General Calculus II

Course Text

This course does not require a text.

Course Description and Objectives

This course is designed to further acquaint students with the principles of Calculus. This includes techniques of integration; application of integration; exponential and logistic models; parametric equations and polar coordinates; sequence and series; and vector and geometry. Upon successful completion of the course, students will be able to:

- Apply L' Hôpital's rule to find the limits of different indeterminate forms
- Compute hyperbolic functions at the given point
- Use hyperbolic identities
- Compute the derivatives of hyperbolic functions
- Solve integration problems using different techniques of Integration: Integration table, u-substitution, trigonometric functions, partial fraction, trigonometric substitution, and Trapezoidal rule
- Apply integral calculus to compute average value of function, volumes, arc lengths, surface of revolution, work, and moments & centers of mass
- Use various tests to determine the convergence and divergence of sequences and series
- Apply Taylor and Maclaurin series for polynomial approximations
- Demonstrate convergence and divergence of power series
- Solve homogeneous differential equations
- Use differential equations to solve 'Growth and Decay' problems
- Solve problems based on eliminating the parameters, conversion between polar and cartesian forms, spirals and circles, polar coordinate system, and rose curve
- Sketch parametric and polar curves
- Apply differentiation and integration to parametric equations and polar functions
- Apply dot product and cross product to vectors in R2 and R3
- Apply differentiation to vector functions
  The topics covered under this course are other indeterminate forms, the hyperbolic functions; the techniques of integration; application of integral calculus; sequences and series; differential equations; parametric equations and polar coordinates; and vectors and geometry.

Course Prerequisites

General Calculus I is a required prerequisite for General Calculus II. If you enroll, the assumption is made that you have previously completed General Calculus I 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
4	Graded Exam 1	125
6	Graded Exam 2	125
7	Midterm Exam	200
9	Graded Exam 3	125
11	Graded Exam 4	125
12	Final Exam	300

Topic	Assessment	Points Available
Total		1000

Course Topics and Objectives

Chapter	Topics	Subtopics
An Introduction to Calculus II	• Introduction	• Welcome to Calculus II • Review: Calculus I in 20 minutes
Math Fun	• Paradoxes • Sequences	• An Introduction to Paradoxes • Paradoxes and Air Safety • Newcomb’s Paradox • Zeno’s Paradox • Fibonacci Numbers • The Golden Ratio
Other Indeterminate Forms	• Indeterminate Form $0 \cdot \infty$, $\infty - \infty$, 1^∞ , 0^0, ∞^0	• L’Hopital’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 • L'Hôpital's rule and zero to the zero power • L'Hôpital's rule and infinity to the zero power
The Hyperbolic Functions	• Hyperbolic Functions	• Defining the Hyperbolic Functions • Hyperbolic Identities • Derivatives of Hyperbolic Functions
Techniques of Integration	• Integration Using Tables • Integrals Involving Powers of Sine and Cosine • Integrals Involving Powers of Other Trigonometric Functions • Integration by Partial Fractions and Repeated Factors	• An Introduction to the Integral Table • Making u-Substitutions • An Introduction to Integrals with Powers of Sine and Cosine • Integrals with Powers of Sine and Cosine • Integrals with Even and Odd Powers of Sine and Cosine • Integrals of Other Trigonometric Functions • Integrals of Odd Powers of Tangent and Any Power of Secant • Integrals with Even Powers of Secant and Any Power of Tangent • Repeated Linear Factors: Part One • Repeated Linear Factors: Part Two

Chapter	Topics	Subtopics
	• An Introduction to Trigonometric Substitution • Trigonometric Substitution Strategy • Numerical Integration	• Distinct and Repeated Quadratic Factors • Partial Fractions of Transcendental Functions • Converting Radicals into Trigonometric Expressions • Using Trigonometric Substitution to Integrate Radicals • Trigonometric Substitutions on Rational Powers • An Overview of Trigonometric Substitution Strategy • Trigonometric Substitution Involving a Definite Integral: Part One • Trigonometric Substitution Involving a Definite Integral: Part Two • Deriving the Trapezoidal Rule • An Example of the Trapezoidal Rule
Applications of Integral Calculus	• The Average Value of a Function • Finding Volumes Using Cross-Sections • Disks and Washers • Shells • Arc Lengths and Functions • Surface of Revolution • Work • Moments and Centers of Mass	• Finding the Average Value of a Function • Finding the Volumes Using Cross-Sectional Slices • An Example of Finding Cross-Sectional Volumes • Solids of Revolution • The Disk Method along the y-Axis • A Transcendental Example of the Disk Method • The Washer Method across the x-Axis • The Washer Method across the y-Axis • Introducing the Shell Method • Why Shells Can Be Better Than Washers • The Shell Method: Integrating with Respect to y • An Introduction to Arc Length • Finding Arc Lengths of Curves Given by Functions • Finding Area of a Surface of Revolution • An Introduction to Work • Calculating Work • Hooke’s Law • Center of Mass • The Center of Mass of a Thin Plate
Sequences and Series	• Sequences • Monotonic and Bounded	• The Limit of a Sequence • Determining the Limit of a Sequence • Monotonic and Bounded Sequences

Chapter	Topics	Subtopics
	Sequences • Infinite Series • Convergence and Divergence • The Integral Test and p-Series • The Direct Comparison Test • The Limit Comparison Test	• An Introduction to Infinite Series • The Summation of Infinite Series • Geometric Series • Telescoping Series • Properties of Convergent Series • The nth-Term Test for Divergence • An Introduction to the Integral Test • Examples of the Integral Test • Using the Integral Test • Defining p-Series • An Introduction to the Direct Comparison Test • Using the Direct Comparison Test • An Introduction to the Limit Comparison Test • Using the Limit Comparison Test • Inverting the Series in the Limit Comparison Test
Sequences and Series (continued)	• The Alternating Series • Absolute and Conditional Convergences • The Ratio and Root Test • Polynomial Approximations of Elementary Functions • Taylor and Maclaurin Polynomials • Taylor and Maclaurin Series • Power Series • Power Series Representations of Functions	• Alternating Series • The Alternating Series Test • Estimating the Sum of an Alternating Series • Absolute and Conditional Convergence • The Ratio Test • Examples of the Ratio Test • The Root Test • Polynomial Approximations of Elementary Functions • Higher-Degree Approximations • Taylor Polynomials • Maclaurin Polynomials • The Remainder of a Taylor Polynomial • Approximating the Value of a Function • Taylor Series • Examples of the Taylor and Maclaurin Series • New Taylor Series • The Convergence of Taylor Series • The Definition of Power Series • The Interval and Radius of Convergence • Finding the Interval and Radius of Convergence: Part One • Finding the Interval and Radius of Convergence: Part Two • Finding the Interval and Radius of Convergence: Part Three • Differentiation and Integration of Power Series

Chapter	Topics	Subtopics
		• Finding Power Series Representations by Differentiation • Finding Power Series Representations by Integration • Integrating Functions Using Power Series
Differential Equations	• Solving a Homogeneous Differential Equation • Growth and Decay Problems	• Separating Homogeneous Differential Equations • Example of Newton's Law of Cooling • Change of Variables • Exponential Growth • Logistic Growth • Radioactive Decay
Parametric Equations and Polar Coordinates	• Understanding Parametric Equations • Calculus and Parametric Equations • Understanding Polar Coordinates • Polar Functions and Slope • Polar Functions and Area	• An Introduction to Parametric Equations • Sketching a Parametric Curve • The Cycloid • Eliminating Parameters • Derivatives of Parametric Equations • Finding the Slopes of Tangent Lines in Parametric Form • Graphing the Elliptic Curve • The Arc Length of a Parameterized Curve • Finding Arc Lengths of Curves Given by Parametric Equations • The Polar Coordinate System • Converting between Polar and Cartesian Forms • Spirals and Circles • Graphing Some Special Polar Functions • Calculus and the Rose Curve • Finding the Slopes of Tangent Lines in Polar Form • Heading toward the Area of a Polar Region • Finding the Area of a Polar Region: Part One • Finding the Area of a Polar Region: Part Two • The Area of a Region bounded by Two Polar Curves: Part One • The Area of a Region bounded by Two Polar Curves: Part Two • The Arc Length of a Polar Curve • Area of surface of revolution in Polar Form

Chapter	Topics	Subtopics
Vectors and the Geometry of R^2 and R^3	• Vectors and the Geometry of R^2 and R^3 • Vector Functions	• Coordinate Geometry in Three Dimensional Space • Introduction to Vectors • Vectors in R^2 and R^3 • An Introduction to the Dot Product • Orthogonal Projections • An Introduction to the Cross Product • Geometry of the Cross Product • Equations of Lines and Planes in R^3 • Introduction to Vector Functions • Derivatives of Vector Functions • Vector Functions: Smooth Curves • Vector Functions: Velocity and Acceleration
Review and Final Exam	Review and Final Exam	• Review and Final Exam

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