

Syllabus - Math 311 - Calculus III

Department of Mathematics
Millersville University

Description

Continuation of Math 211. Vector calculus, functions of several real variables, partial differentiation, implicit functions, multiple integrals, line and surface integrals, and applications. (4 credits)

This course may be taken for general education credit (G2).

Prerequisites

A C- or better in Math 211 or Math Placement.

Objectives

Students will be able to:

- Do computations involving the algebra and geometry of vectors in 2 and 3 dimensions.
- Do computations involving the three-dimensional vector algebra required by linear algebra courses: Dot and cross products, projections, and equations of line and planes in 3 dimensions.
- Solve problems in the calculus of curves in 2 and 3 dimensions, including the unit tangent and unit normals vectors, curvature, and motion along a trajectory.
- Solve problems involving differentiable functions of several variables: Partial differentiation, gradients, directional derivatives, tangent planes, and differentials.
- Locate and classify critical points of functions of several variables, and use them in optimization problems.
- Set up and evaluate multiple integrals, and interchange the order of integration.
- Use spherical coordinates and cylindrical coordinates to compute multiple integrals.
- Solve problems involving line and surface integrals, potential functions, and path independence.
- Solve problems using Green's theorem in the plane, and Gauss's and Stokes' theorems.

Assessment

Students will demonstrate their understanding through work in class, homework, and examinations.

Use of Technology

Students are required to have access to a graphing calculator for this course. The department currently supports the TI 83, 84, and 86.

Calculators (and technology in general) should enhance learning, and students should learn to use them appropriately. Instructors may at times prohibit the use of calculators with symbolic math capabilities, such as the TI-89 or TI-92. Instructors may prohibit the use of calculators on exams, as they deem appropriate.

- Graphical and numerical evidence should be presented as an aid to conjecture and comprehension. They should not substitute for rigorous proof, nor should they replace the acquisition of appropriate symbolic manipulation skills.
- Students should understand the limitations of technology (for example, by seeing situations in which graphical or numerical evidence is unreliable or inconclusive).

In MATH 311, students will:

- Approximate integrals numerically (e.g. using the fnint function on the TI calculators).

Topics

1. Vectors and the Geometry of Space

Vectors in the plane
Vectors in space
Dot products and projections
Cross products
Lines and planes in space
Surfaces in space

2. Vector-Valued Functions

Vector-valued functions and space curves
The calculus of vector-valued functions
Motion in space
Curvature
The tangent and normal vectors to a curve

3. Functions of Several Variables

Functions of several variables
Limits and continuity
Partial derivatives
Tangent planes and linear approximation
The Chain Rule

Directional derivatives and gradients
Extrema of functions of several variables
Lagrange multipliers

4. Multiple Integrals

Double integrals in rectangular coordinates
Area, volume, and center of mass
Double integrals in polar coordinates
Surface area
Triple integrals
Cylindrical coordinates
Spherical coordinates

5. Vector Calculus

Vector fields
Line integrals
Independence of path and conservative fields
Green's Theorem
Curl and divergence
The Divergence Theorem
Stokes' Theorem

Textbooks

Robert Smith and Roland Minton, *Calculus* (4th edition, early transcendentals). New York: McGraw-Hill, 2012.

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