Course: Linear Algebra
Course Number: MATH229
Department: Mathematics

Course Description: This course is designed to introduce students to the theory of systems of linear equations and to mathematical proof. Topics include solving systems of linear equations, linear independence, linear transformations, matrix operations, determinants, vector spaces, eigenvalues and eigenvectors, and applications. Prerequisite: C- or higher in MATH222 Calculus II; waiver by placement testing results; or departmental approval.

COURSE OUTCOMES	SAMPLE OUTCOMES ACTIVITIES	SAMPLE ASSESSMENT TOOLS
Upon successful completion of this course students should:	To achieve these outcomes students may engage in the following activities:	Student learning may be assessed by:
1. Solve systems of linear equations and interpret their results; (QL)	• Write systems of linear equations in matrix form • Determine when a system of linear equations is consistent • Solve systems of linear equations using row reduction and give parametric descriptions of solution sets • Solve applications of linear systems	• Homework • In-class problem sets • Quizzes • Exams
2. Describe properties of linear systems using vectors; (QL)	• Geometrically interpret vectors in R^2 and R^3 • Use and verify algebraic properties of vectors in R^n • Determine whether a vector can be written as a linear combination of a set of other vectors	• Homework • In-class problem sets • Quizzes • Exams

	• Find and give a geometric interpretation of the span of a set of vectors • Determine if a set of vectors are linearly independent	
3. Demonstrate an understanding of linear transformations; (QL)	• Understand the connection between matrix transformations and linear transformations • Find the image of a vector under a transformation • Find the standard matrix of a linear transformation • Show how images can be reflected, contracted, expanded, sheared, and projected using transformations.	• Homework • In-class problem sets • Quizzes • Exams
4. Perform and interpret matrix operations; (QL)	• Understand properties, proofs, and computations involving matrix addition, multiplication, and transposes • Determine when a matrix is invertible and calculate its inverse • Use properties and characterizations of an invertible matrix for proofs	• Homework • In-class problem sets • Quizzes • Exams
5. Compute and interpret determinants of matrices; (QL)	• Compute determinants of square matrices using row reduction and cofactor expansion • Use determinants to show if a set of vectors is linearly independent	• Homework • In-class problem sets • Quizzes • Exams
6. Demonstrate an understanding of vector spaces and subspaces; (QL)	• Define a vector space and a subspace of a vector space	• Homework • In-class problem sets

	• Compare and contrast the null space and column space of a matrix • Find a basis and the dimension of the subspace spanned by given vectors • Examine how to impose a coordinate system on a vector space • Find dim Nul A, dim Row A, dim Col A, and/or rank A for a matrix A	• Quizzes • Exams
7. Demonstrate an understanding of eigenvalues and eigenvectors; (QL)	• Find the basis for the eigenspace corresponding to a given eigenvalue • Use the characteristic equation of a square matrix to calculate its eigenvalues • Find eigenvectors corresponding to eigenvalues	• Homework • In-class problem sets • Quizzes • Exams

This course includes the following core competencies: Quantitative Literacy (QL)