



LECTURE NOTES

# Linear Algebra

Fall 2020

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Instructed by:  
*Kathy Kane*

# Contents

# Chapter 1

## Introduction

DATE: 2020-08-17

ANNOUNCEMENTS:

Instructor - Kathleen Kane

Office Hours - MWF 11:30am - 12:30pm TR 8:00am - 9:00 am

Email - [kkane@ccac.edu](mailto:kkane@ccac.edu)

Phone - (412) 237-4511

Book - Elementary Linear Algebra: Applications Version by Howard Anton and Chris Rorries, 11th edition  
9781118434413

**Assignment(Aug 19 08:50): practice uploading 3 scanned pages in a single pdf**

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## 1.1 Policies and Procedures

### 1.1.1 Learning Outcomes

1. Perform basic operations with vectors in  $n$ -dimensional space.
2. Perform basic operations with matrices.
3. Solve a system of  $m$  linear equations in  $n$  unknowns.
4. Prove basic theorems in a vector space.
5. Perform basic operations with vectors in the standard matrix spaces and function space.
6. Find the matrix representation of a linear transformation between two vector spaces.
7. Find eigenvalues and eigenvectors for a given matrix.
8. Perform basic operations in an inner product space
9. Prove basic theorems in an inner product space.

### 1.1.2 Evaluation

1. Assignments (10%)
2. Testes (70%)
3. Final (weighted) (20%)

### 1.1.3 Testing

1. Required to scan test and submit via pdf
2. 50 minutes each test and 10 minutes to submit test
3. No make up tests
4. One test may be substituted with final exam grade
5. Missing final is automatic F.

## 1.2 Systems of Linear Equations and Matrices

### 1.2.1 Introduction to Systems of Linear Equations

**Example 1** (One solution). *Solve:*

$$\begin{aligned} 3x + y &= 6 \\ 5x - 3y &= 10 \end{aligned}$$

**Solution 1.**

$$\begin{array}{rcl} 3x + y &= 6 & \implies \\ 9x + 3y &= 18 & \\ +[5x - 3y = 10] & & \\ \hline 14x &= 28 & \implies \\ \boxed{x = 2} & & \end{array}$$

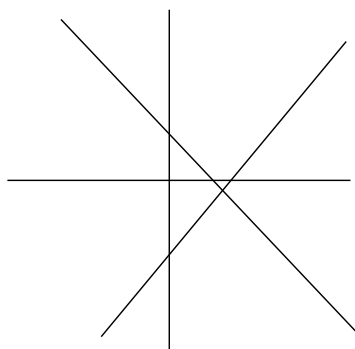


Figure 1.1: one solution

**Example 2** (Infinite solutions). *Solve:*

$$\begin{aligned} 2x - y &= 7 \\ 4x - 2y &= 14 \end{aligned}$$

**Solution 2.**

$$\begin{array}{l}
 4x - 2y = 14 \implies \\
 2x - y = 7 \\
 -[2x - y = 7] \\
 \hline
 \boxed{0 = 0} \text{ (no solution)}
 \end{array}$$

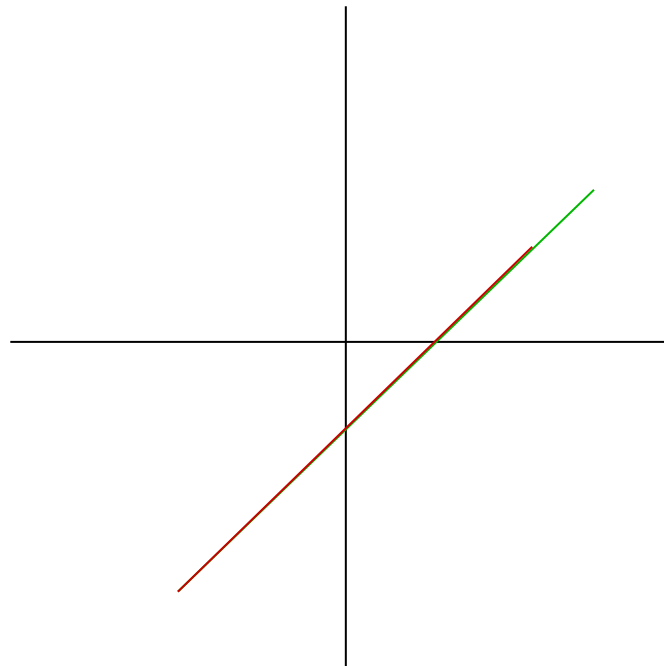


Figure 1.2: infinite solutions

**Example 3** (No solutions).

$$\begin{array}{l}
 2x - y = 6 \\
 4x - 2y = 6
 \end{array}$$

**Solution 3.**

$$\begin{array}{l}
 [4x - 2y = 6] \implies \\
 2x - y = 3 \\
 -[2x - y = 6] \\
 \hline
 \boxed{0 = -3} \text{ (false equation)}
 \end{array}$$