COURSE SYLLABUS

Course: Calculus I and Lab
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. The laboratory component involves use of computer algebra software.

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

9. Trigonometric Functions
    - 9.1. Circular Trigonometric Functions
    - 9.2. Graphing and Properties of Trigonometric Functions
    - 9.3. Solving trigonometric equations algebraically
    - 9.4. Solving trigonometric numerically and graphically
    - 9.5. Periodicity, Amplitude, Shifting
    - 9.7. Data sets of trigonometric functions
    - 9.8. Conic Sections

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. Introduction to Differential Equations
    - 16.1. First-Order Linear Differential Equations
    - 16.2. Logistic Differential Equation and Growth
    - 16.3. Graphical DE Solvers; Euler's Method, Runge-Kutta Method
    - 16.4. Applications: Finance; Decay
    - 16.5. Racetrack Principal
    - 16.6. Predator-Prey Model

17. Parametric Equations
    - 17.1. Parametric Curves and Surfaces in 2D and 3D
    - 17.2. Parametric Derivatives
    - 17.3. Application: Projectile Motion
    - 17.4. Related Rates

18. Integration
    - 18.1. Measuring Area Under a Curve
    - 18.2. Definition of the Integral
    - 18.3. Properties of Integrals, Symmetry
    - 18.4. Integrals of Data Functions
    - 18.5. Numerical Methods: Rectangles, Trapezoids
    - 18.6. Undefined Integrals
    - 18.7. Numerical Calculation of Integrals
    - 18.8. Integral Functions

19. Fundamental Theorem of Calculus
    - 19.1. Derivative of an Integral
    - 19.2. Integral of a Derivative
    - 19.3. Fundamental Formula
    - 19.4. Distance, Velocity, and Acceleration
    - 19.5. Improper Integrals
    - 19.6. More Properties of Integrals
    - 19.7. Applications: Measure Accumulation Totals
    - 19.8. Applications: Velocity, Acceleration, Displacement
    - 19.9. Indefinite Integrals and Antiderivatives
    - 19.10. u-Substitution for Algebraic Antiderivatives