

# Common Course Outline

**MATH 253**

**Calculus III**

**4 Credits**

## Community College of Baltimore County

### Description

**MATH 253 – Calculus III** Covers the major topics of third semester Calculus, including functions of several variables, differentiation and integration, vectors, vector fields, parameterization, Green’s Theorem, and applications.

**4 Credits:** 5 lecture hours

**Prerequisite:** MATH 252 with a grade of “C” or better

### Overall Course Objectives

Upon completion of this course students will be able to:

1. define and apply differentiation and integration rules to various multi-variable functions;
2. express concepts of differentiable and integral multi-variable calculus using appropriate terminology;
3. define vectors and vector fields and compare their definitions to lower dimension analogs;
4. define the parameterization of surfaces and solids;
5. express mathematical information in table, graphical, formulaic, and written formats;
6. apply a working knowledge of mathematical applications relevant to such fields as mathematics, engineering, science, and computer science;
7. apply course-related mathematical theories in order to make informed decisions in real life situations;
8. analyze data and determine an appropriate mathematical function that describes the data;
9. apply appropriate technology, such as graphing calculators and computer algebra system software, to solve mathematical problems;
10. identify efficient and inefficient methods for problem solving;
11. utilize the Internet and other resources to research course-related topics;
12. examine the mathematical contributions made by people from diverse cultures throughout history; and
13. articulate a solution to mathematical problems.

### Major Topics

- I. Functions of several variables

- A. Graphs of functions of several variables
- B. Contour diagrams
- C. Linear functions
- D. Limits and continuity
- II. Vectors
  - A. Displacement vectors and vectors in general
  - B. Dot product and cross product
- III. Differentiating functions of several variables
  - A. Partial derivative: estimate from graph and table; compute algebraically
  - B. Local linearity and the differential
  - C. Gradients and directional derivatives in the plane and space
  - D. Chain Rule
  - E. Second-order partial derivatives
  - F. Taylor Approximations for functions of several variables
- IV. Optimization
  - A. Local extrema
  - B. Global extrema: unconstrained optimization
  - C. Constrained optimization: Lagrange multipliers
- V. Integrating functions of several variables
  - A. Iterated integrals and triple integrals
  - B. Double integrals in polar coordinates
  - C. Change of variables in a multiple integral
- VI. Parameterized curves and surfaces
  - A. Vector-valued functions
  - B. Parameterized curves and surfaces
  - C. Motion, velocity, and acceleration
  - D. Implicit function theorem
- VII. Vector fields
  - A. Definition of a vector field
  - B. Flow of a vector field
  - C. Divergence of a vector field
  - D. Divergence Theorem
  - E. Curl of a vector field
  - F. Stokes Theorem
- VIII. Other Integrals
  - A. The idea of a line integral
  - B. Computing line integrals over parameterized curves
  - C. Gradient fields and path-independent fields
  - D. Path-dependent vector fields and Green's Theorem
  - E. The idea of a flux integral
  - F. Flux integrals over parameterized surfaces

### **Course Requirements**

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

### **Grading/exams**

- At least two tests will be given
- A comprehensive final exam

Date revised: 01/30/2019