DISTANCE CALCULUS @ RWU ROGER WILLIAMS UNIVERSITY

COURSE SYLLABUS

Course Title: **Calculus for Life Sciences**

Abbreviated Title As Appears on Transcript: `Calculus for Life Sciences`

Course Number: DMAT 202

Credit Hours: 3 credits [semester credit hours]

Course Description: A single course in differential and integral calculus for management and business with emphasis on computational techniques and graphical analysis. Topics include a study of the algebraic and numerical aspects of linear, quadratic, polynomial, exponential, and logarithmic functions, function growth, derivative analysis and optimization, integration, applications to life sciences, and the Fundamental Theorem of Calculus.

Prerequisite: Successful completion of 3 years high school mathematics (C- or higher) or instructor consent.

Course Workload: 3 semester credit hours • 3 student work hours per credit hour • 14 week Carnegie semester = 126 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.

Course Professor: Robert R. Curtis, Ph.D.<rcurtis@rwu.edu>, <robert@distancecalculus.com>
Roger Williams University, Extension School, 1 Empire Plaza, Providence, RI, USA 02903.
Roger Williams University, 1 Old Ferry Road, Bristol, RI 02809.
Accredited by New England Commission of Higher Education (NECHE).
See https://www.rwu.edu/academics/accreditation/ for more information.

E-Textbook:

"Business 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 University Academic Integrity Committee.

Learning Outcomes for DMAT 202 - Calculus for Life Sciences

1. To identify, manipulate, and understand the algebraic, numerical, and graphical fundamentals of linear, polynomial, exponential, logarithmic, and rational polynomial functions
2. To understand and compute 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
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 calculate numerically and graphically the core concepts of the integral for applications to signed area measurements;
10. To compute numerically, algebraically, and graphically integrals of a variety of functions;
11. To algebraically compute integrals of basic polynomial and exponential functions, with an introduction to the algebraic substitution technique;
12. To use the tools of differential and integral calculus in various applications in life sciences
13. To understand and compute the Fundamental Theorem of Calculus
14. To understand and compute partial derivatives of multivariable functions, to begin study of optimization in higher dimensions.
15. To utilize computer algebra and graphing software to amplify traditional manual computation techniques.

Syllabus Topics Outline for DMAT 202 - Calculus for Life Sciences

1. Getting Started
   - 1.1 Email and Chat
   - 1.2 Learning About the Course
   - 1.3 Required Hardware
   - 1.4 Software Fundamentals

2. The Big Picture
   - 2.1 Solving (easy) equations in 1 variable.
   - 2.2 What if you can't solve for x?
   - 2.3 Finding solutions numerically
   - 2.4 Finding solutions graphically
   - 2.5 Solving equations of more than 1 variable

3. Functions
   - 3.1 Function notation
   - 3.2 Data sets
   - 3.3 Graphing functions
   - 3.4 Data sets and smooth curves
   - 3.5 Domain and Range
   - 3.6 Algebraic combinations of functions

4. Linear Functions
   - 4.1 Algebraic definition
   - 4.2 Slope
   - 4.3 Graphing linear functions by hand
   - 4.4 Properties of linear functions
   - 4.5 Linear data sets

5. Quadratic Functions
   - 5.1 Algebraic definition
   - 5.2 Graphing and Properties of Quadratic Functions
   - 5.3 Solving quadratic equations algebraically: Factoring
   - 5.4 Solving quadratic equations algebraically: Quadratic formula
   - 5.5 Solving quadratic equations numerically and graphically

6. Power and Polynomial Functions
   - 6.1 Algebraic definition
   - 6.2 Graphing and Properties of Polynomial Functions
   - 6.3 Solving polynomial equations algebraically: factoring
   - 6.4 Solving polynomial equations numerically and graphically
   - 6.5 Radicals and fractional exponents

7. Rational Polynomial Functions
   - 7.1 Algebraic definition
   - 7.2 Graphing and Properties of Rational Polynomial Functions
   - 7.3 Solving rational polynomial equations algebraically: factoring

8. Exponential Functions
   - 8.1 Algebraic definition
   - 8.2 Graphing and Properties of Exponential Functions
   - 8.3 Solving exponential equations numerically and graphically
   - 8.4 Exponential Growth and Applications
   - 8.5 Data sets and exponential functions

9. Logarithmic Functions
   - 9.1 Inverse Functions
   - 9.2 Algebraic Definition
   - 9.3 Graphing and Properties of Logarithmic Functions
   - 9.4 Solving exponential and logarithmic equations algebraically
   - 9.5 Solving logarithmic equations numerically and graphically
   - 9.6 Logarithmic Growth and Applications
   - 9.7 Data sets and logarithmic functions

10. General Inverse Functions
   - 10.1 When do functions have inverses?
   - 10.2 Converting Functions to Numerical Tables & Interpolation

10.3 Computing the Inverse Function Numerically
10.4 Interesting Examples of Algebraic Functions without Algebraic Inverses
10.5 Graphical Relationships
10.6 Applications of Inverse Functions

11. Growth: Preparing for the Derivative
11.1 Growth of Linear Functions
11.2 Growth of Power Functions
11.3 Growth of Exponential Functions
11.4 Dominance of Growth of Functions
11.5 Percentage Growth of Functions
11.6 Global Scale: Infinite Limits
11.7 Data Functions and Interpolation
11.8 Approximation of Functions by Linear Functions

12. Exponential Functions and Natural Logarithms
12.1 e = Euler's Number
12.2 Natural Logarithm
12.3 Growth Analysis
12.4 Applications: Carbon Dating
12.5 Percentage Growth and Steady Growth of Exponential Functions
12.6 Data Functions and Logarithmic Analysis
12.7 Applications: Compound Growth Rates
12.8 Applications: World Population
12.9 Applications: Growth and Half-Life Decay

13. The Derivative of Polynomial, Exponential, Logarithmic, and Fractional Powers
13.1 Instantaneous Growth Rates
13.2 Definition of the Derivative
13.3 Computing the Derivative Graphically
13.4 Computing the Derivative Algebraically
13.5 Computing the Derivative Numerically
13.6 Average Growth Rate vs. Instantaneous Growth Rate
13.7 Applications of the Derivative: Spread of Disease
13.8 Finding Maxima and Minima of Functions
13.9 Relating a Function and Its Derivative

14. Computing Derivatives
14.1 Sum, Difference, Product, Quotient Rule
14.2 Chain Rule
14.3 Instantaneous Percentage Growth
14.4 Growth Dominance

15. Using Derivatives
15.1 Finding Maxima and Minima

15.2 Finding Good Representative Plots
15.3 The Second Derivative

16. Integration
16.1 Measuring Area Under a Curve
16.2 Definition of the Integral
16.3 Properties of Integrals, Symmetry
16.4 Integrals of Data Functions
16.5 Numerical Methods: Rectangles, Trapezoids
16.6 Undefined Integrals
16.7 Numerical Calculation of Integrals

17. Fundamental Theorem of Calculus
17.1 Derivative of an Integral
17.2 Integral of a Derivative
17.3 Fundamental Formula
17.4 Properties of Integrals
17.5 Indefinite Integrals and Antiderivatives
17.6 u-Substitution

18. Higher Dimensions
18.1 Multivariable Functions
18.2 Partial Derivatives
18.3 Tangent Planes
18.4 Optimization