

MAT250 | Calculus I

Course Text

This course does not require a text.

Course Description

This course is designed to acquaint students with calculus principles such as derivatives, integrals, limits, approximation, applications and integration, and curve sketching. During this course, students will gain experience in the use of calculus methods and learn how calculus methods may be applied to practical applications. Topics covered include Special Functions, Limits, Derivatives, Computational Techniques, Applications of Differentiations, and Applications of Integration.

Learning Outcomes

After completing this course, you will be able to:

1. Demonstrate the continuity or discontinuity of the function.
2. Solve the limit problems by using various Limit laws.
3. Demonstrate various rules of derivatives.
4. Compute derivatives.
5. Demonstrate derivatives for trigonometric, exponential, and logarithmic functions.
6. Apply Implicit differentiation.
7. Apply L'Hôpital's Rule to find the limit of indeterminate forms.
8. Sketch the graphs using the derivatives.
9. Compute area between the curves using integration.
10. Solve vertical motion problems.
11. Illustrate the Fundamental Theorem of Calculus.
12. Demonstrate convergence and divergence of improper integrals.

Course Prerequisites

Precalculus is a required prerequisite for Calculus I. If you enroll, the assumption is made that you have previously completed Precalculus for credit with a passing score.

Academic Integrity Statement

Academic integrity is the pursuit of scholarly activity in an honest, truthful and responsible manner. Violations of academic integrity include, but are not limited to, plagiarism, cheating, fabrication and academic misconduct. Failure to comply with the Academic Integrity Policy can result in a failure and/or zero on the attempted assignment/examination, a removal from the course, disqualification to enroll in future courses, and/or revocation of an academic transcript. Penalties for academic integrity violations can be retroactively applied upon discovery, and at our discretion.

Course Completion Policy

In order for a course to be considered complete, **all required coursework must be attempted, submitted, and graded.** Required coursework consists of graded assignments. Any Academic Integrity Policy violations may prevent a course from being considered complete.

Course Evaluation Criteria

Your score provides a percentage score and letter grade for each course. A passing percentage is 70% or higher.

There are a total of 1000 points in the course:

Topic	Assessment	Points	Learning Outcomes
1	Graded Review: Topic 1	20	1
2	Graded Quiz: Topics 1 & 2	55	1 & 2
3	Graded Exam: Topics 1-3	100	1-3
4	Graded Review: Topic 4	20	4
5	Graded Quiz: Topics 4 & 5	55	4-6
6	Graded Exam: Topics 4-6	100	4-7
7	Graded Review: Topic 7	20	8
8	Graded Quiz: Topics 7 & 8	55	8 & 9
9	Graded Exam: Topics 7-9	100	8 & 9
10	Graded Review: Topic 10	20	10
11	Graded Quiz: Topics 10 & 11	55	10 & 11
12	Graded Exam: Topics 10-12	100	10-12
13	Graded Final Exam	300	All
Total		1000	

Course Roadmap *Graded items in **bold***

Subtopics

- Welcome
- Academic Honesty

Assignments

- Academic Honesty and Integrity Lesson
- Statement of Academic Honesty and Integrity (required)

Topic 1 | Preliminaries and Functions

Subtopics

- Welcome to Calculus
- The Two Questions of Calculus
- Average Rates of Change
- How to Do Math
- Functions
- Graphing Lines
- Parabolas
- Some Non-Euclidean Geometry

Assignments

- Topic 1: Pre-Reading: What Do You Think?
- Preliminaries and Functions
- Practice Review: Topic 1
- **Graded Review: Topic 1**

Topic 2 | Limits and Continuity

Subtopics

- Finding Rate of Change over an Interval
- Finding Limits Graphically
- The Formal Definition of a Limit
- The Limit Laws, Part I
- The Limit Laws, Part II
- One-Sided Limits
- The Squeeze Theorem
- Continuity and Discontinuity
- Evaluating Limits
- Limits and Indeterminate Forms
- Two Techniques for Evaluating Limits
- An Overview of Limits

Assignments

- Topic 2: Pre-Reading: What Do You Think?
- Limits and Continuity
- Pathfinder: Limits and Continuity
- Practice Review: Topic 2
- **Graded Quiz: Topics 1 & 2**

Topic 3 | Derivatives

Subtopics

- Rates of Change, Secants, and Tangents
- Finding Instantaneous Velocity

Assignments

- Topic 3: Pre-Reading: What Do You Think?

- The Derivative
- Differentiability
- The Slope of a Tangent Line
- Instantaneous Rate
- The Equation of a Tangent Line
- More on Instantaneous Rate
- The Derivative of the Reciprocal Function
- The Derivative of the Square Root Function

- Derivatives
- Pathfinder: The Calculus Lab
- Practice Review: Topic 3
- **Graded Exam: Topics 1-3**

Topic 4 | Computational Techniques

Subtopics

- A Shortcut for Finding Derivatives
- A Quick Proof of the Power Rule
- Uses of the Power Rule
- The Product Rule
- The Quotient Rule
- An Introduction to the Chain Rule
- Using the Chain Rule
- Combining Computational Techniques

Assignments

- Topic 4: Pre-Reading: What Do You Think?
- Computational Techniques
- Practice Review: Topic 4
- **Graded Review: Topic 4**

Topic 5 | Implicit Differentiation

Subtopics

- An Introduction to Implicit Differentiation
- Finding the Derivative Implicitly
- Using Implicit Differentiation
- Applying Implicit Differentiation

Assignments

- Topic 5: Pre-Reading: What Do You Think?
- Implicit Differentiation
- Practice Review: Topic 5
- **Graded Quiz: Topics 4 & 5**

Topic 6 | Dealing with Indeterminate Forms

Subtopics

- Indeterminate Forms
- An Introduction to L'Hôpital's Rule
- Basic Uses of L'Hôpital's Rule
- More Exotic Examples of Indeterminate Forms
- L'Hôpital's rule and Indeterminate Products
- L'Hôpital's rule and Indeterminate Differences
- L'Hôpital's rule and One to the Infinite Power
- Another example of One to the Infinite Power

Assignments

- Topic 6: Pre-Reading: What Do You Think?
- Dealing With Indeterminate Forms
- Practice Review: Topic 6
- **Graded Exam: Topics 4-6**

Topic 7 | Applications of Differentiations

Subtopics

- Acceleration and the Derivative
- Solving Word Problems Involving Distance and Velocity
- Higher-Order Derivatives and Linear Approximation
- Using the Tangent Line Approximation Formula
- Newton's Method
- The Connection Between Slope and Optimization
- The Fence Problem
- The Box Problem
- The Can Problem
- The Wire-Cutting Problem
- The Pebble Problem
- The Ladder Problem
- The Baseball Problem
- The Blimp Problem
- Math Anxiety

Assignments

- Topic 7: Pre-Reading: What Do You Think?
- Applications of Differentiations
- Practice Review: Topic 7
- **Graded Review: Topic 7**

Topic 8 | Curve Sketching

Subtopics

- An Introduction to Curve Sketching
- Three Big Theorems
- Morale Moment
- Critical Points
- Maximum and Minimum
- Regions Where a Function Increases or Decreases
- The First Derivative Tests
- Math Magic
- Concavity and Inflection Points
- Using the Second Derivative to Examine Concavity
- The Mobius Band
- Graphs of Polynomial Functions
- Cusp Points and the Derivative
- Domain-Restricted Functions and the Derivative
- The Second Derivative Test
- Vertical Asymptotes
- Horizontal Asymptotes and Infinite Limits
- Graphing Functions with Asymptotes
- Functions with Asymptotes and Holes
- Functions with Asymptotes and Critical Points

Assignments

- Topic 8: Pre-Reading: What Do You Think
- Curve Sketching
- Practice Review: Topic 8
- **Graded Quiz: Topics 7 & 8**

Topic 9 | Introduction to Integrals

Subtopics

- Antidifferentiation
- Antiderivatives of Powers of x
- Antiderivatives of Trigonometric and Exponential Functions
- Undoing the Chain Rule
- Integrating Polynomials by Substitution
- Integrating Composite Trigonometric Functions by Substitution
- Integrating Composite Exponential and Rational Functions by Substitution
- More Integrating Trigonometric Functions by Substitution
- Choosing Effective Function Decompositions
- Approximating Areas of Plane Regions
- Areas, Riemann Sums, and Definite Integrals
- The Fundamental Theorem of Calculus, Part I
- The Fundamental Theorem of Calculus, Part II
- Illustrating the Fundamental Theorem of Calculus
- Evaluating Definite Integrals

Assignments

- Topic 9: Pre-Reading: What Do You Think?
- Introduction to Integrals
- Practice Review: Topic 9
- **Graded Exam: Topics 7-9**

Topic 10 | Applications of Integrals

Subtopics

- Antiderivatives and Motion
- Gravity and Vertical Motion
- Solving Vertical Motion Problems
- The Area between Two Curves
- Limits of Integration and Area
- Common Mistakes to Avoid When Finding Areas
- Regions Bound by Several Curves
- Finding Areas by Integrating with Respect to y : Part One
- Finding Areas by Integrating with Respect to y : Part Two
- Area, Integration by Substitution, and Trigonometry

Assignments

- Topic 10: Pre-Reading: What Do You Think
- Applications of Integrals
- Pathfinder: Curve Sketching
- Practice Review: Topic 10
- **Graded Review: Topic 10**

Topic 11 | 3 Techniques of Integration

Subtopics

- Finding Partial Fraction Decompositions
- Partial Fractions
- Long Division
- An Introduction to Integration by Parts
- Applying Integration by Parts to the Natural Log Function
- Inspirational Examples of Integration by Parts
- Repeated Application of Integration by Parts
- Algebraic Manipulation and Integration by Parts

Assignments

- Topic 11: Pre-Reading: What Do You Think?
- Techniques of Integration
- Practice Review: Topic 11
- **Graded Quiz: Topics 10 & 11**

Topic 12 | Special Functions

Subtopics

- A Review of Trigonometry
- Graphing Trigonometric Functions
- The Derivatives of Trigonometric Functions
- The Number Pi
- Graphing Exponential Functions
- Derivatives of Exponential Functions
- The Music of Math
- Evaluating Logarithmic Functions
- The Derivative of the Natural Log Function
- Using the Derivative Rules with Transcendental Functions
- The Exponential and Natural Log Functions
- Differentiating Logarithmic Functions
- Logarithmic Differentiation
- The Basics of Inverse Functions
- Finding the Inverse of a Function
- Derivatives of Inverse Functions
- The Inverse Sine, Cosine, and Tangent Functions
- The Inverse Secant, Cosecant, and Cotangent Functions
- Evaluating Inverse Trigonometric Functions
- Derivatives of Inverse Trigonometric Functions
- More Calculus of Inverse Trigonometric Functions
- Defining the Hyperbolic Functions
- Hyperbolic Identities
- Derivatives of Hyperbolic Functions

Assignments

- Topic 12: Pre-Reading: What Do You Think
- Special Functions
- Practice Review: Topic 12
- **Graded Exam: Topics 10-12**
- Preparing for Your Proctored Final Exam

Topic 13 | Review & Final Exam

Subtopics

- Complete all course assignments
- Submit the End of Course Survey

Assignments

- Final Exam Preparation Guide
- **Final Exam**

Related Courses

**PHY250: General
Physics I**

**PHY250L: General
Physics I Lab**

**PHIL101:
Introduction to
Philosophy**