

Separate Algebra 2 CP Curriculum Guide

TRUMBULL PUBLIC SCHOOLS

Trumbull, Connecticut

CP Algebra 2 Grades 10-12

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CP Algebra 2

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Table of Contents

CORE VALUES AND BELIEFS	2
INTRODUCTION & PHILOSOPHY	2
COURSE GOALS	2
COURSE ENDURING UNDERSTANDINGS	4
COURSE ESSENTIAL QUESTIONS	4
COURSE KNOWLEDGE & SKILLS	5
UNITS OF STUDY	5
Unit 1A: Linear Equations.....	5
Unit 1B: Systems of Linear Equations.....	7
Unit 2: Linear Inequalities and Systems of Linear Inequalities.....	8
Unit 3: Radicals and Complex Numbers.....	11
Unit 4: Relations and Functions.....	13
Unit 5A: Polynomials and their Operations.....	15
Unit 5B: Factoring Polynomials.....	16
Unit 6: Graphing Transformations of Functions.....	17
Unit 7: Graphing Quadratic Functions.....	19
Unit 8A: Solving Quadratic Equations.....	20
Unit 8B: Quadratic Word Problems.....	22
Unit 9: Trigonometric Functions.....	23
Unit 10: Rational Functions.....	24
Unit 11: Solving Non-Polynomial Equations.....	25
Unit 12: Operations with Functions and Inverses *If time allows.....	26
CURRENT REFERENCES	28
COURSE CREDIT	28
TPS VISION OF THE GRADUATE SKILLS AND DISPOSITIONS	28
ASSURED STUDENT PERFORMANCE RUBRICS	29
TEACHER GUIDE – College Prep Algebra 2	32

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

College Preparatory Algebra II is designed for the student who has successfully completed CP Algebra I and most have completed CP Geometry and prepares them for CP College Mathematics and CP Practical Applications. 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 and solving exponential equations using the properties of logarithms. Trigonometric ratios are introduced using the unit circle and other circles on the coordinate plane, expanding on students' prior knowledge of right triangle trigonometry.

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. The following Course Goals derive from the 2016 International Society for Technology in Education Standards.

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

5c. Students break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem solving.

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 three trigonometric functions (sine, cosine, tangent) and their fundamental relationships.
- technology can help them analyze, organize, and display data to support their conclusions.

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 . . .

- how to solve linear, quadratic, polynomial, rational, and radical functions,
- how to identify linear, quadratic, and polynomial graphs.
- how to solve linear inequalities and systems of linear inequalities.
- the three trigonometric functions (sine, cosine, tangent) and the unit circle.

Students will be able to . . .

- analyze and graph linear, quadratic, and polynomial functions.
- use properties of exponents to solve equations.
- solve linear inequalities and systems of linear inequalities.
- use trigonometric functions to solve applied problems involving right triangles.

UNITS OF STUDY

Unit 1 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.

Unit 1A: Linear Equations

Unit Standards

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

Unit 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?

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

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

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 1B: Systems of Linear Equations

Unit Standards

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

Unit Essential Questions

- What does the number of solutions (none, one or infinite) of a system of linear equations represent?
- What strategies can be used to solve systems of linear equations effectively?

Scope and Sequence

- 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

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 2: Linear Inequalities and Systems of 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.

Unit Standards

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

Unit 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?

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

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 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.

Unit Standards

Simplifying Radicals

- 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

Unit Essential Questions

- What does i signify?
- What is the difference between an imaginary number and a complex number?
- When does a radical need to be simplified?
- How can radical expressions be simplified and manipulated?
- What determines if radicals can be added, subtracted, multiplied, or divided?

Scope and Sequence

Simplifying Radicals

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

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

Complex Numbers

- Find square roots of negative numbers
- Simplify imaginary numbers
- Add and subtract complex numbers
- Multiply complex numbers
- Divide complex numbers

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

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.

Unit Standards

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

Unit 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?

Scope and Sequence

Function Characteristics

- Function notation
- Determine if a relation is a function
- Vertical Line Test
- Classify functions as linear versus nonlinear
- 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

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

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 8 (1-hour) class blocks

Unit 5A: Polynomials and their Operations

Unit Overview

In this unit, students will explore the properties of polynomial expressions and their operations.

Unit Standards

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

Unit Essential Questions

- How are properties of exponents used to simplify expressions?
- In what situations is it necessary to add, subtract, or multiply polynomials?
- When is it appropriate to use synthetic division to divide polynomials?

Scope and Sequence

Properties of Exponents

- Simplify expressions including quotients of monomials
 - Include negative exponents

Operations with Polynomials

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

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

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 8 (1-hour) class blocks

Unit 5B: Factoring Polynomials

Unit Overview

In this unit, students will explore factoring techniques for trinomials.

Unit Standards

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

Unit Essential Questions

- What methods can be used to factor a trinomial effectively?

Scope and Sequence

- Factoring polynomials by:
 - GCF
 - Grouping (4 term polynomial)
 - Trinomials with $a = 1$
 - Trinomials with $a > 1$
 - Difference of Squares
 - Perfect square trinomials
 - Sum/Difference of Cubes

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

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 6: Graphing Transformations of Functions

Unit Overview

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

Unit Standards

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

Unit 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, 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?

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)
- 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)
- 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

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 8 (1-hour) class blocks

Unit 7: Graphing Quadratic Functions

Unit Overview

This unit focuses on graphing quadratic functions in standard form and analyzing their features. Students will also practice finding zeros, identifying key features, and using the graphing calculator for accurate visual representation.

Unit Standards

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

Unit Essential Questions

- How do you graph quadratic functions from standard form?
- How do you determine maximum and minimum values of a function?
- How do you determine if a parabola will be opening up or down?

Scope and Sequence

- Graph from standard form using a table
- Use axis of symmetry, vertex, y-intercept, and symmetric point
- Find the domain and range
- Determine if the graph is opening up or down

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

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 3 (1-hour) class blocks

Unit 8A: Solving Quadratic Equations

Unit Overview

In this unit, students will learn various methods for solving quadratic. They will explore solving using the square-root property, zero-product property, quadratic formula, and completing the square.

Unit Standards

- 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

Unit 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?
- 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?

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)
- Use grouping to factor and solve polynomial equations
- Solve equations in quadratic form

Quadratic Formula

- Use the quadratic formula to find all real and complex solutions to quadratic equations

Solving Quadratic Equations by Completing the Square

- 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

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 8 (1-hour) class blocks

Unit 8B: Quadratic Word Problems

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.

Unit Standards

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

Unit Essential Questions

- What do the solutions and the vertex to a quadratic equation mean in a real-world situation?
- How can quadratic equations be used to solve geometric word problems?
- How can we use quadratic functions to model projectile motion problems?

Scope and Sequence

- Solve quadratic word problems involving projectile motion
- Solve geometric word problems

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

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 9: 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.

Unit Standards

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

Unit 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 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?

Scope and Sequence

Trigonometric Functions in Right Triangles

- Special right triangles
- Find sine, cosine, tangent 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

Angle Not on the Unit Circle

- Evaluate sine, cosine, tangent trig functions given a point
- Evaluate sine, cosine, tangent 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

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 16 (1-hour) class blocks

Unit 10: Rational Functions

Unit Overview

In this unit, students will focus on simplifying, adding, subtracting, multiplying, and dividing rational expressions.

Unit Standards

CCSS.MATH.CONTENT.HSA.RAT.A.1

CCSS.MATH.CONTENT.HSA.CED.A.3

Unit Essential Questions

- What is a rational expression?
- Why can you cancel out common factors and still have an equivalent expression?
- How do you solve a rational equation?
- How do you find the least common multiple of polynomial expressions and thus the least common denominator of rational expressions?

Scope and Sequence

Multiplying and Dividing Rational Expressions

- Simplifying rational expressions
- 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 denominators
- Simplify complex fractions with different and the same LCDs

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

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 11: 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 and equations with rational exponents, as well as multi-step absolute value equations.

Unit Standards

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

Unit Essential Questions

- How do you solve radical equations involving square 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?

Scope and Sequence

Solving Radical Equations

- Solve square 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

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 12: Operations with Functions and Inverses *If time allows

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.

Unit Standards

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

Unit 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?

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

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

CURRENT REFERENCES

There is no textbook for this course.

2023 Connecticut Core Standards for Mathematics

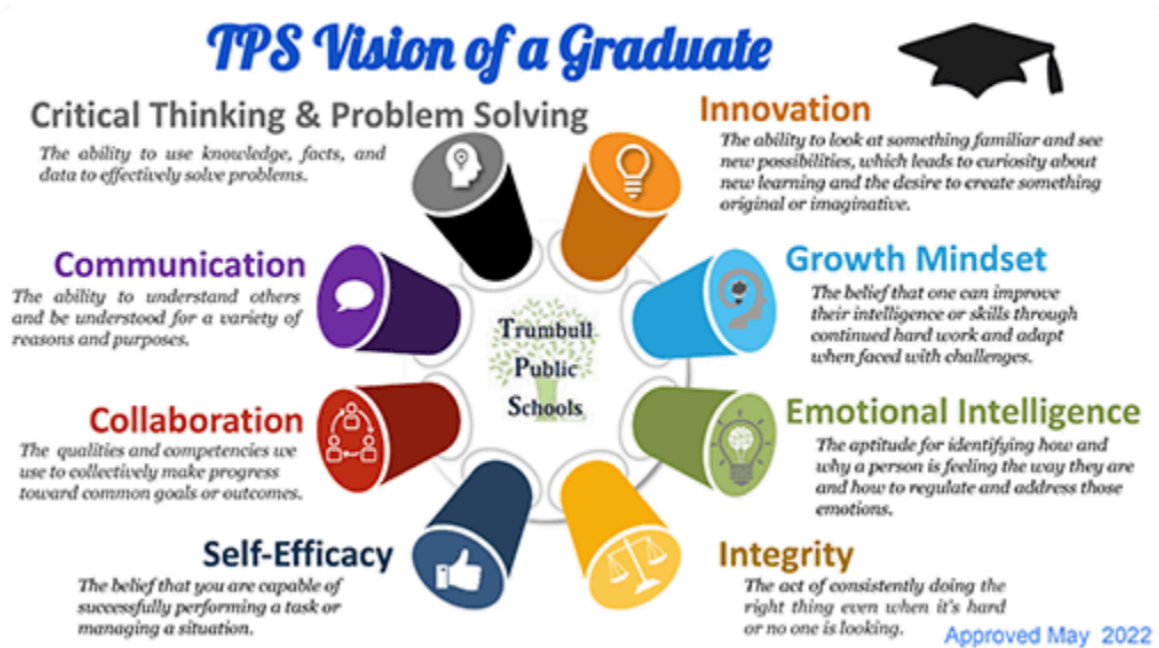
https://corestandards.org/wp-content/uploads/2023/09/Math_Standards1.pdf

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 – College Prep Algebra 2

Unit One A: 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

Unit 1A Assessment (Graphing Calculator Permitted)

Maximum 13 class periods

Unit One B: Systems of Linear Equations

Solving Systems of Linear Equations

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

Unit 1B Assessment (Graphing Calculator Permitted)

Maximum 7 class periods

Unit Two: Linear Inequalities

Solving Linear Inequalities in One Variable

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

Solving Linear Inequalities in Two Variables

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

Solving Systems of Inequalities

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

Unit 2 Assessment (Graphing Calculator Permitted)

Maximum 6 class periods

Unit Three: Radicals and Complex Numbers

Simplifying Radicals

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

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

Complex Numbers

- Find square roots of negative numbers
- Simplify imaginary numbers
- Add and subtract complex numbers
- Multiply complex numbers
- Divide complex numbers

Unit 3 Assessment (Graphing Calculator Permitted)

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 versus nonlinear functions
- 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

Extrema

- Find the relative maximums and minimums from graph

Unit 4 Assessment (Graphing Calculator Permitted)

Maximum 8 class periods

Unit Five A: Operations of Polynomial Expressions

Properties of Exponents

- Simplify expressions including quotients of monomials
 - include negative exponents

Operations with Polynomials

- Find the degree and identify the leading coefficient
- Add and subtract polynomials
- Multiply polynomials (distributive and FOIL)
- Divide polynomials
 - Divide by monomial
 - Synthetic division

Unit 5A Assessment (Graphing Calculator Permitted)

Maximum 8 class periods

Unit Five B: Factoring of Polynomial Expressions

Factoring Polynomials

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

Unit 5B Assessment (Graphing Calculator Permitted)

Maximum 7 class periods

END OF SEMESTER 1 - 59 class periods

Unit Six - 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
- 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
- Find the domain and range of the function
- Write an equation for the function given a graph

Unit 6 Assessment (Graphing Calculator Permitted)

Maximum 8 class periods

Unit Seven: Graphing Quadratic 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

Unit 7 Assessment (Graphing Calculator Permitted)

Maximum 3 class periods

Unit Eight A : 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, grouping

Quadratic Formula

- Find all real and complex solutions to quadratic equations by using the quadratic formula

Solving Quadratic Equations by Completing the Square

- Solve by completing the square $a = 1$

Unit 8A Assessment (Graphing Calculator Permitted)

Maximum 8 class periods

Unit Eight B : Quadratic and Polynomial Applications

Quadratic Word Problems

- Geometric word problems
- Projectile Motion word problems

Unit 8B Assessment (Graphing Calculator Permitted)

Maximum 9 class periods

Unit Nine A: Trigonometric Functions

Trigonometric Functions in Right Triangles

- Special right triangles (no calculator)
- Sine, cosine, and tangent 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

Unit 9A Assessment (Graphing Calculator Permitted)

Maximum 5 class periods

Unit Nine B: Trigonometric Functions

Angle Measure in Radians and Degrees

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

Angle Not on the Unit Circle

- Evaluate sine, cosine, tangent trig functions given a point
- Evaluate sine, cosine, tangent trig functions given a trig ratio

Unit 13 Assessment (Graphing Calculator Permitted)

Maximum 11 class periods

Unit Ten: Rational Functions

Multiplying and Dividing Rational Expressions

- Simplifying rational expressions
- Multiply and divide rational expressions
- Simplify complex fractions

Adding and Subtracting Rational Expressions

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

Unit 10 Assessment (Graphing Calculator Permitted)

Maximum 9 class periods

Unit Eleven: Solving Non-polynomial Equations

Solving Radical Equations

- Solve square root equations
- Solve equations with rational exponents

Solving Absolute Value Equations

- Solve multi-step absolute value equations

Unit 11 Assessment (Graphing Calculator Permitted)

Maximum 7 class periods

END OF SEMESTER 2 - 60 class periods

***If Time allows: 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