

Proof-Based Math Readings

Session: Proof Techniques

2023 Summer

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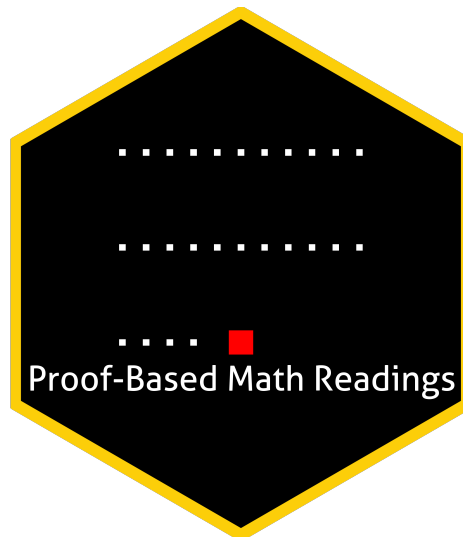
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0 Motivation

- *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 (3.3 Edition, 2022) 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 (3.3 Edition, 2022)**
-  **Book of Proof - Richard Hammack (3.3 Edition, 2022, 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 (3.3 Edition, 2022, Playlist by Michael Penn, Chapters 1-14)**
-  **Book of Proof - Richard Hammack (3.3 Edition, 2022, Playlist by Valerie Hower, Chapters 1-12)**
-  **Book of Proof - Richard Hammack (3.3 Edition, 2022, Workbook by Justin Wright)**
-  **Appendix A: Elements of Style for Proofs - Dana C. Ernst (2024)**

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 below:

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

 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 (If we struggle in this chapter, we should review Chapter 12)	
 Book of Proof	Week 11-12 
Chapter 13: Proofs in Calculus (It is natural to struggle in this chapter)	

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)