

## COURSE OUTLINE

### **Mathematics 112 (C-ID Number: 140) Calculus for Business (C-ID Title: Business Calculus)**

#### **Catalog Statement**

MATH 112 is a one-semester course in calculus for business, management, and social science majors. Topics in this course include: techniques of differentiating; maximum-minimum problems; curve sketching; derivatives and applications of exponential and logarithmic functions; techniques of integration; simple differential equations; the calculus of functions of several variables, including Lagrange multipliers and multiple integration.

Total Lecture Units: 5.0

Total Laboratory Units: 0.0

**Total Course Units: 5.0**

Total Lecture Hours: 80.0

Total Laboratory Hours: 0.0

Total Laboratory Hours To Be Arranged: 0.0

**Total Faculty Contact Hours: 80.0**

Prerequisite: Placement is based on a composite of test scores and academic background or satisfactory completion of MATH 118, MATH 101, or MATH 120, or MATH 220B.

Recommended preparation: MATH 100

#### **Course Entry Expectations**

Prior to enrolling in the course, the student should be able to:

- solve and graph linear and quadratic equations and inequalities in both one and two variables;
- solve absolute value equations and inequalities;
- solve linear equations and inequalities;
- perform polynomial operations;
- perform operations with rational expressions;
- solve equations with radicals;
- solve a quadratic equation using various methods;
- find the equation of a line given two points;
- solve a non-linear system algebraically;
- find the inverse of a function;
- use the three properties of logarithms to simplify logarithmic expressions;
- solve exponential and logarithmic equations;
- graph the three basic conic sections;
- find the  $n$ th term of a geometric series;
- divide synthetically.

## **Course Exit Standards**

Upon successful completion of the required coursework, the student will be able to:

- demonstrate understanding of exponents, linear equations and inequalities, and functions;
- differentiate various types of functions by using the product, quotient and chain rules;
- find the derivatives of polynomial, rational, exponential and logarithmic functions;
- use derivatives to find rates of change and tangent lines;
- sketch the graph of functions using horizontal and vertical asymptotes, intercepts, and first and second derivatives to determine intervals where the function is decreasing and increasing, maximum and minimum values, intervals of concavity and points of inflection;
- apply the rules of differentiation to solve optimization problems;
- apply the calculus of exponential and logarithmic functions to application problems;
- apply the various techniques of integration to definite, indefinite, and improper integrals by using the general integral formulas, integration by substitution, and other integration techniques;
- analyze the marginal cost, profit and revenue when given the appropriate function;
- use calculus to analyze revenue, cost and profit;
- use integration in business and economics applications;
- solve separable differential equations;
- utilize partial differentiation to optimize functions (both unconstrained and constrained) of two variables;
- evaluate multiple integrals.

## **Course Content**

**Total Faculty Contact Hours = 80.0**

### **Preliminaries (6 hours)**

Algebra review  
The Cartesian Coordinate System  
Lines

### **Functions, Limits, and the Derivative (12 hours)**

Functions and their graphs, including exponential and logarithmic functions  
The algebra of functions  
Functions and mathematical models  
Limits and intuitive limit definition of derivative  
One-sided limits and continuity  
Increments, tangent lines and rate of change

### **Differentiation (12 hours)**

Rules of differentiation, including sum, difference, product and quotient rules  
The chain rule  
Marginal functions in economics  
Higher-order derivatives  
Implicit differentiation and related rates  
Differentials

### **Applications of the Derivative (13 hours)**

Applications of the first derivative – increasing/decreasing and extrema  
Applications of the second derivative – concavity and points of inflection  
Curve sketching  
Optimization - extreme value theorem  
Optimization – applications

**Exponential and Logarithmic Functions (10 hours)**

Exponential functions  
Logarithmic functions  
Compound interest  
Differentiation of exponential functions  
Differentiation of logarithmic functions  
Exponential functions as mathematical models

**Integration (12 hours)**

Antiderivatives, indefinite integrals and the rules of integration  
Integration by substitution  
Approximating definite integral as a sum  
Area and the definite integral  
The Fundamental Theorem of Calculus  
Evaluating definite integrals  
Area between two curves  
Applications of the definite integral to business and economics

**Additional Topics in Integration (5 hours)**

Integration by parts  
Numerical integration (optional)  
Improper integrals

**Calculus of Several Variables (10 hours)**

Functions of several variables  
Partial derivatives  
Maxima and minima of functions of several variables  
Constrained maxima and minima and the method of Lagrange multipliers  
Double integration

**Methods of Instruction**

The following methods of instruction may be used in this course:

- lecture and discussion;
- graphing calculator or computer demonstrations.

### **Out of Class Assignments**

The following out of class assignments may be used in this course:

- homework (e.g. problem sets related to course content);
- group assignments and projects (e.g. analyze a business' profit and loss, analyze supply and demand for a product);
- computer or graphing calculator assignments.

### **Methods of Evaluation**

The following methods of evaluation may be used in this course:

- quizzes;
- five to seven chapter examinations are required;
- a comprehensive final examination is required.

### **Textbooks**

Lial, Margaret, Raymond Greenwell, and Nathan Ritchey. *Calculus with Applications*. 11<sup>th</sup> ed. Boston: Pearson, 2015. Print.  
12<sup>th</sup> Grade Textbook Reading Level. ISBN: 978-0-321-97942-1

### **Student Learning Outcomes**

Upon successful completion of the required coursework, the student will be able to:

- differentiate various types of functions of a single variable using product, quotient, and chain rules;
- apply the various techniques of integration to definite, indefinite, and improper integrals of functions of a single variable;
- differentiate and integrate select functions of more than one variable;
- apply calculus to business related application problems.