

# Proof-Based Math Readings

## Session: Real Analysis

2023 Summer

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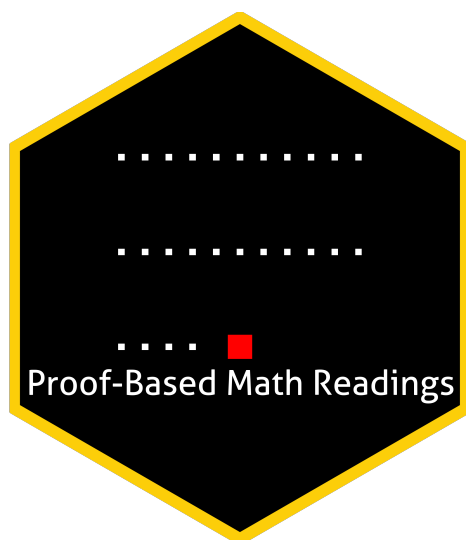
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## 0 Motivation

- *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 *Real Analysis*.

## 1 Prerequisites

- CGPA: 3.00/4.00. Proof Techniques 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.
- We discuss the topics and exercises at  [Proof-Based Math Readings \[Discord\]](#).
- 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 - Jiri Lebl (Version 6.1, 2024)** 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 - Jiri Lebl \(Version 6.1, 2024\)](#)
-  [Basic Analysis I: Introduction to Real Analysis - Jiri Lebl \(Version 6.1, 2024, Playlist by Casey Rodriguez\)](#)
-  [Basic Analysis I: Introduction to Real Analysis - Jiri Lebl \(Version 6.1, 2024, Notes by Casey Rodriguez\)](#)

### 3.2 Supplementary

#### 3.2.1 Real Analysis

-  [Real Analysis - Wrath of Math \(2024\)](#) → Start with this playlist if you find the main book challenging
-  [Real Analysis - Michael Penn \(2021\)](#)
-  [Understanding Analysis - Stephen Abbott \(2nd Edition 2016, Playlist by Marc Renault\)](#)
-  [Understanding Analysis - Stephen Abbott \(2nd Edition 2016, Solutions by Ulisse Mini, Jesse Liby\)](#)

#### 3.2.2 Calculus

-  [Essence of Calculus - 3Blue1Brown \(2023\)](#)
-   [Single Variable Calculus - David Jerison \(2006\) and Multivariable Calculus - Denis Auroux \(2007\)](#)
-  [Sequences and Series Calculator - Geogebra](#)
-  [Function Graph - Geogebra](#)

#### 3.2.3 Proof Techniques

-  [Book of Proof - Richard Hammack \(3.3 Edition, 2022\)](#)
-  [Book of Proof - Richard Hammack \(3.3 Edition, 2022, Playlist by Jeremy Teitelbaum, Chapters 1-12\)](#)
-  [Book of Proof - Richard Hammack \(3.3 Edition, 2022, Playlist by Michael Penn, Chapters 1-14\)](#)

## 4 Reading Schedule

- **BAI** is the abbreviation of Basic Analysis I: Introduction to Real Analysis - Jiri Lebl (Version 6.1, 2024).
- We use [Understanding Analysis - Stephen Abbott \(2nd Edition 2016, Solutions by Ulisse Mini, Jesse Liby\)](#) for exercises.

### **BAI, Chapter 0: Introduction**

**Week 01** 

List of Notation (Page 309-312)

**0.1** About this book

**0.2** About analysis

**0.3** Basic set theory

### **BAI, Chapter 1: Real Numbers**

**Week 02** 


**1.1** Basic properties

**1.2** The set of real numbers

**1.3** Absolute value and bounded functions

**1.4** Intervals and the size of  $\mathbb{R}$

### **BAI, Chapter 2: Sequence and Series**

**Week 03-04-05** 

**2.1** Sequences and limits


**2.2** Facts about limits of sequences

**2.3** Limit superior, limit inferior, and Bolzano-Weierstrass

**2.4** Cauchy sequences

**2.5** Series

### **BAI, Chapter 3: Continuous Functions**

**Week 06-07-08** 


**3.1** Limits of functions

**3.2** Continuous functions

**3.3** Extreme and intermediate value theorems

**3.4** Uniform continuity

### **BAI, Chapter 4: The Derivative**


**Week 09-10** 

**4.1** The derivative

**4.2** Mean value theorem

**4.3** Taylor's theorem

### **BAI, Chapter 5: The Riemann Integral**

**Week 11-12** 

**5.1** The Riemann integral

**5.2** Properties of the integral

**5.3** Fundamental theorem of calculus

## 5 Further Readings (Optional)

 [Introduction To Metric Spaces - Paige Bright \(2023\)](#)