straighterline

Syllabus

MAT251 | **Calculus II**

Course Text

This course does not require a text.

Course Description

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.

Learning Outcomes

After completing this course, you will be able to:

1. Solve integration problems using different techniques of integration: integration table, u-substitution, trigonometric functions, partial fraction, trigonometric substitution, and Trapezoidal rule.
2. Apply integral calculus to compute average value of function, volumes, arc lengths, surface of revolution, work, and moments & centers of mass.
3. Use various tests to determine the convergence and divergence of sequences and series.
4. Apply Taylor and Maclaurin series for polynomial approximations.
5. Demonstrate convergence and divergence of power series.
6. Solve homogeneous differential equations.
7. Use differential equations to solve ‘Growth and Decay’ problems.
8. Sketch parametric and polar curves.
9. Apply differentiation and integration to parametric equations and polar functions.
10. Apply dot product and cross product to vectors in R2 and R3.
11. Apply differentiation to vector functions.

Course Prerequisites

Calculus I is a required prerequisite for this course. If you enroll, the assumption is made that you have previously completed Calculus I 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	30	Review
2	Graded Quiz: Topics 1 & 2	75	1
3	Graded Exam: Topics 1-3	125	1 & 2
4	Graded Review: Topic 4	35	3 & 4
5	Graded Quiz: Topics 4 & 5	75	3 & 4
6	Graded Exam: Topics 4-6	125	3-5
7	Graded Review: Topic 7	35	6 & 7
8	Graded Quiz: Topics 7 & 8	75	6-9
9	Graded Exam: Topics 7-9	125	6-11
10	Graded Final Exam	300	All
Total		1000	

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

Intro | Introduction and Getting Started

Subtopics

- Welcome
- Academic Honesty

Assignments

- Academic Honesty and Integrity Lesson

- Statement of Academic Honesty and Integrity (required)

Topic 1 | An Introduction to Calculus II

Subtopics

- Welcome to Calculus II
- Review: Calculus I in 20 minutes

Assignments

- Topic 1: Pre-Reading: What Do You Think?
- An Introduction to Calculus II
- Practice Review: Topic 1
- **Graded Review: Topic 1**

Topic 2 | Techniques of Integration

Subtopics

- 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
- 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

Assignments

- Topic 2: Pre-Reading: What Do You Think?
- Techniques of Integration
- Practice Review: Topic 2
- **Graded Quiz: Topics 1 & 2**

Topic 3 | Applications of Integral Calculus

Subtopics

- Finding the Average Value of a Function
- Finding 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
- An Introduction to Work
- Calculating Work
- Hooke’s Law
- Center of Mass
- The Center of Mass of a Thin Plate

Assignments

- Topic 3: Pre-Reading: What Do You Think?
- Applications of Integral Calculus
- Pathfinder: Equations in Action
- Practice Review: Topic 3
- **Graded Exam: Topics 1-3**

Topic 4 | Sequences and Series

Subtopics

- The Limit of a Sequence
- Determining the Limit of a Sequence
- The Squeeze and Absolute Value Theorems
- Monotonic and Bounded Sequences
- 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

Assignments

- Topic 4: Pre-Reading: What Do You Think?
- Sequences and Series
- Practice Review: Topic 4
- **Graded Review: Topic 4**

Topic 5 | Sequences and Series (continued)

Subtopics

- 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

Assignments

- Topic 5: Pre-Reading: What Do You Think?
- Sequences and Series (continued)
- Pathfinder: Convergence Explorer
- Practice Review: Topic 5
- **Graded Quiz: Topics 4 & 5**

- 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
- Finding Power Series Representations by Differentiation
- Finding Power Series Representations by Integration
- Integrating Functions Using Power Series

Topic 6 | Improper Integrals

Subtopics

- The First Type of Improper Integral
- The Second Type of Improper Integral
- Infinite Limits of Integration, Convergence, and Divergence

Assignments

- Topic 6: Pre-Reading: What Do You Think?
- Improper Integrals
- Practice Review: Topic 6
- **Graded Exam: Topics 4-6**

Topic 7 | Differential Equations

Subtopics

- Solving Separable Differential Equations
- Finding a Particular Solution
- Direction Fields
- Euler's Method for Solving Differential Equations Numerically
- First-Order Linear Differential Equations
- Separating Homogeneous Differential Equations
- Change of Variables
- Exponential Growth
- Logistic Growth
- Radioactive Decay

Assignments

- Topic 7: Pre-Reading: What Do You Think?
- Differential Equations
- Practice Review: Topic 7
- **Graded Review: Topic 7**

Topic 8 | Parametric Equations and Polar Coordinates

Subtopics

- An Introduction to Parametric Equations

Assignments

- The Cycloid
- Eliminating Parameters
- Derivatives of Parametric Equations
- 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

- Topic 8: Pre-Reading: What Do You Think
- Parametric Equations and Polar Coordinates
- Pathfinder: Vectors Quest
- Practice Review: Topic 8
- **Graded Quiz: Topics 7 & 8**

Topic 9 | Vectors and the Geometry of R^2 and R^3

Subtopics

- 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

Assignments

- Topic 9: Pre-Reading: What Do You Think?
- Vectors and the Geometry of R^2 and R^3
- Practice Review: Topic 9
- **Graded Exam: Topics 7-9**

Topic 10 | 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