

MA 123 Elementary Calculus

MA 123 Course Competencies

General Education Competencies

- A. Knowledge of human cultures and the physical and natural worlds through study in the sciences and mathematics, social sciences, humanities, histories, languages, and the arts.
- B. Intellectual and practical skills, including
 - inquiry and analysis
 - critical and creative thinking
 - written and oral communication
 - quantitative literacy
 - information literacy
 - teamwork and problem solving
- C. Personal and social responsibility, including
 - civic knowledge and engagement (local and global)
 - intercultural knowledge and competence
 - ethical reasoning and action
 - foundations and skills for lifelong learning
- D. Integrative and applied learning, including synthesis and advanced accomplishment across general and specialized skills.

Student Learning Outcomes for Quantitative Reasoning

In MA 123, students will learn to:

1. Interpret information presented in mathematical and/or statistical forms by (Gen Ed Comp B):
 - Approximating limits graphically and numerically and evaluate limits analytically
 - Defining the derivative of a function and evaluate the derivative using the definition.
2. Illustrate and communicate mathematical and/or statistical information symbolically, visually, and/or numerically by (Gen Ed Comp A, B, C):
 - Listing the conditions for the continuity of a function at a point and determine the intervals of continuity of a function.
 - Using calculus to sketch the graph of functions.
3. Determine when computations are needed and execute the appropriate computations by (Gen Ed Comp A, B):
 - Evaluating infinite limits and limits at infinity.
 - Determining the derivative of a function using differentiation rules for algebraic functions including polynomial, rational, root, exponential, and logarithmic functions.
 - Using product rule, quotient rule, and chain rule techniques to determine derivatives of functions.

- Finding indefinite and definite integrals of a function using integration rules for algebraic functions including polynomial, rational, root, exponential, and logarithmic functions.
 - Using substitution techniques to determine the definite and indefinite integrals of functions.
4. Apply an appropriate model to the problem to be solved by (Gen Ed Comp A, B, C):
- Writing the equation of the line tangent to a curve at a given point using derivatives.
5. Make inferences, evaluate assumptions, and assess limitations in estimation modeling and/or statistical analysis by (Gen Ed Comp A, D):
- Using derivatives to solve application problems including problems involving optimization and exponential growth and decay.
 - Using definite integrals to find the area under a curve and the area between two curves.

MA 123 Course Outline

I. Functions - Review

- A. Notation
- B. Evaluation
- C. Domain and Range
- D. Graphs
- E. Composition
- F. Models

II. Limits of a Function

- A. Definition
- B. Left and Right Handed Limits
- C. Graphical Limits
- D. Algebraic Limits
- E. Infinite Limits
- F. Limits at Infinity

III. Continuity

- A. Definition
- B. Graphical Description
- C. Algebraic Description

IV. Derivatives

- A. Definition
- B. Differentiation Formulas
 - 1. Power Rule
 - 2. Product Rule
 - 3. Quotient Rule
 - 4. The Chain Rule
- C. Higher Order Derivatives
- D. Applications
 - 1. Absolute Extrema
 - 2. Optimization

V. Graphing With Calculus

- A. Increasing and Decreasing Functions
- B. Relative Extrema
- C. Concavity
- D. Inflection Points
- E. Curve Sketching

VI. Exponential and Logarithmic Functions

- A. Equations
- B. Graphs
- C. Applications
- D. Derivatives

VII. Integration

- A. Antiderivatives
- B. Fundamental Theorem of Calculus
- C. Definite Integrals
- D. Indefinite Integrals
- E. Substitution Integrals
- F. Applications
 - 1. Rate of Change
 - 2. Areas Between Curves