

# Proof-Based Math Readings

## Session: Proof Techniques

2023 Summer

**Zeki Akyol\***

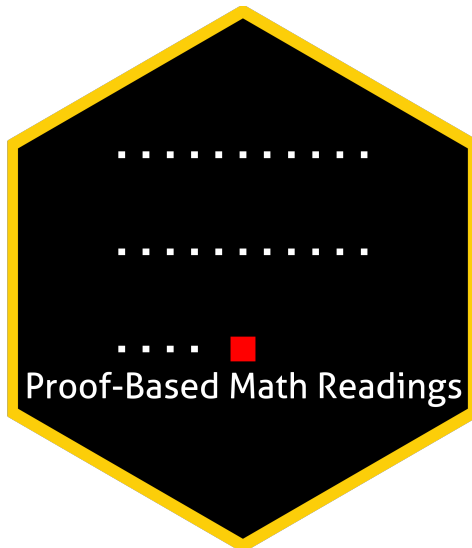
Department of Economics  
Istanbul Technical University

[Click here for the most recent versions of the syllabuses](#)

Version: 16 April 2024, 12:58 PM

### Table of contents

<b>0</b>	<b>Motivation</b>	<b>2</b>
<b>1</b>	<b>Prerequisites</b>	<b>2</b>
<b>2</b>	<b>Format</b>	<b>2</b>
<b>3</b>	<b>Resources [All are open-access]</b>	<b>2</b>
3.1	Main Book and Main Book's Playlist . . . . .	2
3.2	Supplementary . . . . .	2
3.2.1	Proof . . . . .	2
3.2.2	Calculus . . . . .	2
<b>4</b>	<b>Reading Schedule</b>	<b>3</b>
<b>5</b>	<b>Further Readings (Optional)</b>	<b>3</b>



---

\*zekiakyol.com


## 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 the  [Application Form](#) to join our reading group anytime.
- Applicants are informed about their application results within a week via email.

## 2 Format

- This session takes 6 weeks.
- We discuss the topics/exercises that we struggle with at  [Proof-Based Math Readings \[Discord\]](#).
- We do not have face-to-face/online meetings due to the 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 (3.3 Edition, 2022)** 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 two additional companion playlists. Because our main playlist does not cover Chapter 13-14, we cover these chapters from Michael 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 \(2007\)](#)



[Sequences and Series Calculator - Geogebra](#)



[Function Graph - Geogebra](#)

## 4 Reading Schedule

I recommend the following study routine below:

- 1) Read a chapter from the book.
- 2) Watch the playlist of the chapter.
- 3) Solve odd-numbered exercises and check their solutions at the end of the book.
- 4) Solve even-numbered exercises in the book.
- 5) If you cannot solve/understand an exercise, discuss the exercise in our Discord server.
- 6) 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 


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

### Book of Proof

Week 03 


Chapter 7: Proving Non-Conditional Statements  
Chapter 8: Proofs Involving Sets  
Chapter 9: Disproof  
Chapter 10: Mathematical Induction

### Book of Proof

Week 04 

Chapter 11: Relations  
Chapter 12: Functions



### Book of Proof

Week 05-06 

We first read Chapter 14, then Chapter 13. These chapters are more challenging than the previous ones.  
Chapter 14: Cardinality of Sets  
Chapter 13: Proofs in Calculus

## 5 Further Readings (Optional)

We can use the following book to solve more problems. Although the book is not open-access, its official slides are.

-  Mathematical Proofs A Transition to Advanced Mathematics - Gary Chartrand, Albert D. Polimeni, Ping Zhang (**Chapter 0-14**, 4th Edition, 2018)
-  [Mathematical Proofs A Transition to Advanced Mathematics - Gary Chartrand, Albert D. Polimeni, Ping Zhang \(\*\*Chapter 0-14\*\*, 4th Edition, 2018, Slides\)](#)

You can check out our Real Analysis syllabus at [github.com/zekiakyol/proof-based-math-readings](https://github.com/zekiakyol/proof-based-math-readings)