

MAT 150 CALCULUS I

Department of Mathematics
Southern Connecticut State University

I. Catalog Description

Functions, limits, differentiation of algebraic and trigonometric, exponential, and logarithmic functions with applications, indeterminate forms, elementary integration, Riemann sums. A graphing calculator approved by the instructor is required.

II. Credit

- (A) MAT 150 carries four 4 semester hours of college credit.
- (B) MAT 150 is required of all mathematics majors.
- (C) MAT 150 satisfies the All-University requirement in mathematics.

III. Prerequisite

The student must satisfy one of the following three prerequisites:

- (A) passed MAT 122 Precalculus with a grade of C- or better;
- (B) achieved a satisfactory score on the placement examination;
- (C) passed high school calculus(including trigonometry) with a grade of B or better.

Specifically, the following material is prerequisite:

- (D) Functions: polynomial, rational, exponential, logarithmic, trigonometric ;
- (E) Trigonometry.

IV. Format

- (A) MAT 150 is primarily a lecture-based course.
- (B) A graphing calculator approved by the instructor is required.

V. Outline

Instructors and students are expected to use technology such as the graphing calculator and/or computer to investigate and illustrate concepts from symbolic, graphical, and numerical points of view.

(A) Limits

1. Slope and the limit of the difference quotient
2. Analytic methods for finding limits
3. Infinite limits
4. The $\epsilon - \delta$ definition of limit (proofs at least for linear functions)
5. Continuity

(B) Derivatives with applications

1. Definition and interpretation as a rate of change
2. Differentiation rules
3. The product and quotient rules
4. The chain rule
5. Maxima and minima of functions on closed intervals
6. Applied optimization problems
7. Derivatives of trigonometric functions
8. Derivatives of exponential and logarithmic functions
9. Implicit differentiation and related rates
10. Newton's method

(C) More applications of the derivative

1. Increasing and decreasing functions
2. The Mean Value Theorem
3. The first derivative test and applications
4. Simple curve sketching
5. Higher derivatives
6. Curve sketching and asymptotes
7. Indeterminate forms and L'Hôpital's rule
8. More indeterminate forms

(D) The Integral

1. Antiderivatives
2. Elementary area computations
3. Riemann sums and the integral

4. Evaluation of integrals
5. The Fundamental Theorem of Calculus
6. Integration by substitution

VI. Current Text

G. Thomas, M. Weir, J. Hass, F. Giordano, *Thomas' Calculus, Early Transcendentals*, 11th edition, Addison Wesley, 2007.

Sections covered :

- Chapter 1 : Sections 1.1 – 1.6.
- Chapter 2 : Sections 2.1 – 2.7.
- Chapter 3 : Sections 3.1 – 3.4, first half of 3.5, 3.6 – 3.9, 3.10(optional).
- Chapter 4 : Sections 4.1 – 4.8.
- Chapter 5 : Sections 5.1 – 5.5.

VII. Outcomes

Students passing MAT 150 should minimally be able to do each of the following tasks.

By hand (without the use of technology):

- (A) Evaluate limits of simple functions (including rational functions) analytically and graphically.
- (B) Use L'Hôpital's rule to compute limits.
- (C) Compute $f'(x)$ using the definition for polynomials of degree ≤ 2 .
- (D) Compute $f'(x)$ using differentiation rules (particularly the chain rule).
- (E) State and apply the definition of continuity.
- (F) Find asymptotes.
- (G) Apply the first and second derivative tests to find extrema and inflection points, both for graphs and in applications.
- (H) Find the derivatives of inverse trigonometric functions.
- (I) Find the antiderivative of basic functions.
- (J) Use the method of substitution to find antiderivatives.
- (K) Evaluate definite integrals.

- (L) Be able to state and carefully apply theorems such as the Mean Value Theorem, the Intermediate Value Theorem, Rolle's Theorem and the Fundamental Theorem of Calculus.

Using technology (Graphing calculator):

- (A) Estimate limits using graphs and tables.
- (B) Use Newton's method to find zeros of a function.
- (C) Graph a function and its derivative and exhibit knowledge of the relationship between the significant features of the graphs as it relates to calculus.
- (D) Estimate areas using a summation process.
- (E) Evaluate definite integrals using the numerical integration function on the calculator.