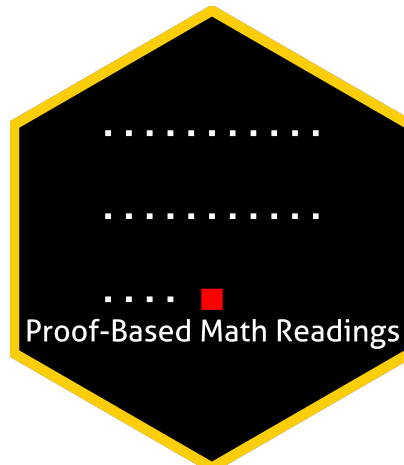# Proof-Based Math Readings Session: Optimization*

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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 *Optimization*.

1 Prerequisites and Format

- Proof Techniques resources below.
- Please use the 🔗 Application Form to join our reading group; you will receive a response within a week.
- 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 👾.

2 Resources

2.1 Main Book and Main Book's Playlist

A First Course in Optimization Theory - Rangarajan K. Sundaram (1996) is our main book because it is well-written and well-structured.

- 📘 A First Course in Optimization Theory - Rangarajan K. Sundaram (1996)
- 📘 A First Course in Optimization Theory - Rangarajan K. Sundaram (1996, Solutions by Frederick Robinson)
- 📘 A First Course in Optimization Theory - Rangarajan K. Sundaram (1996, Solutions by Paolo Pin)

2.2 Supplementary

2.2.1 Optimization

- ▶ Foundations for Optimization - Mark Walker (2020)
- ▶ Optimization - Mark Walker (2020)

2.2.2 Proof Techniques

- 📘 Book of Proof - Richard Hammack (3.4 Edition, 2025)
- ▶ Book of Proof - Richard Hammack (3.4 Edition, 2025, Playlist by Jeremy Teitelbaum)
- ▶ Book of Proof - Richard Hammack (3.4 Edition, 2025, Playlist by Michael Penn)

2.2.3 Real Analysis

- 📘 Basic Analysis I: Introduction to Real Analysis - Jiri Lebl (Version 6.2, 2025)
- ▶ Basic Analysis I: Introduction to Real Analysis - Jiri Lebl (Version 6.2, 2025, Playlist by Casey Rodriguez)
- ▶ Introduction To Metric Spaces - Paige Bright (2023)

3 Reading Schedule

AFCOT is the abbreviation of **A First Course in Optimization Theory - Rangarajan K. Sundaram (1996)**.

> 📘 **AFCOT** **Week 01-02** 🗓
>
> Appendix A: Set Theory and Logic: An Introduction
>
> Appendix B: The Real Line
>
> Appendix C: Structures on Vector Spaces
>
> Chapter 1: Mathematical Preliminaries

> 📘 **AFCOT** **Week 03-04** 🗓
>
> Chapter 2: Optimization in $\mathbb{R}^n$

> 📘 **AFCOT** **Week 05-06** 🗓
>
> Chapter 3: Existence of Solutions: The Weierstrass Theorem
>
> Chapter 4: Unconstrained Optima

> 📘 **AFCOT** **Week 07-08-09** 🗓
>
> Chapter 5: Equality Constraints and the Theorem of Lagrange
>
> Chapter 6: Inequality Constraints and the Theorem of Kuhn and Tucker

> 📘 **AFCOT** **Week 10-11-12** 🗓
>
> Chapter 7: Convex Structures in Optimization Theory
>
> Chapter 8: Quasi-Convexity and Optimization

4 Further Readings (Optional)

> 📘 Optimization by Vector Space Methods - David G. Luenberger (1997)
>
> ▶ Optimization by Vector Space Methods - David G. Luenberger (1997, Playlist by Peter Galbacs)