

COURSE SYLLABUS

Course Title: Honors Calculus II

Abbreviated Title Honors Calculus II
As Appears on Transcript

Course Number: DMAT 264

Credit Hours: 5 credits [semester credit hours]

Course Description: An honors-level second course in the differential and integral calculus for engineering and science with emphasis on computational techniques, graphical analysis, and algebraic methods. Topics include integration theory, algebraic methods of integration, integral functions and transformations, improper and numerical integrals, applications of integration to geometry and physics, double integrals, integration over regions with parametric boundary, splines, barriers, Taylor's Theorem, L'Hopital's Rule, infinite sequences and series. Honors courses will include greater breadth and depth of topics, and develop technical writing skills, culminating in a mathematical term paper on an approved topic.

Prerequisite: Successful completion with B grade or higher in Calculus I or equivalent, or consent of instructor.

Course Workload: 5 semester credit hours • 3 student work hours per credit hour • 14 week Carnegie semester = 210 hours student course workload average

Examination Requirements: Proctored written and oral final examination must be passed at 70% or higher to earn passing grade in course. "B" and "A" grade paths have additional examinations and assignments. See <https://www.distancecalculus.com/grades/> for more information.

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Accredited by New England Commission of Higher Education (NECHE).
See <https://www.rwu.edu/academics/accreditation/> for more information.

E-Textbook:

Calculus & LiveMath by Robert R. Curtis, Ph.D., adapted from Davis/Porta/Uhl
Calculus&Mathematica courseware series

Mathematical Software: LiveMath™ Computer Algebra & Graphing System

ADA ACCOMMODATIONS

Roger Williams University has a continuing commitment to providing reasonable accommodations for students with documented disabilities. Students with disabilities who need accommodations in order to fully participate in this class are urged to contact Student Accessibility Services, as soon as possible, to explore the arrangements needed to be made to assure access. Student Accessibility Services is open Monday through Friday from 8:00AM to 5:00PM Eastern Time; Email: sas@rwu.edu or Voice: 401-254-3841. For more information about SAS, visit

<https://www.rwu.edu/undergraduate/academics/student-academic-success/student-accessibility-services-sas>

COURSE RULES

Academic Honesty

Academic Dishonesty in a Distance course includes copying or relying upon another person's work. Working with other students is good and encouraged, but the work you submit for this course must be genuinely your own work. Private tutors are allowed, but you must notify the instructor that you have obtained a private tutor to aid in your studies. Any documented instance of Academic Dishonesty will be grounds for immediate failure in this course.

Final (and Other) Examinations

A written and oral proctored final exam will occur at the student's location over video with the course professor; The student must score 70% or higher on this final exam to be eligible to earn a passing grade in the course.

Communication

Communication is the key to success in a Distance course. It is the student's responsibility to keep good communication channels with the instructors during the course; failure to participate in the course does not constitute "dropping" the course (Withdrawal from the course must be requested in writing to the instructors before the completion date deadline)

Roger Williams University Policies & Procedures

Roger Williams University has Policies & Procedures that all students must follow, including the Roger Williams University Student Handbook. Student must agree to follow all stated rules governing student conduct listed on the Roger Williams University website, and at the [Roger Williams University Course Catalog](#)

Course Completion 1 Year Rule

All Distance Calculus students are afforded 1 Year to finish their course from the Date of Enrollment. Students will be placed in the Academic Semester based upon their Date of Enrollment for academic records purposes. If a student does not finish the course, and does not request a Course Withdrawal for a W, then an "F" grade will be issued.

No Chatbots / AI

Students must pledge to **not** use any Chatbot/AI at all - **period**. Student must pledge to **limit** use of search engines (Google, Bing, etc) to a minimal level. Student must pledge to not engage in dishonest disguise of any Chatbot/AI/Search Engine source of information as student's own honest academic work. Verified chatbot usage will result in an "F" course grade, and will be referred to the Roger Williams

Learning Outcomes for DMAT 264 - Honors Calculus II

1. To understand and compute algebraic integrals using a variety of symbolic techniques, including substitution, integration by parts, integration via differentiation, iteration methods
2. To understand and compute with the Fundamental Theorem of Calculus
3. To understand and compute solutions to applications problems involving integrals
4. To compute measurements of volumes of geometric objects using integrals (slides, surfaces of rotation)
5. To understand and compute with Green's Theorem
6. To understand and compute parametric and Polar function integrals
7. To understand and compute double integrals
8. To understand and compute splines and polynomial approximations
9. To understand and compute with Taylor's Theorem
10. To understand and compute with L'Hopital's Rule and using expansions to compute limits
11. To understand and compute sequences and series
12. To understand and compute convergence or divergence of sequences and series using various tests (Ratio, Integral, p-Test)
13. To understand and compute 3D vector analysis, dot product, planes, and cross products
14. To understand and compute partial derivatives and tangent planes to a surface

Honors Topics:

- 15.*To understand the concept of integration in finite terms and its connection to integration techniques
- 16.*To understand and compute basic solutions of differential equations in relation to integration techniques.
- 17.*To understand and compute polynomial approximations to solutions of differential equations.
- 18.*To understand and compute near-finite-term integrals and their expression in power series.
- 19.*To understand and compute integrals using complex integration techniques
- 20.*To understand and compute numerical integration techniques of Newton, Midpoint, and Runge-Kutta, and higher RK approximations.
- 21.*To understand and explore higher integral functions, such as those defined by elliptical and hyperbolic integrals
- 22.*To explore initial topics in Analytical Number Theory
- 23.*To understand higher special functions defined by either series or integral formulations
- 24.*To understand and compute more advanced polynomial and rational polynomial approximation techniques (Chebyshev, et al)
- 24.*To develop mathematical technical writing skills, culminating in a term paper on an approved topic

Syllabus Topics Outline for DMAT 264 - Honors Calculus II

1. Getting Started
 - 1.1 Email and Chat

- 1.2 Learning About the Course
- 1.3 Required Hardware
- 1.4 Software Fundamentals

2. Integration
 - 2.1 Measuring Area Under a Curve
 - 2.2 Definition of the Integral
 - 2.3 Properties of Integrals, Symmetry
 - 2.4 Integrals of Data Functions
 - 2.5 Numerical Methods: Rectangles, Trapezoids
 - 2.6 Undefined Integrals
 - 2.7 Numerical Calculation of Integrals

3. Fundamental Theorem of Calculus
 - 3.1 Derivative of an Integral
 - 3.2 Integral of a Derivative
 - 3.3 Fundamental Formula
 - 3.4 Distance, Velocity, and Acceleration
 - 3.5 Improper Integrals
 - 3.6 More Properties of Integrals
 - 3.7 Applications: Measure Accumulation Totals
 - 3.8 Indefinite Integrals and Antiderivatives

4. Measurements via Slicing
 - 4.1 Measuring Area via Slicing
 - 4.2 Measuring Volume via Slicing
 - 4.3 Density and Mass
 - 4.4 Accumulation of Rates
 - 4.5 Arc Length

5. Computing Integrals
 - 5.1 Algebraic Antiderivatives
 - 5.2 Integrals of Standard Functions: Polynomial, Exponential, Trigonometric, Logarithmic
 - 5.3 Transforming Integrals: u-substitution
 - 5.4 Measuring Area under Parametric Curves
 - 5.5 Integrals of Polar Functions

6. Integral Functions & Computation
 - 6.1 Integral Functions and Monotonicity
 - 6.2 Integral Functions as Numerical Tabulations with Interpolation
 - 6.3 Computing the Inverse Function Numerically
 - 6.4 Inverse Circular and Hyperbolic Trigonometric Functions & Integrals

7. Measurements via Slicing
 - 7.1 Measuring Area via Slicing

- 7.2 Measuring Volume via Slicing
- 7.3 Density and Mass
- 7.4 Accumulation and Rates
- 7.5 Arc Length

- 8. Double Integrals
 - 8.1 Measuring Area and Volume
 - 8.2 Gauss-Green Formula
 - 8.3 Changing Order of Iterated Integrals

- 9. Integration Techniques
 - 9.1 Separable Differential Equations
 - 9.2 Integration By Parts
 - 9.3 Integration Patterns and Reduction Formulas
 - 9.4 Partial Fractions Technique
 - 9.5 Trigonometric Integrals
 - 9.6 Trigonometric Substitution
 - 9.7* Integration via Differentiation Technique
 - 9.8* DeMoivre's Theorem
 - 9.9* Complex Integration

- 10. Taylor's Expansion of a Function
 - 10.1 Splines and Smooth Splines
 - 10.2 Points of Contact
 - 10.3 Application: Road Curves
 - 10.4 Taylor Expansion
 - 10.5 Recognizing Familiar Expansions
 - 10.6 Using Expansions for Approximations
 - 10.7 Derivatives and Integrals of Expansions
 - 10.8 Expansions At Other Points
 - 10.9 Newton's Method
 - 10.10 Calculating Limits: L'Hopital's Rule
 - 10.11* Expansions and Solving Differential Equations
 - 10.12* Complex Exponentials
 - 10.13* Euler, Midpoint, Runge-Kutta Integral Estimates

- 11. Sequences and Series
 - 11.1 Sequences of Numbers
 - 11.2 Series of Numbers
 - 11.3 Convergence
 - 11.4 Convergence of Taylor Expansions
 - 11.5 Barriers: Radius of Convergence
 - 11.6 Shared Convergence Intervals for Derivatives and Integrals of Functions
 - 11.7 Applications: Drug Dosing

- 12. Power Series
 - 12.1 Basic Definition
 - 12.2 Solutions of Differential Equations
 - 12.3 Convergence Intervals of Power Series
 - 12.4 Ratio Test and Other Convergence Tests
 - 12.5 Finding Series Convergence Values via Power and Taylor Series
 - 12.6* Famous Number Theory Infinite Series Values
 - 12.7* Near-Finite Term Integration Formulas via Power Series

- 13.* Differential Equations
 - 13.1* Types of Differential Equations
 - 13.2* Linkage to Algebraic and Numerical Integration Theory
 - 13.3* Power Series Solutions to Differential Equations
 - 13.4* Elliptical and Hyperbolic Integration Functions

- 14. Polar Coordinates
 - 14.1 Basic Graphing
 - 14.2 Recognizable Curves
 - 14.3 Differentiation and Integration in Polar Coordinates

- 15. Vector Analysis
 - 15.1 Vector Arithmetic
 - 15.2 Dot Product, Cross Product
 - 15.3 Planes
 - 15.4 Partial Derivatives
 - 15.5 Tangent Planes

- 16.* Algebraic Integration Theory
 - 16.1* Machine Integration Engines
 - 16.2* Integration in Finite Terms
 - 16.3* Integrability and Limitations
 - 16.4* Defining advanced special functions using integrals or series

- 17.* Special Functions and Approximations
 - 17.1* Approximating Functions with Polynomials and Rational Polynomials
 - 17.2* Defining advanced special functions using integrals or series
 - 17.3* Elliptical Curves and Fermat's Last Theorem
 - 17.4* Exploring Special Named Functions