

Proof-Based Math Readings

Session: Proof Techniques

2023 Summer

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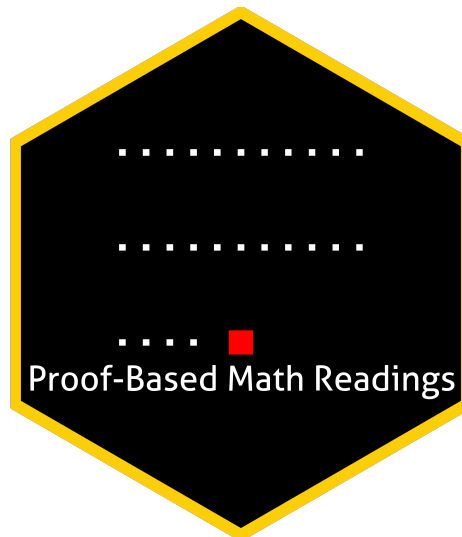
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0 Motivation

- *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

- CGPA: 3.00/4.00. 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 just 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)