

Mathematics 18 Syllabus (Updated Spring 2021)

Lecture schedule based on *Linear Algebra and Its Applications*, sixth edition by David C. Lay, Judi J. McDonald, and Steven R. Lay.

Section	Lectures	Topic
1.1	1	Systems of Linear Equations
1.2	1	Row Reduction and Echelon Forms
1.3	1	Vector Equations
1.4	1	The Matrix Equation $A\mathbf{x} = \mathbf{b}$
1.5	1	Solution Sets of Linear Systems
1.7	1	Linear Independence
1.8	1	Introduction to Linear Transformations
1.9	1	The Matrix of a Linear Transformation
2.1	1	Matrix Operations
2.2	1	The Inverse of a Matrix
2.3	1	Characterizations of Invertible Matrices
4.1	1	Vector Spaces and Subspaces
4.2	1	Null Spaces, Column Spaces, and Linear Transformations
4.3	1	Linearly Independent Sets; Bases
4.5	1	The Dimension of a Vector Space
4.4	1	Coordinate Systems
4.6*	1	Change of Basis
3.1	1	Introduction to Determinants
3.2	1	Properties of Determinants
5.1	1	Eigenvectors and Eigenvalues
5.2	1	The Characteristic Equation
5.3	1	Diagonalization
6.1 & 6.7	1	Inner Product, Length, and Orthogonality
		Inner Product Spaces
6.2	1	Orthogonal Sets
6.3	1	Orthogonal Projections
6.4	1	The Gram-Schmidt Process
6.5 or 7.1	1	Least-Squares Problems
		Diagonalization of Symmetric Matrices

*May be skipped for time. See the "Notes" on the next page.

Notes

- The standard number of days a class meets is 28 (for Winter) or 29 (for Fall and Spring). Allowing for two midterm exams, this leaves 26 or 27 meeting times. The suggested lecture schedule given above includes 27 lecture periods.
- Section 4.6 (Change of Basis) may be omitted for time. This is especially pertinent during Winter Quarter, when there may be only 26 lectures available (since the suggested schedule above includes 27 lectures).
- Section 3.3 (Cramer's Rule, Volume, and Linear Transformations) may be included (after Section 3.2), at the instructor's discretion, if time allows.
- Chapter 3 is included in the above outline after Chapter 4. The purpose for including Chapter 3 in the course is to introduce the determinant as a device for characterizing singular square matrices in preparation for using the determinant to define the characteristic polynomial of a square matrix in Chapter 5. For this reason, Chapter 3 is included immediately prior to Chapter 5. (We remark also that Chapter 3 is independent of Chapter 4.)
- In the outline above, Section 4.5 precedes Section 4.4. It is felt that the concept of dimension logically precedes the concept of coordinates. That is, it is more natural to first show every basis of a vector space has the same number of vectors before introducing coordinates. Additionally, if covering Section 4.6 (Change of Basis), it seems more natural to follow "change of basis" immediately after "change of coordinates" since the two topics are aspects of the same idea. (Coordinates are more naturally introduced as part of the discussion of change of coordinates; i.e., change of basis.)
- Some instructors prefer to substitute Section 7.1 for Section 6.5 for the final lecture.

MATLAB Portion of Math 18 Syllabus

Math 18 has lectures and recitation sections like all other big classes. Distinctive in Math 18 (and Math 20D) is that regular Math 18 homework is accompanied by homework in MATLAB, and typically there is a simple quiz on MATLAB which is provided through a department testing procedure (so the instructor does not need to do much work). Most instructors count the MATLAB homework 5% of the grade and the MATLAB “final quiz” 5% of the grade for a total of 10%.

MATLAB homework assignments can be found online at www.math.ucsd.edu/~math18

1. Introduction
2. Systems of Linear Equations (Lay, Chapter 1)
3. Matrix Algebra (Lay, Sections 2.1–2.3)
4. Eigenvalues, Determinants, and Diagonalization (Lay, Sections 5.1–5.3)
5. Orthogonality and Least Squares (Lay, Sections 6.1 – 6.5)

The department provides tutors for the MATLAB Assignments, a MATLAB final quiz, and grading of the MATLAB portion of the course. The intention is that the Math 20D professor need not worry about MATLAB instruction at all or even worry much about logistics. We suggest the instructor announce (post on web):

1. The webpage for the MATLAB assignments is www.math.ucsd.edu/~math18
2. MATLAB tutoring is available in the basement B432. It starts in week 2, students can just walk in (schedule to be posted on the web)
3. The dates you want MATLAB homework assignments to be due (typically to complement your class midterms and quizzes)
4. Where to turn homework in: the homework drop boxes in the basement of APM
5. Your grading policy
6. The week when you want your students to take the MATLAB final quiz (e.g. 9th week). MATLAB staff handles and posts schedule of times in that week.

Our MATLAB offering is run by a professor, whose role is to help you. You should always feel free to contact her/him and you will get an email from her/him a bit before your course starts. The department also employs a senior MATLAB TA.

An important feature of the MATLAB homework is that it fills a gap in the lectures. The syllabus does not touch any of the many applications sections in the textbook. Applications are left to the MATLAB assignments which is pedagogically a natural place for them. Thus the only application type word problems in Math 18 are typically in the MATLAB assignments. We suggest you take a quick glance at the assignments with an eye to their math content. Beware that assignment 5 comes at the end of the course, and often the instructor sets it due about Monday of the last week of class.