Common Course Outline
MATH 257
Linear Algebra
4 Credits

The Community College of Baltimore County

Description

MATH 257 – Linear Algebra is one of the suggested elective courses for students majoring in Mathematics, Computer Science or Engineering. Included are geometric vectors, matrices, systems of linear equations, vector spaces, linear transformations, determinants, eigenvectors and inner product spaces.

4 Credits: 5 lecture hours

Prerequisite: MATH 251 with a grade of "C" or better

Overall Course Objectives

Upon successfully completing the course, students will be able to:
1. perform matrix operations;
2. use Gaussian Elimination, Cramer's Rule, and the inverse of the coefficient matrix to solve systems of Linear Equations;
3. find the inverse of a matrix by Gaussian Elimination or using the adjoint matrix;
4. compute the determinant of a matrix using cofactor expansion or elementary row operations;
5. apply Gaussian Elimination to solve problems concerning Markov Chains;
6. verify that a structure is a vector space by checking the axioms;
7. verify that a subset is a subspace and that a set of vectors is a basis;
8. compute the dimensions of subspaces;
9. compute the matrix representation of a linear transformation;
10. apply notions of linear transformations to discuss rotations and reflections of two dimensional space;
11. compute eigenvalues and find their corresponding eigenvectors;
12. diagonalize a matrix using eigenvalues;
13. apply properties of vectors and dot product to prove results in geometry;
14. apply notions of vectors, dot product and matrices to construct a best fitting curve;
15. construct a solution to real world problems using problem methods individually and in groups;
16. examine the mathematical contributions made by people from diverse cultures throughout history;
17. articulate a solution to mathematical problems;
18. apply appropriate technology to the solution of mathematical problems; and

19. solve application based linear algebra problems which pertain to pure sciences, the social sciences, medical sciences, technological sciences, humanities and the arts.

Major Topics
  I. Linear equations and matrices
- A. Linear systems
- B. Matrices
- C. Properties of matrix operations
- D. Solutions of equations, Markov Chains
- E. The inverse of a matrix

 II. Determinants
- A. Definition and properties
- B. Cofactor expansion and applications
- C. Determinants from a computational point of view

III. Vectors and vector spaces
- A. Vectors in the plane
- B. N-vectors
- C. Cross product in R3, geometry proofs
- D. Vector spaces and subspaces
- E. Linear independence
- F. Basis and dimension
- G. The rank of a matrix and applications

IV. Linear transformations and matrices
- A. Definition and examples
- B. The kernel and range of a linear transformation
- C. The matrix of a linear transformation
- D. Rotations and reflections of two dimensional space
- E. Similarity of matrix representation

 V. Eigenvalues and eigenvectors
- A. Diagonalization
- B. Diagonalization of symmetric matrices

VI. Inner product spaces
- A. Orthonormal bases by Gram-Schmidt Process
- B. Applications of dot product

Course Requirements

Grading procedures will be determined by the individual faculty member but will include the following:

Grading/exams
- At least two exams in addition to the final which will count for no less than 20% of the overall course grade.
- A comprehensive final exam which will count no less than 20% of the overall course grade.
- A project and regular homework assignments will be required and to be counted no more than 15% toward the final course grade.

Other Course Information

This course is an approved General Education course in the Mathematics category. Please refer to the current CCBC Catalog for General Education course criteria and outcomes.