MOHAWK VALLEY COMMUNITY COLLEGE

UTICA AND ROME, NEW YORK

COURSE OUTLINE

CALCULUS 2

MA152

Revised– 12/07

Reviewed and found acceptable – 5/08

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Reviewed and Revised - 2/22

COURSE OUTLINE

Title: Calculus 2

Catalog No.: MA152

Credit Hours: 4

Lab Hours: 0

Prerequisite: MA151 Calculus 1

Catalog Description: This is the second in a sequence of three courses in calculus. Topics include the integration of trigonometric functions, the differentiation and integration of the inverse trigonometric functions, further techniques in integration, L'Hospital's Rule, improper integrals, and infinite series. Applications are included.

Course Objectives

1. To help the student learn the basics of the calculus of functions of one variable.

2. To raise the student’s level of logical thinking by requiring the student to write some basic calculus proofs.

3. To increase the student’s ability to use technology as a problem-solving tool by requiring the student to use technology as an aid in solving applied problems.

4. To challenge the student, through both applied and theoretical problems, to appreciate calculus as a problem-solving art.

General Student Learning Outcomes

1. The student will demonstrate the ability to interpret and communicate mathematics in writing.
2. The student will demonstrate the ability to work effectively in a group by participating in group work and demonstrating openness toward diverse points of view; drawing upon knowledge and experience of others; and demonstrating skill in negotiating differences and working toward correct solutions.
3. The student will be able to state a problem correctly, reason analytically to its solution, and interpret the result.
4. The student will be able to solve equations and application problems from numerical, graphical, and / or analytical perspectives.
5. The student will demonstrate an understanding of how mathematics can be used to analyze real world situations.
6. The student will be able to use technology to collect and / or analyze data and to solve problems.

SUNY Learning Outcomes

1. The student will develop well-reasoned arguments by demonstrating an ability to write proofs.
2. The student will identify, analyze, and evaluate arguments as they occur in their own and other’s work.
3. The student will demonstrate the ability to interpret and draw inferences from mathematical models such as formulas, graphs, tables, and schematics.
4. The student will demonstrate the ability to represent mathematical information symbolically, visually, numerically, and verbally.
5. The student will demonstrate the ability to employ quantitative methods such as arithmetic, algebra, geometry, or statistics to solve problems.
6. The student will demonstrate the ability to estimate and check mathematical results for reasonableness.

**Major Topics to be Covered**

**1. Differentiation**

The derivatives of the logarithmic, exponential, and inverse trigonometric functions are further developed. Applications include maximum and minimum problems, curve sketching, and rates of change.

**Student Learning Outcomes**

The student will be able to:

* 1. Find the derivative of functions involving logarithmic functions.
  2. Find a derivative using logarithmic differentiation.
  3. Find the derivative of functions involving exponential functions.
  4. Evaluate the derivative of an inverse function at a point.
  5. Find the derivative of a function involving inverse trigonometric functions.
  6. Find instantaneous rates of change.

**2. Integration**

Integration formulas for the remaining basic trigonometric functions are developed. Integration formulas for the inverse trigonometric, logarithmic, and exponential functions are discussed. The standard techniques of integration such as integration by parts, partial fractions, and trigonometric substitutions are discussed. Applications include, but are not limited to, area, volume, and arc length.

**Student Learning Outcomes**

The student will be able to:

* 1. Integrate exponential functions.
  2. Integrate functions that result in a natural logarithmic function.
  3. Integrate the six basic trigonometric functions.
  4. Integrate functions that result in an inverse sine, inverse tangent, or inverse secant function.
  5. Evaluate integrals using integration by parts.
  6. Evaluate integrals of rational functions using partial fraction decomposition.
  7. Evaluate integrals using trigonometric substitution.
  8. Determine integrals for the inverse trigonometric functions.
  9. Determine integrals for logarithmic functions.
  10. Evaluate integrals using integration tables.
  11. Find the arc length of a function over a specified interval.
  12. Determine volumes of solids.
  13. Find the area between two curves.

**3. Indeterminate Forms, L’Hopital’s Rule and Improper Integrals**

Limits producing the indeterminate forms are revisited. L’Hospital’s Rule is further utilized as a means of evaluating these types of limits. Improper integrals are considered.

**Student Learning Outcomes**

The student will be able to:

* 1. Evaluate limits involving the indeterminate forms 0/0 and ∞/∞ via L’Hopital’s Rule.
  2. Evaluate limits involving the indeterminate forms 0 • ∞, 1∞, 00 , ∞-∞,and ∞0.
  3. Evaluate improper integrals with infinite integration limits.
  4. Evaluate improper integrals with an infinite discontinuity.

**4. Infinite Series**

The basic definitions and concepts of sequences and series are

introduced followed by a discussion of the standard tests for convergence of a series with nonnegative terms. Absolute convergence and alternating series are studied. Power series and Taylor Series are introduced along with a discussion of the use of series for computational purposes.

**Student Learning Outcomes**

The student will be able to:

* 1. Write out terms of sequences and series.
  2. Determine whether a sequence converges or diverges.
  3. Recognize and find the sum of geometric and telescoping series.
  4. Apply the nth-term test, integral test, comparison test and ratio test.
  5. Decide whether a p-series converges or diverges.
  6. Decide whether an alternating series converges or diverges.
  7. Determine the interval of convergence of a power series.
  8. Find a power series representation of a rational function using a geometric power series.

4.9 Develop a Taylor series for a given function.

4.10 Use Taylor polynomials to approximate function values.

**5. Mathematical Reasoning**

One intention of the MA152 course is to give the student insight into mathematical proof. Understanding theorem statements, writing short proofs, and deriving formulas are included.

**Student Learning Outcomes**

The student will be able to:

5.1 Prove integration and/or differentiation formulas for the inverse trigonometric functions.

5.2 Analyze the applicability of theorems, including the Fundamental Theorem of Calculus, L’Hopital’s Rule, and various series convergence and divergence tests.

# Teaching Guide

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