

# Proof-Based Math Readings

## Session: Linear Algebra

### 2024 Spring

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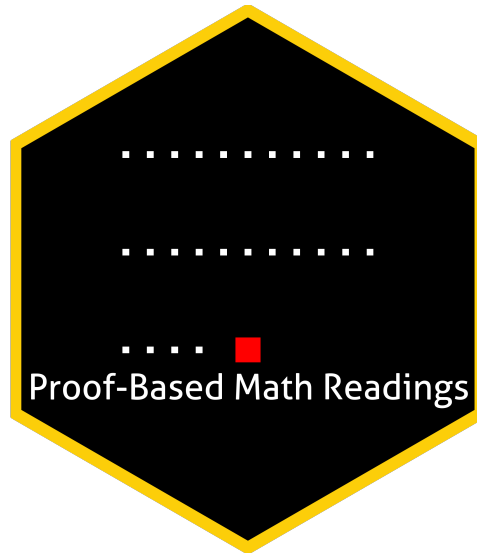
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## Table of contents

<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	Linear Algebra . . . . .	2
3.2.2	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 *Linear Algebra*.
- This session is dedicated to Sheldon Axler's lovely cat, 🐱 Moon, who passed away in August 2023.

## 1 Prerequisites

- CGPA: 3.00/4.00
- 📖 *Book of Proof* - Richard Hammack (3.3 Edition, 2022)
- ▶ *Linear Algebra* - Gilbert Strang (2005)
- Please use our 🔗 *Application Form* to join our reading group anytime.
- Applicants will be informed about their application results within a week via email.

## 2 Format

- This session will last 12 weeks.
- We will discuss the topics/exercises that we struggle with at 🗨️ *Proof-Based Math Readings [Discord]*.
- We will 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

**Linear Algebra Done Right** by Sheldon Axler is our main book for this session because it is well-written, well-structured, and open-access.

- 📖 *Linear Algebra Done Right* - Sheldon Axler (4th Edition, 2024)
- 📖 *Linear Algebra Done Right* - Sheldon Axler (4th Edition, 2024, Errata)
- ▶ *Linear Algebra Done Right* - Sheldon Axler (4th Edition, 2024, Companion playlist to the book)
- 📖 *Linear Algebra Done Right* - Sheldon Axler (3rd Edition, 2015, Solutions by linearalgebras)
- 📖 *Linear Algebra Done Right* - Sheldon Axler (3rd Edition, 2015, Solutions by jubnoske08)
- 📖 *Linear Algebra Done Right* - Sheldon Axler (3rd Edition, 2015, Solutions by solverer.com)

### 3.2 Supplementary

#### 3.2.1 Linear Algebra

- ▶ *Essence of Linear Algebra* - 3Blue1Brown (2023)
- ▶ *Linear Algebra Done Right* - Sheldon Axler (3rd Edition, 2015, Companion playlist by Robert Won)
- ▶ *Linear Algebra Done Right* - Sheldon Axler (3rd Edition, 2015, Companion playlist by Jason Morton)
- ▶ *Linear Algebra Done Right* - Sheldon Axler (3rd Edition, 2015, Companion playlist by Felix Leditzky)
- 📖 *Mathematical Proofs A Transition to Advanced Mathematics* - Gary Chartrand, Albert D. Polimeni, Ping Zhang (Chapter 17: Proofs in Linear Algebra, 4th Edition, 2018) and Odd-Numbered Exercise Solutions

#### 3.2.2 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


- **LADR** is the abbreviation of Linear Algebra Done Right - Sheldon Axler (4th Edition, 2024).

### **LADR, Chapter 1: Vector Spaces**

**Week 01**  **25 March - 31 March**


LADR, Chapter 1.A:  $\mathbf{R}^n$  and  $\mathbf{C}^n$   
LADR, Chapter 1.B: Definition of Vector Space  
LADR, Chapter 1.C: Subspaces

### **LADR, Chapter 2: Finite-Dimensional Vector Spaces**

**Week 02-03**  **01 April - 14 April**


LADR, Chapter 2.A: Span and Linear Independence  
LADR, Chapter 2.B: Bases  
LADR, Chapter 2.C: Dimension

### **LADR, Chapter 3: Linear Maps**

**Week 04-05-06**  **15 April - 05 May**


LADR, Chapter 3.A: Vector Space of Linear Maps  
LADR, Chapter 3.B: Null Spaces and Ranges  
LADR, Chapter 3.C: Matrices  
LADR, Chapter 3.D: Invertibility and Isomorphisms  
LADR, Chapter 3.E: Products and Quotients of Vector Spaces

### **LADR, Chapter 5: Eigenvalues and Eigenvectors**

**Week 07-08**  **06 May - 19 May**


LADR, Chapter 5.A: Invariant Subspaces  
LADR, Chapter 5.B: The Minimal Polynomial  
LADR, Chapter 5.C: Upper-Triangular Matrices  
LADR, Chapter 5.D: Diagonalizable Operators

### **LADR, Chapter 6: Inner Product Spaces**

**Week 09-10**  **20 May - 02 June**

LADR, Chapter 6.A: Inner Products and Norms  
LADR, Chapter 6.B: Orthonormal Bases  
LADR, Chapter 6.C: Orthogonal Complements and Minimization Problems

### **LADR, Chapter 7: Operators on Inner Product Spaces**

**Week 11-12**  **03 June - 16 June**

LADR, Chapter 7.A: Self-Adjoint and Normal Operators  
LADR, Chapter 7.B: Spectral Theorem  
LADR, Chapter 7.C: Positive Operators  
LADR, Chapter 7.D: Isometries, Unitary Operators, and Matrix Factorization  
LADR, Chapter 7.E: Singular Value Decomposition  
LADR, Chapter 7.F: Consequences of Singular Value Decomposition