



Pine Grove Area

SCHOOL DISTRICT

Mathematics

Calculus

September 18, 2008

I. PHILOSOPHY:

The Calculus course of the Pine Grove Area School District has been structured to systematically introduce and reinforce the language of mathematics along with the use of fundamental operations, measurement, probability, statistics, algebra, and geometry. These skills will be practiced using many “real-world” application problems, including ones which will provide opportunities for “hands-on” learning. The course will allow for the accommodation of many learning styles, motivational levels, and academic abilities.

II. CORE CONCEPTS:

1. Fundamentals of Calculus- Identify, graph, and solve problems relating to linear, polynomial, rational, trigonometric, exponential, logarithmic, and hyperbolic functions.
2. Limits and Continuity- Define properties (theorems) of limits and function continuity, evaluate expressions involving limits (finite and infinite), and solve problems involving function continuity.
3. Fundamentals of Differentiation- Define rules/properties of differentiation (both explicit and implicit) and apply them in finding derivatives of linear, polynomial, rational, trigonometric, exponential, logarithmic, and hyperbolic functions.
4. Applications of Differentiation- Apply fundamentals of differentiation in the solving of real-world problems.
5. Fundamentals of Integration- Define rules/properties of integration (both definite and indefinite) and apply them in finding integrals of linear, polynomial, rational, trigonometric, exponential, logarithmic, and hyperbolic functions.
6. Applications of Integration- Apply fundamentals of integration in the solving of real-world problems.

III. COURSE OF STUDY:

A. Course Name: Calculus

B. Grade Level: 12

C. Length of Course: Full year

1. Frequency: Daily

2. Duration: 42 minutes

D. Academic Level: College Preparatory

E. Credits: 1

F. Prerequisites: Algebra I, II, III/Trigonometry, Geometry, Pre-Calculus

G. Course Description:

This course will be a continuation and expansion of topics begun in the Pre-Calculus course. It will include finding both the derivatives (by using the sum, product, quotient, and chain rules) and integrals of polynomial, exponential, logarithmic, and trigonometric functions and their practical applications.

IV. CONTENT: Calculus

CORE CONCEPT 1: Fundamentals of Calculus

MAJOR OBJECTIVE: Identify, graph, and solve problems relating to linear, polynomial, rational, trigonometric, exponential, logarithmic, and hyperbolic functions.

CURRICULUM STANDARD:			
PA State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 2.2F</p> <ul style="list-style-type: none"> Demonstrate skills for using computer spreadsheets and scientific and graphing calculators. 	<p>Teacher will guide students to:</p> <p>Graph and recognize the graphs of each of the various functions by using technology.</p>	<p>Teacher evaluation of:</p> <p>Whole class/small group discussions</p> <p>Teacher observations of:</p> <ul style="list-style-type: none"> student use of graphing calculators student board work <p>Student notebooks/written work</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Notebooks</p> <p>Graphing Calculators</p> <p>Manipulatives</p> <p>Supplemental materials</p>
<p>PA Standards 2.8.S</p> <ul style="list-style-type: none"> Analyze properties and relationships of functions and categorize them by their characteristics (e.g., linear, polynomial, rational, trigonometric, exponential, logarithmic, and hyperbolic). 	<p>Teacher will guide students to:</p> <p>Recognize characteristics associated with each of the various functions.</p> <p>Apply the characteristics associated with each of the various functions in helping to solve problems relating to them.</p>	<p>Teacher evaluation of:</p> <p>Whole class/small group discussions</p> <p>Teacher observations of:</p> <ul style="list-style-type: none"> student group work student board work <p>Student notebooks/written work</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Notebooks</p> <p>Graphing Calculators</p> <p>Manipulatives</p> <p>Supplemental materials</p>

CONTENT: Calculus

CORE CONCEPT 2: Limits and Continuity

MAJOR OBJECTIVE: Define properties (theorems) of limits and function continuity, evaluate expressions involving limits (finite and infinite), and solve problems involving function continuity.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 2.2.B</p> <ul style="list-style-type: none"> ▪ Use estimation to solve problems for which an exact answer is not needed. 	<p>Teacher will guide students to:</p> <p>Estimate a limit using either a numerical (table/chart) or graphical approach.</p>	<p>Teacher evaluation of:</p> <p>Whole class/small group discussions</p> <p>Teacher observations of:</p> <ul style="list-style-type: none"> - student use of graphing calculators - student group work - student board work <p>Student notebooks/written work</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Notebooks</p> <p>Graphing Calculators</p> <p>Manipulatives</p> <p>Supplemental materials</p>
<p>PA Standard 2.8.S</p> <ul style="list-style-type: none"> ▪ Analyze properties and relationships of functions (e.g., linear, polynomial, rational, trigonometric, exponential, logarithmic, and hyperbolic). 	<p>Teacher will guide students to:</p> <p>Recognize properties associated with limits and function continuity.</p> <p>Apply the limit properties in order to help evaluate limits algebraically.</p>	<p>Teacher evaluation of:</p> <p>Whole class/small group discussions</p> <p>Teacher observations of:</p> <ul style="list-style-type: none"> - student group work - student board work <p>Student notebooks/written work</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Notebooks</p> <p>Graphing Calculators</p> <p>Manipulatives</p> <p>Supplemental materials</p>

CONTENT: Calculus

CORE CONCEPT 2: Limits and Continuity

MAJOR OBJECTIVE: Define properties (theorems) of limits and function continuity, evaluate expressions involving limits (finite and infinite), and solve problems involving function continuity.

CURRICULUM STANDARD:			
State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
PA Standard 2.8.T <ul style="list-style-type: none">Analyze and categorize functions by their characteristics.	Teacher will guide students to: Apply the definition of function continuity in order to determine if a given function is or is not continuous.	Teacher evaluation of: Whole class/small group discussions Teacher observations of: <ul style="list-style-type: none">- student use of graphing calculators- student group work- student board work Student notebooks/written work	Textbook resources Computer programs/web sites Notebooks Graphing Calculators Manipulatives Supplemental materials

CONTENT: Calculus

CORE CONCEPT 3: Fundamentals of Differentiation

MAJOR OBJECTIVE: Define rules/properties of differentiation (both explicit and implicit) and apply them in finding derivatives of linear, polynomial, rational, trigonometric, exponential, logarithmic, and hyperbolic functions.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 2.8.S</p> <ul style="list-style-type: none">Analyze properties and relationships of functions (e.g., linear, polynomial, rational, trigonometric, exponential, logarithmic, and hyperbolic).	<p>Teacher will guide students to:</p> <p>Recognize properties associated with differentiation.</p> <p>Apply the differentiation properties in order to find the derivatives of various functions.</p>	<p>Teacher evaluation of:</p> <p>Whole class/small group discussions</p> <p>Teacher observations of:</p> <ul style="list-style-type: none">student group workstudent board work <p>Student notebooks/written work</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Notebooks</p> <p>Graphing Calculators</p> <p>Manipulatives</p> <p>Supplemental materials</p>

CONTENT: Calculus

CORE CONCEPT 4: Applications of Differentiation

MAJOR OBJECTIVE: Apply fundamentals of differentiation in the solving of real-world problems.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 2.2.A</p> <ul style="list-style-type: none"> ▪ Develop and use computation concepts, operations and procedures with real numbers in problem-solving situations. 	<p>Teacher will guide students to:</p> <p>Apply the properties of differentiation in solving real-world problems.</p>	<p>Teacher evaluation of:</p> <p>Whole class/small group discussions</p> <p>Teacher observations of:</p> <ul style="list-style-type: none"> - student use of graphing calculators - student group work - student board work <p>Student notebooks/written work</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Notebooks</p> <p>Graphing Calculators</p> <p>Manipulatives</p> <p>Supplemental materials</p>
<p>PA Standard 2.5.A</p> <ul style="list-style-type: none"> ▪ Select and use appropriate mathematical concepts and techniques from different areas of mathematics and apply them to solving non-routine and multi-step problems. 	<p>Teacher will guide students to:</p> <p>Apply concepts from other branches of mathematics in helping to solve real-world problems involving differentiation.</p>	<p>Teacher evaluation of:</p> <p>Whole class/small group discussions</p> <p>Teacher observations of:</p> <ul style="list-style-type: none"> - student use of graphing calculators - student group work - student board work <p>Student notebooks/written work</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Notebooks</p> <p>Graphing Calculators</p> <p>Manipulatives</p> <p>Supplemental materials</p>

CONTENT: Calculus

CORE CONCEPT 4: Applications of Differentiation

MAJOR OBJECTIVE: Apply fundamentals of differentiation in the solving of real-world problems.

CURRICULUM STANDARD:			
State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 2.8D</p> <ul style="list-style-type: none"> Formulate expressions, equations, inequalities, systems of equations, systems of inequalities and matrices to model routine and non-routine problem situations. 	<p>Teacher will guide students to:</p> <p>Formulate expressions, equations, and inequalities in helping to solve real-world problems involving differentiation.</p>	<p>Teacher evaluation of:</p> <p>Whole class/small group discussions</p> <p>Teacher observations of:</p> <ul style="list-style-type: none"> student group work student board work <p>Student notebooks/written work</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Notebooks</p> <p>Graphing Calculators</p> <p>Manipulatives</p> <p>Supplemental materials</p>
<p>PA Standards 2.11.A</p> <ul style="list-style-type: none"> Determine and interpret the maximum and minimum values over a specified interval in problem situations. 	<p>Teacher will guide students to:</p> <p>Solve real-world problems involving extrema.</p>	<p>Teacher evaluation of:</p> <p>Whole class/small group discussions</p> <p>Teacher observations of:</p> <ul style="list-style-type: none"> student use of graphing calculators student group work student board work <p>Student notebooks/written work</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Notebooks</p> <p>Graphing Calculators</p> <p>Manipulatives</p> <p>Supplemental materials</p>

CONTENT: Calculus

CORE CONCEPT 5: Fundamentals of Integration

MAJOR OBJECTIVE: Define rules/properties of integration (both definite and indefinite) and apply them in finding integrals of linear, polynomial, rational, trigonometric, exponential, logarithmic, and hyperbolic functions.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 2.8.S</p> <ul style="list-style-type: none">Analyze properties and relationships of functions (e.g., linear, polynomial, rational, trigonometric, exponential, logarithmic, and hyperbolic).	<p>Teacher will guide students to:</p> <p>Recognize properties associated with integration.</p> <p>Apply the integration properties in order to find the integrals of various functions.</p>	<p>Teacher evaluation of:</p> <p>Whole class/small group discussions</p> <p>Teacher observations of:</p> <ul style="list-style-type: none">student group workstudent board work <p>Student notebooks/written work</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Notebooks</p> <p>Graphing Calculators</p> <p>Manipulatives</p> <p>Supplemental materials</p>

CONTENT: Calculus

CORE CONCEPT 6: Applications of Integration

MAJOR OBJECTIVE: Apply fundamentals of integration in the solving of real-world problems.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 2.2.A</p> <ul style="list-style-type: none"> ▪ Develop and use computation concepts, operations and procedures with real numbers in problem-solving situations. 	<p>Teacher will guide students to:</p> <p>Apply the properties of integration in solving real-world problems.</p>	<p>Teacher evaluation of:</p> <p>Whole class/small group discussions</p> <p>Teacher observations of:</p> <ul style="list-style-type: none"> - student use of graphing calculators - student group work - student board work <p>Student notebooks/written work</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Notebooks</p> <p>Graphing Calculators</p> <p>Manipulatives</p> <p>Supplemental materials</p>
<p>PA Standard 2.5.A</p> <ul style="list-style-type: none"> ▪ Select and use appropriate mathematical concepts and techniques from different areas of mathematics and apply them to solving non-routine and multi-step problems. 	<p>Teacher will guide students to:</p> <p>Apply concepts from other branches of mathematics in helping to solve real-world problems involving integration.</p>	<p>Teacher evaluation of:</p> <p>Whole class/small group discussions</p> <p>Teacher observations of:</p> <ul style="list-style-type: none"> - student use of graphing calculators - student group work - student board work <p>Student notebooks/written work</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Notebooks</p> <p>Graphing Calculators</p> <p>Manipulatives</p> <p>Supplemental materials</p>

CONTENT: Calculus

CORE CONCEPT 6: Applications of Integration

MAJOR OBJECTIVE: Apply fundamentals of integration in the solving of real-world problems.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 2.8.D</p> <ul style="list-style-type: none"> ▪ Formulate expressions, equations, inequalities, systems of equations, systems of inequalities and matrices to model routine and non-routine problem situations. 	<p>Teacher will guide students to:</p> <p>Formulate expressions, equations, and inequalities in helping to solve real-world problems involving integration.</p>	<p>Teacher evaluation of:</p> <p>Whole class/small group discussions</p> <p>Teacher observations of:</p> <ul style="list-style-type: none"> - student group work - student board work <p>Student notebooks/written work</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Notebooks</p> <p>Graphing Calculators</p> <p>Manipulatives</p> <p>Supplemental materials</p>
<p>PA Standard 2.11.C</p> <ul style="list-style-type: none"> ▪ Graph and interpret rates of growth/decay. 	<p>Teacher will guide students to:</p> <p>Solve real-world problems involving growth/decay.</p>	<p>Teacher evaluation of:</p> <p>Whole class/small group discussions</p> <p>Teacher observations of:</p> <ul style="list-style-type: none"> - student use of graphing calculators - student group work - student board work <p>Student notebooks/written work</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Notebooks</p> <p>Graphing Calculators</p> <p>Manipulatives</p> <p>Supplemental materials</p>

V. EXPECTED LEVELS OF ACHIEVEMENT

A. Students are expected to reach the proficient level (a grade of “D” or above) of achievement, including all of the skills noted in the specific content area of this curriculum.

B. The grading system for Calculus class is as follows:

Grading Scale	
A	90%-100%
B	80%-89%
C	70%-79%
D	60%-69%
F	0%-59%

Each student’s grade will be determined at the conclusion of each marking period. Progress notes will be issued halfway through each marking period for those students who are performing below 70%.