

# Common Course Outline

**MATH 257**

**Linear Algebra**

**4 Semester Hours**

## The Community College of Baltimore County

### Description

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. Prerequisites: Calculus I(MATH 251) or equivalent.

### Overall Course Objectives

Upon successfully completing the course, students will be able to:

1. Perform Matrix Operations (I, 1, 2, 3, 4, 6, 7)
2. Use Gaussssian Elimination, Cramer's Rule, and the inverse of the coefficient matrix to solve systems of Linear Equations (I, IV, 1, 2, 3, 4, 6, 7)
3. Find the inverse of a matrix by Gaussian Elimination or using the adjoint matrix (II, IV, 1, 2, 4)
4. compute the determinant of a matrix using cofactor expansion or elementary row operations (IV, 1, 2, 4)
5. Apply Gaussian Elimination to solve problems concerning Markov Chains (II, IV, 1, 2, 4)
6. Verify that a structure is a Vector Space by checking the axioms (I, 1, 2)
7. Verify a subset is a Subspace, and a set of vectors is a Basis (I, II, 1, 2, 5)
8. Compute the Dimensions of Subspaces (I, 1, 2)
9. Compute the Matrix Representation of a linear transformation (I, IV, V, 1, 2, 3, 4, 5, 6, 7)
10. Apply notions of linear transformations to discuss rotations and reflections of two dimensional space(I, IV, V, 1, 2, 3, 4, 5, 6, 7)
11. Compute Eigenvalues and find their corresponding Eigenvectors (I, III, IV, 1, 2, 4, 7)
12. Diagonalize a matrix using eigenvalues (I, IV, 1, 2, 4)
13. Apply properties of vectors and dot product to prove results in geometry (I, IV, V, 1, 2, 3, 4, 5, 6, 7)
14. Apply notions of vectors, dot product and matrices to construct a best fitting curve (I, IV, V, 1, 2, 3, 4, 5, 6, 7)
15. Construct a solution to real world problems using problem methods individually and in groups. (II, III, V, VI, 2, 3, 7)
16. Examine the mathematical contributions made by people from diverse cultures throughout history. (V, 5)
17. Articulate a solution to mathematical problems. (II, 2)
18. Apply appropriate technology to the solution of mathematical problems. (IV, 4, 5)

### Major Topics

- I Linear Equations and Matrices
  - A. Linear Systems
  - B. Matrices
  - C. Properties of Matrix Operations
  - D. Solutions of Equations, Markov Chain
  - 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  $R^3$ , 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 (General Education Goal #VII)**

Students will be given opportunity to collaborate via group work and/or oral presentation of problem solutions. There will be multiple opportunities for the instructor to assess student progress in the course through classwork and/or homework.

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

Tests, Exams, and/or Quizzes: There will be at least two exams. Individual faculty will notify students of the testing procedures to be used.

Comprehensive Final Exam: The course will include a comprehensive final exam, which may include a final project.

Final Grades: Grades will be determined by individual faculty members.

The Community College of Baltimore County is committed to providing a high-quality learning experience that results in growth in knowledge, attitudes, and skills necessary to function successfully as a transfer student, in a career and as a citizen. To accomplish this goal, we maintain high academic standards and expect students to accept responsibility for their individual growth by attending classes, completing all homework and other assignments, participating in class activities and preparing for tests.

We take seriously our responsibility to maintain high-quality programs and will periodically ask you to participate in assessment activities to determine whether our students are attaining the knowledge, attitudes and skills appropriate to various courses and programs. The assessment activities may take many different forms such as surveys, standardized or faculty-developed tests, discussion groups or portfolio evaluations. We ask that you take these activities seriously so that we can obtain valid data to use for the continuous improvements of CCBC's course and programs.

Date revised: 05/17/00  
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