# Proof-Based Math Readings Session: Real Analysis\*

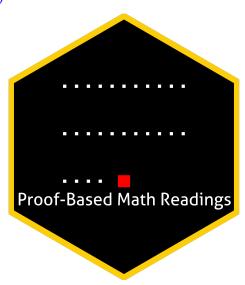
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Version: 03 May 2025, 09:48 PM

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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 Real Analysis.

# 1 Prerequisites

- 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.
- 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

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 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 (2025) → 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 (3.4 Edition, 2025)
- Book of Proof Richard Hammack (3.4 Edition, 2025, Playlist by Jeremy Teitelbaum, Chapters 1-12)
- Book of Proof Richard Hammack (3.4 Edition, 2025, Playlist by Michael Penn, Chapters 1-14)

# 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

#### Further Readings (Optional) 5

► Introduction To Metric Spaces - Paige Bright (2023)