Math 30 : Calculus I

California State University, Sacramento · Department of Mathematics & Statistics

This is the first course in a one year course covering one-dimesionla differential and integral calculus including infinite series. It is designed for students majoring in Physics, Chemistry, Engineering, Computer Science, and Mathematics. Students who have the prerequisites for Math 30 but who have taken a mathematics course within the past two years may need to take Math 29 before enrolling in Math 30.

The purpose of this course is to give students a firm foundation in the basic concepts of the calculus, e.g. limit, derivative, integral, and infinite series; but every opportunity should be taken to apply these newly acquired mathematical tools to a variety of interesting physical and geometrical problems. Althouogh a certain degree of proficiency with the techniques of differentiation and integration is expected of each student, teaching emphasis should also be placed on the fundamental concepts of the calculus and on its applications to nontrivial problems. With this pedagogical emphasis in mind, students will be given periodic writing assignments which encourage them to think through concepts of the course. It is recommended that each new concept be introduced geometrically, algebraically, and numerically.

Catalog Description

Functions and their graphs; limits; the derivative and some of its applications; trigonometric and hyperbolic functions and their inverses; the integral; the fundamental theorem; some applications of the integral. **Graded**: Graded Student. **Units**: 4.0.

Prerequisites

Math 29 or four years of high school mathematics which includes two years of algebra, one year of geometry, and one year of mathematical analysis; completion of ELM requirement and Calculus Readiness Diagnostic Test.

Text

Calculus Early Transcendental, 8/e, by James Stewart

Learning Objectives

- Understand the definition of the derivative; use the definition to find the derivative of simple functions, and interpret the definition geometrically and in a variety of applied contexts including instantaneous velocity.
- Know the fundamental rules of differentiation including the chain rule and use these rules to compute the derivatives of polynomials, rational functions, exponential, logarithmic, and trigonometric functions.
- Use the limits and the derivative to identify asymptotes, relative extrema, and inflection points of curves and apply these techniques to curve sketching.
- Know the Mean Value Theorem and the Extreme Value Theorem and use these theorems to locate and find zeros of functions and to solve optimization problems.

Area B-4 Mathematical Concepts and Quantitative Reasoning Student Learning Outcomes

Students will be able to:

1. Solve problems by thinking logically, making conjectures, and constructing valid mathematical arguments.
2. Make valid inferences from numerical, graphical and symbolic information.
3. Apply mathematical reasoning to both abstract and applied problems, and to both scientific and non-scientific problems.

Writing Component

This is an area B4 GE course and has a writing component. To satisfy the writing requirement graded assignments involving writing and understanding of complex technical prose, interpretation of theoretical ideas, and the use of mathematical ideas will be part of the course.

Assignments

A variety of reading and problem solving assignments will be part of the course.

Examinations

There will be regular midterm examinations and a comprehensive final examination for this course.

Course Outline

I. Concept of tangent line and limit
   A. Tangent line average and instantaneous velocities
   B. Limits definitions, examples
   C. Properties limit theorems
   D. Continuity intermediate value theorem, maximum-minimum theorem

II. Differentiation
   A. Definition; geometric and algebraic
   B. Rules: linearity, product rule, quotient rule, chain rule, derivatives of algebraic functions and trigonometric functions
   C. Implicit differentiation
   D. Higher derivatives: interpret higher derivatives (graphs of $f(x)$, $f'(x)$ and $f''(x)$ for some common functions)
   E. Related rates
   F. Differentials: linear approximations

III. Transcendental functions
   A. Exponential functions: elementary properties, derivatives
   B. Inverse functions: graphs, derivatives
   C. Logarithmic functions: elementary properties, derivatives

D. Inverse trigonometric functions: graphs, derivatives
E. Hyperbolic functions: graphs, derivatives (optional)

IV. Mean value theorem and curve sketching

A. Maximum-minimum problems
B. Mean value theorem
C. Curve sketching

V. Integration

A. Approximation of area and Riemann sums
B. Definition of the definite integral
C. Properties of the definite integral
D. Fundamental theorem of calculus
E. Integration by elementary substitutions