

# Math 15A: Linear Algebra

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## Course Description

Applied linear algebra, possibly will be including:  
Matrices, determinants, linear equations, vector spaces, eigenvalues, quadratic forms, linear programming. Emphasis on techniques and applications.

## Suggested Materials

- *Linear Algebra and Its Applications*, by David Lay, 5th edition. We will not follow the order of the textbook precisely, but it should be a useful reference.

## Prerequisites/Corequisites

MATH 5a or permission of the instructor, placement by examination, or any mathematics course numbered 10 or above.

## Course Objectives

Roughly contents of Chapter 1, 2, 3, 4, 5, 6. In reality, the order might be chapter 1, chapter 4, chapter 2, chapter 3 and chapter 5, 6, for which the reason will be explained in class.

## Course Structure

A rough guideline is as below:

Section	Topic
1.1	System of Linear Equations
1.2	Row Reduction and Echelon Forms
1.3	Vector Equations
1.4	The Matrix Equation $Ax = b$
1.5	Solution sets of Linear Equations
1.7	Linear Independence
1.8	Introduction to Linear Transformations
1.9	The Matrix of a Linear Transform
2.1	Matrix Operations
2.2	The Inverse of a Matrix
*2.3	Characterization of Invertible Matrices
2.8	Subspaces of $\mathbb{R}^n$
2.9	Dimension and Rank
3.1	Introduction to Determinants
3.2	Properties of Determinants
*3.3	Cramer's Rule, Volume, and Linear Transformations
4.1	Vector Spaces and Subspaces
4.2	Null Spaces, Column Spaces, and Linear Transformations
4.3	Linearly Independent Sets; Bases
4.5	The Dimension of a Vector Space
4.6	Rank
4.7	Change of Basis
5.1	Eigenvectors and Eigenvalues
5.2	The Characteristic Equation
5.3	Diagonalization
5.4	Eigenvectors and Linear Transformations
6.1	Inner Product, Length, and Orthogonality
6.2	Orthogonal Sets
6.3	Orthogonal Projections
6.4	Gram-Schmidt Process
*7.1	Diagonalization of Symmetric Matrices
*7.2	Quadratic Forms
*7.4	The Singular Value Decomposition
*Chapter 8	Affine Concepts

### Assessments

Homework due twice a week, except for maybe the first week and final.  
One midterm and one final exam. The latter might be a project or/and take home.

### Grading Policy

The assignments should be around 50 percent of the total grade, with exam and participation be another 50 percent (roughly 30 and 20 respectively).

## Schedule and weekly learning goals

The schedule is tentative and subject to change. The learning goals below should be viewed as the key concepts you should grasp after each week, and also as a study guide before each exam, and at the end of the semester.

## Course Policies

### Attendance Policy

Students are expected to attend every lecture and to participate actively. Questions are always welcome, both in and out of class. Please read the relevant material in the textbook before class. Should you miss a class, get the notes from your fellow students; I am also available to help review topics that you miss.

### Academic Integrity and Honesty

You are expected to follow the University's policy on academic integrity, which is distributed annually as section 4 of the Rights and Responsibilities Handbook (see <http://www.brandeis.edu/studentaffairs/srcs/rr/index.html>). Instances of alleged dishonesty will be forwarded to the Department of Student Development and Conduct for possible referral to the Student Judicial System. Potential sanctions include failure in the course and suspension from the University. If you have any questions about how these policies apply to your conduct in this course, please ask.

### Accommodations

Brandeis seeks to welcome and include all students. If you are a student who needs accommodations as outlined in an accommodations letter, please talk with me and present your letter of accommodation as soon as you can. I want to support you.

In order to provide test accommodations, I need the letter more than 48 hours in advance. I want to provide your accommodations, but cannot do so retroactively. If you have questions about documenting a disability or requesting accommodations, please contact Student Accessibility Support (SAS) at 781.736.3470 or [access@brandeis.edu](mailto:access@brandeis.edu).

Many resources are available to help with the academic and non-academic factors that contribute to student success (finances, health, food supply, housing, mental health counseling, academic advising, physical and social activities, etc.). Please explore the links on the Support at Brandeis page <https://www.brandeis.edu/support/undergraduate-students/browse.html> to find out more about the resources that the University provides to help you and your classmates achieve success.