

General Calculus I

Course Text

This course does not require a text.

Course Description and Objectives

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.

Upon successful completion of the course, students will be able to:

- Solve the limit problems by using various Limit laws
- Demonstrate the continuity or discontinuity of the function
- Demonstrate various rules of derivatives
- Compute derivatives
- Demonstrate derivatives for trigonometric, exponential, and logarithmic functions
- Apply Implicit differentiation
- Use tangent line approximation
- Use derivatives to solve optimization and related rates problem
- Sketch the graphs using the derivatives
- Solve integration using substitution method
- Illustrate the Fundamental Theorem of Calculus
- Compute area between the curves using integration
- Apply L'Hôpital's Rule to find the limit of indeterminate forms
- Use Logarithmic differentiation
- Apply various techniques to evaluate integration
- Demonstrate convergence and divergence of improper integrals
- Solve transcendental functions and their inverses.
- Solve First Order linear differential equation

Course Prerequisites

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

Important Terms

In this course, different terms are used to designate tasks:

- **Proctoring:** all final exams require proctoring which can be completed conveniently from your home. A webcam is required.
- **Tutoring:** memberships include online tutoring for students to access with any content/subject related questions in the place of faculty. If your tutor is not able to answer your questions please contact a student advisor.
- **Exam:** a graded online test.
- **Exercises:** ungraded practice exercises and quiz questions.

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.

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 Available
3	Graded Exam 1	125
7	Graded Exam 2	125
8	Midterm Exam	200
11	Graded Exam 3	125
15	Graded Exam 4	125
16	Final Exam	300
Total		1000

Course Topics and Objectives

#	Chapter	Topics	Subtopics
1	The Basics	• Overview	• Welcome to Calculus

#	Chapter	Topics	Subtopics
		<ul style="list-style-type: none"> Precalculus Review 	<ul style="list-style-type: none"> The Two Questions of Calculus Average Rates of Change How to Do Math Functions Rational functions Complex number Zeros of polynomial Graphing Lines Parabolas Some Non-Euclidean Geometry
2	Limits	<ul style="list-style-type: none"> The Concept of the Limit Evaluating Limits 	<ul style="list-style-type: none"> 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
3	An Introduction to Derivatives	<ul style="list-style-type: none"> Understanding the Derivative Using the Derivative Some Special Derivatives 	<ul style="list-style-type: none"> Rates of Change, Secants, and Tangents Finding Instantaneous Velocity 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
4	Computational Techniques	<ul style="list-style-type: none"> The Power Rule The Product and Quotient Rules The Chain Rule 	<ul style="list-style-type: none"> 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

#	Chapter	Topics	Subtopics
5	Special Functions	<ul style="list-style-type: none"> • Trigonometric Functions • Exponential Functions • Logarithmic Functions 	<ul style="list-style-type: none"> • 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
6	Implicit Differentiation	<ul style="list-style-type: none"> • Implicit Differentiation Basics • Applying Implicit Differentiation 	<ul style="list-style-type: none"> • An Introduction to Implicit Differentiation • Finding the Derivative Implicitly • Using Implicit Differentiation • Applying Implicit Differentiation
7	Applications of Differentiations	<ul style="list-style-type: none"> • Position and Velocity • Linear Approximation • Optimization • Related Rates 	<ul style="list-style-type: none"> • 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 • Solving word problems on Optimization (The Fence Problem, The Box Problem, The Can Problem, The Wire-Cutting Problem, etc.) • Solving word problems on Related rates (The Pebble Problem, The Ladder Problem, The Baseball Problem, The Blimp Problem, etc.) • Math Anxiety
8	Curve Sketching	<ul style="list-style-type: none"> • Introduction • Critical Points • Concavity • Graphing Using the Derivative • Asymptotes 	<ul style="list-style-type: none"> • 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 • Magic Math

#	Chapter	Topics	Subtopics
			<ul style="list-style-type: none"> • 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
9	The Basics of Integration	<ul style="list-style-type: none"> • Antiderivatives • Integration by Substitution • Illustrating Integration by Substitution • The Fundamental Theorem of Calculus 	<ul style="list-style-type: none"> • 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
10	Applications of Integration	<ul style="list-style-type: none"> • Motion • Finding the Area between Two Curves • Integrating with Respect to y 	<ul style="list-style-type: none"> • 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

#	Chapter	Topics	Subtopics
			<ul style="list-style-type: none"> 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 Trigonometric substitution
11	L'Hôpital's Rule	<ul style="list-style-type: none"> Indeterminate Quotients 	<ul style="list-style-type: none"> Indeterminate Forms An Introduction to L'Hôpital's Rule Basic Uses of L'Hôpital's Rule More Exotic Examples of Indeterminate Forms
12	Elementary Functions and Their Inverses	<ul style="list-style-type: none"> Inverse Functions The Calculus of Inverse Functions Inverse Trigonometric Functions The Calculus of Inverse Trigonometric Functions 	<ul style="list-style-type: none"> 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
13	Techniques of Integration	<ul style="list-style-type: none"> An Introduction to Integration by Partial Fractions Integration by Parts 	<ul style="list-style-type: none"> 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
14	Improper Integrals	<ul style="list-style-type: none"> Improper Integrals 	<ul style="list-style-type: none"> The First Type of Improper Integral The Second Type of Improper Integral

#	Chapter	Topics	Subtopics
			<ul style="list-style-type: none"> • Infinite Limits of Integration, Convergence, and Divergence
15	Differential Equations	<ul style="list-style-type: none"> • Separable Differential Equations • Solving First-Order Linear Differential Equations 	<ul style="list-style-type: none"> • An Introduction to Differential Equation • Solving Separable Differential Equations • Finding a Particular Solution • Direction Fields • Euler's Method for Solving Differential Equations Numerically • First-Order Linear Differential Equations
16	Review and Final Exam	Review and Final Exam	<ul style="list-style-type: none"> • Review and Final Exam

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