

TRUMBULL PUBLIC SCHOOLS

Trumbull, Connecticut

ACP Algebra 2 Grades 10-11

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Curriculum Writing Team:

Shannon Bolan	Mathematics Teacher, Trumbull High School
Amanda Bull	Mathematics Teacher, Trumbull High School
Kristin Sroka	Mathematics Department Chair, Trumbull High School
Susan C. Iwanicki, Ed. D. Assistant Superintendent	

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The Trumbull Board of Education promotes non-discrimination in all of its programs, including educational opportunities and services provided to students, student assignment to schools and classes, and educational offerings and materials.

CORE VALUES AND BELIEFS

The Trumbull High School community engages in an environment conducive to learning which believes that all students will **read and write effectively**, therefore communicating in an articulate and coherent manner. All students will participate in activities **that present problem-solving through critical thinking**. Students will use technology as a tool applying it to decision making. We believe that by fostering self-confidence, self-directed and student-centered activities, we will promote **independent thinkers and learners**. We believe **ethical conduct** to be paramount in sustaining the welcoming school climate that we presently enjoy.

Approved 8/26/2011

INTRODUCTION & PHILOSOPHY

Advanced College Preparatory Algebra II is designed for the student who has successfully completed ACP Algebra I and ACP Geometry and prepares them for ACP PreCalculus and ultimately ACP or AP Calculus. Students will build on their work with linear, quadratic and exponential functions to extend their repertoire of functions to include polynomial, rational, and radical functions. Students will work closely with expressions that define functions and continue to expand and hone their abilities to model situations and to solve equations including solving quadratic equations over the set of complex numbers. Trigonometric ratios are introduced using the unit circle and other circles on the coordinate plane, expanding on students' prior knowledge of right triangle trigonometry.

The new curriculum continues to incorporate the State Standards while addressing the needs of SAT preparation. The curriculum prepares students for success in Precalculus and Calculus.

COURSE GOALS

The Standards for Mathematical Practice describe varieties of expertise that all teachers of mathematics will develop in their students.

These practices rest on important “processes and proficiencies” which have long been valued in mathematics education.

1. Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary.

2. Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it

symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved.

Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to

ISTE Computational Thinker Students develop and employ strategies for understanding (Standard 5) and solving problems in ways that leverage the power of technological methods to develop and test solutions. 5b. Students collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision making. compute them; and knowing and flexibly using different properties of operations and objects.

3. Construct viable arguments and critique the reasoning of others.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is.

4. Model with mathematics.

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace.

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5. Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data.

They are able to use technological tools to explore and deepen their understanding of concepts.

6. Attend to precision.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning.

They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

7. Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure.

They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects.

8. Look for and express regularity in repeated reasoning.

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

COURSE ENDURING UNDERSTANDINGS

Students will understand . . .

- various aspects of linear, quadratic, polynomial, rational, and radical functions which occur frequently in a variety of applications.
- how to represent the solution of linear inequalities and systems of linear inequalities
- the relationship between functions and their inverses, and the operations and compositions of functions
- the six trigonometric functions and their fundamental relationships.

COURSE ESSENTIAL QUESTIONS

- How can we solve equations and inequalities?
- What do the coefficients and constants in a function tell us about its graph and solutions?
- How do we solve and interpret systems of linear equations and inequalities, and what do their solutions represent?
- How do we simplify and perform operations with radical and complex expressions, and how do these help solve equations with no real solutions?
- What are the key properties of functions, and how do we determine if a relation is a function and find its domain and range?
- How do transformations such as translations, reflections, and dilations affect the graph of a function?
- What methods can we use to factor polynomials and solve quadratic equations, and how do the solutions to equations relate to the graphs of functions?
- How can we solve rational equations and simplify rational expressions?

- What are trigonometric functions and how do we use the unit circle to evaluate trig ratios?
- How are functions and their inverses related, and how can we find and verify inverses of functions?

COURSE KNOWLEDGE & SKILLS

Students will know . . .

- linear, quadratic, polynomial, rational, and radical functions, and their graphs.
- how to solve linear inequalities and systems of linear inequalities.
- inverses, operations and composition of functions.
- the six trigonometric functions and the unit circle.

Students will be able to . . .

- analyze and graph linear, quadratic, polynomial, rational, and radical functions.
- solve linear inequalities and systems of linear inequalities.
- define the six trigonometric functions.
- use trigonometric functions to solve applied problems involving right triangles.

UNITS OF STUDY

Unit 1 - Linear Equations

Unit Overview

This unit introduces key algebraic concepts necessary for success in advanced mathematics. Students will strengthen foundational skills, explore linear relationships, and solve systems of equations using multiple methods. Emphasis will be placed on developing procedural fluency, conceptual understanding, and application through problem-solving and technology.

Essential Questions

- What methods can be used to simplify, solve, and analyze algebraic expressions and equations?
- What is a linear function?
- What are the different ways equations for linear functions may be represented?
- What is the significance of the slope and y-intercept of a linear function?
- How do linear relationships help us describe patterns of change?
- What strategies can be used to solve systems of linear equations effectively?
- What does the number of solutions (none, one, or infinite) of a system of linear equations represent?

Standards Alignment

Simplifying Algebraic Expressions

- CCSS.MATH.CONTENT.HSA.SSE.A.1
- CCSS.MATH.CONTENT.HSA.SSE.A.1.A

Solving Linear Equations

- CCSS.MATH.CONTENT.HSA.REI.A.1
- CCSS.MATH.CONTENT.HSA.REI.B.3
- CCSS.MATH.CONTENT.HSA.CED.A.4

Slope

- CCSS.MATH.CONTENT.HSF.IF.B.6

Linear Functions

- CCSS.MATH.CONTENT.HSF.IF.C.7.A
- CCSS.MATH.CONTENT.HSF.IF.C.8.A
- CCSS.MATH.CONTENT.HSA.CED.A.2
- CCSS.MATH.CONTENT.HSF.BF.A.1

Solving Systems of Linear Equations

- CCSS.MATH.CONTENT.HSA.REI.C.5
- CCSS.MATH.CONTENT.HSA.REI.C.6

Scope and Sequence

Simplifying Algebraic Expressions

- Order of operations
- Distributive property
- Write algebraic expressions from verbal expressions

Solving Linear Equations

- Solve multi-step equations
- Solve equations using the fraction-busting method
- Solve literal equations

Slope

- Slope as a constant rate of change
- Find slope from points
- Find slope from a graph of a line

Linear Functions

- Slope-intercept form
- Write an equation in slope-intercept form given a graph
- Graph linear functions from slope-intercept form
- Convert equations into slope-intercept form
- Point-slope form
- Write an equation given slope and point
- Write an equation given 2 points
- Find x- and y-intercepts from any form
- Write an equation of a parallel or perpendicular line given a point and an equation of another line
- Graph lines on the graphing calculator

Solving Systems of Linear Equations

- Solve by graphing (by hand and on the graphing calculator)
- Solve by substitution
- Solve by elimination
- Identify systems that have no solution and infinitely many solutions

Assured Assessments

Formative Assessment:

- Homework assignments with feedback
- Online assignments with interactive platforms that provide immediate feedback
- Class discussions and collaborative work
- Quick checkpoint quizzes

Summative Assessment:

- Unit test covering all objectives (Graphing Calculator Permitted)

Resources and Materials

- Graphing calculators
- Interactive online platforms (e.g., Desmos, Khan Academy)
- Worksheets and practice sets
- Videos for flipped classroom lessons

Time Allotment: Approximately 13 (1-hour) class blocks

Unit 2 - Linear Inequalities

Unit Overview

This unit builds on linear concepts by exploring inequalities and their representations. Students will solve and graph inequalities in one and two variables and analyze systems of inequalities.

Essential Questions

- What are the similarities and differences between equations and inequalities?
- How can solutions to inequalities be represented algebraically using different notations?
- How can solutions to inequalities be represented graphically?
- What does the solution to a system of inequalities represent?
- How do the solutions of a system of equalities and a system of inequalities differ?

Standards Alignment

Solving Linear Inequalities in One Variable

- CCSS.MATH.CONTENT.HSA.REI.B.3
- CCSS.MATH.CONTENT.HSA.CED.A.1

Solving Linear Inequalities in Two Variables

- CCSS.MATH.CONTENT.HSA.REI.D.12
- CCSS.MATH.CONTENT.HSA.CED.A.3

Solving Systems of Inequalities

- CCSS.MATH.CONTENT.HSA.REI.D.12

Scope and Sequence

Solving Linear Inequalities in One Variable

- Solve inequalities
- Write solutions in set-builder and interval notation
- Graph solutions on a number line

Solving Linear Inequalities in Two Variables

- Graph inequalities on the coordinate plane
- Write inequalities given a graph
- Graph inequalities on the graphing calculator

Solving Systems of Inequalities

- Solve a system by graphing on the coordinate plane
- Identify systems that have no solution

Assured Assessments

Formative Assessment:

- Homework assignments with feedback
- Online assignments with interactive platforms that provide immediate feedback
- Class discussions and collaborative work
- Quick checkpoint quizzes

Summative Assessment:

- Unit test covering all objectives (No Graphing Calculator)

Resources and Materials

- Graphing calculators
- Interactive online platforms (e.g., Desmos, Khan Academy)
- Worksheets and practice sets
- Videos for flipped classroom lessons

Time Allotment: Approximately 5 (1-hour) class blocks

Unit 3 - Radicals and Complex Numbers

Unit Overview

This unit introduces students to radicals, rational exponents, and complex numbers, laying the groundwork for advanced mathematical concepts. Emphasis is placed on simplifying expressions, performing operations, and understanding the properties of complex numbers.

Essential Questions

- When does a radical need to be simplified?
- How can radical expressions be simplified and manipulated?
- What is the relationship between radicals and rational exponents?
- What does i signify?
- What is the difference between an imaginary number and a complex number?
- How are operations with complex numbers similar to and different from operations with real numbers?

Standards Alignment

Simplifying Radicals

- CCSS.MATH.CONTENT.HSN.RN.A.1
- CCSS.MATH.CONTENT.HSN.RN.A.2

Rational Exponents

- CCSS.MATH.CONTENT.HSN.RN.A.1
- CCSS.MATH.CONTENT.HSN.RN.A.2

Operations with Radicals

- CCSS.MATH.CONTENT.HSA.SSE.A.2

Complex Numbers

- CCSS.MATH.CONTENT.HSN.CN.A.1
- CCSS.MATH.CONTENT.HSN.CN.A.2
- CCSS.MATH.CONTENT.HSN.CN.A.3

Scope and Sequence

Simplifying Radicals

- Rewrite square roots in simplest radical form (whole numbers and variables under radical)
- Rewrite cube roots in simplest radical form (integers and variables under radical)

Rational Exponents

- Convert expressions between radical and rational exponents
- Simplify expressions with rational exponents and rewrite in simplest radical form

Operations with Radicals

- Add and subtract square roots (whole numbers only)
- Multiply square roots (whole numbers only, including radical expressions with multiple terms)
- Divide square roots and rationalize denominators (including with conjugates)

Complex Numbers

- Find square roots of negative numbers
- Simplify imaginary numbers
- Add and subtract complex numbers
- Multiply complex numbers
- Divide complex numbers (including with conjugates)

Assured Assessments

Formative Assessment:

- Homework assignments with feedback
- Online assignments with interactive platforms that provide immediate feedback
- Class discussions and collaborative work
- Quick checkpoint quizzes

Summative Assessment:

- Unit test covering all objectives (No Graphing Calculator)

Resources and Materials

- Graphing calculators
- Interactive online platforms (e.g., Desmos, Khan Academy)
- Worksheets and practice sets
- Videos for flipped classroom lessons

Time Allotment: Approximately 10 (1-hour) class blocks

Unit 4 - Relations and Functions

Unit Overview

This unit explores the foundational concepts of functions, their representations, and characteristics. Students will analyze functions graphically, algebraically, and numerically, focusing on domain, range, and behavior.

Essential Questions

- What defines a function, and how can it be represented?
- When is a relation classified as a function?
- What is the difference between a discrete and a continuous function?
- How are domain and range determined and expressed in different notations?
- What is the difference between domain and range?
- What can the end behavior, zeros, and extrema of a function tell us?
- What are the extrema of functions?
- How do you identify the end behavior of graphs?
- How do you find zeros of a function algebraically, graphically, and with technology?

Standards Alignment

Function Characteristics

- CCSS.MATH.CONTENT.HSF.IF.A.1
- CCSS.MATH.CONTENT.HSF.IF.A.2
- CCSS.MATH.CONTENT.HSF.IF.B.4

Domain and Range

- CCSS.MATH.CONTENT.HSF.IF.A.1
- CCSS.MATH.CONTENT.HSF.IF.B.5

Evaluating Functions

- CCSS.MATH.CONTENT.HSF.IF.A.2

End Behavior

- CCSS.MATH.CONTENT.HSF.IF.B.4

Zeros and Extrema

- CCSS.MATH.CONTENT.HSF.IF.C.7

Scope and Sequence

Function Characteristics

- Function notation
- Determine if a relation is a function

- Vertical Line Test
- Classify functions as linear, exponential, quadratic, cubic, rational, or radical
- Classify functions as discrete, continuous, or neither (i.e., discontinuous piecewise)

Domain and Range

- Find the domain and range of discrete functions in set-builder notation
- Find the domain and range of continuous and piecewise functions in set-builder and interval notation

Evaluating Functions

- Evaluate functions algebraically
 - At specific real number values
 - At expressions
- Evaluate functions from a table and graph

End Behavior

- Describe the end behavior of a function, given a graph, using limit notation

Zeros

- Find the zeros of a function from a graph
- Find the zeros of a function using the graphing calculator

Extrema

- Find the relative maximums and minimums from a graph
- Find the relative maximums and minimums from a graph using the graphing calculator

Assured Assessments

Formative Assessment:

- Homework assignments with feedback
- Online assignments with interactive platforms that provide immediate feedback
- Class discussions and collaborative work
- Quick checkpoint quizzes

Summative Assessment:

- Unit test covering all objectives (Graphing Calculator Required)

Resources and Materials

- Graphing calculators
- Interactive online platforms (e.g., Desmos, Khan Academy)
- Worksheets and practice sets
- Videos for flipped classroom lessons

Time Allotment: Approximately 10 (1-hour) class blocks

Unit 5 - Piecewise Functions

Unit Overview

This unit focuses on piecewise-defined functions and their graphical representations. Students will learn to write equations, graph functions, and analyze their behavior.

Essential Questions

- How is an equation of a piecewise function written?
- How do you graph a piecewise function?
- How can the domain and range of piecewise functions be determined?
- How do we evaluate piecewise functions effectively?

Standards Alignment

Graphing Piecewise Functions

- CCSS.MATH.CONTENT.HSF.IF.C.7

Domain and Range

- CCSS.MATH.CONTENT.HSF.IF.B.5

Evaluating Functions

- CCSS.MATH.CONTENT.HSF.IF.A.2

Scope and Sequence

Graphing Piecewise Functions

- Write a piecewise equation given a graph
- Graph a piecewise function

Domain and Range

- Find the domain and range of piecewise functions in set-builder and interval notation

Evaluating Functions

- Evaluate a piecewise function at specific real number values algebraically
- Evaluate a piecewise function at specific real number values from a graph

Assured Assessments Formative Assessment:

- Homework assignments with feedback

- Online assignments with interactive platforms that provide immediate feedback
- Class discussions and collaborative work
- Quick checkpoint quizzes

Summative Assessment:

- Unit test covering all objectives (Graphing Calculator Permitted)

Resources and Materials

- Graphing calculators
- Interactive online platforms (e.g., Desmos, Khan Academy)
- Worksheets and practice sets
- Videos for flipped classroom lessons

Time Allotment: Approximately 6 (1-hour) class blocks

Unit 6 - Polynomial Expressions

Unit Overview

In this unit, students will explore the properties of polynomial expressions, their operations, and factoring techniques. The unit also includes solving literal equations that require factoring.

Essential Questions

- How are properties of exponents used to simplify expressions?
- How are polynomial expressions added, subtracted, or multiplied?
- When is it appropriate to use long division to divide polynomials and when is it appropriate to use synthetic?
- How do we factor polynomial expressions effectively?
- How can literal equations be solved using factoring?

Standards Alignment

Properties of Exponents

- CCSS.MATH.CONTENT.HSN.RN.A.1

Operations with Polynomials

- CCSS.MATH.CONTENT.HSA.APR.A.1
- CCSS.MATH.CONTENT.HSA.APR.A.2

Factoring Polynomials

- CCSS.MATH.CONTENT.HSA.SSE.A.2
- CCSS.MATH.CONTENT.HSA.SSE.B.3

Solving Literal Equations

- CCSS.MATH.CONTENT.HSA.CED.A.4

Scope and Sequence

Properties of Exponents

- Simplify expressions including quotients of monomials
 - Include negative exponents
 - Include rational exponents

Operations with Polynomials

- Add and subtract polynomials
- Multiply polynomials (distributive and FOIL)
- Divide polynomials
 - Divide by monomial
 - Long division
 - Synthetic division

Factoring Polynomials

- Greatest Common Factor (GCF)
- Grouping
- Trinomials with $a = 1$
- Trinomials with $a > 1$
- Difference of Squares
- Perfect square trinomials
- Sum and Difference of cubes

Solving Literal Equations

- Solve literal equations that require factoring

Assured Assessments

Formative Assessment:

- Homework assignments with feedback
- Online assignments with interactive platforms that provide immediate feedback
- Class discussions and collaborative work
- Quick checkpoint quizzes

Summative Assessment:

- Unit test covering all objectives (Graphing Calculator Permitted)

Resources and Materials

- Graphing calculators

- Interactive online platforms (e.g., Desmos, Khan Academy)
- Worksheets and practice sets
- Videos for flipped classroom lessons

Time Allotment: Approximately 15 (1-hour) class blocks

Unit 7 - Transformations of Functions

Unit Overview

In this unit, students will learn how to graph various types of functions, including absolute value, quadratic, cubic, square root, and cube root functions, using transformations. They will explore how translations, reflections, and dilations affect the graphs and how to write equations for transformed functions.

Essential Questions

- What are parent functions and what are each of their key points?
- How do transformations (translations, reflections, and dilations) affect the graph of a function?
- How can you identify key features (vertex, inflection point, endpoint) of different functions?
- How do you write an equation for a function given its graph?
- How do the domain and range of a function relate to its transformations?

Standards Alignment

Function Equations and Graphing

- CCSS.MATH.CONTENT.HSF.BF.B.3

Scope and Sequence

Graphing Absolute Value Functions

- Graph the parent function using a table
- Identify the vertex
- Apply transformations (translate, reflect, dilate vertically)
- Find the domain and range
- Write an equation for the transformed function

Graphing Quadratic Functions from Vertex Form

- Graph the parent function using a table
- Identify the vertex
- Apply transformations (translate, reflect, dilate vertically)
- Find the domain and range
- Write an equation for the transformed function

Graphing Cubic Functions

- Graph the parent function using a table
- Identify the point of inflection
- Apply transformations (translate, reflect, dilate vertically)
- Find the domain and range
- Write an equation for the transformed function

Graphing Square Root Functions

- Graph the parent function using a table
- Identify the endpoint
- Apply transformations (translate, reflect, dilate vertically)
- Find the domain and range
- Write an equation for the transformed function

Graphing Cube Root Functions

- Graph the parent function using a table
- Identify the point of inflection
- Apply transformations (translate, reflect, dilate vertically)
- Find the domain and range
- Write an equation for the transformed function

Assured Assessments

Formative Assessment:

- Homework assignments with feedback
- Online assignments with interactive platforms that provide immediate feedback
- Class discussions and collaborative work
- Quick checkpoint quizzes

Summative Assessment:

- Unit test covering all objectives (No Graphing Calculator)

Resources and Materials

- Graphing calculators
- Interactive online platforms (e.g., Desmos, Khan Academy)
- Worksheets and practice sets
- Videos for flipped classroom lessons

Time Allotment: Approximately 7 (1-hour) class blocks

Unit 8 - Graphing Quadratic and Polynomial Functions

Unit Overview

This unit focuses on graphing quadratic and polynomial functions, analyzing their features, and determining their behavior based on the function's degree and leading coefficient. Students will also practice finding zeros, identifying key features, and using the graphing calculator for accurate visual representation.

Essential Questions

- How do you determine maximum or minimum values of a quadratic function?
- How do the degree and leading coefficient of a polynomial function affect its graph?
- How can you determine the end behavior and zeros of a quadratic or polynomial function?
- How do you graph quadratic functions from standard form?
- How do you find the zeros of a quadratic or polynomial function using a graphing calculator?
- In what cases could a quadratic equation have one or no zeros?

Standards Alignment

- CCSS.MATH.CONTENT.HSA.REI.D.10
- CCSS.MATH.CONTENT.HSA.CED.A.2
- CCSS.MATH.CONTENT.HSA.SSE.A.1

Scope and Sequence

Graphing Quadratic Functions

- Graph from standard form using a table
- Use axis of symmetry, y-intercept, and vertex
- Find the domain and range
- Find zeros using the graphing calculator

Graphing Polynomial Functions

- Determine the degree and leading coefficient
- Describe end behavior using limit notation
- Identify real zeros and analyze their multiplicities
- Find zeros and extrema using the graphing calculator

Assured Assessments

Formative Assessment:

- Homework assignments with feedback
- Online assignments with interactive platforms that provide immediate feedback
- Class discussions and collaborative work
- Quick checkpoint quizzes

Summative Assessment:

- Unit test covering all objectives (No Graphing Calculator)

Resources and Materials

- Graphing calculators
- Interactive online platforms (e.g., Desmos, Khan Academy)
- Worksheets and practice sets
- Videos for flipped classroom lessons

Time Allotment: Approximately 6 (1-hour) class blocks

Unit 9 - Solving Quadratic and Polynomial Equations

Unit Overview

In this unit, students will learn various methods for solving quadratic and polynomial equations. They will explore solving using the square-root property, zero-product property, quadratic formula, and completing the square. Additionally, they will investigate the discriminant to determine the number and type of roots.

Essential Questions

- How can the square-root property be used to solve quadratic equations with both real and complex solutions?
- How does the zero-product property help in solving quadratic and polynomial equations?
- How do you solve quadratic equations using the quadratic formula?
- How can the discriminant be used to analyze the solutions of quadratic equations?
- What types of solutions of a quadratic equation are possible?
- How can completing the square be applied to solve quadratic equations with both simple and complex coefficients?
- What information can be easily determined when a quadratic is factored?

Standards Alignment

- CCSS.MATH.CONTENT.HSA.SSE.A.1
- CCSS.MATH.CONTENT.HSA.CED.A.4
- CCSS.MATH.CONTENT.HSA.REI.B.4
- CCSS.MATH.CONTENT.HSA.REI.C.7

Scope and Sequence

Square-Root Property

- Solve quadratic equations with real solutions using the square-root property
- Solve quadratic equations with complex solutions using the square-root property

Zero-Product Property

- Solve quadratic equations by factoring (GCF, trinomials, difference of squares)
- Solve polynomial equations by factoring
- Use grouping to factor and solve polynomial equations
- Solve equations in quadratic form
- Write a polynomial equation given the roots

Quadratic Formula

- Use the quadratic formula to find all real and complex solutions to quadratic equations
- Solve polynomial equations involving sum and difference of cubes (factor first, then use quadratic formula)

The Discriminant

- Use the discriminant to describe the number and types of roots for a quadratic equation
- Graph the related function to confirm solutions to a quadratic equation

Solving Quadratic Equations by Completing the Square

- Solve quadratic equations by completing the square when $a = 1$
- Solve quadratic equations by completing the square when $a > 1$

Assured Assessments

Formative Assessment:

- Homework assignments with feedback
- Online assignments with interactive platforms that provide immediate feedback
- Class discussions and collaborative work
- Quick checkpoint quizzes

Summative Assessment:

- Unit test covering all objectives (Graphing Calculator Permitted)

Resources and Materials

- Graphing calculators
- Interactive online platforms (e.g., Desmos, Khan Academy)
- Worksheets and practice sets
- Videos for flipped classroom lessons

Time Allotment: Approximately 10 (1-hour) class blocks

Unit 10 - Quadratic and Polynomial Applications

Unit Overview

In this unit, students will apply their knowledge of quadratic and polynomial equations to solve real-world problems. They will work with geometric, numerical, and projectile motion problems, as well as create polynomial expressions from real-life scenarios.

Essential Questions

- How can quadratic equations be used to solve geometric word problems?
- How can we use quadratic functions to model projectile motion problems?
- How do we create polynomial expressions based on real-world situations?
- What do the zeros and the vertex of a quadratic function mean in a real-world situation?

Standards Alignment

- CCSS.MATH.CONTENT.HSA.CED.A.2
- CCSS.MATH.CONTENT.HSA.REI.B.3

Scope and Sequence

Quadratic Word Problems

- Geometric word problems
- Find the numbers word problems
- Projectile motion word problems

Polynomial Word Problems

- Write a polynomial expression from a real-world problem

Assured Assessments

Formative Assessment:

- Homework assignments with feedback
- Online assignments with interactive platforms that provide immediate feedback
- Class discussions and collaborative work
- Quick checkpoint quizzes

Summative Assessment:

- Unit test covering all objectives (Graphing Calculator Permitted)

Resources and Materials

- Graphing calculators
- Interactive online platforms (e.g., Desmos, Khan Academy)
- Worksheets and practice sets
- Videos for flipped classroom lessons

Time Allotment: Approximately 6 (1-hour) class blocks

Unit 11 - Rational Expressions and Equations

Unit Overview

In this unit, students will focus on simplifying, adding, subtracting, multiplying, and dividing rational expressions. They will also solve rational equations and check for extraneous solutions.

Essential Questions

- What is a rational expression?
- Where are rational expressions undefined?
- How do you find the least common multiple of polynomial expressions and thus the least common denominator of rational expressions?
- How do you simplify rational expressions?
- How can you solve and check for extraneous solutions in rational equations?
- When you divide two rational functions, how do you determine the domain of the resulting function?

Standards Alignment

- CCSS.MATH.CONTENT.HSA.RAT.A.1
- CCSS.MATH.CONTENT.HSA.CED.A.3

Scope and Sequence

Multiplying and Dividing Rational Expressions

- Simplifying rational expressions
- Determine undefined values
- Simplify complex fractions
- Multiply and divide rational expressions

Adding and Subtracting Rational Expressions

- Find the LCM of monomials and polynomials
- Add and subtract rational expressions with monomial and polynomial denominators
- Simplify complex fractions with different and the same LCDs

Solving Rational Equations

- Solve rational equations
- Check for extraneous solutions

Assured Assessments

Formative Assessment:

- Homework assignments with feedback
- Online assignments with interactive platforms that provide immediate feedback
- Class discussions and collaborative work
- Quick checkpoint quizzes

Summative Assessment:

- Unit test covering all objectives (Graphing Calculator Permitted)

Resources and Materials

- Graphing calculators
- Interactive online platforms (e.g., Desmos, Khan Academy)
- Worksheets and practice sets
- Videos for flipped classroom lessons

Time Allotment: Approximately 10 (1-hour) class blocks

Unit 12 - Operations with Functions and Inverses

Unit Overview

This unit will explore operations with functions, such as addition, subtraction, multiplication, and division, and the composition of functions. Additionally, students will learn about inverse functions and how to determine if a function is one-to-one and how to find its inverse.

Essential Questions

- How can you add, subtract, multiply, and divide functions?
- What is the composition of functions, and how do you evaluate it?
- How is $f(g(x))$ different from $g(f(x))$?
- How do you determine if a function has an inverse, and how do you find it?
- How are the graphs of functions and their inverses related?
- Why are some inverses of functions not functions?
- What is the horizontal line test and what does it determine?
- Why would certain functions need to have a restricted domain in order to find its inverse?
- How are the domain and range of a function related to the domain and range of its inverse?
- How do you verify a pair of functions are inverses algebraically?

Standards Alignment

- CCSS.MATH.CONTENT.HSF.BF.A.1
- CCSS.MATH.CONTENT.HSF.BF.B.4

Scope and Sequence

Operations with Functions

- Add, subtract, multiply, and divide functions
- Identify domain restrictions

Composition of Functions

- Evaluate composite functions
- Perform composition of functions

Inverse Functions and Relations

- Determine if a function is one-to-one
- Find an inverse relation and its graph
- Use the horizontal line test to verify if a function has an inverse
- Discuss the necessity of domain restrictions for inverses
- Verify inverses

Assured Assessments

Formative Assessment:

- Homework assignments with feedback
- Online assignments with interactive platforms that provide immediate feedback
- Class discussions and collaborative work
- Quick checkpoint quizzes

Summative Assessment:

- Unit test covering all objectives (Graphing Calculator Permitted)

Resources and Materials

- Graphing calculators
- Interactive online platforms (e.g., Desmos, Khan Academy)
- Worksheets and practice sets
- Videos for flipped classroom lessons

Time Allotment: Approximately 7 (1-hour) class blocks

Unit 13 - Trigonometric Functions

Unit Overview

In this unit, students will learn about trigonometric functions in right triangles, the unit circle, and how to evaluate trig functions for different angle measures. They will also work with angle conversions and solve real-world problems.

Essential Questions

- How do we use trigonometric ratios to solve right triangles?
- What is the relationship between the angle of elevation and the angle of depression in a right triangle?
- What is the difference between an angle in geometry and an angle in trigonometry?
- What are coterminal angles?
- How can we convert between angle measures in degrees and radians?
- What is the unit circle, and how can we use it to evaluate trig functions?
- What are the defining characteristics of a reference angle for a nonquadrantal angle in standard position?

Standards Alignment

- CCSS.MATH.CONTENT.HSF.TF.A.1
- CCSS.MATH.CONTENT.HSF.TF.B.5

Scope and Sequence

Trigonometric Functions in Right Triangles

- Special right triangles (no calculator)
- Find all six trig ratios for a given triangle
- Solve trig equations using a calculator (in degree mode)
- Applications: angle of elevation and depression

Angle Measure in Radians and Degrees

- Draw angles in standard position
- Find coterminal angles
- Convert between degrees and radians
- Find reference angles

Unit Circle

- Find sine and cosine of special angles using the unit circle
- Use the quadrant and reference angles to evaluate trig functions

Angle Not on the Unit Circle

- Evaluate trig functions given a point
- Evaluate trig functions given a trig ratio

Assured Assessments

Formative Assessment:

- Homework assignments with feedback
- Online assignments with interactive platforms that provide immediate feedback
- Class discussions and collaborative work

- Quick checkpoint quizzes

Summative Assessment:

- Unit test covering all objectives (2 parts: 1 with Graphing Calculator, 1 without)

Resources and Materials

- Graphing calculators
- Interactive online platforms (e.g., Desmos, Khan Academy)
- Worksheets and practice sets
- Videos for flipped classroom lessons

Time Allotment: Approximately 9 (1-hour) class blocks

Unit 14 - Solving Non-Polynomial Equations

Unit Overview

This unit will focus on solving equations involving radicals and absolute values. Students will learn to solve square root, cube root, and equations with rational exponents, as well as multi-step absolute value equations.

Essential Questions

- How do you solve radical equations involving square roots, cube roots, and rational exponents?
- How do you create two cases to solve multi-step absolute value equations?
- How can you determine if a radical or absolute value equation has no solution?
- What does it mean to have an extraneous solution to a radical equation?

Standards Alignment

- CCSS.MATH.CONTENT.HSA.REI.B.3
- CCSS.MATH.CONTENT.HSA.REI.D.10

Scope and Sequence

Solving Radical Equations

- Solve square root equations
- Solve cube root equations
- Solve equations with rational exponents

Solving Absolute Value Equations

- Solve multi-step absolute value equations

Assured Assessments

Formative Assessment:

- Homework assignments with feedback
- Online assignments with interactive platforms that provide immediate feedback
- Class discussions and collaborative work
- Quick checkpoint quizzes

Summative Assessment:

- Unit test covering all objectives (Graphing Calculator Permitted)

Resources and Materials

- Graphing calculators
- Interactive online platforms (e.g., Desmos, Khan Academy)
- Worksheets and practice sets
- Videos for flipped classroom lessons

Time Allotment: Approximately 5 (1-hour) class blocks

CURRENT REFERENCES

There is no textbook for this course.

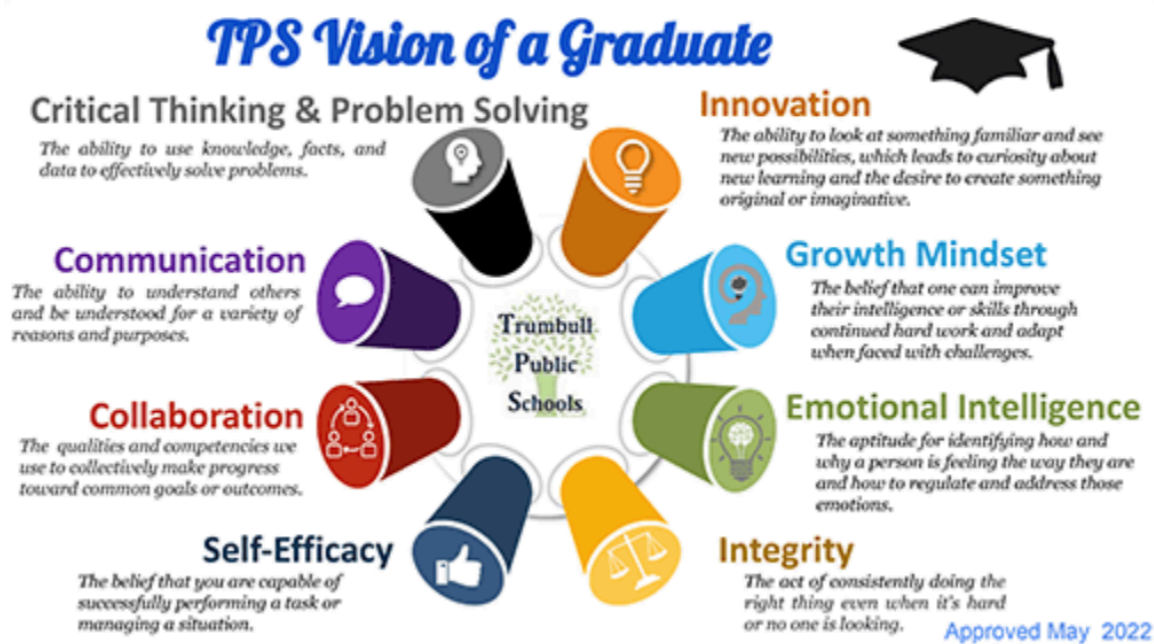
2023 Connecticut Core Standards for Mathematics

https://corestandards.org/wp-content/uploads/2023/09/Math_Standards1.pdf

COURSE CREDIT

1.0 credits in mathematics
One class period for one year

TPS VISION OF THE GRADUATE SKILLS AND DISPOSITIONS



ASSURED STUDENT PERFORMANCE RUBRICS

TPS Vision of the Graduate Rubric

Skill Rubric: **Critical Thinking/Problem Solving Gr 9-12 (rev. 2024)**

(Note: VOG Rubrics may be revised by the district committee as needed)

Indicator of Attainment	Beginning 1	Meets 2	Exceeds 3
UNDERSTANDING Identifies the problem question or issue being addressed.	Exhibits limited and/or no understanding of key concepts.	Exhibits an understanding of key concepts.	Exhibits a thorough and accurate understanding of key concepts and can access those concepts from multiple perspectives.
PLANNING Applies systematic thinking and selects strategies to address the problem, question or issue.	Shows limited to no evidence of a plan, model or strategy to solve a problem.	Shows a plan, model or strategy to solve a problem.	Shows innovative and creative thinking to solve a problem.
QUESTIONING Analyzes relevant information related to the problem, question or issue.	Unable to or has difficulty questioning and analyzing numerical, written, or visual data and identifying related evidence.	Questions and analyzes numerical, written, or visual data and selects the relevant evidence.	Questions and analyzes numerical, written, or visual data and selects the most relevant and impactful evidence. Describes why different approaches to a problem or situation could yield the same or similar results.
REFLECTION Makes evidence-based conclusions/solutions and makes adjustments as needed to address the problem, question or issue.	Solution is inadequately supported or supported with minimal evidence, limited analysis of data and relevant information.	Solution is accurately supported by evidence and the student makes conclusions based on appropriate evidence.	Solution is thorough, accurate, and evidence-based. Shows extensive, thoughtful and reflective thinking on how a problem is solved and makes adjustments as needed.

SCORING

Beginning: 4 - 6

Meets: 7 - 9 **GOAL**

Exceeds: 10 - 12

TEACHER GUIDE

Unit One: Linear Equations

Simplifying Algebraic Expression

- Order of operations
- Distributive property
- Write algebraic expressions from verbal expressions

Solving Linear Equations

- Solve multi-step equations
- Solve equations using the fraction-busting method
- Solve literal equations

Slope

- Slope as a constant rate of change
- Find slope from points
- Find slope from a graph of a line

Linear Functions

- Slope-intercept form
 - Write an equation in slope-intercept form given a graph
 - Graph linear functions from slope-intercept form
 - Convert equations into slope-intercept form
- Point-slope form
 - Write an equation given slope and point
 - Write an equation given 2 points
- Find x- and y-intercepts from any form
- Write an equation of a parallel or perpendicular line given a point and an equation of another line
- Graph lines on the graphing calculator

Solving Systems of Linear Equations

- Solve by graphing
 - by hand
 - on the graphing calculator
- Solve by substitution
- Solve by elimination
- Identify systems that have no solution and infinitely many solutions

Unit 1 Assessment (Graphing Calculator Permitted)

Maximum 13 class periods

Unit Two: Linear Inequalities

Solving Linear Inequalities in One Variable

- Solve inequalities
 - Write solutions in set-builder and interval notation
 - Graph solutions on a number line

Solving Linear Inequalities in Two Variables

- Graph inequalities on the coordinate plane
- Write inequalities given a graph
- Graph inequalities on the graphing calculator

Solving Systems of Inequalities

- Solve a system by graphing on the coordinate plane
- Identify systems that have no solution

Unit 2 Assessment (No Graphing Calculator)

Maximum 5 class periods

Unit Three: Radicals and Complex Numbers

Simplifying Radicals

- Rewrite square roots in simplest radical form
 - whole numbers and variables under radical
- Rewrite cube roots in simplest radical form
 - integers and variables under radical

Rational Exponents

- Convert expressions between radical and rational exponents
- Simplify expression with rational exponents
 - rewrite in simplest radical form

Operations with Radicals

- Add and subtract square roots
 - whole numbers only
- Multiply square roots
 - whole numbers only
 - include multiplying radical expressions with multiple terms
- Divide square roots
 - Rationalizing denominator (including with conjugate)

Complex Numbers

- Find square roots of negative numbers
- Simplify imaginary numbers
- Add and subtract complex numbers
- Multiply complex numbers
- Divide complex numbers (including with conjugate)

Unit 3 Assessment (No Graphing Calculator)

Maximum 10 class periods

Unit Four: Relations and Functions

Function Characteristics

- Function notation
- Determine if a relation is a function
 - Vertical Line Test
- Classify functions as linear, exponential, quadratic, cubic, rational, or radical
- Classify functions as discrete, continuous, or neither (i.e. discontinuous piecewise)

Domain and Range

- Find the domain and range of discrete functions in set-builder notation
- Find the domain and range of continuous and piecewise functions in set-builder and interval notation

Evaluating Functions

- Evaluate functions algebraically
 - at specific real number values
 - at expressions
- Evaluate functions from a table and graph

End Behavior

- Describe the end behavior of a function, given a graph, using limit notation

Zeros

- Find the zeros of a function from a graph
- Find the zeros of a function using the graphing calculator

Extrema

- Find the relative maximums and minimums from graph
- Find the relative maximums and minimums from graph using the graphing calculator

Unit 4 Assessment (Graphing Calculator Required)

Maximum 10 class periods

Unit Five: Piecewise Functions

Graphing Piecewise Functions

- Write a piecewise equation given a graph
- Graph a piecewise function

Domain and Range

- Find the domain and range of piecewise functions in set-builder and interval notation

Evaluating Functions

- Evaluate a piecewise function at specific real number values algebraically
- Evaluate a piecewise function at specific real number values from a graph

Unit 5 Assessment (Graphing Calculator Permitted)

Maximum 6 class periods

Unit Six: Polynomial Expressions

Properties of Exponents

- Simplify expressions including quotients of monomials
 - include negative exponents
 - include rational exponents

Operations with Polynomials

- Add and subtract polynomials
- Multiply polynomials (distributive and FOIL)
- Divide polynomials
 - Divide by monomial
 - Long division
 - Synthetic division

Factoring Polynomials

- GCF
- Grouping
- Trinomials with $a = 1$
- Trinomials with $a > 1$
- Difference of Squares
- Perfect square trinomials
- Sum and Difference of cubes

Solving Literal Equations

- Solve literal equations that require factoring

Unit 6 Assessment (Graphing Calculator Permitted)

Maximum 15 class periods

END OF SEMESTER 1 - 59 class periods

Unit Seven: Transformations of Functions

Graphing Absolute Value Functions

- Graph the parent function by making a table
- Identify the vertex of the function
- Graph absolute value functions using transformations
 - Translate, Reflect, Dilate vertically
- Find the domain and range of the function
- Write an equation for the function given a graph

Graphing Quadratic Functions from Vertex Form

- Graph the parent function by making a table
- Identify the vertex of the function
- Graph quadratic functions using transformations
 - Translate, Reflect, Dilate vertically
- Find the domain and range of the function
- Write an equation for the function given a graph

Graphing Cubic Functions

- Graph the parent function by making a table
- Identify the point of inflection of the function
- Graph cubic functions using transformations
 - Translate, Reflect, Dilate vertically
- Find the domain and range of the function
- Write an equation for the function given a graph

Graphing Square Root Functions

- Graph the parent function by making a table
- Identify the endpoint of the function
- Graph square root functions using transformations
 - Translate, Reflect, Dilate vertically
- Find the domain and range of the function
- Write an equation for the function given a graph

Graphing Cube Root Functions

- Graph the parent function by making a table
- Identify the point of inflection of the function
- Graph cube root functions using transformations
 - Translate, Reflect, Dilate vertically
- Find the domain and range of the function
- Write an equation for the function given a graph

Unit 7 Assessment (No Graphing Calculator)

Maximum 7 class periods

Unit Eight: Graphing Quadratic and Polynomial Functions

Graphing Quadratic Functions

- Graph from standard form using a table
- Graph from standard form using axis of symmetry, y-intercept, and vertex
- Find the domain and range of a quadratic function
- Find the zeros of a quadratic function using the graphing calculator

Graphing Polynomial Functions

- Find the degree and identify the leading coefficient
- Describe end behavior using limit notation, determine odd/even degree, state the # of real zeros
- Identify the “behavior of the graph” at each zero using the multiplicity of each zero
- Find zeros and maxes and mins in graphing calculator

Unit 8 Assessment (No Graphing Calculator)

Maximum 6 class periods

Unit Nine : Solving Quadratic and Polynomial Equations

Square-Root Property

- Solve quadratic equations with real solutions using square-root property
- Solve quadratic equations with complex solutions using square-root property

Zero - Product Property

- Solve quadratic equations by factoring
 - GCF, trinomials, difference of squares
- Solve polynomial equations by factoring
 - Grouping
 - Solve equations in quadratic form
- Write a polynomial equation given the roots

Quadratic Formula

- Find all real and complex solutions to quadratic equations by using the quadratic formula
- Solve polynomial equations involving sum and difference of cubes
 - factor first, then use quadratic formula

The Discriminant

- Use the discriminant to describe the number and types of root for a quadratic equation
- Graph the related function to confirm solutions to a quadratic equation

Solving Quadratic Equations by Completing the Square

- Solve by completing the square $a = 1$
- Solve by completing the square $a > 1$

Unit 9 Assessment (Graphing Calculator Permitted)

Maximum 10 class periods

Unit Ten: Quadratic and Polynomial Applications

Quadratic Word Problems

- Geometric word problems
- Find the numbers word problems
- Projectile Motion word problems

Polynomial Word Problems

- Write a polynomial expression from a real world problem

Unit 10 Assessment (Graphing Calculator Permitted)

Maximum 6 class periods

Unit Eleven: Rational Expressions and Equations

Multiplying and Dividing Rational Expressions

- Simplifying rational expressions
- Determine undefined values
- Simplifying with -1
- Multiply and divide rational expressions
- Simplify complex fractions

Adding and Subtracting Rational Expressions

- LCM of monomials and polynomials
- Monomial denominators
- Polynomial denominators
- Complex fractions with different LCDs
- Complex fractions with same LCDs

Solving Rational Equations

- Solve a rational equation
 - check for extraneous solutions

Unit 11 Assessment (Graphing Calculator Permitted)

Maximum 10 class periods

Unit Twelve: Operations with Functions and Inverses

Operations with Functions

- Add, subtract, multiply and divide functions (Identify domain restrictions)

Composition of Functions

- Evaluate composite functions
- Perform composition of functions

Inverse Functions and Relations

- Determine if a function is one-to-one
- Find an inverse relation
- Find and graph an inverse
- Horizontal line test
- Inverses with restricted domains (just show why a function would need to be restricted in order to find its inverse)
- Verify inverses

Unit 12 Assessment (Graphing Calculator Permitted)

Maximum 7 class periods

Unit Thirteen: Trigonometric Functions

Trigonometric Functions in Right Triangles

- Special right triangles (no calculator)
- Find all six trig ratios for a given triangle
- Solve trig equations using a calculator (in degree mode)
 - 1 step equations
- Find a missing side length
- Find a missing angle
- Applications
 - include angle of elevation and depression

Angle Measure in Radians and Degrees

- Draw angles in standard position
- Find coterminal angles
- Convert between degrees and radians
- Quadrantal angles
- Find reference angles

Unit Circle

- Find sine and cosine of a special angle using a point on the unit circle
- Find all six trig ratios for special angles using the unit circle
 - Use the quadrant and the reference angle to evaluate without a calculator

Angle Not on the Unit Circle

- Evaluate trig functions given a point
- Evaluate trig functions given a trig ratio

Unit 13 Assessment (2 parts - 1 w/Graphing Calculator, 1 w/out)

Maximum 9 class periods

Unit Fourteen: Solving Non-polynomial Equations

Solving Radical Equations

- Solve square root equations
- Solve cube root equations
- Solve equations with rational exponents

Solving Absolute Value Equations

- Solve multi-step absolute value equations

Unit 14 Assessment (Graphing Calculator Permitted)

Maximum 5 class periods

END OF SEMESTER 2 - 60 class periods