MAT 151 Calculus II

Department of Mathematics
Southern Connecticut State University

I. Catalog Description

Continuation of MAT 150. Calculus of inverse trigonometric functions, techniques and applications of integration, numerical integration, improper integrals, integration with polar coordinates, parametric curves, infinite sequences and series, power series, Taylor's formula, vectors in two and three-dimensions.

II. Credit

(A) MAT 151 carries four (4) semester hours of college credit.

(B) MAT 151 is required of all mathematics majors.

III. Prerequisite

The student must have passed MAT 150 with a grade of C- or better. Specifically, the following material is prerequisite:

(A) Limits, including L'Hôpital's Rule

(B) Derivatives of polynomial, rational, exponential, logarithmic, trigonometric, and inverse trigonometric functions

(C) Applications of the derivative as a rate of change and to graphs of functions

(D) Indefinite integrals, including the method of substitution

(E) Definite integrals, including application to finding area below a curve

IV. Format

MAT 151 is primarily a lecture–based course.

V. Technology

Use of a computer algebra system is required.

VI. Course Objectives

Students passing MAT 151 should minimally be able to do each of the following tasks.

By hand (without the use of technology):

(a) Evaluate integrals using elementary anti-differentiation rules including inverse trigonometric functions, substitution, integration by parts, the method of partial fractions, and integral tables.

(b) Set up definite integrals that represent area (in rectangular and polar coordinates), volume, and arc length.

(c) Determine whether a sequence converges or diverges.

(d) State the definition of the sum of a series.

(e) Find the sum of basic telescopic series and geometric series.

(f) Compute several terms of the Taylor polynomial for a function.

(g) Manipulate power series in some basic ways.

(h) Do basic vector arithmetic, including the dot product and cross product in 2-dimensional and 3-dimensional spaces.

(i) Find the equations of lines in $\mathbb{R}^3$.

Using a computer algebra system:

(a) Implement a numerical integration method.

(b) Evaluate complicated definite integrals that represent area, volume, arc length, and other applications.

(c) Find derivatives and anti-derivatives using the symbolic capabilities of a computer algebra system.

(d) Obtain 2-dimensional graphs of functions in rectangular or polar coordinates and graphs of parametric functions.

(e) Investigate the convergence of a sequence.

(f) Investigate the convergence (and sum if pertinent) of an infinite series.

(g) Approximate definite integrals using series.

(h) Compare a function $f(x)$ with its Taylor polynomials.

VII. Outline

Instructors and students are expected to use technology to investigate and illustrate concepts from symbolic, graphical, and numerical points of view.

Integration with applications (40%)

(a) Areas of planar regions

(b) Numerical integration (at least trapezoidal and Simpson's rules)

(c) Volumes of solids of revolution

(d) Arc length

(e) Work

(f) Center of mass, fluid force or other non-geometric applications (optional)

(g) The definition of the natural logarithm as an integral

(h) Integral tables and simple substitutions (do trigonometric substitution and trigonometric integrals via table)

(i) Integration by parts

(j) Partial fractions

(k) Improper integrals

Polar coordinates and parametric curves (15%)

(a) Definition of polar coordinates

(b) Area computations with polar coordinates

(c) Parametric curves

Infinite Serie (30%)

(a) Infinite sequences

(b) Infinite series

(c) Tests for convergence

(d) Alternating series, absolute and conditional convergence

(e) Power series

(f) Taylor series and Taylor polynomials

Vectors (15%)

(a) Vectors in two and three dimensions

(b) Dot product and cross product

(c) Lines and curves in space

VIII. Recommended Text

W. Briggs, L. Cochran, B. Gillett, Calculus, 3rd edition, Pearson.

Recommended sections

- Chapter 6: Sections 6.1–6.3, 6.7, 6.8, (6.4 optional)
- Chapter 8: Sections 8.1, 8.2, 8.5–8.8.
- Chapter 10: Sections 10.1–10.6.
- Chapter 11: Sections 11.1–11.3, (11.4 optional).
- Chapter 12: Sections 12.1, 12.2, 12.3 (skip derivatives).
- Chapter 13: Sections 13.1–13.5.

VIII. Waiver Policy

This course may be waived.

IX. Preparation

- Prepared on October 3, 2012. (Therese Bennett, Alain D?Amour, Emmett Dennis, John Scheuermann, Robert Vaden-Goad)
- Approved by the Mathematics DCC on November 6, 2012.
- Approved by the Mathematics Department on November 8, 2012.
- Revised on September 29, 2014 by Therese Bennett and Leon Brin.
- Revisions approved by the Mathematics DCC on November 25, 2014.
- Revision on November 1, 2020 by J. Hong.
- Approved by the MDCC, 9–0–0, November 5, 2020.
- Revised outline prepared by MDTC, November 17, 2020.