MATH 1D: CALCULUS

Foothill College Course Outline of Record

Heading	Value
Effective Term:	Summer 2024
Units:	5
Hours:	5 lecture per week (60 total per quarter)
Prerequisite:	MATH 1C.
Advisory:	Demonstrated proficiency in English by placement via multiple measures OR through an equivalent placement process OR completion of ESLL 125 & ESLL 249.
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Non-GE
Transferable:	CSU/UC
Grade Type:	Letter Grade (Request for Pass/No Pass)
Repeatability:	Not Repeatable

Student Learning Outcomes

- Students will solve problems involving applications of multiple integrals and vector calculus.
- Students will develop conceptual understanding of Integration involving functions of multiple variables and theorems and concepts related to vector calculus.
- Students will demonstrate the ability to evaluate multiple integrals, and line and flux integrals.

Description

Introduction to integration of functions of more than one variable, including double, triple, flux, and line integrals. Additional topics include polar, cylindrical and spherical coordinates, parameterization, vector fields, path-independence, divergence and curl.

Course Objectives

The student will be able to:

1. Demonstrate an understanding of integration of functions of several variables
2. Demonstrate an understanding of parameterization and vector fields, including equations of planes in vector form and using parametric equations, and computation of arc length
3. Demonstrate an understanding of line integrals
4. Demonstrate an understanding of flux integrals
5. Demonstrate an understanding of the calculus of vector fields, including divergence and curl of a vector field, the divergence theorem, Stokes' theorem, and Green's theorem
6. Use technology, such as graphing calculators and/or computer software, to assist in solving problems involving any of the topics in (1) through (5) above
7. Discuss mathematical problems and write solutions in accurate mathematical language and notation
8. Interpret mathematical solutions

Course Content

1. Integrating functions of several variables
    a. The definite integral of a function of two variables
    b. Iterated integrals
    c. Triple integrals
    d. Double integrals in polar coordinates
    e. Integrals in cylindrical and spherical coordinates
    f. Change of variables in a multiple integral
    g. Applications
        i. Area
        ii. Volume
        iii. Center of mass
        iv. Moments of inertia
2. Parameterization and vector fields
    a. Parameterized curves
        i. Tangent vector
        ii. Normal vector
        iii. Binormal vector
    b. Parameterized surfaces
        i. Planes - in vector form and using parametric equations
        ii. Non-linear surfaces
    c. Motion, velocity, and acceleration
    d. Vector fields
        i. Conservative
        ii. Gradient
    e. The flow of a vector field
    f. Arc length
    g. Curvature
3. Line integrals
    a. Parametric equations
    b. The idea of a line integral
    c. Computing line integrals over parameterized curves
    d. Gradient fields and path-independent fields
    e. Path-dependent vector fields and Green's theorem
4. Flux integrals
    a. The idea of a flux integral
    b. Flux integrals for graphs, cylinders, and spheres
    c. Flux integrals over parameterized surfaces
5. Calculus of vector fields
    a. The divergence of a vector field
    b. The divergence theorem
    c. The curl of a vector field
    d. Stokes' theorem
    e. Green's theorem
6. Use technology, such as graphing calculators and/or computer software, to assist in solving problems involving any of the topics in (1) through (5) above
    a. Use appropriate technology to graph vector fields and use the graphs to solve various types of problems involving vector fields, such as line integrals, flow lines, divergence and curl

   b. Use appropriate technology to graph parameterized curves and surfaces in both 2- and 3-dimensional space
7. Discuss mathematical problems and write solutions in accurate mathematical language and notation
   a. Application problems from other disciplines
   b. Proper notation
8. Interpret mathematical solutions
   a. Explain the significance of solutions to application problems

Lab Content

Not applicable.

Special Facilities and/or Equipment

1. Access to graphing technology, such as a graphing calculator or graphing software.
2. When taught online/hybrid: students need internet access and access to course management system and specific software related to the course.

Method(s) of Evaluation

Methods of Evaluation may include but are not limited to the following:

Written homework
Quizzes and tests
Comprehensive final examination

Method(s) of Instruction

Methods of Instruction may include but are not limited to the following:

Lecture
Discussion
Cooperative learning exercises

Representative Text(s) and Other Materials

Hughes-Hallet, et al.. Calculus: Single and Multivariable, 8th ed.. 2020.

Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

1. Homework problems covering subject matter from text and related material ranging from 30-60 problems per week. Students will need to employ critical thinking in order to complete assignments
2. Five hours per week of lecture covering subject matter from text and related material. Reading and study of the textbook, related materials, and notes
3. Student projects covering subject matter from textbook and related materials. Projects will require students to discuss mathematical problems, write solutions in accurate mathematical language and notation, and interpret mathematical solutions. Projects may require the use of a computer algebra system, such as Mathematica or MATLAB
4. Worksheets: Problems and activities covering the subject matter. Such problems and activities will require students to think critically. Such worksheets may be completed inside and/or outside of class

Discipline(s)

Mathematics