before the end of WWII, "Principles of Algebraic Geometry"- Griffiths/Harris, & any one of Milnor's or Lee's books.

I wish you great fortune, and make sure to have fun! I am excited for what you have to bring for the future of mathematics!!!!

Research Level. Most likely never taught in a graduate level(post-doc). I created this because I wanted to learn PL Topology & more about Algebraic Topology; but at this point I'm just compiling a bunch of crap I find that is new. This is the time for specialization, and for you to just read papers and do research in whatever field you want, but here's some books:

- Piecewise-Linear Topology ("Spaces of PL Manifolds and Categories of Simple Maps"- Waldhausen & "Cellular Structures in Topology" - Fritsch)- Heavy on Cat. Theory and DT

- More Algebraic Topology ("Handbook of Algebraic Topology"- I.M. James)

- More Differential Topology (subsection: Surgery theory) ("The Geometric Hopf Invariant and Surgery Theory" by Crabb/Ranicki & "On Thom Spectra, Orientability, and Cobordism" - Yuli B. Rudyak)

- More Differential Equations ("Theory of Differential Equations"- Andrew Russell Forsyth (VI Volume Set))

*Note: For more, see books with "Monograph", "Annals", and/or "Handbook" in their title. They are the **latest** developments in mathematics for their time; collections of the most recent papers written together in a connective and comprehensive format for a particular topic. It is, at this point, literally impossible to update a complete list. Example: I recently just found a 500 page monograph just released 4 months ago at the time of writing this (2/14/21), so once again, this is the end. Best of luck.*