



MATH 080: LINEAR ALGEBRA

Proposer:**Name:**

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Effective Term:

Fall 2024

Credit Status:

Credit - Degree Applicable

Subject:

MATH - Mathematics

Course Number:

080

Discipline:

And/Or	(	Discipline	)
		Mathematics	

Catalog Title

Linear Algebra

Catalog Description

This course develops the techniques and theory needed to solve and classify systems of linear equations. Solution techniques include row operations, Gaussian elimination, and matrix algebra. The course investigates the properties of vectors in two and three dimensions, leading to the notion of an abstract vector space. Vector space and matrix theory are presented including topics such as inner products, norms, orthogonality, eigenvalues, eigenspaces, and linear transformations. Selected applications of linear algebra are included. Supplemental learning assistance is available for students to strengthen skills and to reinforce student mastery of concepts. Students enrolled in MATH 080 may access the supplemental learning assistance by enrolling in MATH 400, an open entry/open exit non-credit course.

Prerequisites

MATH 066 or equivalent college course with a minimum grade of C

Validation**Validation Type**

Sequential - Same Discipline

Course

MATH 066

Complete the Prerequisite/Corequisite Objectives and provide sound quantitative research to document the need for the requisite.

Method of Instruction:

Distance Education

Lecture and/or Discussion

Course Units/Hours:**Course Units Minimum:**

4

Lecture Hours Minimum (week)

4

Lab Hours Minimum (week)

0

Activity Hours Minimum (week)

0

Total Contact Hours Minimum (semester)

70

Total Outside Hours Minimum (semester)

140

Total Student Learning Minimum Hours (semester)

210

Repeatability:

No

Open Entry/Exit:

No

Field Trips:

Not Required

Grade Mode:

Standard Letter

TOP Code:

170100 - Mathematics, General

SAM Code:

E - Non-Occupational

Course Content

Methods of Assessment:

Oral presentations
Problem solving assignments or activities
Problem solving quizzes or exams
Project
Short answer quizzes or exams

Course Topics:

Course Topics	
1	Determinants Definition and Properties Three Fundamental Theorems Determinants, Adjoint Matrices, and Inverses Cramers Rule
2	Systems of Linear Equations and Matrices Vectors and Matrices Vector and Matrix Algebra Mathematical Induction Gaussian/Gauss-Jordan Elimination with m equations in n unknowns Homogeneous Systems of Equations The Inverse of a Square Matrix and relationship to solving systems The Transpose of a Matrix and Symmetric Matrices Elementary Matrices, Special Matrices, and Matrix Inverses
3	Applications will be included and may be chosen from the following list: Quadratic Forms and Conic Sections Least Squares Approximation Electrical Networks Linear Programming Cubic Spline Interpolation Markov Chains Graph Theory Game Theory Leontief economic models Forest Management Computer Graphics Fractals and Chaos Cryptography Genetics Population Growth Harvesting of Animal Populations
4	Eigenvalues, Eigenvectors, and Linear Transformations Eigenvalues, Eigenvectors, and Eigenspaces Similar Matrices and Diagonalization Symmetric Matrices and Orthogonal Diagonalization General Linear Transformations Kernel and Range Inverse Linear Transformations

5	Vector Spaces Definition and Basic Properties Subspaces Linear Independence, Linear Combination, Span Basis and Dimension Rank, Nullity, Row Space, Column Space, Null Space Inner Product Spaces, Angles and Projections Change of Basis Orthonormal Basis Gram-Schmidt Process Orthogonal Matrices
6	Euclidean Vector Spaces Vector Arithmetic for $\mathbb{R}^n$ Dot Product and Projections Cross Product Lines and Planes in Space Euclidean n -space Linear Transformations and Associated Matrices

Course Objectives:

Course Objectives	
1	Use bases and orthonormal bases to solve problems in linear algebra.
2	Prove results in linear algebra (using appropriate proof-writing techniques), such as linear independence of vectors; properties of subspaces; linearity, injectivity and surjectivity of functions; properties of eigenvectors and eigenvalues.
3	Find eigenvalues and eigenvectors and use them in applications.
4	Find the dimension of spaces such as those associated with matrices and linear transformations.
5	Find solutions of systems of equations using various methods.

Course Outcomes:

Course Outcomes	
1	Bases: Students will be able to transform between bases, including the creation, geometric connections, and the application of orthogonal and orthonormal bases.
2	Diagonalization: Students will be able to transform between bases, including the creation, geometric connections, and the application of orthogonal and orthonormal bases.
3	Matrices: Students will be able to prove and know relationships between fundamental matrix spaces, such as row space, column space, nullspace, rank, and nullity.
4	Proofs: Students will understand and prove relationships between matrices, systems of equations, and determinants.

Assignments:

Assignment Type:	Details
Reading	Read a section of the textbook nightly. For example, an instructor might assign students to read section 4.1 before class so that students come to class with a basic understanding of what the lecture will cover.
Writing	Write step by step solution to linear problems. Students are required to prove theorems step by step and to write the reasons in words for each step.
Homework	Instructors can assign problems from the book and/or write up a problem set. For example, complete section 2.3 problems 1-20 odd. Weekly Problem sets can be assigned to give weekly review from the problems from the book. This will increase a students overall problem solving and critical thinking skills. The additional practice on such a variety of topics covered in that section will build a students' confidence in their ability to identify which technique to use and in their problem solving abilities

Textbooks or other support materials

Resource Type:	Details
Books	Elementary Linear Algebra, Anton, Wiley 12th edition, 2019 978-1-119-26804-8

Equity Review:

Yes

Transferable to CSU

Yes - Approved

CSU General Education

CSU GE B4: Mathematics

Transferable to CSU

Transferable to UC

Yes - Proposed



UC/IGETC General Education

IGETC 2: Math Concepts & Quantitative Reasoning
Transferable to UC

Other Degree Attributes

Degree Applicable
Not a Basic Skills Course

Distance Learning Addendum

DLA Math 080-1.pdf

Banner Title:

Linear Algebra

Curriculum Committee Approval Date:

02/07/2024

Academic Senate Approval Date:

02/14/2024

District Governing Board Approval Date:

03/11/2024

Course Control Number:

CCC000535235

C-ID:

MATH250