

COURSE OUTLINE **Calculus with Applications**

Course Description

MA 148. Calculus with Applications. 3 hours credit. Prerequisite: Placement score or MA 131 or MA 135 or the equivalent with a C or better. This course will enable the student to differentiate and integrate algebraic, logarithmic and exponential functions and apply those concepts to real-world business and social-science applications, including marginal analysis.

Course Relevance

The concepts learned in this course are essential for understanding optimization theory, marginal analysis, business, economics and social sciences, both in application and for future study.

Required Materials and Supplies

Larson. (2009) *Brief Calculus: an applied approach* (8th ed.), Boston, MA: Houghton-Mifflin Publishing.

Graphing Calculator: Any version of the TI-83/84 is required. If students have other kinds, they will be responsible for learning how to use them.

Learning Outcomes

The intention is for the student to be able to:

1. Use rules of differentiation.
2. Apply slopes and marginal analysis to real-life growth and decay, business and social-science applications.
3. Use the derivative to analyze graphs of functions.
4. Evaluate definite and indefinite integrals directly and by u-substitution.

Learning PACT Skills that will be DEVELOPED and documented in this course:

Through involvement in this course, the student will develop ability in the following PACT skills area(s):

Analytical Thinking Skills

1. Problem solving
 - Through the use of a graphing calculator and by solving word problems and multi-step problems, the student develops problem-solving skills.

Communication Skills

1. Reception and interpretation of messages
 - Through the process of working through application problems, the student will develop the ability to interpret and evaluate real world application problems from text form into a mathematical equation.

Technology Skills

1. Discipline-specific technology
 - Through the use of graphing calculators, the student will learn basic skills involved in problem solving with the aid of visual graphs and immediate calculations that apply to mathematics and real world situations.

Major Summative Assessment Task(s)

The learning outcome(s) and Learning PACT skill(s) will be demonstrated by:

1. Taking a comprehensive final exam (A skill) including open-ended questions that require conceptualization of abstract ideas (C skill) and accurate performance of mathematical procedures including the use of a graphing calculator (T skill).

Course Content

- I. Skills/Competencies – Actions that are essential to achieve the course outcomes:
 - A. Factoring
 - B. Simplifying expressions
 - C. Solving equations
 - D. Modeling applications
 - E. Graphing and using the graphing calculator
 - F. Differentiating all types of functions
 - G. Integrating using the power rule and substitution
- II. Themes – Key recurring concepts that run throughout this course:
 - A. Differentiation
 - B. Mathematical models
 - C. Integration
 - D. Optimization
 - E. Marginal analysis
 - F. Algebraic manipulation
- III. Issues – Key areas of conflict that must be understood in order to achieve the intended outcome:
 - A. Transferring textual concepts to graphs
 - B. Applying prerequisite material
 - C. Following sequential problem-solving methods
- IV. Concepts – Key concepts that must be understood to address the issues:
 - A. Mathematical notation
 - B. College algebra
 - C. Graphing
 - D. Logical patterns for problem solving
 - E. Definitions and theorems

Learning Units

- I. Algebra review
 - A. Exponents and radicals
 - B. Factoring (optional)
 - C. The Cartesian Plane
 - D. Lines in the plane and slope
 - E. Functions

- II. Derivatives
 - A. Limits
 - B. Continuity
 - C. The derivative and slope of the graph
 - D. Some rules for differentiation
 - E. Rate of change: velocity and marginals
 - F. The product and quotient rules
 - G. The chain rule
 - H. Higher-order derivatives
 - I. Implicit differentiation
 - J. Related rates

- III. Applications of derivatives
 - A. Increasing and decreasing functions
 - B. Extrema and the first derivative test
 - C. Concavity and the second derivative test
 - D. Optimization problems
 - E. Business and economics applications
 - F. Asymptotes
 - G. Curve Sketching: a summary

- IV. Exponential and logarithmic functions
 - A. Exponential functions
 - B. Natural exponential functions
 - C. Derivatives of exponential functions
 - D. Logarithmic functions
 - E. Derivatives of logarithmic functions
 - F. Exponential growth and decay

- V. Integration
 - A. Anti-derivatives and the Indefinite Integrals
 - B. Integration by substitution and the general power rule
 - C. Exponential and logarithmic integrals
 - D. Area and the fundamental theorem of calculus
 - E. The area of a region bounded by two graphs (optional)
 - F. The definite integral as the limit of a sum

Learning Activities

Independent learning activities will be assigned to assist the student in achieving the intended learning outcomes. Activities identified in the syllabus, such as class discussion, lecture, reading, group work or projects, will also contribute to learning.

Grade Determination

The student will be graded on learning activities and assessment tasks. Grade determinants may include the following: daily work, quizzes, chapter or unit tests, comprehensive examinations, projects, presentations, class participation, and other methods of evaluation employed at the discretion of the instructor.