

# **DARIEN PUBLIC SCHOOLS**

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## **CURRICULUM GUIDE**

### **Algebra 2**

Approved by the Board of Education On February 25, 2003

# **DARIEN PUBLIC SCHOOLS**

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## **CURRICULUM GUIDE AUTHORS**

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Patrick Dooley\*, Dan Haron, Shirley Taylor, Ann Hannon, Susan Wood, Tom Jockers,  
Mike O'Brien, Marsha Kasony, Bonita Messman, Mike Sullivan, Dan Record

\* Main author

## **DATES**

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Board of Education Approval on February 25, 2003

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# **SECTION I - Course Information**

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## **STATEMENT OF PHILOSOPHY**

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### **H.S. MATHEMATICS DEPARTMENT PHILOSOPHY**

We believe in creating learning environments where students practice and acquire the knowledge of mathematics. We believe that students should be able to proficiently apply a range of numerical, algebraic, geometric, and statistical concepts and the skills to formulate, analyze, and solve real world problems. The learning environment will facilitate inquiry, use of technology and the exploration of real world phenomena. It will support continuous development of mathematical skills and the appreciation of mathematics as a discipline. Our mathematics program seeks to graduate students who will possess a sense of numbers, data analysis, spatial relationships, symbolic representations, and the ability to communicate mathematics with others.

### **DISTRICT MATHEMATICS PHILOSOPHY**

Mathematics is a vigorous and growing discipline – a universal language useful for communication and research in other disciplines. We want our students to reason and communicate mathematically, to be mathematical problem-solvers, to value mathematics and to feel confident in their ability to use mathematics. Creating such a foundation necessitates a well-articulated and developmentally appropriate mathematics program for all, developing the mathematical power of each.

Mathematics is more than a collection of concepts and skills to be mastered. It is the exploration of ideas and concepts, the understanding of relationships, the ability to make predictions, to analyze data, to estimate results, to communicate ideas and to solve problems in this ever-changing world. It is no longer limited to the study of complex calculations and formulas. We are moving from a curriculum often dominated by memorization of isolated facts and procedures to one that emphasizes conceptual understandings, multiple representations, deliberate connections and mathematical problem solving. Rather than being a transmitter of knowledge, the teacher becomes a facilitator of learning, guiding, questioning, listening, clarifying and creating an environment in which the student is an active participant in learning.

The needs of today's society demand that all students become mathematically literate to function effectively. It will be necessary for our students to be able to use mathematics

in their personal lives, further studies and future workplaces. As educators, we must recognize that students have differing abilities, performance levels, needs and interests and provide them with the best mathematics education possible so that they may achieve their personal ambitions and career goals.

Too often, students have learned to compute without understanding why the computation procedures make sense or how they apply to their lives. Instruction must focus on the behaviors that contribute to the development of mathematical thinking and number sense – explaining procedures used, justifying reasoning, judging the reasonableness of solutions and reflecting on the application of concepts.

When students gain knowledge from meaningful experiences, they are much more likely to retain and use what they have learned. Sound practice in the teaching of mathematics means that students are guided to use concrete materials and explore ideas with classmates. In this way, knowledge evolves from personal experience.

The fundamental objective of education has always been to prepare students to be contributing members of the society in which they live. The objectives of this mathematics curriculum support and affirm this tradition.

## PROGRAM GOALS

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- Introduce to students the family tree of the complex number system.
- Have students graph different types of functions in the coordinate plane.
- Show the students different methods of solving a system of equations.
- Students should be able to recognize, solve and analyze quadratic equations.
- Give the students an understanding of imaginary numbers and their implications.
- Students should be able solve different types of problems involving exponents.
- The investigation of polynomials should lead students to the fundamental theorem of algebra.
- Have students learn the definition and the properties of logarithms.
- Students should be able to factor several types of polynomials.
- Students should know both the factor theorem and the rational root theorem .
- Irrational numbers and all the operations that involve irrational numbers should be covered.
- Given a real world situation relating two variables, students should be able to use an exponential, linear, quadratic, or cubic function as a mathematical model.

## **OVERVIEW**

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This course emphasizes the importance of mathematics through the development and application of extended algebraic concepts and skills. An underlying theme throughout the curriculum is the concept of a mathematical function. Students will study several different kinds of algebraic functions including linear functions, quadratic functions, cubic functions, exponential functions, logarithmic functions, and both rational and irrational algebraic functions. A heavy emphasis is placed on finding real life situations that can be modeled using any one of the functions studied. The relationship between mathematical concepts and their meaning in the real world is key. Students will also be introduced to the concepts of a complex number and imaginary number and how they fit into our mathematical system. Graphing these functions by hand and by using a graphing calculator will also be stressed. Use of the aforementioned TI-83 graphing calculator is extensive throughout the course and is an important tool in supplementing the students' knowledge.

Algebra 2 is offered for any student who has successfully completed both Algebra 1 and Geometry. However, upon approval, Geometry and Algebra 2 can be taken simultaneously.

## **ESSENTIAL QUESTIONS**

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1. What are the different classifications of numbers?
2. What is a function and how does it apply to real-life situations?
3. What is the most efficient way to graph a function?
4. How can we effectively use a graphing calculator to enhance the learning process?

### **K-12 Essential Questions**

- How does math help us to make sense of our world?
- How does math help us to understand real-world phenomena, make decisions and meet challenges?
- What are the natural and cultural patterns around us?
- How does math, as a universal language, empower us and help us to communicate?

## **PROCESS SKILLS**

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- Reading (Comprehending)
- Reading (Analyzing)
- Writing mathematical equations
- Listening
- Viewing
- Studying
- Reasoning and Reflecting
- Using Learning Resources, manipulatives, Technology
- Working Independently and Collaboratively
- Designing
- Creating
- Quantifying
- Understanding Number Operations
- Computing
- Using and Creating Formulas
- Problem Solving
- Graphing
- Applying Probability and Statistics
- Applying Scientific Method

## **STUDENT PERFORMANCE SUMMARY**

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- Cooperative learning
- Computer based lab work
- Graphing projects
- Oral Presentation with visuals
- Practical and Theoretical Applications
- Preparation for Standardized Tests
- Projects linked to science
- Tests and Quizzes
- Homework
- Class Participation

## **GRADING GUIDELINES**

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	<b><u>Expectations of Students</u></b>	<b><u>% of Report Card Grade</u></b>
Homework	100% of all assignments	0 -10%
Notebook	All notes maintained	
Tests	All tests taken/made up	45 – 60%
Quizzes	All quizzes taken/made up	30 – 40%
Mid-Year Exams		20% of semester grade
Final Exams		20% of semester grade
Projects		0 – 20%
Class Participation		0 – 5%

## SECTION II – Units of Study

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### SUMMARY OF UNITS

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CHAPTER/UNIT	Duration (weeks)
UNIT 1: SETS OF NUMBERS AND ALGEBRIAC PROPERTIES	2-3
UNIT 2: FUNCTIONS AND RELATIONS	2-3
UNIT 3: LINEAR FUNCTIONS	2-3
UNIT 4: SYSTEM OF LINEAR EQUATIONS AND INEQUALITIES	3-4
UNIT 5: QUADRATIC FUNCTIONS AND COMPLEX NUMBERS	5-6
UNIT 6: EXPONENTIAL AND LOGARITHMIC FUNCTIONS	5-6
UNIT 7: RATIONAL ALGEBRAIC FUNCTIONS	4-5
UNIT 8: IRRATIONAL ALGEBRAIC FUNCTIONS	4-5
UNIT 9: HIGHER DEGREE FUNCTIONS	3-4
UNIT 10: SEQUENCES AND SERIES	2-3

## UNIT 1: SETS OF NUMBERS AND ALGEBRIAC PROPERTIES

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- 1) Can the student properly classify a number?
- 2) Can a student evaluate and simplify an expression?

### STANDARDS

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**1. Number Sense** Students will use numbers to count, measure, compare, order, scale, locate and label, and use a variety of numerical representations to present, interpret, communicate and connect various kinds of numerical information.

**2. Operations** Students will add, subtract, multiply and divide with whole numbers, fractions, decimals and integers, and develop strategies for selecting the appropriate computational and operational methods for solving problems.

### CONTENT KNOWLEDGE OBJECTIVES

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#### Content:

1. Sets of numbers
2. The field axioms
3. Variables and expressions
4. Polynomials
5. Equations
6. Inequalities
7. Order of operations

#### Skills:

1. Classify a number
2. State properties
3. Recognize and name polynomials
4. Simplify expressions
5. Evaluate expressions
6. Solve equations and inequalities

### VOCABULARY

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Complex number, real number imaginary number, rational number, irrational number, integer, whole number, natural number, digit, transcendental number, axiom, lemma, corollary, hypothesis, monomial, binomial, trinomial

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## **ACTIVITIES**

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- Preliminary algebra diagnostic

## **PERFORMANCE ASSESSMENT**

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Tests, Quizzes, homework, special projects  
See page 8 for additional assessments

## **CORE TEXT FOR STUDENTS**

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Algebra and Trigonometry, Paul A. Foerster, Addison Wesley

## **ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS**

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See Section IV, Learning Resources

## **MATERIALS AND SUPPLIES**

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See Section IV, Learning Resources

## **UNIT 2: FUNCTIONS AND RELATIONS**

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1. Can the student graph an equation with two variables
  2. Where and how do functions appear in the real world?
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**1. Number Sense** Students will use numbers to count, measure, compare, order, scale, locate and label, and use a variety of numerical representations to present, interpret, communicate and connect various kinds of numerical information.

**2. Operations** Students will add, subtract, multiply and divide with whole numbers, fractions, decimals and integers, and develop strategies for selecting the appropriate computational and operational methods for solving problems.

**3. Estimation and Approximation** Students will make estimates and approximations, and judge the reasonableness of results.

**9. Algebra and Functions** Students will use algebraic skills and concepts, including functions, to describe real-world phenomena symbolically and graphically, and to model quantitative change.

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### **CONTENT KNOWLEDGE OBJECTIVES**

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#### **Content:**

1. Graphs of equations with two variables
2. Graphs of functions
3. Functions in the real world
4. Domain and Range
5. Function notation
6. Relation vs. Function

#### **Skills:**

1. Plot the graph of a given equation
  2. Tell whether a variable is independent or dependent
  3. Determine the domain and range
  4. Sketch a reasonable graph of a real world situation
  5. Graph an asymptote
  6. Determine the difference between a relation and a function
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## **VOCABULARY**

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Ordered pair, Cartesian coordinate system, domain, range, dependent variable, independent variable, asymptote, relation, function

## **ACTIVITIES**

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1. Using the vertical line test to determine if a relation is a function
2. Sketching graphs of real world phenomena

## **PERFORMANCE ASSESSMENT**

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Tests, Quizzes, homework, special projects  
See page 8 for additional assessments

## **CORE TEXT FOR STUDENTS**

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Algebra and Trigonometry, Paul A. Foerster, Addison Wesley

## **ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS**

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See Section IV, Learning Resources

## **MATERIALS AND SUPPLIES**

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See Section IV, Learning Resources

## UNIT 3: LINEAR FUNCTIONS

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1. Can the student convert a linear equation from form to form?
2. Can the student draw the graph of a linear equation?
3. Can the student determine the linear equation from given information?

## STANDARDS

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**1. Number Sense** Students will use numbers to count, measure, compare, order, scale, locate and label, and use a variety of numerical representations to present, interpret, communicate and connect various kinds of numerical information.

**2. Operations** Students will add, subtract, multiply and divide with whole numbers, fractions, decimals and integers, and develop strategies for selecting the appropriate computational and operational methods for solving problems.

**8. Patterns** Students will discover, analyze, describe, extend and create patterns, and use patterns to describe mathematical and other real-world phenomena.

**9. Algebra and Functions** Students will use algebraic skills and concepts, including functions, to describe real-world phenomena symbolically and graphically, and to model quantitative change.

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## CONTENT KNOWLEDGE OBJECTIVES

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### Content

1. Properties of linear equations
2. Slope intercept form of a linear equation
3. Point-slope form of a linear equation
4. Standard form of a linear equation
5. Parallel and perpendicular lines
6. Linear functions as mathematical models
7. Direct and inverse variation \*

### Skills

1. Graph a linear function
2. Find the slope of the line given two points

3. Find the x and y intercepts of a linear equation
4. Graph horizontal and vertical lines and discover their slope
5. Convert a linear equation from slope intercept form to standard form and vice versa
6. Transform an equation in point-slope form to the other two forms
7. Given information about its graph, write the particular linear equation
8. Find the slope of parallel and perpendicular lines
9. Investigate linear functions as mathematical models
10. Solve variation (linear) functions

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## **VOCABULARY**

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Linear function, general equation, x-intercept, y-intercept, slope, rise, run, horizontal, vertical, parallel, perpendicular, reciprocal, direct variation, inverse variation

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## **ACTIVITIES**

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TI-83 graph exploration

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## **PERFORMANCE ASSESSMENT**

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Tests, Quizzes, Homework, Special projects  
See page 8 for additional assessments

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## **CORE TEXT FOR STUDENTS**

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Algebra and Trigonometry, Paul A. Foerster, Addison Wesley

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## **ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS**

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See Section IV, Learning Resources

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## **MATERIALS AND SUPPLIES**

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See Section IV, Learning Resources

## UNIT 4: SYSTEM OF LINEAR EQUATIONS AND INEQUALITIES

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1. Can a student solve a system of equations using a variety of methods?
2. Can a student graph a system of linear inequalities?

### STANDARDS

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**2. Operations** Students will add, subtract, multiply and divide with whole numbers, fractions, decimals and integers, and develop strategies for selecting the appropriate computational and operational methods for solving problems.

**9. Algebra and Functions** Students will use algebraic skills and concepts, including functions, to describe real-world phenomena symbolically and graphically, and to model quantitative change.

### CONTENT KNOWLEDGE OBJECTIVES

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#### Content:

1. Systems of two or more linear equations
2. Systems of two non-linear equations
3. Solving systems
4. Function terminology
5. Function composition
6. Systems of Inequalities
7. Linear programming

#### Skills:

1. Solve systems of equations by graphing
2. Solve systems of equations by using the elimination method
3. Solve systems of equations by using the substitution method
4. Solve systems of two non-linear equations with two variables
5. Find the intersection of real-world graphs
6. Use function,  $f(x)$ , terminology
7. Solve a system of three equations with three variables using matrices
8. Graph a system of linear inequalities
9. Use linear programming techniques to find optimum values of two independent variables

## **VOCABULARY**

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System, simultaneous equations, inconsistent equations, dependent equations, independent equations, matrix, “ $f$  of  $x$ ”, linear programming, feasible region, maximize, minimize

## **ACTIVITIES**

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Linear Programming  
TI-83 calculator exploration using matrices

## **PERFORMANCE ASSESSMENT**

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Tests, Quizzes, homework, special projects  
See page 8 for additional assessments

## **CORE TEXT FOR STUDENTS**

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Algebra and Trigonometry, Paul A. Foerster, Addison Wesley

## **ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS**

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See Section IV, Learning Resources

## **MATERIALS AND SUPPLIES**

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See Section IV, Learning Resources

## UNIT 5: QUADRATIC FUNCTIONS AND COMPLEX NUMBERS

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1. What type of situation does a quadratic function model in real life?
2. How are complex numbers used in mathematics?

### STANDARDS

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**1. Number Sense** Students will use numbers to count, measure, compare, order, scale, locate and label, and use a variety of numerical representations to present, interpret, communicate and connect various kinds of numerical information.

**3. Estimation and Approximation** Students will make estimates and approximations, and judge the reasonableness of results.

**8. Patterns** Students will discover, analyze, describe, extend and create patterns, and use patterns to describe mathematical and other real-world phenomena.

**9. Algebra and Functions** Students will use algebraic skills and concepts, including functions, to describe real-world phenomena symbolically and graphically, and to model quantitative change.

### CONTENT KNOWLEDGE OBJECTIVES

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#### Content:

1. Definition of a quadratic function
2. Graphs of quadratic function
3. Quadratic function terminology
4. Imaginary and complex numbers
5. Methods for solving quadratic functions
6. Quadratic word problems

#### Skills:

1. Write the general equation of a quadratic function
2. Graph a parabola and identify its vertex, axis of symmetry, and other major features
3. Find the vertex of a parabola given its equation
4. Write the vertex form of a quadratic function using the completing the square method
5. Use the quadratic formula to find the solutions of a quadratic equation

6. Find the discriminant of a quadratic and use it to identify the nature of the roots
7. Classify an equations roots as rational, irrational or complex
8. Solve quadratic word problems
9. Given three noncollinear points, determine the related quadratic equation

## **VOCABULARY**

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Quadratic, parabola, axis of symmetry, x-intercept, roots, solutions, zeros, constant, vertex, maximum, minimum, symmetric point, discriminant, quadratic formula, imaginary number,  $i$ , complex number

## **ACTIVITIES**

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TI-83 exploration

## **PERFORMANCE ASSESSMENT**

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Tests, Quizzes, homework, special projects  
See page 8 for additional assessments

## **CORE TEXT FOR STUDENTS**

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Algebra and Trigonometry, Paul A. Foerster, Addison Wesley

## **ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS**

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See Section IV, Learning Resources

## **MATERIALS AND SUPPLIES**

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See Section IV, Learning Resources

## UNIT 6: EXPONENTIAL AND LOGARITHMIC FUNCTIONS

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1. How do exponential functions relate to real world situations?
2. How do logarithmic functions relate to real world situations?

### STANDARDS

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**4. Ratios, Proportions and Percents** Students will use ratios, proportions and percents to represent relationships between quantities and measures and solve problems involving ratios, proportions and percents.

**8. Patterns** Students will discover, analyze, describe, extend and create patterns, and use patterns to describe mathematical and other real-world phenomena.

**9. Algebra and Functions** Students will use algebraic skills and concepts, including functions, to describe real-world phenomena symbolically and graphically, and to model quantitative change.

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### CONTENT KNOWLEDGE OBJECTIVES

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#### Content

1. Exponentiation for positive integer exponents
2. Power properties
3. Rational exponents
4. Powers and radicals
5. Scientific notation
6. Exponential equations
7. Logarithms
8. Properties of logarithms
9. Inverses of functions
10. Mathematical models

#### Skills

1. Define the general equation of an exponential function
2. Recognize and graph an exponential equation
3. Evaluate expressions that have powers with positive integer exponents
4. Use the properties of exponents

5. Evaluate and simplify powers that involve rational exponents
6. Evaluate expressions containing radicals and/or fractional exponents
7. Transform numbers to and from scientific notation
8. Multiply or divide numbers in scientific notation
9. Solve an exponential equation using base 10 logarithms
10. Define a base  $b$  logarithm
11. Use the properties of logarithms to transform and/or solve equations
12. Find a function's inverse equation and graph both
13. Use exponential equations to solve real-world problems

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## **VOCABULARY**

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Exponent, base, power, mantissa, characteristic, compound interest, logarithm, natural logarithm, inverse function

## **ACTIVITIES**

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Compound interest problems  
Exponential growth and decay problems

## **PERFORMANCE ASSESSMENT**

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Tests, Quizzes, Homework, Special projects  
See page 8 for additional assessments

## **CORE TEXT FOR STUDENTS**

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Algebra and Trigonometry, Paul A. Foerster, Addison Wesley

## **ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS**

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See Section IV, Learning Resources

## **MATERIALS AND SUPPLIES**

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See Section IV, Learning Resources

## UNIT 7: RATIONAL ALGEBRAIC FUNCTIONS

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1. What happens to an algebraic function when the variable denominator is close to zero?

### STANDARDS

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**2. Operations** Students will add, subtract, multiply and divide with whole numbers, fractions, decimals and integers, and develop strategies for selecting the appropriate computational and operational methods for solving problems.

**3. Estimation and Approximation** Students will make estimates and approximations, and judge the reasonableness of results.

**9. Algebra and Functions** Students will use algebraic skills and concepts, including functions, to describe real-world phenomena symbolically and graphically, and to model quantitative change.

### CONTENT KNOWLEDGE OBJECTIVES

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#### Content:

1. Rational function graphs
2. Discontinuities and asymptotes
3. Special products and factoring
4. Long division of polynomials
5. The factor theorem and rational root theorem
6. Products and quotients of rational expressions
7. Sums and differences of rational expressions
8. Graphs of rational functions
9. Solving rational functions
10. Basic variation functions

#### Skills:

1. Define a rational algebraic function
2. Simplify a rational algebraic function
3. Graph a rational algebraic function and find its discontinuities and asymptotes
4. Factoring a difference of squares
5. Factoring a sum or difference of cubes
6. Factor by splitting the middle term
7. Multiply polynomials using FOIL or similar extensions

8. Finding and analyzing the discriminant of a quadratic
9. Divide polynomials by using long division
10. Factor cubics and higher degree polynomials
11. Find a polynomials possible rational roots
12. Multiply and divide rational expressions
13. Add and subtract rational expressions
14. Solving fractional equations
15. Use variation functions to solve real-world problems

## **VOCABULARY**

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Canceling, discontinuity, hole, asymptote, conjugates, factor, perfect square, perfect cube, prime quadratic, remainder, root, simplified, numerator, denominator, quotient, product, direct variation, inverse variation

## **ACTIVITIES**

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Inverse and direct variation word problems

## **PERFORMANCE ASSESSMENT**

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Tests, Quizzes, homework, special projects  
See page 8 for additional assessments

## **CORE TEXT FOR STUDENTS**

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Algebra and Trigonometry, Paul A. Foerster, Addison Wesley

## **ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS**

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See Section IV, Learning Resources

## **MATERIALS AND SUPPLIES**

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See Section IV, Learning Resources

## UNIT 8: IRRATIONAL ALGEBRAIC FUNCTIONS

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1. What is the difference between rational functions and irrational functions?
2. What does it mean for an equation to have an extraneous solution?

### STANDARDS

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**3. Estimation and Approximation** Students will make estimates and approximations, and judge the reasonableness of results.

**4. Ratios, Proportions and Percents** Students will use ratios, proportions and percents to represent relationships between quantities and measures and solve problems involving ratios, proportions and percents.

**9. Algebra and Functions** Students will use algebraic skills and concepts, including functions, to describe real-world phenomena symbolically and graphically, and to model quantitative change.

### CONTENT KNOWLEDGE OBJECTIVES

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#### Content

1. Graphs of irrational functions
2. Irrational numbers
3. Simplifying radicals
4. Solving radical equations
5. Roots
6. Variation functions with non integer exponents
7. Adding and subtracting radical expressions
8. Multiplying and dividing radical expressions

#### Skills

1. Find the value of an irrational algebraic function for a given domain
2. Write a radical expression in simplest form
3. Rationalize a denominator
4. Add and subtract radicals
5. Multiply and divide radicals
6. Find the solution set of a radical equation
7. Determine if a solution is extraneous
8. Determine a proportionality constant of a variation function
9. Use the variation function in a real life situation

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## **VOCABULARY**

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Irrational, radical, index, root, radicand, conjugate, rationalize, extraneous solution,

## **ACTIVITIES**

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Variation function problems

## **PERFORMANCE ASSESSMENT**

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Tests, Quizzes, Homework, Special projects

See page 8 for additional assessments

## **CORE TEXT FOR STUDENTS**

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Algebra and Trigonometry, Paul A. Foerster, Addison Wesley

## **ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS**

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See Section IV, Learning Resources

## **MATERIALS AND SUPPLIES**

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See Section IV, Learning Resources

## UNIT 9: HIGHER DEGREE FUNCTIONS

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1. What significance does the fundamental theorem of algebra have?
2. What are the different methods for finding roots of polynomial equations?

### STANDARDS

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**1. Number Sense** Students will use numbers to count, measure, compare, order, scale, locate and label, and use a variety of numerical representations to present, interpret, communicate and connect various kinds of numerical information.

**2. Operations** Students will add, subtract, multiply and divide with whole numbers, fractions, decimals and integers, and develop strategies for selecting the appropriate computational and operational methods for solving problems.

**9. Algebra and Functions** Students will use algebraic skills and concepts, including functions, to describe real-world phenomena symbolically and graphically, and to model quantitative change.

### CONTENT KNOWLEDGE OBJECTIVES

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#### Content

1. Complex numbers
2. Solutions of quadratics
3. Synthetic division
4. Graphs of higher degree functions
5. The remainder theorem
6. Product and sum of roots

#### Skills

1. Factor quadratics over the set of complex numbers
2. Recognize graphs of functions in degree one through four
3. Add, subtract, multiply and divide complex numbers
4. Finding the shortcut for multiplying complex conjugates
5. Simplify an imaginary number raised to a power
6. Write the equation of a quadratic given its roots
7. Use synthetic division to divide a polynomial by one of its linear factors
8. Find all of a polynomial's zeros
9. Use the fundamental theorem of algebra to find the nature of a polynomial's roots

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**VOCABULARY**

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Cubic, quartic, quintic, complex number, root, synthetic division

**ACTIVITIES**

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Sketch a graph of a higher degree polynomial

**PERFORMANCE ASSESSMENT**

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Tests, Quizzes, Homework, Special projects  
See page 8 for additional assessments

**CORE TEXT FOR STUDENTS**

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Algebra and Trigonometry, Paul A. Foerster, Addison Wesley

**ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS**

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See Section IV, Learning Resources

**MATERIALS AND SUPPLIES**

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See Section IV, Learning Resources

## UNIT 10: SEQUENCES AND SERIES (400 ONLY)

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1. Can the student describe a sequence?
2. Can the student compute sequences?

### STANDARDS

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**6. Spatial Relationships and Geometry** Students will analyze and use spatial relationships and basic concepts of geometry to construct, draw, describe and compare geometric models and their transformations, and use geometric relationships and patterns to solve problems.

**8. Patterns** Students will discover, analyze, describe, extend and create patterns, and use patterns to describe mathematical and other real-world phenomena.

**9. Algebra and Functions** Students will use algebraic skills and concepts, including functions, to describe real-world phenomena symbolically and graphically, and to model quantitative change.

**10. Discrete Mathematics** Students will use the concepts and processes of discrete mathematics to analyze and model a variety of real-world situations that involve recurring relationships, sequences, networks, combinations and permutations.

### CONTENT KNOWLEDGE OBJECTIVES

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#### Content

1. Arithmetic and geometric sequences
2. Arithmetic and geometric means
3. Arithmetic and geometric series
4. Convergent geometric series
5. Sequences and series as mathematical models
6. Factorials

#### Skills

Given the first few terms of a sequence, discover a pattern

Given the first few terms of a sequence, write a few more terms

Given the first few terms of a sequence, get a formula for  $t_n$  and calculate other term values

Given the first few terms of a sequence, tell whether it is arithmetic, geometric, or neither

Given a value of  $t_n$  for a specified arithmetic or geometric sequence, find the value of  $n$  and vice versa  
Find a specified number of arithmetic or geometric means between two numbers  
Calculate  $S_n$  and the  $n$ th partial sum  
Tell whether a geometric series converges and if it does find its limit

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## **VOCABULARY**

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Arithmetic means, arithmetic sequence, arithmetic series, array, finite series, geometric means, geometric sequence, geometric series, infinite series, progression, sequence, partial sums

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## **PERFORMANCE ASSESSMENT**

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Tests, Quizzes, Homework, Special projects  
See page 8 for additional assessments

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## **CORE TEXT FOR STUDENTS**

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Algebra and Trigonometry, Paul A. Foerster, Addison Wesley

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## **ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS**

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See Section IV, Learning Resources

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## **MATERIALS AND SUPPLIES**

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See Section IV, Learning Resources

## SECTION III - Goals and Standards

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### RELATED GOALS and STANDARDS

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## Connecticut Content Standards

**1. Number Sense** Students will use numbers to count, measure, compare, order, scale, locate and label, and use a variety of numerical representations to present, interpret, communicate and connect various kinds of numerical information.

**2. Operations** Students will add, subtract, multiply and divide with whole numbers, fractions, decimals and integers, and develop strategies for selecting the appropriate computational and operational methods for solving problems.

**3. Estimation and Approximation** Students will make estimates and approximations, and judge the reasonableness of results.

**4. Ratios, Proportions and Percents** Students will use ratios, proportions and percents to represent relationships between quantities and measures and solve problems involving ratios, proportions and percents.

**5. Measurement** Students will make and use measurements in both customary and metric units to approximate, measure and compute length, area, volume, mass, temperature, angle and time.

**6. Spatial Relationships and Geometry** Students will analyze and use spatial relationships and basic concepts of geometry to construct, draw, describe and compare geometric models and their transformations, and use geometric relationships and patterns to solve problems.

**7. Probability and Statistics** Students will use basic concepts of probability and statistics to collect, organize, display and analyze data, simulate events and test hypotheses.

**8. Patterns** Students will discover, analyze, describe, extend and create patterns, and use patterns to describe mathematical and other real-world phenomena.

**9. Algebra and Functions** Students will use algebraic skills and concepts, including functions, to describe real-world phenomena symbolically and graphically, and to model quantitative change.

**10. Discrete Mathematics** Students will use the concepts and processes of discrete mathematics to analyze and model a variety of real-world situations that involve recurring relationships, sequences, networks, combinations and permutations.

## **NCTM Standards**

### **1. Number & Operations**

- Understand numbers, ways of representing numbers, relationships among numbers, and number systems
- Understand meanings of operations and how they relate to one another
- Compute fluently and make reasonable estimates

### **2. Algebra**

- Understand patterns, relations, and functions
- Represent and analyze mathematical situations and structures using algebraic symbols
- Use mathematical models to represent and understand quantitative relationships
- Analyze change in various contexts

### **3. Geometry**

- Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships
- Specify locations and describe spatial relationships using coordinate geometry and other representational systems
- Apply transformations and use symmetry to analyze mathematical situations
- Use visualization, spatial reasoning, and geometric modeling to solve problems

### **4. Measurement**

- Understand measurable attributes of objects and the units, systems, and processes of measurement
- Apply appropriate techniques, tools, and formulas to determine measurements

### **5. Data Analysis & Probability**

- Understand and apply basic concepts of probability

### **6. Problem Solving**

- build new mathematical knowledge through problem solving;
- solve problems that arise in mathematics and in other contexts;
- apply and adapt a variety of appropriate strategies to solve problems;

- monitor and reflect on the process of mathematical problem solving

### **7. Reasoning & Proof**

- recognize reasoning and proof as fundamental aspects of mathematics;
- make and investigate mathematical conjectures;
- develop and evaluate mathematical arguments and proofs;
- select and use various types of reasoning and methods of proof

### **8. Communication**

- organize and consolidate their mathematical thinking through communication;
- communicate their mathematical thinking coherently and clearly to peers, teachers, and others;
- analyze and evaluate the mathematical thinking and strategies of others;
- use the language of mathematics to express mathematical ideas precisely

### **9. Connections**

- recognize and use connections among mathematical ideas;
- understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
- recognize and apply mathematics in contexts outside of mathematics.

### **10. Representation**

- create and use representations to organize, record, and communicate mathematical ideas;
- select, apply, and translate among mathematical representations to solve problems;
- use representations to model and interpret physical, social, and mathematical phenomena

## SECTION IV – Learning Resources

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### SUPPLEMENTAL RESOURCES (Most located in math department closet)

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#### Text books

- Algebra 2 and Trigonometry, John Benson et. al., McDougal, Littell
- Algebra 2 with Trigonometry, Eugene Nichols et. al. , Holt
- Algebra and Trigonometry Structure and Method, Mary Dolciani et. al. , Houghton Mifflin

#### Websites

- [www.nctm.org](http://www.nctm.org)
- [www.learner.org/exhibits/dailymath](http://www.learner.org/exhibits/dailymath)
- [www.math.temple.edu/~paulos](http://www.math.temple.edu/~paulos)
- [www.mathforum.org](http://www.mathforum.org)
- [www.maa.org](http://www.maa.org)
- [www.mathematicallycorrect.com](http://www.mathematicallycorrect.com)
- [www.personal.cfw.com/~clayford](http://www.personal.cfw.com/~clayford)
- [www.math.com](http://www.math.com)
- [www.math.uah.edu/psol](http://www.math.uah.edu/psol)
- [www.nilesonline.com/stats](http://www.nilesonline.com/stats)
- [www.mathmistakes.com](http://www.mathmistakes.com)
- [www.innumeracy.com](http://www.innumeracy.com)
- [www.techlar.com/fractals](http://www.techlar.com/fractals)
- [www.superstringtheory.com](http://www.superstringtheory.com)

#### Other Resources

- TTL/C-5 Computer Lab
- Microsoft Excel
- TI-83 graphing calculator
- World Almanac
- Media center
- Winplot
- LiveMath
- Access