MATH 311 – CALCULUS III – SYLLABUS

Department of Mathematics
Millersville University

Description

A continuation of MATH 211. Topics include 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

C- or better in MATH 211

Course Objectives

Students will learn the theory and techniques of calculus and it's applications. By the conclusion of this course the successful student will be able to:

- Write vectors in component form and as linear combinations of standard unit vectors.
- Add and subtract vectors algebraically and graphically and use in applications.
- Calculate dot and cross products of vectors.
- Find the angle between vectors, the component and projections of one vector onto another.
- Find parametric and symmetric equations of a line in space.
- Find the distance between two objects in space.
- Identify surfaces in space.
- Determine limits, continuity, derivatives, and integrals of vector-valued functions.
- Use vectors to solve applied problems involving velocity, force, and work.
- Determine the curvature of vector-valued functions.
- Find the unit tangent vector, normal vector and binormal vector of a vector-valued function.
- Determine the parametric representation of surfaces in space.
- Apply calculus techniques to functions of more than one independent variable including limits, partial derivatives, directional derivatives, and the chain rule.
- Find the gradient of multivariable functions.
- Calculate extrema of multivariable functions.
- Calculate double and/or triple integrals and use to find area, volume, and center of mass, and surface area.

- Calculate double integrals in polar coordinates and triple integrals in cylindrical and spherical coordinates.
- Find the potential function of a conservative vector field and understand the qualities of a conservative vector field.
- Calculate line integrals.
- Use Green's theorem to calculate line integrals and areas.
- Calculate the curl and divergence of a vector field and understand the qualities of each.
- Calculate surface integrals
- Use the divergence theorem and Stokes' theorem to evaluate line integrals or flux integrals.

Assessment

Assessment of student achievement of the course objectives will vary from one instructor to another. Typical assessment will be made 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. Additionally, Millersville University students have access to the mathematical software, *Mathematica*, which may be used at the instructor's discretion.

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.

Topics

1. Vectors and the geometry of space
    a. Vectors in the plane
    b. Vectors in space
    c. The dot product
    d. The cross product
    e. Lines and planes in space
    f. Surfaces in space
2. Vector-valued functions
    a. Vector-valued functions
    b. The calculus of vector-valued functions
    c. Motion in space

    d. Curvature
    e. Tangent and normal vectors
3. Functions of several variables and partial differentiation
    a. Functions of several variables
    b. Limits and continuity
    c. Partial derivatives
    d. Tangent planes and linear approximations
    e. The chain rule
    f. The gradient and directional derivatives
    g. Extrema of functions of several variables
    h. Constrained optimization and Lagrange multipliers
4. Multiple integrals
    a. Double integrals
    b. Area, volume and center of mass
    c. Double integrals in polar coordinates
    d. Surface area
    e. Triple integrals
    f. Cylindrical coordinates
    g. Spherical coordinates
5. Vector calculus
    a. Vector fields
    b. Line integrals
    c. Independence of path and conservative vector fields
    d. Green's theorem
    e. Curl and divergence
    f. Surface integrals
    g. The divergence theorem
    h. Stokes' theorem