

MAT 271 CALCULUS I

COURSE DESCRIPTION:

Prerequisites: MAT 172 or satisfactory score on placement test

Corequisites: None

This course covers in depth the differential calculus portion of a three-course calculus sequence. Topics include limits, continuity, derivatives, and integrals of algebraic and transcendental functions of one variable, with applications. Upon completion, students should be able to apply differentiation and integration techniques to algebraic and transcendental functions. *This course has been approved to satisfy the Comprehensive Articulation Agreement for the general education core requirement in natural sciences/mathematics.* Course Hours Per Week: Class, 3. Lab, 2. Semester Hours Credit, 4.

LEARNING OUTCOMES:

1. Students will be able to evaluate limits and continuity, and compute derivatives and integrals of selected functions. Students will display proficiency by demonstrating the following competencies:
 - a. Define a limit.
 - b. Use algebraic techniques to evaluate limits.
 - c. Evaluate a one-sided limit.
 - d. Evaluate limits at infinity.
 - e. Define continuity and determine whether or not a function is continuous at a point and on an interval.
 - f. Define a derivative and use the definition to differentiate selected functions.
 - g. Use the product, quotient, and chain rules to differentiate selected functions.
 - h. Differentiate selected trigonometric functions.
 - i. Differentiate the natural and general exponential and logarithmic functions.
 - j. Implicitly differentiate selected two-variable equations.
 - k. Differentiate inverse trigonometric functions
 - l. Define and differentiate the hyperbolic functions and their inverses.
 - m. Evaluate indefinite and definite integrals of elementary functions, including selected trigonometric functions.
 - n. Evaluate indefinite and definite integrals by substitution.
 - o. Integrate natural and general exponential functions.
 - p. Integrate functions whose antiderivatives involve logarithms.
 - q. Integrate functions whose antiderivatives involve inverse trigonometric functions.
 - r. State the basic properties of the definite integral.
 - s. Apply the Fundamental Theorem of Calculus.
2. Students will be able to utilize calculus techniques in order to analyze the properties and sketch graphs of functions. Students will display proficiency by demonstrating the following competencies.
 - a. Identify horizontal, vertical, and slant asymptotes.
 - b. Use the first derivative to determine where a function is increasing and decreasing, and the location of relative extrema.

- c. Use the second derivative test to determine concavity of intervals of functions and the location of points of inflection.
 - d. Use the first derivative test to determine whether critical values are maxima, minima, or neither.
 - e. Use the second derivative test to determine whether critical values are maxima, minima, or neither.
 - f. Use the information from the first and second derivatives to sketch the graphs of selected functions.
 - g. Identify the absolute extrema of functions.
 - h. State Rolle's Theorem and find values which satisfy it.
 - i. State the Mean Value Theorem and find values which satisfy it.
3. Students will be able to utilize the techniques of differentiation and integration together with appropriate technology to solve practical problems and to analyze and communicate results. Students will display proficiency by demonstrating the following competencies.
- a. Solve practical problems involving related rates.
 - b. Use differentials to approximate error and change.
 - c. Use Newton's method to approximate the zero of a function.
 - d. Use derivatives to solve optimization problems.
 - e. Use derivatives to solve practical problems involving rectilinear motion.
 - f. Find the area of a region bounded by a curve and the x-axis using n rectangles and limits.
 - g. Find the area of a region bounded by a curve and the x-axis using indefinite integrals.
 - h. Use integrals to solve practical problems involving rectilinear motion.

OUTLINE OF INSTRUCTION:

- I. Limits and Derivatives
 - A. The Tangent and Velocity Problems
 - B. The Limit of a Function
 - C. Calculating Limits Using the Limit Laws
 - D. The Definition of a Limit
 - E. Continuity
 - F. Limits at Infinity; Horizontal Asymptotes
 - G. Derivatives and Rates of Change
 - H. The Derivative as a Function
- II. Differentiation Rules
 - A. Derivatives of Polynomials and Exponential Functions
 - B. The Product and Quotient Rules
 - C. Derivatives of Trigonometric Functions
 - D. The Chain Rule
 - E. Implicit Differentiation
 - F. Derivatives of Logarithmic Functions
 - G. Rates of Change in the Natural and Social Sciences
 - H. Exponential Growth and Decay
 - I. Related Rates
 - J. Linear Approximations and Differentials
 - K. Hyperbolic Functions

- III. Applications of Differentiation
 - A. Maximum and Minimum Values
 - B. The Mean Value Theorem
 - C. How Derivatives Affect the Shape of a Graph
 - D. Indeterminate Forms and L'Hôpital's Rule
 - E. Curve Sketching
 - F. Optimization Problems
 - G. Newton's Method
 - H. Antiderivatives

- IV. Integrals
 - A. Areas and Distances
 - B. The Definite Integral
 - C. The Fundamental Theorem of Calculus
 - D. Indefinite Integrals and the Net Change Theorem
 - E. The Substitution Rule
 - F. The Logarithm Defined as an Integral

REQUIRED TEXTBOOK AND MATERIALS:

Stewart, James. Calculus: Early Transcendentals. 6th ed. Thomson Brooks/Cole, 2008.

TI-83/84 Graphing Calculator

STATEMENT OF DISABILITIES ACCOMMODATION:

Students who require academic accommodations due to any physical, psychological, or learning disability are encouraged to request assistance from a disability services counselor within the first two weeks of class. Likewise, students who potentially require emergency medical attention due to any chronic health condition are encouraged to disclose this information to a disability services counselor within the first two weeks of class. Counselors can be contacted by calling 536-7207 x 1413 or by visiting the Student Development Office in the Phail Wynn Jr. Student Services Center, room 1309.