

# Proof-Based Math Readings

## Session: Real Analysis

### 2023 Fall

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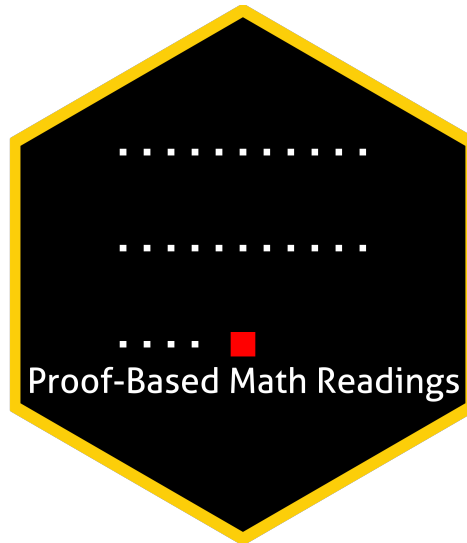
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Version: 06 March 2024, 10:28 PM

## 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	Real Analysis . . . . .	2
3.2.2	Calculus . . . . .	2
3.2.3	Proof . . . . .	2
<b>4</b>	<b>Reading Schedule</b>	<b>3</b>




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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 *Real Analysis*.

## 1 Prerequisites

- CGPA: 3.00/4.00 and **Book of Proof - Richard Hammack (3.3 Edition, 2022)**.
- 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 12 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

**Basic Analysis I: Introduction to Real Analysis [Volume I]** by Jiri Lebl is our main book for this session because it is well-written, well-structured, and open-access.

Casey Rodriguez's playlist is our main playlist because his narrative is just great.





-  **Basic Analysis I: Introduction to Real Analysis [Volume I] - Jiri Lebl (Version 6.0, 2023)**
-  **Real Analysis - Casey Rodriguez (2020, Companion playlist to the main book)**
-  **Real Analysis - Casey Rodriguez (2020, Companion notes to the main book)**

### 3.2 Supplementary


#### 3.2.1 Real Analysis

-  **Real Analysis - Michael Penn (2021)**
-  **Real Analysis - Wrath of Math (2023)**
-  **Understanding Analysis - Stephen Abbott (2nd Edition 2016, Playlist by Marc Renault)**
-  **Understanding Analysis - Stephen Abbott (2nd Edition 2016, Solutions by Ulisse Mini, Jesse Liby)**
-  **Introduction To Metric Spaces - Paige Bright (2023)**

#### 3.2.2 Calculus

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

#### 3.2.3 Proof

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

## 4 Reading Schedule

- **BAI** is Basic Analysis I: Introduction to Real Analysis [Volume I] - Jiri Lebl (Version 6.0, 2023).
- We use Understanding Analysis - Stephen Abbott (2nd Edition 2016, Solutions) for exercises.

### 📅 Week 01-02

- 📖 **BAI, List of Notation** (Page 309-312)
- 📖 **BAI, Chapter 0: Introduction**
  - BAI, Chapter 0.1: About this book
  - BAI, Chapter 0.2: About analysis
  - BAI, Chapter 0.3: Basic set theory
- 📖 **BAI, Chapter 1: Real Numbers**
  - BAI, Chapter 1.1: Basic properties
  - BAI, Chapter 1.2: The set of real numbers
  - BAI, Chapter 1.3: Absolute value and bounded functions
  - BAI, Chapter 1.4: Intervals and the size of  $\mathbb{R}$

### 📅 Week 03-04-05

- 📖 **BAI, Chapter 2: Sequence and Series**
  - BAI, Chapter 2.1: Sequences and limits
  - BAI, Chapter 2.2: Facts about limits of sequences
  - BAI, Chapter 2.3: Limit superior, limit inferior, and Bolzano-Weierstrass
  - BAI, Chapter 2.4: Cauchy sequences
  - BAI, Chapter 2.5: Series

### 📅 Week 06-07

- 📖 **BAI, Chapter 3: Continuous Functions**
  - BAI, Chapter 3.1: Limits of functions
  - BAI, Chapter 3.2: Continuous functions
  - BAI, Chapter 3.3: Extreme and intermediate value theorems
  - BAI, Chapter 3.4: Uniform continuity

### 📅 Week 08-09

- 📖 **BAI, Chapter 4: The Derivative**
  - BAI, Chapter 4.1: The derivative
  - BAI, Chapter 4.2: Mean value theorem
  - BAI, Chapter 4.3: Taylor's theorem

### 📅 Week 10-11

- 📖 **BAI, Chapter 5: The Riemann Integral**
  - BAI, Chapter 5.1: The Riemann integral
  - BAI, Chapter 5.2: Properties of the integral
  - BAI, Chapter 5.3: Fundamental theorem of calculus

### 📅 Week 12

- 📖 **BAI, Chapter 6: Sequence of Functions**
  - BAI, Chapter 6.1: Pointwise and uniform convergence
  - BAI, Chapter 6.2: Interchange of limits