BAKER COLLEGE
STUDENT LEARNING OUTCOMES

MTH3510 MULTIVARIABLE CALCULUS
4 Semester Hours

Student Learning Outcomes & Enabling Objectives

1. Manipulate vector-valued functions.
    a. Calculate dot and cross products.
    b. Locate points in space using position vectors, unit vectors, and Cartesian forms of vectors.
    c. Describe lines, planes, and surfaces using vectors.
    d. Define a plane in space using a point in the plane and a vector that is normal to the plane.
    e. Visualize vectors and vector fields.

2. Apply differentiation and integration techniques to solve problems involving geometry of graphs, lines, curves, planes, and surfaces in 2 and 3 dimensional spaces in the Cartesian, polar, cylindrical, and spherical coordinate systems.
    a. Calculate limits, derivatives, and integrals for vector-valued functions.
    b. Represent surfaces in space using the three dimensional rectangular coordinate system with cylindrical and spherical coordinates.
    c. Describe particle motion by defining the position, velocity, and acceleration using vector notation.
    d. Write iterated integrals for calculating areas and volumes in rectangular and polar form.
    e. Solve application problems related to calculating mass, finding the center of mass, and finding moments of inertia.

3. Solve application problems of optimization involving minimum and maximum, including least squares regression analysis, using partial derivatives.
    a. Define the total differential of a function of two variables by generalizing differentials from elementary calculus.
    b. Explore LaPlace's Equation as an example of partial differential equations.
    c. Identify the gradient of two or more variables.
    d. Apply Lagrange multipliers to optimization problems with constraints.

4. Apply differentiation and integration to surfaces in space.
    a. Describe cylindrical surfaces, quadric surfaces, and surfaces of revolution using multivariable functions.

b. Use double and triple integrals to find area, volume, and mass.

5. Apply fundamental theorems in vector fields to evaluate rotational, gravitational, and electric fields.
    a. Utilize Green's Theorem to evaluate line integrals, including related applications.
    b. Evaluate heat flow using surface integrals
    c. Apply the Divergence Theorem to complete flux calculations.
    d. Apply Stokes's Theorem to create a physical representation of curl.

Big Ideas and Essential Questions

Big Ideas

- Analysis of figures and surfaces in 2- and 3- dimensional space
- Optimization of minimums and maximums using partial derivatives
- Vector Fields

Essential Questions

- How do Calculus techniques help me describe and solve problems involving geometry of lines, curves, planes, and surfaces in 2 and 3 dimensional spaces?
- How do Calculus techniques allow me to understand and analyze optimization problems?
- How do Calculus techniques enable me to evaluate rotational, gravitational, and electric fields?

These SLOs are not approved for experiential credit.

Effective: Fall 2020