Course Title: Calculus	**Length of Course:** 30 cycles
Grade Level(s): 11 - 12	**Periods Per Cycle:** 6
Units of Credit: 1	**Length of Period:** 43 minutes
Classification: Elective	**Total Instructional Time:** 129 hours

Course Description

This is an advanced course in modern mathematics for the college bound students. The course covers topics on the algebra of functions, analytic geometry, the concepts of limits and continuity, as well as an introduction to basic integral and differential calculus.

Prerequisite: Successful completion of Trigonometry or Trigonometry Honors

Instructional Strategies, Learning Practices, Activities, and Experiences

Anticipatory Sets	Flexible Groups	Projects
Assessments	Graphic Organizers	Teacher Demonstrations
Bell Ringers	Guided Practice	Technology Integration
Class Discussions	High-Level Questioning	Videos/DVD's
Closure	Homework	Wait Time
Critical Thinking	Posted Objectives	

Assessments

Assessments (Teacher-Created)	Projects	Classwork
Higher-Level Questioning		

Materials/Resources

Textbook: <u>Calculus</u> Eleventh Edition (Larson, Edwards)	Internet Resources

Adopted: 9/17/03
Revised: 8/17/09; 5/19/14; 5/20/2019

Limits and Their Properties	
The Standards of Mathematical Practices	
Make sense of problems and persevere in solving them. **Construct viable arguments and critique the reasoning of others.** **Use appropriate tools strategically.** **Look for and make use of structure.**	**Reason abstractly and quantitatively.** **Model with mathematics.** **Attend to precision.** **Look for and express regularity in repeated reasoning.**
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Limits	1. Define Limits 2. Investigate Limit Behavior 3. Define Limit Properties

Limit Techniques	1. Apply the Following Limit Techniques
	    o Substitution
	    o Cancellation
	    o Rationalization
	    o Charting
	    o Graphing

Continuity and One-Sided Limits	1. Define Continuity and One-sided Limits 2. Test for Continuity 3. Define Properties of Continuous Functions 4. Apply Intermediate Value Theorem 5. Utilize One-sided Limit Techniques
Infinite Limits	1. Define Infinite Limits 2. Utilize Infinite Limits Techniques 3. Charting 4. Graphing 5. Define Properties of Infinite Limits 6. Find Vertical Asymptotes

Differentiation	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Derivative and Tangent Line	1. Define Derivative 2. Calculate Tangent Lines using Derivatives

Basic Rules of Derivatives	1. Apply the Following Basic Rules of Derivatives
	    o Constant rule
	    o Power rule
	    o Constant multiple rule
	    o Sum and difference rule
	    o Product and quotient rule
	    o Trigonometric rules
	    o Higher-order derivatives
	    o Chain rule

Implicit Differentiation	1. Utilize Implicit Differentiation Techniques **2.11.11.A** - Determine maximum and minimum values of a function over a specified interval. **2.11.11.B** - Interpret maximum and minimum values in problem situations. .
Application of Derivatives	1. Apply Derivatives to Related Rate Problems

Applications of Derivatives	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**

Extrema on an Interval
    o   Absolute max/min
    o   Relative max/min
    o   Critical points
	1. Define Extrema on an Interval
	2. Calculate Absolute max/min on an Interval
	3. Calculate Relative max/min on an Interval
	4. Calculate Critical Points on an Interval

Rolle's Theorem	1. Define and Apply Rolle's Theorem
Mean Value Theorem	1. Define and Apply Mean Value Theorem

Function Behavior	1. Determine the Following Function Behaviors:
	      o First derivative test
	      o Concavity
	      o Points of inflection
	      o Second derivative test
	      o Limits at Infinity
	2. Define Limits at Infinity
	3. Find Horizontal Asymptotes

Curve Sketching Using Function Behavior	1. Sketch a Function Based on the Following Function Behaviors:
	      o First derivative test
	      o Concavity
	      o Points of inflection
	      o Second derivative test
	      o Limits at Infinity

Applied Min/Max Problems	1. Applied Derivative Techniques on Min/Max Problems (Optimization)
L'Hopital's Rule	1. Evaluate Indeterminate Limits by using L'Hopital's Rule
Differentials	1. Define Differentials 2. Calculate Error Propagation 3. Determine Differentials of Functions

Integration	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Antiderivatives/Indefinite Integrals	1. Apply Integration Rules 2. Calculate General and Particular Solutions **2.11.11.E** - Estimate areas under curves using sequences of areas.
Area	1. Calculate Area using Sigma Notation 2. Calculate Area using Upper and Lower Sums
Riemann Sums/Definite Integrals	1. Define Riemann Sums/Definite Integrals 2. Apply Properties of Riemann Sums/Definite Integrals 3. Evaluate Definite Integrals
Fundamental Theorem of Calculus	1. Apply Fundamental Theorem of Calculus
Second Fundamental Theorem of Calculus	1. Apply the Second Fundamental Theorem of Calculus
Mean Value Theorem	1. Find the Mean Value Theorem of a Function
Average Value	1. Find the Average Value of a Function
Integration by Substitution	1. Perform Integration by Substitution on Composite Functions 2. Use Change of Variables to Integrate Indefinite Functions
Numerical Integration	1. Calculate Area using the Trapezoidal Rule

Logarithmic, Exponential, and Other Transcendental Functions	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Natural Logarithmic Functions	1. Apply the Properties of Natural Logarithmic Functions 2. Find the Derivative of Natural Logarithmic Functions 3. Integrate Natural Logarithmic Functions
Integrals of Trigonometric Functions	1. Integrate Trigonometric Functions
Inverse Functions	1. Find the Inverse of a Function
Derivatives and Integrals	1. Calculate the Derivative of Exponential Functions, Bases Other than e, and Inverse Trigonometric Functions 2. Integrate Exponential Functions, Bases Other than e, and Inverse Trigonometric Functions

Differential Equations	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
General and Particular Solutions	1. Find General and Particular Solutions of Differential Equations
Slope Fields	1. Use Slope Fields to Solve Differential Equations **2.11.11.C** - Graph and interpret rates of growth/decay.
Growth and Decay	1. Calculate Growth and Decay Rates of Differential Equations
Separation of Variables	1. Use Separation of Variables to Solve Differential Equations
First-Order Linear Differential Equation	1. Solve First-Order Linear Differential Equations

Applications of Integration	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
	2.11.12.E - Describe the method for estimating the area under curves and apply to real-world situations.
Area Between Two Curves	1. Calculate Area Between Two Curves of Nonintersecting and Intersecting Curves

Volume of a Solid	1. Find the Volume of a Solid using the Following Methods:
	    o Disk method
	    o Washer method
	    o Shell method

Arc Length	1. Calculate Arc Length using Integration