

# Proof-Based Math Readings

## Session: Proof Techniques

2023 Summer

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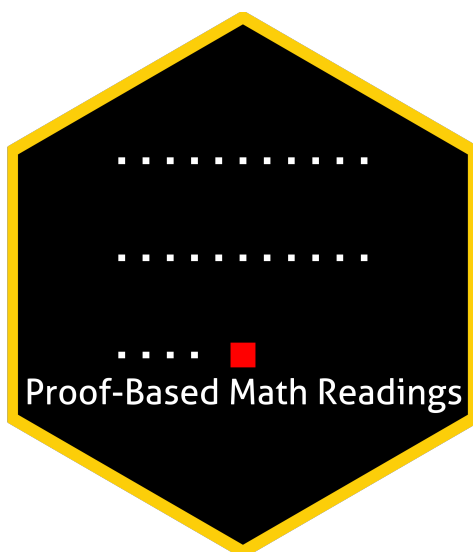
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## 0 Motivation

- *Proof-Based Math Readings* is a free and independent online reading group where we study mathematics required in economics master's/PhD programs using an intuitive approach.
- This session of the reading group is on *Proof Techniques*.

## 1 Prerequisites

- CGPA: 3.00/4.00
- Please use our  [Application Form](#) to join our reading group anytime.
- People who applied will be informed about their application results within a week.

## 2 Format

- This session will last 6 weeks from 12 June 2023 to 23 July 2023.
- We will discuss the topics/exercises that we struggle with at  [Proof-Based Math Readings \[Discord\]](#).
- We will not have face-to-face/online meetings due to size of the group.
- Members are expected to read the chapters, and watch the chapter videos from the book's playlist.

## 3 Resources [All are open-access]

### 3.1 Main Book and Main Book's Playlist

**Book of Proof** by Richard Hammack 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 \(3.3 Edition, 2022, Companion playlist by Jeremy Teitelbaum, Chapter 1-12\)](#)

### 3.2 Supplementary

#### 3.2.1 Proof

In case we need to watch a proof topic from another instructor, we have 2 additional companion playlists. Because our main playlist does not cover Chapter 13-14, we will cover these chapters from Penn's playlist.

 [Book of Proof - Richard Hammack \(3.3 Edition, 2022, Companion playlist by Michael Penn, Chapter 1-14\)](#)

 [Book of Proof - Richard Hammack \(3.3 Edition, 2022, Companion playlist by Valerie Hower, Chapter 1-12\)](#)

 [Book of Proof - Richard Hammack \(3.3 Edition, 2022, Companion workbook by Justin Wright\)](#)

#### 3.2.2 Calculus

In case we need to remember a topic from calculus, we can use these playlists.

 [Essence of Calculus - 3Blue1Brown \(2023\)](#)

  [Single Variable Calculus - David Jerison \(2006\)](#)

  [Multi Variable Calculus - Denis Auroux \(2007\)](#)

## 4 Reading Schedule

I recommend this study routine:

- 1) We read the chapter from the main book.
- 2) We watch the main playlist of the chapter.
- 3) We solve odd-numbered exercises and check their solutions at the end of the main book.
- 4) We solve even-numbered exercises in the main book.
- 5) If we cannot solve/understand an exercise, we can discuss the exercise in our Discord server.
- 6) We move on to the next chapter of the main book.

### Week 01

📅 12 June - 18 June

- 📖 Book of Proof, Chapter 1: Sets
- 📖 Book of Proof, Chapter 2: Logic
- 📖 Book of Proof, Chapter 3: Counting

### Week 02

📅 19 June - 25 June

- 📖 Book of Proof, Chapter 4: Direct Proof
- 📖 Book of Proof, Chapter 5: Contrapositive Proof
- 📖 Book of Proof, Chapter 6: Proof by Contradiction

### Week 03

📅 26 June - 02 July

- 📖 Book of Proof, Chapter 7: Proving Non-Conditional Statements
- 📖 Book of Proof, Chapter 8: Proofs Involving Sets
- 📖 Book of Proof, Chapter 9: Disproof
- 📖 Book of Proof, Chapter 10: Mathematical Induction

### Week 04

📅 03 July - 09 July

- 📖 Book of Proof, Chapter 11: Relations
- 📖 Book of Proof, Chapter 12: Functions

### Week 05-06

📅 10 July - 23 July

These two chapters are essential for real analysis, so they are more challenging than the previous ones.  
We first read Chapter 14, then Chapter 13.

- 📖 Book of Proof, Chapter 14: Cardinality of Sets
- 📖 Book of Proof, Chapter 13: Proofs in Calculus

## 5 Further Readings & Playlists (Optional)

If we want to solve more problems after this session, the following resources will be extremely helpful.

- 📖 Mathematical Proofs A Transition to Advanced Mathematics - Gary Chartrand, Albert D. Polimeni, Ping Zhang (**Chapter 0-14**, 4th Edition, 2018)
- 📖 **Basic Analysis I: Introduction to Real Analysis [Volume I]** - Jiri Lebl (**Chapter 0**, Version 6.0, 2023)
- 📺 **Real Analysis** - Casey Rodriguez (**Video 1-2**, 2020, Companion playlist to Basic Analysis I)