

**MOREHOUSE COLLEGE
DEPARTMENT OF MATHEMATICS**

**LINEAR ALGEBRA
MATH 271**

PREREQUISITE: Math 161 with a grade of C or better

TEXT: Linear Algebra and its applications, 3rd ed., by David C. Lay

RECOMMENDED

SUPPLEMENT: The Student Study Guide

COVERAGE: Chapters 1-5 and parts of 6-7.

COURSE OUTLINE

1. Linear Equations in Linear Algebra.

- 1.1. Systems of Linear Equations
- 1.2. Row Reduction and Echelon Forms
- 1.3. Vector Equations
- 1.4. The Matrix Equation $A\mathbf{x} = \mathbf{b}$
- 1.5. Solution Sets of Linear Systems
- 1.6. Applications of Linear Systems
- 1.7. Linear Independence
- 1.8. Introduction to Linear Transformations
- 1.9. The Matrix of a Linear Transformation
- 1.10. Linear Models in Business, Science, and Engineering

2. Matrix Algebra

- 2.1. Matrix Operations
- 2.2. The Inverse of a Matrix
- 2.3. Characterizations of Invertible Matrices
- 2.4. Partitioned Matrices
- 2.5. Matrix Factorizations
- 2.6. The Leontief Input-Output Model
- 2.7. Applications to Computer Graphics
- 2.8. Subspaces of \mathbf{R}^n
- 2.9. Dimension and Rank

3. Determinants

- 3.1. Introduction to Determinants
- 3.2. Properties of Determinants
- 3.3. Cramer's Rule, Volume, and Linear Transformations

4. Vector Spaces

- 4.1. Vector Spaces and Subspaces
- 4.2. Null Spaces, Column Spaces, and Linear Transformations
- 4.3. Linearly Independent Sets; Bases
- 4.4. Coordinate Systems
- 4.5. The Dimension of a Vector Space
- 4.6. Rank
- 4.7. Change of Basis
- 4.8. Applications to Difference Equations
- 4.9. Applications to Markov Chains

5. Eigenvalues and Eigenvectors

- 5.1. Eigenvectors and Eigenvalues
- 5.2. The Characteristic Equation
- 5.3. Diagonalization
- 5.4. Eigenvectors and Linear Transformations
- 5.5. Complex Eigenvalues
- 5.6. Discrete Dynamical Systems
- 5.7. Applications to Differential Equations
- 5.8. Iterative Estimates for Eigenvalues

6. Orthogonality and Least Squares

- 6.1. Inner Product, Length, and Orthogonality
- 6.2. Orthogonal Sets
- 6.3. Orthogonal Projections
- 6.4. The Gram-Schmidt Process
- 6.5. Least-Squares Problems
- 6.6. Applications to Linear Models

7. Symmetric Matrices and Quadratic Forms

- 7.1. Diagonalization of Symmetric Matrices
- 7.2. Quadratic Forms