

## Calculus

### **COURSE DESCRIPTION:**

The Calculus course is a comprehensive look at the study of differential and integral calculus concepts including limits, derivative and integral computation, linearization, Riemann sums, the Fundamental Theorem of Calculus, and differential equations. Applications include graph analysis, linear motion, average value, area, volume, and growth and decay models.

**PREREQUISITES:** Pre-Calculus

**COURSE LENGTH:** Two semesters

**COURSE MATERIALS:** Java is needed for the embedded graphing calculator applet (GCalc). A free download is available at <http://www.java.com/en/download/>.

### **COURSE OUTLINE:**

#### **UNIT I: LIMITS AND CONTINUITY**

Section A- Concept of a Limit  
Section B- Algebraic Computation of a Limit  
Section C- Limits Involving Infinity  
Section D- Continuity  
Section E- Intermediate Value Theorem

#### **Unit II: DERIVATIVES**

Section A- Concept of a Derivative  
Section B- Differentiability  
Section C- Graphs of  $f$  and  $f'$   
Section D- Motion along a Line  
Section E- Tangent Line Approximation

#### **Unit III: DIFFERENTIATION**

Section A- Basic Computation Rules  
Section B- Higher Order Derivatives  
Section C- Product, Quotient, and Chain Rules  
Section D- Implicit Differentiation  
Section E- Derivatives of Inverse Functions

#### **Unit IV: GRAPH BEHAVIOR**

Section A- Asymptotes and End-Behavior  
Section B- Increasing/Decreasing Behavior and Concavity  
Section C- Relative Extreme Values and Points of Inflection  
Section D- Absolute Extreme Values and Extreme Value Theorem  
Section E- Graph Analysis

## Calculus (continued)

### COURSE OUTLINE (continued):

#### **Unit V: DERIVATIVE APPLICATIONS**

Section A- Mean Value and Rolle's Theorems

Section B- Rates of Change

Section C- Related Rates

Section D- Optimization

#### **Unit VI: ANTIDIFFERENTIATION**

Section A- Antiderivatives and Definite Integrals

Section B- Slope Fields

Section C- Basic Computation Rules

Section D- Substitution Rule

Section E- Initial Value Problems

#### **Unit VII: THE DEFINITE INTEGRAL**

Section A- Area and the Riemann Sums

Section B- Approximation Methods

Section C- Fundamental Theorem of Calculus, Part 1

Section D- Computation of Definite Integrals

Section E- Fundamental Theorem of Calculus, Part 2

#### **Unit VIII: INTEGRAL APPLICATIONS**

Section A- Total Change

Section B- Average Value of a Function

Section C- Motion along a Line Revisited

#### **Unit IX: AREA AND VOLUME**

Section A- Area between Two Curves

Section B- Volume of Solids Using Cross Sections

Section C- Volume of Solids of Revolution

#### **Unit X: DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS**

Section A- Separable Differential Equations

Section B- Modeling Using Differential Equations

Section C- Growth and Decay Model