

University of Houston
Department of Mathematics
Syllabus—Math 2331, Linear Algebra

Text: “*Introduction to Linear Algebra*” by Gilbert Strang, Third Edition. Wellesley-Cambridge Press.

Text Web Site: <http://web.mit.edu/18.06/www/>

Online Lectures: <http://web.mit.edu/18.06/www/Video/video-fall-99-new.html>

Prerequisite: Credit for or concurrent enrollment in MATH 1432 and in laboratory section.

Course Description: Solutions of linear systems of equations, vector spaces and subspaces, orthogonality, determinants, linear transformations.

Course Outline

Chapter 1: Introduction to Vectors

1.1-1.2 Vectors and Linear Combinations, Lengths and Dot Products

Chapter 2: Solving Linear Equations

- 2.1 Vectors and Linear Equations
- 2.2 The Idea of Elimination
- 2.3 Elimination Using Matrices.
- 2.4 Rules for Matrix Operations
- 2.5 Inverse Matrices
- 2.6 Elimination = Factorization: $\mathbf{A} = \mathbf{LU}$
- 2.7 Transposes and Permutations

Exam

Chapter 3: Vector Spaces and Subspaces

- 3.1 Spaces of vectors
- 3.2 The Nullspace of \mathbf{A} : Solving $\mathbf{Ax} = \mathbf{0}$
- 3.3 The Rank and the Row Reduced Form
- 3.4 The Complete Solution to $\mathbf{Ax} = \mathbf{b}$.
- 3.5 Independence, Basis and Dimension
- 3.6 Dimensions of the Four Subspaces

Chapter 4: Orthogonality

- 4.1 Orthogonality of the Four Subspaces
- 4.2 Projections
- 4.3* Least Squares Approximations (Optional)

4.4 Orthogonal Bases and Gram-Schmidt

*Application to least squares at end of 4.4 is optional

Exam

Chapter 5: Determinants

5.1 The Properties of Determinants

5.2 Permutations and Cofactors

5.3 Cramer's Rule, Inverses, and Volumes

Chapter 6: Eigenvalues and Eigenvectors

6.1 Introduction to Eigenvalues

6.2 Diagonalizing a Matrix

6.4 Symmetric Matrices

6.5 Positive Definite Matrices

6.6 Similar Matrices

6.7* Singular Value Decomposition (Optional)

Exam

Chapter 7: Linear Transformations

7.1 The Idea of a Linear Transformation

7.2 The Matrix of a Linear Transformation

Review

Final Exam