Course: Calculus I
Number: Math 213
Credit-Hours: 4 credits [semester credit hours]

Course Description: Covers the differential calculus of a single variable and introduces integration. Topics include limits and continuity, differentiation of algebraic and transcendental functions, applications of derivatives to rates of change, optimization, and curve sketching, and the Fundamental Theorem.

Prerequisites: Successful completion (C- or higher) of MATH 136 (Precalculus with Trigonometry) or equivalent.

Course Workload: 4 semester credit hours • 3 student work hours per credit hour • 14 week Carnegie semester = 168 hours student course workload average

Examination Requirements: Proctored written final examination must be passed at 60% or higher to earn passing grade in course. “B” and “A” grade paths have additional examinations. See http://www.distancecalculus.com/grades/ for more information.

Course Professor: Robert R. Curtis, Ph.D. <robert@distancecalculus.com>

University Information: Roger Williams University, University College, 1 Empire Plaza, Providence, RI, USA 02903. Accredited by New England Commission of Higher Education (NECHE). See https://www.rwu.edu/academics/accreditations for more information.

E-Textbook: “The Primitives of Precalculus” by Robert R. Curtis, Ph.D.
E-Textbook: “Calculus&LiveMath” by Davis/Porta/Uhl et al. / Curtis
Mathematics Software: LiveMath™ Computer Algebra & Graphing System
Detailed Syllabus

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. Growth: Preparing for the Derivative
    10.1. Growth of Linear Functions
    10.2. Growth of Power Functions
    10.3. Growth of Exponential Functions
    10.4. Dominance of Growth of Functions
    10.5. Percentage Growth of Functions
    10.6. Global Scale: Infinite Limits
    10.7. Data Functions and Interpolation
    10.8. Approximation of Functions by Linear Functions

11. Continuity
    11.1. Limits
    11.2. Continuous Functions
    11.3. Jump Discontinuities
    11.4. Piecewise Functions and Continuity
    11.5. Limit Rules
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. Inverse Functions
   12.8. Applications: Compound Interest and Finance
   12.9. Applications: World Population

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. Logarithmic Differentiation
   14.4. Instantaneous Percentage Growth
   14.5. Growth Dominance
   14.6. Applications: Linear Dimensions

15. Using Derivatives
   15.1. Finding Maxima and Minima
   15.2. Finding Good Representative Plots
   15.3. Applications: Maximizing Volume
   15.4. The Second Derivative
   15.5. Applications: The Space Shuttle Challenger
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. Distance, Velocity, and Acceleration
   17.5. Improper Integrals
   17.6. More Properties of Integrals
   17.7. Applications: Measure Accumulation Totals
   17.8. Indefinite Integrals and Antiderivatives
   17.9. u-Substitution