

**COURSE SYLLABUS**

**Course Title: Honors Calculus I**

Abbreviated Title Honors Calculus I  
As Appears on Transcript

Course Number: DMAT 254

Credit Hours: 5 credits [semester credit hours]

Course Description: An honors-level first course introduction to differential and integral calculus for engineering and science students, with emphasis on a modern, empirical exposition of the classical subject. Topics include a study of the algebraic, numerical, and graphical aspects of polynomial, exponential, logarithmic, and trigonometric functions, limits, function growth, derivative analysis and optimization, introduction to differential equations, methods and applications of integration, numerical computations of integrals including the Monte-Carlo method, and the Fundamental Theorem of Calculus. 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 grade B or higher in Precalculus with Trigonometry 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](mailto: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

## Learning Outcomes for DMAT 254 - Honors Calculus I

1. To identify, manipulate, and understand the algebraic, numerical, and graphical fundamentals of linear, polynomial, exponential, logarithmic, rational polynomial, and trigonometric functions;
2. To understand and compute algebraic, numerical, and graphical limits at finite and infinite values;
3. To understand and compute the fundamental concept of the derivative;
4. To understand and compute various measurements of growth of a function
5. To algebraically compute derivatives of common functions using summation, product, quotient, and chain rules for derivatives;
6. To formulate and understand introductory analytical proofs in application to the concepts of limits and the derivative;
7. To understand and compute optimization of functions using derivatives, finding critical values;
8. To understand and compute the second derivative;
9. To understand and compute the Mean Value Theorem and related concepts;
10. To understand and compute first order differential equations;
11. To understand and compute implicit differentiation and related rates;
12. To understand and compute parametric equations, including projectile motion;
13. To understand and calculate numerically and graphically the core concepts of the integral for applications to signed area measurements;
14. To compute numerically, algebraically, and graphically integrals of a variety of functions;
15. To algebraically compute integrals of basic polynomial, exponential, and trigonometric functions, with an introduction to the algebraic substitution technique;
16. To use of tools of differential and integral calculus in various applications
17. To understand and compute the Fundamental Theorem of Calculus
18. To understand and compute an integral functions, including inverse trigonometric and logarithmic integrals that do not algebraically resolve;
19. To utilize computer algebra and graphing software to amplify traditional manual computation techniques.

### Honors Additional Topics:

- 20.\*To investigate data interpolation and algebraic modeling of data sets using polynomial and trigonometric functions
- 21.\*To investigate Predator-Prey differential equations modeling
- 22.\*To investigate numerical limits error analysis, the need for Lagrange, Newton, L'Hopital, Extrapolation methods
- 23.\*To understand and compute integrals with the Monte-Carlo method
- 24.\*To understand the concept of algebraic integration in Finite Terms
- 25.\*To develop mathematical technical writing skills, culminating in a term paper on an approved topic.

\* = Additional topics for Honors course

Syllabus Topics Outline for DMAT 254 - Honors Calculus I

1. Getting Started
  - 1.1 Email and Chat
  - 1.2 Learning About the Course
  - 1.3 Required Hardware
  - 1.4 Software Fundamentals
  
2. Growth: Preparing for the Derivative
  - 2.1 Growth of Linear Functions
  - 2.2 Growth of Power Functions
  - 2.3 Growth of Exponential Functions
  - 2.4 Dominance of Growth of Functions
  - 2.5 Percentage Growth of Functions
  - 2.6 Global Scale: Infinite Limits
  - 2.7 Data Functions and Interpolation
  - 2.8 Approximation of Functions by Linear Functions
  
3. Continuity
  - 3.1 Limits
  - 3.2 Continuous Functions
  - 3.3 Jump Discontinuities
  - 3.4 Piecewise Functions and Continuity
  - 3.5 Limit Rules
  
4. Exponential Functions and Natural Logarithms
  - 4.1  $e$  = Euler's Number
  - 4.2 Natural Logarithm
  - 4.3 Growth Analysis
  - 4.4 Applications: Carbon Dating
  - 4.5 Percentage Growth and Steady Growth of Exponential Functions
  - 4.6 Data Functions and Logarithmic Analysis
  - 4.7 Inverse Functions
  - 4.8 Applications: Compound Growth Rates
  - 4.9 Applications: World Population
  
5. The Derivative of Polynomial, Exponential, Logarithmic, and Fractional Powers
  - 5.1 Instantaneous Growth Rates
  - 5.2 Definition of the Derivative
  - 5.3 Computing the Derivative Graphically
  - 5.4 Computing the Derivative Algebraically
  - 5.5 Computing the Derivative Numerically
  - 5.6 Average Growth Rate vs. Instantaneous Growth Rate
  - 5.7 Applications of the Derivative: Spread of Disease
  - 5.8 Finding Maxima and Minima of Functions
  - 5.9 Relating a Function and Its Derivative

6. Computing Derivatives
  - 6.1 Sum, Difference, Product, Quotient Rule
  - 6.2 Chain Rule
  - 6.3 Instantaneous Percentage Growth
  - 6.4 Growth Dominance
  
7. Using Derivatives
  - 7.1 Finding Maxima and Minima
  - 7.2 Finding Good Representative Plots
  - 7.3 Applications: Maximizing Volume
  - 7.4 The Second Derivative
  - 7.5 Applications: The Space Shuttle Challenger
  
8. Differential Equations
  - 8.1 Linear Differential Equations
  - 8.2 Logistic Equations
  - 8.3 Rate Track Principal
  - 8.4 Approximations - Introduction to Taylor's Theorem
  
9. Integration
  - 8.1 Measuring Area Under a Curve
  - 8.2 Definition of the Integral
  - 8.3 Properties of Integrals, Symmetry
  - 8.4 Integrals of Data Functions
  - 8.5 Numerical Methods: Rectangles, Trapezoids
  - 8.6 Undefined Integrals
  - 8.7 Numerical Calculation of Integrals
  - 8.8\* Monte-Carlo Method of Integration
  
9. Fundamental Theorem of Calculus
  - 9.1 Derivative of an Integral
  - 9.2 Integral of a Derivative
  - 9.3 Fundamental Formula
  - 9.4 Distance, Velocity, and Acceleration
  - 9.5 Improper Integrals
  - 9.6 More Properties of Integrals
  - 9.7 Applications: Measure Accumulation Totals
  - 9.8 Indefinite Integrals and Antiderivatives
  
10. Integral Functions & Computation
  - 10.1 u-Substitution
  - 10.2 Integral Functions and Monotonicity
  - 10.3 Integral Functions as Numerical Tabulations with Interpolation
  - 10.4 Computing the Inverse Function Numerically

10.5 Inverse Circular and Hyperbolic Trigonometric Functions & Integrals

11.\* Limits Revisited

11.1\* Limitations of Numerics with Limits

11.2\* Lagrange, Newton, Extrapolation Numerical Methods

11.3\* L'Hopital's Rule for Limits

11.4\* Introduction to Polynomial and Rational Polynomial Approximation

12.\* Predator-Prey Systems

12.1\* Parametric Solutions of Differential Equations

12.2\* Predator-Prey Models

12.3\* Applications

13.\* Data Interpolation

13.1\* Linear and Quadratic Approximations

13.2\* Polynomial Approximations and Interpolation

13.3\* Trigonometric Function Interpolation

13.4\* Taylor's Theorem

14.\* Integration in Finite Terms

14.1\* Machine Integration Engines

14.2\* Finite Terms

14.3\* Quadrature and Limitations

15.\* Mathematical Writing

15.1\* Cogent writing

15.2\* Mathematical Presentation

15.3\* Term Paper Topic and Research