Math 100 : Applied Linear Algebra

California State University, Sacramento · Department of Mathematics & Statistics

Math 100 is designed to introduce the concepts of linear algebra from a formal and practical point of view. It is designed to provide non-mathematics majors with a knowledge of the tools of linear algebra. This encourages an appreciation for abstract structure and logical processes needed to understand and apply the mathematical results of the standard classical topics of linear algebra. Math 100 inclides systems of linear equations, matrices, determinants, vectos in 2-space and 3-space, and eigenvalues/eigenvectors. The emphasis in this course is on calculations and applications incolcing the above topics. Proofs and "abstract" tpoics of linear algebra should not be enphasized in Math 100. Students will be given periodic writing assignments that encourage them to think through concepts of the course.

Catalog Description

Linear algebra and its elementary applications. Topics: Matrix algebra; simultaneous linear equations; linear dependence and vector spaces; rank and inverses; determinants; numerical solution of simultaneous linear equations; linear transformations; eigenvalues and eigenvectors; unitary and similarity transformations; quadratic forms. Note: May not be taken for credit toward a mathematics major. **Graded**: Graded Student. **Units**: 3.0.

Prerequisites

Math 26B or Math 31

Learning Objectives

- Understand Gaussian elimination method and use this method to solve $m \times n$ systems of equations $(n, m < 6)$ and to interpret the solution.
- Understand the representation of linear transformation as matrices, interpret the elementary matrices as linear transformations, find the matrix representation of expansions, contractions, translations, rotations, reflections, understand the relationship between Gaussian elimination and the elementary matrices, and use elementary matrices to find the inverse of an $n \times n$ $(n < 5)$ matrix.
- Understand and apply the definitions of a subspace, a spanning set, a linearly independent set, a basis, and dimension to $\mathbb{R}^2$ and $\mathbb{R}^3$, understand the connections between these concepts, and generalize these ideas to general vector space.
- Find the kernel and range of a linear transformation, understand relationship between the dimension of the kernel and range, find the eigenvalues and eigenvectors of a linear transformation and use the eigenvectors to diagonalize an $n \times n$ matrix.

Text

Linear Algebra and Its Application 4/e, by Lay

Coverage

Chapters $1 - 5$, 7

Assignments

A variety of reading and problem solving assignments will be part of the course.

Examinations

There will be regular midterm examinations and a comprehensive final examination for this course.

Course Outline

I. Systems of Linear Equations

   A. Introduction
   B. Gaussian elimination
   C. Homogeneous eystems
   D. Matrices and matrix operations
   E. Methods of finding the inverse of a matrix

II. Determinants

   A. The determinant functio
   B. Evaluating determinants by row reduction
   C. Properties of determinants
   D. Cramer's rule

III. Vectors in 2-Space and 3-Space

   A. Norm of a vector
   B. Dot product and projections
   C. Cross product
   D. Lines and planes in 3-space
   E. Applications

IV. Vector Spaces

   A. Euclidean n-space
   B. Subspaces
   C. Linear independence
   D. Basis and dimension
   E. Rank of a matrix
   F. Length and angle in inner product spaces
   G. Orthonormal bases
   H. Applications in n-space

V. Linear Transformations

   A. Introduction and properties
   B. Matrices for linear transformations
   C. Applications

VI. Eigenvalues and Eigenvectors

A. Definitions and properties

B. Diagonalization

C. Symmetric matrices

D. Applications