

COURSE SYLLABUS

Course: Calculus I
Number: Math 165
Units: 4 Credits

Course Description: This is a first course in the main Calculus sequence for math and science majors. Topics include an introductory differential calculus, and beginning the study of integral calculus; functions, graphs, analytic geometry of lines and circles, limits, continuity, derivatives, differential calculus of algebraic and trigonometric functions; applications to rate problems, maxima and minima and curve sketching. Antiderivatives; the definite integral with applications from geometry and physics; logarithmic and exponential functions.

Prerequisites: MATH 121 or equivalent precalculus course including trigonometry.

Detailed Syllabus:

0. Getting Started

1. Email and Chat
2. Learning About the Course
3. Fundamentals of LiveMath Maker

1. Growth: Preparing for the Derivative

1. Growth of Linear Functions
2. Growth of Power Functions
3. Growth of Exponential Functions
4. Dominance of Growth of Functions
5. Percentage Growth of Functions
6. Global Scale: Infinite Limits
7. Data Functions and Interpolation
8. Approximation of Functions by Linear Functions
9. Growth of Trigonometric Functions

2. Continuity

1. Limits
2. Continuous Functions
3. Jump Discontinuities
4. Piecewise Functions and Continuity
5. Limit Rules

3. Exponential Functions and Natural Logarithms

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2. Natural Logarithm

3. Growth Analysis
4. Applications: Carbon Dating
5. Percentage Growth and Steady Growth of Exponential Functions
6. Data Functions and Logarithmic Analysis
7. Inverse Functions
8. Applications: Compound Interest and Finance
9. Applications: World Population

4. The Derivative

1. Instantaneous Growth Rates
2. Definition of the Derivative
3. Computing the Derivative Graphically
4. Computing the Derivative Algebraically
5. Computing the Derivative Numerically
6. Average Growth Rate vs. Instantaneous Growth Rate
7. Applications of the Derivative: Spread of Disease
8. Finding Maxima and Minima of Functions
9. Relating a Function and Its Derivative
10. Approximating functions using trigonometric functions.

5. Computing Derivatives

1. Sum, Difference, Product, Quotient Rule
2. Chain Rule
3. Logarithmic Differentiation
4. Instantaneous Percentage Growth
5. Growth Dominance
6. Applications: Linear Dimensions

6. Using Derivatives

1. Finding Maxima and Minima
2. Finding Good Representative Plots
3. Applications: Maximizing Volume
4. The Second Derivative
5. Applications: The Space Shuttle Challenger

7. Introduction to Differential Equations

1. Basic Linear Differential Equations
2. Logistic Growth
3. Logistic Differential Equation
4. Applications: Pollution
5. Applications: Business Growth and Limitations
6. Applications: Radioactive Decay
7. The Race Track Principal
8. Predator-Prey Model

8. Parametric Plots

1. Standard Examples in 2D and 3D
2. The Cycloid
3. Derivatives of Parametric Functions
4. Applications: Projectile Motion

5. Applications: Predator-Prey

9. Integration

1. Measuring Area Under a Curve
2. Definition of the Integral
3. Properties of Integrals, Symmetry
4. Integrals of Data Functions
5. Numerical Methods: Rectangles, Trapezoids
6. Undefined Integrals
7. Numerical Calculation of Integrals

10. Fundamental Theorem of Calculus

1. Derivative of an Integral
2. Integral of a Derivative
3. Fundamental Formula
4. Distance, Velocity, and Acceleration
5. Improper Integrals
6. More Properties of Integrals
7. Applications: Measure Accumulation Totals
8. Indefinite Integrals and Antiderivatives

11. Measurements via Slicing

1. Measuring Area via Slicing
2. Measuring Volume via Slicing
3. Density and Mass
4. Accumulation
5. Arc Length