MATH 275 – LINEAR ALGEBRA | 3 CREDITS

SYLLABUS

CATALOG DESCRIPTION

An applications approach to introductory linear algebra. Covers systems of linear equations, matrices, linear independence, vector spaces, inner product spaces, linear transformations, eigenvalues, eigenvectors and applications.

Prerequisites: A grade of "C" or better in MATH 189 (Calculus II).

Semester Offered: Fall

Common Student Learning Outcomes

Upon successful completion of San Juan College programs and degrees, the student will demonstrate competency in…

BROAD AND SPECIALIZED LEARNING

Students will actively and independently acquire, apply, and adapt skills and knowledge with an awareness of global contexts.

CRITICAL THINKING

Students will think analytically and creatively to explore ideas, make connections, draw conclusions and solve problems.

CULTURAL AND CIVIC ENGAGEMENT

Students will act purposefully, reflectively, and ethically in diverse and complex environments.

EFFECTIVE COMMUNICATION

Students will exchange ideas and information with clarity in multiple contexts.

INFORMATION LITERACY

Students will be able to recognize when information is needed and have the ability to locate, evaluate, and use it effectively.

INTEGRATING TECHNOLOGIES

Students will demonstrate fluency in the application and use of technologies in multiple contexts.

Student work from this class may be randomly selected and used anonymously for assessment of course, program, and/or institutional learning outcomes. For more information, please refer to the Dean of the appropriate School.

General Learning Outcomes

Upon successful completion of the course, the student will be able to…

A. Systems of Linear Equations
B. Matrices and Determinants
C. Vector Spaces
D. Linear Transformations
E. Eigenvalues and Eigenvectors
F. Inner Product Spaces
G. Basic Mathematical Proofs

Specific Learning Outcomes

Upon successful completion of the course, the student will be able to…

A. Systems of Linear Equations

A.1 Understand what is meant by the solutions of a linear system and be able to solve systems of linear equations by elimination and substitution.
A.2 Be able to solve systems of linear equations using elementary row operations.
A.3 Understand what is meant by row echelon form, reduced row echelon form, pivot positions, and free variables, and be able to find them, given a system of equations.
A.4 Know the algebraic properties of $\mathbf{R}^n$.
A.5 Understand and be able to compute the span of a set of vectors in $\mathbf{R}^n$.
A.6 Be able to use systems of equations to solve application problems.

B. Matrices and Determinants

B.1 Be able to perform matrix algebra and know the basic properties of matrix addition, subtraction, scalar multiplication, and multiplication.
B.2 Be able to find the inverse, transpose, and determinant of a matrix.
B.3 Be able to utilize matrix algebra to solve systems of equations.
B.4 Know the properties of determinants of matrices.
B.5 Understand the relationship between invertible matrices and equivalent statements regarding matrices and matrix equations (Invertible Matrix Theorem).
B.6 Be able to use matrices in applications

C. Vector Spaces

C.1 Be able to verify that a set has the structure of a vector space.
C.2 Understand and be able to verify the linear independence/dependence of a set of vectors.
C.3 Understand and be able to find the basis for vector spaces and subspaces for $\mathbf{R}^n$ as well as abstract vector spaces.
C.4 Understand and be able to find the dimension of a subspace of a vector space and the column space, null space, and rank of a matrix A.
C.5 Be able to use the Rank/Dimension Theorem.
C.6 Be able to perform change of basis coordinates using transition matrices.
C.7 Be able to use mathematical models and matrices in applications, including Markov chains.

D. Linear Transformations

D.1 Be able to verify that a function between vector spaces is a linear transformation.
D.2 Be able to find the kernel and range of a linear transformation.
D.3 Be able to calculate the matrix of a linear transformation with respect to a given basis.
D.4 Be able to use transition matrices to find the matrix of a linear transformation.
D.5 Be able to use linear transformations in applications.
D.6 Be able to show that a linear transformation is one-to-one and/or onto.

E. Eigenvalues & Eigenvectors

E.1 Understand and be able to find the eigenvalues and eigenvectors of a matrix.
E.2 Understand and be able to find the characteristic equation of a matrix A.
E.3 Be able to use eigenvalues to diagonalize matrices.

E.4 Be able to use eigenvalues to solve problems in discrete dynamical systems, stochastic processes, quadratic forms, and/or transcendental functions of matrices.

F. Inner Product Spaces

F.1 Be able to find inner-products.
F.2 Know the properties of inner products and be able to use inner products to determine whether vectors are orthogonal.
F.3 Understand and be able to verify orthonormal bases.
F.4 Be able to find orthogonal projections in $\mathbf{R}^n$.
F.5 Be able to find coordinates in orthonormal bases.
F.6 Be able to construct orthonormal bases using the Gram-Schmidt algorithm.
F.7 Be able to use inner product spaces in applications.

G. Basic Mathematical Proofs

G.1 Be able to write and construct simple mathematical proofs using direct proof, proof by contradiction, and proof by induction.

Other Requirements:

The TI-82, TI-83, TI-84, TI-85 or TI-86 graphing calculator is required for the course (TI-Nspire calculators that are equivalent to these are acceptable). A **TI-83 Plus or TI-84 Plus Graphing Calculator** is strongly recommended. Graphing calculators capable of symbolic manipulation (such as TI-89, TI-92, TI-Nspire CAS systems and other such calculators) will not be allowed on examinations, the final exam and where the instructor sees fit.