

# Proof-Based Math Readings

## Session: Linear Algebra

### 2024 Spring

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Version: 24 August 2023, 01:40 PM

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## 0 Motivation

- *Proof-Based Math Readings* is an 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*.

## 1 Prerequisites

- CGPA: 3.00/4.00 and  [Linear Algebra - Gilbert Strang \(2005\)](#)
- Please apply by uploading your CV and transcript to this  [Google Form](#) until 23:59, 10 March 2024. Please upload your CV and transcript as **NameSurname.pdf**, not **CV.pdf**. Students who applied will be informed about their application results via email at 10:00, 12 March 2024.






## 2 Format

- This session will last 12 weeks from 25 March 2024 to 16 June 2024.
- 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, open-access, and -most importantly- the author's cat is on the cover photo of the playlist.


-  [Linear Algebra Done Right - Sheldon Axler \(4th Edition, 2023, Forthcoming\)](#)
-  [Linear Algebra Done Right - Sheldon Axler \(3rd Edition, 2015, Companion playlist to the book\)](#)
-  [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 \(3rd Edition, 2015, Companion playlist by Felix Leditzky\)](#)
-  [Linear Algebra - Elliot Nicholson \(2021\)](#)
-  [Mathematical Proofs A Transition to Advanced Mathematics - Gary Chartrand, Albert D. Polimeni, Ping Zhang \(Chapter 17 Proof in Linear Algebra, 4th Edition, 2018\) 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, 2023).

### **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**  **01 April - 07 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 03-04-05**  **08 April - 28 April**


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 Isomorphism  
LADR, Chapter 3.E: Products and Quotients of Vector Spaces  
LADR, Chapter 3.F: Duality

### **LADR, Chapter 4: Polynomials**

**Week 06**  **29 April - 05 May**


There is no subsection in this chapter, so we will read the whole chapter.

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

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


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