Proof-Based Math Readings
Session: Proof Techniques*

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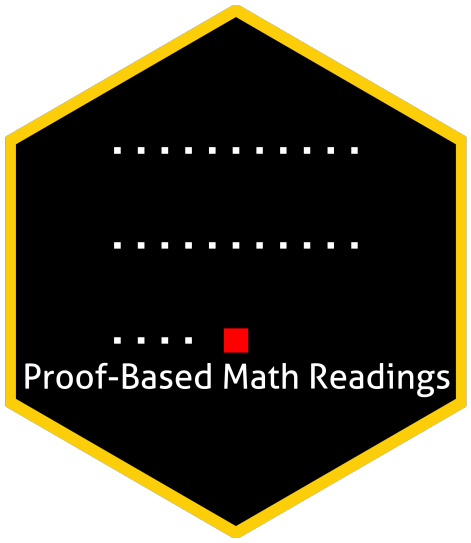

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0 Motivation

- *Proof-Based Math Readings* is a free, independent online reading group where we study the mathematics required for economics master's and PhD programs through an intuitive approach. Active since May 2023.
- This session of the reading group is on *Proof Techniques*.

1 Prerequisites

- Calculus resources below.
- Please use the Application Form to join our reading group; you will receive a response within a week.

2 Format

- This session takes 12 weeks. We do not have face-to-face/online meetings due to the size of the group.
- Members read the main book and discuss the topics/exercises in the Proof-Based Math Readings Discord .

3 Resources [All are open-access]

3.1 Main Book and Main Book's Playlist

Book of Proof - Richard Hammack (3.4 Edition, 2025) is our main book because it is a well-written and well-structured pedagogical masterpiece. It is also open-access and provides detailed solutions for odd-numbered exercises at the end of the book.

Jeremy Teitelbaum's playlist on Book of Proof is our main playlist because his narrative is great.

- Book of Proof - Richard Hammack (3.4 Edition, 2025)
- Book of Proof - Richard Hammack (3.4 Edition, 2025, Playlist by Jeremy Teitelbaum, Chapters 1-12)

3.2 Supplementary

3.2.1 Proof Techniques

Because our main playlist does not cover Chapters 13-14, we cover these chapters from Michael Penn's playlist.

- Book of Proof - Richard Hammack (3.4 Edition, 2025, Playlist by Michael Penn, Chapters 1-14)
- Book of Proof - Richard Hammack (3.4 Edition, 2025, Playlist by Valerie Hower, Chapters 1-12)
- Book of Proof - Richard Hammack (3.4 Edition, 2025, Workbook by Justin Wright)
- Appendix A: Elements of Style for Proofs - Dana C. Ernst (2025)

3.2.2 Calculus

- Essence of Calculus - 3Blue1Brown (2023)
- Single Variable Calculus - David Jerison (2006)
- Multivariable Calculus - Denis Auroux (2007)
- Sequences and Series Calculator - Geogebra
- Function Graph - Geogebra

4 Reading Schedule

I recommend the following study routine:

1) First, read a chapter from the book, then watch the corresponding playlist.
2) Solve the odd-numbered exercises and check their solutions at the end of the book.
3) Solve the even-numbered exercises and check their solutions using our unofficial solutions manual.
4) If you cannot solve or understand an exercise, discuss it in our Discord.
5) Then, move on to the next chapter.

Book of Proof **Week 01**

Chapter 1: Sets
Chapter 2: Logic
Chapter 3: Counting

Book of Proof **Week 02-03**

Chapter 4: Direct Proof
Chapter 5: Contrapositive Proof
Chapter 6: Proof by Contradiction

Book of Proof **Week 04-05**

Chapter 7: Proving Non-Conditional Statements
Chapter 8: Proofs Involving Sets
Chapter 9: Disproof

Book of Proof **Week 06**

Chapter 10: Mathematical Induction

Book of Proof **Week 07-08**

Chapter 11: Relations
Chapter 12: Functions

Book of Proof **Week 09-10**

Chapter 14: Cardinality of Sets (This chapter requires a solid understanding of Chapter 12)

Book of Proof **Week 11-12**

Chapter 13: Proofs in Calculus (This chapter is denser than the previous ones)

5 Further Readings (Optional)

Mathematical Proofs A Transition to Advanced Mathematics - G. Chartrand, A. Polimeni, P. Zhang (**Chapters 0-14**, 4th Edition, 2018)
Mathematical Proofs A Transition to Advanced Mathematics - G. Chartrand, A. Polimeni, P. Zhang (**Chapters 0-14**, 4th Edition, 2018, Slides)