MATH 1C: CALCULUS

Course Outline of Record

<table>
<thead>
<tr>
<th>Heading</th>
<th>Value</th>
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<tbody>
<tr>
<td>Effective Term:</td>
<td>Summer 2022</td>
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<tr>
<td>Units:</td>
<td>5</td>
</tr>
<tr>
<td>Hours:</td>
<td>5 lecture per week (60 total per quarter)</td>
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<tr>
<td>Prerequisite:</td>
<td>MATH 1B or 1BH.</td>
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<td>Advisory:</td>
<td>Demonstrated proficiency in English by placement via multiple measures OR through an equivalent placement process OR completion of ESLL 125 &amp; ESLL 249.</td>
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<tr>
<td>Degree &amp; Credit Status:</td>
<td>Degree-Applicable Credit Course</td>
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<tr>
<td>Foothill GE:</td>
<td>Area V: Communication &amp; Analytical Thinking</td>
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<tr>
<td>Transferable:</td>
<td>CSU/UC</td>
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<tr>
<td>Grade Type:</td>
<td>Letter Grade (Request for Pass/No Pass)</td>
</tr>
<tr>
<td>Repeatability:</td>
<td>Not Repeatable</td>
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Student Learning Outcomes

- Students will solve problems involving applications of functions of multiple variables and series.
- Students will develop conceptual understanding of sequences and series and functions of multiple variables and their rates of change. They will learn to demonstrate and communicate this understanding in a variety of ways, such as: reasoning with definitions and theorems, connecting concepts, and connecting multiple representations, as appropriate.
- Students will demonstrate the ability to model lines and planes in space and calculate partial and directional derivatives of functions of multiple variables.

Description

Introduction to functions of more than one variable, including vectors, partial differentiation, the gradient, contour diagrams and optimization. Additional topics include infinite series, convergence and Taylor series.

Course Objectives

The student will be able to:

a. Analyze sequences and series.
b. Apply convergence tests to sequences and series.
c. Approximate functions using Taylor polynomials.
d. Investigate vectors, including dot and cross products.
e. Demonstrate the ability to work with functions of more than one variable, which includes topics such as limits, continuity, the limit of a function at a point, computing both the equation of a plane and the equation of a tangent plane to a surface at a point, and parametric and vector equations of lines in 3-space.
f. Differentiate functions of more than one variable, including the directional derivative, the gradient, the chain rule, and the determination of whether a function is differentiable.
g. Optimize functions of more than one variable for both constrained and unconstrained optimization problems; use of the second derivative test to find local extrema and test for saddle points.
h. Use technology, such as graphing calculators and/or computer software to assist in solving problems involving any of the topics in (1) through (7) above.
i. Discuss mathematical problems and write solutions in accurate mathematical language and notation.
j. Interpret mathematical solutions.

Course Content

a. Analyze sequences and series
   i. Sequences
      1. Convergence and divergence of sequences
      2. Limits
      3. Convergence theorems
   ii. Series
      1. Geometric series
      2. Alternating series
      3. Power series
         a. Differentiation of power series
         b. Integration of power series
      4. Applications to other disciplines
b. Apply convergence tests to sequences and series
   i. Convergence and divergence of series
   ii. Tests for convergence
   iii. Radius of convergence
   iv. Interval of convergence
c. Approximate functions using Taylor polynomials
   i. Taylor polynomials
      1. Applications to other disciplines
      2. Error in Taylor polynomial approximations
   ii. Taylor series
      1. Finding and using Taylor series
      2. Applications to other disciplines
d. Investigate vectors, including dot and cross products
   i. Displacement vectors
   ii. Vectors operations in two-space and three-space
   iii. Dot product
   iv. Cross product
   v. Triple products
   vi. Projections
   vii. Applications to other disciplines
e. Demonstrate the ability to work with functions of more than one variable
   i. Functions of several variables
   ii. Graphs of functions of several variables
   iii. Lines in 3-space
      1. Parametric representations
      2. Vector representations
   iv. Contour diagrams
   v. Cross-sections
   vi. Level curves
   vii. Linear functions
1. Rectangular equation of a plane
2. Equation of a tangent plane at a point

viii. Limits and continuity
1. Limit of a function at a point

f. Differentiate functions of more than one variable, including the directional derivative, the gradient, and the chain rule
i. Partial derivatives
   1. Definition
   2. Algebraic computation

ii. Tangent planes
iii. Linear approximations
   1. Applications to other disciplines

iv. Gradients
   1. Applications to other disciplines

v. Directional derivatives
   1. Applications to other disciplines

vi. The chain rule
   1. Applications to other disciplines

vii. Higher-order partial derivatives

viii. Differentiability
   1. Partial derivatives
   2. Directional derivatives
   3. Differentiability of a surface at a point

g. Optimize functions of more than one variable for both constrained and unconstrained optimization problems
i. Local extrema
   1. Definitions
   2. Second derivative test
      a. Local maximum
      b. Local minima
      c. Saddle points

ii. Optimization

iii. Constrained optimization
   1. Lagrange multipliers

iv. Applications to other disciplines

h. Use technology, such as graphing calculators and/or computer software to assist in solving problems involving any of the topics in (1) through (7) above
i. Calculator/computer utilities for solving problems involving sequences and series

ii. Calculator/computer utilities for constructing graphs of functions and relations in 3-space, contour diagrams, and graphs of cross-sections

iii. Calculator/computer programs for evaluating directional derivatives

i. Discuss mathematical problems and write solutions in accurate mathematical language and notation
   i. Application problems from other disciplines

ii. Proper notation

j. Interpret mathematical solutions
   i. Explain the significance of solutions to application problems

Special Facilities and/or Equipment
Access to graphing technology, such as a graphing calculator or graphing software.

Method(s) of Evaluation
Methods of Evaluation may include but are not limited to the following:

Written homework
Quizzes and tests
Proctored 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


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

a. 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.

b. Five hours per week of lecture covering subject matter from text and related material. Reading and study of the textbook, related materials and notes.

c. 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.

d. 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

Lab Content
Not applicable.