COURSE: Introductory Calculus

GRADE LEVEL: 12

LENGTH OF COURSE: 90 days per semester

TEXT: Calculus I with Precalculus A One-year Course

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COURSE DESCRIPTION:

Introductory Calculus provides an introduction to analytic geometry and calculus. It is designed to meet the needs of a majority of students taking a first year calculus at the college or university level. It does not replace a first year college calculus course. This course is comprised of both Precalculus and Calculus I topics including functions, limits, and derivatives. These topics are discussed with emphasis on real-life applications, problem solving, technology and communicating mathematics. The aim is to provide an introduction to calculus to students who will need to use it effectively later in engineering, mathematics, the physical and life sciences, as well as economics.

CURRICULUM WRITING TEAM:

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DATE OF REVISION:

2007

Wallenpaupack Area School District

Course: Introductory Calculus

Unit: Prerequisites

Grade Level: Grade 12

PA Standards:
2.1.11.A
2.2.11.A
2.2.11.F
2.5.11.A
2.5.11.B
2.5.11.C
2.5.11.D
2.8.11.A
2.8.11.D
2.8.11.E
2.8.11.J
2.8.11.K
2.8.11.L
2.8.11.M
2.8.11.N
2.8.11.Q
2.8.11.R
2.8.11.S
2.8.11.T
2.9.11.J

Topics:	Skills:
-Solving Equations -Solving Inequalities -Graphical Representations of Data -Graphs of Equations -Linear Equations in Two Variables	-Identify different types of equations -Solve linear equations in one variable -Solve quadratic equations by factoring, extracting square roots, completing the square, and the Quadratic Formula -Solve polynomial equations of degree 3 or greater -Solve equations involving radicals -Solve equations involving absolute value -Represent solutions of linear inequalities -Solve linear inequalities -Solve absolute value inequalities -Solve quadratic inequalities -Solve rational inequalities -Solve polynomial inequalities -Utilize the distance formula to calculate the distance between two points -Calculate the midpoint between two points using the Midpoint Formula -Model and solve real-life problems using a coordinate plane -Sketch the graphs of the various families of equations -Find x and y intercepts of a graph -Determine the type of symmetry a graph has both geometrically and analytically -Find the center and the radius of a circle given the equation in either standard form or general form

	-Determine the equation of a circle given the center and the radius or given key components about the circle -Sketch graphs of circles -Use graphs of equations in solving real-life problems -Calculate the slope of a line through two points -Determine whether two lines are parallel, perpendicular or neither based upon their slopes -Use slope to graph a linear equation in two variables -Interpret slopes in real life situations -Interpret slope as a ratio or a rate of change -Find slope intercept form of a line given key characteristics of the line -Find point slope form of a line given key characteristics of the line -Find the general (standard) form of a line given key characteristics of the line -Write equations of lines through given points that are parallel and perpendicular to given lines -Use linear equations in two variables to model and solve real-life problems
Activities:	**Performance Assessments:**
Textbook problem solving Individual, partner, & small group work Board work Utilizing the scientific and graphing calculator	Teacher produced tests and quizzes Class assignments Homework Class participation Board work Teacher observation

Course: Introductory Calculus

Unit: Functions and Their Graphs

Grade Level: Grade 12

PA Standards:
2.1.11.A
2.2.11.A
2.2.11.C
2.5.11.A
2.5.11.B
2.8.11.A
2.8.11.E
2.8.11.J
2.8.11.K
2.8.11.N
2.8.11.O
2.8.11.Q
2.8.11.R
2.8.11.S
2.8.11.T
2.11.11.A
2.11.11.B

Topics:	Skills:
-Functions -Analyzing Graphs of Functions -Shifting, Reflecting, and Stretching Graphs -Combinations of Functions -Inverse Functions	-Decide whether relations between two variables are functions -Use function notation and evaluate functions -Find the domain and range of functions -Use functions to model and solve real-life problems -Use the Vertical Line Test for functions -Find the zeros of functions -Determine increasing, decreasing and constant intervals of functions -Identify functions as odd or even -Identify and graph linear functions -Identify and graph step functions and other piecewise functions -Identify relative maxima and relative minima based on increasing and decreasing intervals -Recognize graphs of common functions -Use vertical and horizontal shifts to sketch graphs of functions -Use reflections to sketch graphs of functions -Use nonrigid transformations to sketch graphs of functions (dilations) -Add, subtract, multiply, and divide functions -Find the composition of functions -Use combinations of functions to

	model and solve real-life problems -Verify that two functions are inverse functions of one another -Use the graph of a function to decide whether the function has an inverse function -Use the Horizontal Line Test to determine if functions are one-to-one -Find inverse functions analytically
Activities:	**Performance Assessments:**
Textbook problem solving Individual, partner, & small group work Board work Utilizing the scientific and graphing calculator	Teacher produced tests and quizzes Class assignments Homework Class participation Board work Teacher observation

Course: Introductory Calculus	**Grade Level:** Grade 12
Unit: Polynomial and Rational Functions	**PA Standards:** 2.1.11.A 2.2.11.A 2.2.11.F 2.5.11.A 2.5.11.B 2.5.11.C 2.5.11.D 2.8.11.E 2.8.11.J 2.8.11.O 2.8.11.Q 2.8.11.R 2.8.11.S 2.8.11.T 2.9.11.J

Topics:	Skills:
-The Fundamental Theorem of Algebra -Rational Functions	-Understand and Use the Fundamental Theorem of Algebra -Understand and use the Rational Zeros Test -Find all the zeros of a polynomial function by applying the rational zeros tests in conjunction with technology -Write a polynomial function in both linear factored form and in standard form with real coefficients, given its zeros -Find the domain of rational functions -Find horizontal and vertical asymptotes of graphs of rational functions -Analyze and sketch graphs of rational functions -Use long polynomial division or synthetic division to find oblique (slant) asymptotes of rational graphs -Sketch graphs or rational functions that have slant asymptotes -Use rational functions to model and solve real-life problems
Activities:	**Performance Assessments:**
Textbook problem solving Individual, partner, & small group work Board work Utilizing the scientific and graphing calculator	Teacher produced tests and quizzes Class assignments Homework Class participation Board work Teacher observation

Course: Introductory Calculus   **Grade Level:** Grade 12

Unit: Limits and Their Properties   **PA Standards:** 2.1.11.A
2.2.11.A
2.2.11.B
2.2.11.D
2.2.11.E
2.2.11.F
2.4.11.A
2.5.11.A
2.5.11.B
2.5.11.C
2.5.11.D
2.8.11.A
2.8.11.C
2.8.11.E
2.8.11.J
2.8.11.O
2.8.11.Q
2.8.11.R
2.8.11.S
2.8.11.T

Topics:	Skills:
-A Preview of Calculus -Finding Limits Graphically and Numerically -Evaluating Limits Analytically -Continuity and One-Sided Limits -Infinite Limits	-Understand what calculus is and how it compares with precalculus -Understand that the tangent line is basic to calculus -Understand that the area problem is also basic to calculus -Estimate a limit using a numerical or graphical approach -Learn different ways that a limit can fail to exist -Study and use a formal definition of limit (epsilon and delta definition) -Evaluate a limit using properties of limits -Develop and use a strategy for finding limits -Evaluate a limit using dividing out and rationalizing techniques -Evaluate a limit using the Squeeze Theorem -Determine continuity at a point and continuity on an open interval -Determine one-sided limits and continuity on a closed interval -Understand the need for one-sided limits -Use properties of continuity -Distinguish between removable and non-removable discontinuity -Understand and use the Intermediate

	Value Theorem -Determine infinite limits from the left and from the right -Find and sketch the vertical asymptotes of the graph of a function
Activities:	**Performance Assessments:**
Textbook problem solving Individual, partner, & small group work Board work Utilizing the scientific and graphing calculator	Teacher produced tests and quizzes Class assignments Homework Class participation Board work Teacher observation

Course: Introductory Calculus   **Grade Level:** Grade 12

Unit: Differentiation   **PA Standards:**
2.1.11.A
2.2.11.A
2.2.11.F
2.4.11.A
2.5.11.A
2.5.11.B
2.5.11.C
2.5.11.D
2.6.11.C
2.8.11.A
2.8.11.E
2.8.11.J
2.8.11.K
2.8.11.L
2.8.11.M
2.8.11.N
2.8.11.O
2.8.11.Q
2.8.11.R
2.8.11.S
2.9.11.G
2.9.11.I
2.10.11.B

Topics:	Skills:
-The Derivative and the Tangent Line Problem -Basic Differentiation Rules and Rates of Change -The Product and Quotient Rules and Higher-Order Derivatives -The Chain Rule -Implicit Differentiation -Related Rates	-Find the slope of the tangent line to a curve at a point -Use the limit definition to find the derivative of a function -Understand the relationship between differentiability and continuity -Find the derivative of a function using the Constant Rule -Find the derivative of a function using the Power Rule -Find the derivative of a function using the Constant Multiple Rule -Find the derivative of a function using the Sum and Difference Rules -Use derivatives to find rates of change -Find the derivative of a function using the Product Rule -Find the derivative of a function using the Quotient Rule -Find a higher order derivative of a function -Apply the derivative and second derivative to position, velocity and acceleration -Use derivatives to model and solve real-life problems -Find the derivative of a composite function

	using the Chain Rule -Find the derivative of a function using the General Power Rule -Simplify the derivative of a function using algebra -Use the first and second derivatives to determine linear and quadratic approximations of a function -Distinguish between functions written in implicit form and explicit form -Use implicit differentiation to find the derivative of a function -Find a related rate -Use related rates to solve real-life problems
Activities:	**Performance Assessments:**
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Course: Introductory Calculus   **Grade Level:** Grade 12

Unit: Applications of Differentiation   **PA Standards:**
2.1.11.A
2.2.11.A
2.2.11.C
2.2.11.F
2.4.11.A
2.4.11.B
2.5.11.A
2.5.11.B
2.5.11.C
2.5.11.D
2.8.11.E
2.8.11.J
2.8.11.N
2.8.11.O
2.8.11.S
2.8.11.T
2.11.11.A
2.11.11.B

Topics:	Skills:
-Extrema on an Interval -Rolle's Theorem and the Mean Value Theorem -Increasing and Decreasing Functions and the First Derivative Test -Limits at Infinity -Concavity and the Second Derivative Test -Summary of Curve Sketching -Optimization Problems	-Understand the definition of extrema of a function on an interval -Understand the definition of relative extrema of a function on an open interval -Find extrema on a closed interval -Understand and use Rolle's Theorem -Understand and use the Mean Value Theorem -Determine intervals on which a function is increasing or decreasing -Apply the First Derivative Test to find relative extrema of a function -Determine intervals on which a function is concave up or concave down -Find any points of inflection of the graph of a function -Apply the Second Derivative Test to find relative extrema of a function -Determine limits at infinity, both finite and infinite -Determine the horizontal asymptotes, if any, of the graph of a function -Analyze and sketch the graph of a function -Use calculus to solve applied minimum and maximum problems
Activities:	**Performance Assessments:**
Textbook problem solving Individual, partner, & small group work Board work	Teacher produced tests and quizzes Class assignments Homework

Utilizing the scientific and graphing calculator	Class participation Board work Teacher observation