Virginia Western Community College
MTH 263
Calculus I

Prerequisites
Completion of MTH 167 or equivalent with a grade of C or better.

Course Description
Presents concepts of limits, derivatives, differentiation of various types of functions and use of differentiation rules, application of differentiation, antiderivatives, integrals and applications of integration.

Semester Credits: 4 **Lecture Hours: 4**

Required Materials
Textbook:
University Calculus. Hass, Weir & Thomas. 4th edition. Pearson/Addison-Wesley. ISBN: 9780134995540.

Other Required Materials:
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Course Outcomes

At the completion of this course, the student should be able to:

- Explain the concepts of the derivative and differentiability.
- Explain the concepts of limit and continuity.
- Determine derivatives for appropriate algebraic and transcendental functions.
- Apply differentiation to solve problems of motion, optimization, and related rates.
- Apply the first and higher derivatives in determining extrema and concavity of curves for the solution of science and engineering problems.
- Reconstruct a function from knowledge of its derivative.
- Understand and evaluate antiderivatives, make substitutions to evaluate integrals of algebraic and transcendental functions.
- Evaluate definite integrals by definition.
- Evaluate Riemann sums.

Course Objectives

- Limits
  - Differentiate between the limit and the value of a function at a point
  - Find the limit of a function by numerical, graphical and analytic methods
  - Apply Limit Laws
  - Calculate one-sided limit of a function
  - Prove the existence of a limit using precise definition of the limit
  - Determine the continuity of a function
  - Calculate Vertical and Horizontal asymptotes using limits
- Derivatives and Differentiation Rules
  - Define Derivatives and Rates of Change
  - Compute derivatives of basic functions using the definition of the derivative
  - Differentiate polynomial, rational, radical, exponential and logarithmic functions
  - Find equation of a tangent line using derivative
  - Differentiate trigonometric functions
  - Apply product, quotient, chain rules
  - Apply implicit differentiation and find derivatives of inverse trigonometric functions
  - Apply concept of rates of change to natural and social sciences
  - Apply the concept of related rates
  - Define hyperbolic functions and their derivatives
  - Find linear approximation of a function at a given point
- Applications of Differentiation
  - Calculate local and absolute maximum and minimum values of a function
  - Apply Rolle's Theorem and Mean Value Theorem to study properties of a function
  - Find critical points, and intervals of increasing and decreasing values of a function
  - Find points of inflection and intervals of different concavities
  - Sketch a curve for a given function
  - Apply rules of differentiation to solve optimization problems
  - Find antiderivatives for basic functions using knowledge of derivatives
- Integrals
  - Relate areas to definite integrals using sigma notation, Riemann Sums, and limits. [Note: L?Hopital?s Rule is in Calc II but may be used for instructional purposes here.]
  - Apply Fundamental Theorem of Calculus to find definite integrals and derivatives
  - Find indefinite integrals of polynomials and basic trigonometric and exponential function
  - Apply Net Change Theorem
  - Perform integration using substitution
  - Find areas between curves
  - Find average value of a function

Textbook Topical Description

2	Limits and Continuity
2.1	Rates of Change and Tangents to Curves
2.2	Limits of a Function and Limit Laws
2.3	The Precise Definition of a Limit
2.4	One-Sided Limits
2.5	Continuity
2.6	Limits Involving Infinity: Asymptotes of Graphs
3	Differentiation
3.1	Tangents and the Derivative at a Point
3.2	The Derivative as a Function
3.3	Differentiation Rules
3.4	The Derivative as a Rate of Change
3.5	Derivatives of Trigonometric Functions
3.6	The Chain Rule
3.7	Implicit Differentiation
3.8	Derivatives of Inverse Functions and Logarithms
3.9	Inverse Trigonometric Functions
3.10	Related Rates
3.11	Linearization and Differentials
7.3	Hyperbolic Functions
4	Applications of Derivatives
4.1	Extreme Values of Functions
4.2	The Mean Value Theorem and Rolle's Theorem
4.3	Monotonic Functions and the First Derivative Test
4.4	Concavity and Curve Sketching
4.6	Applied Optimization
4.8	Antiderivatives
5	Integration
5.1	Area and Estimating with Finite Sums
5.2	Sigma Notation and Limits of Finite Sums
5.3	The Definite Integral
5.4	The Fundamental Theorem of Calculus
5.5	Indefinite Integrals and the Substitution Rule
5.6	Area Bounded Between Curves

Notes to Instructors

Comprehensive final exam is required.

ADA Statement (PDF)
Title IX Statement (PDF)