NEW MILFORD PUBLIC SCHOOLS

New Milford, Connecticut

Honors Algebra 2

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New Milford's Mission Statement

The mission of the New Milford Public Schools, a collaborative partnership of students, educators, family and community, is to prepare each and every student to compete and excel in an ever-changing world, embrace challenges with vigor, respect and appreciate the worth of every human being, and contribute to society by providing effective instruction and dynamic curriculum, offering a wide range of valuable experiences, and inspiring students to pursue their dreams and aspirations.

Subject/Course: **Mathematics/Honors Algebra 2** **UNIT 1: Analyzing Equations & Inequalities**

Time Frame: 2 week

<table>
<tr><th colspan="3">UNIT 1: Analyzing Equations and Inequalities
Stage 1 Desired Results</th></tr>
<tr><td rowspan="4">ESTABLISHED GOALS
CCSS.Math.Content.HSA.SSE.A.1
Interpret expressions that represent a quantity in terms of its context.*
CCSS.Math.Content.HSA.SSE.A.1.a
Interpret parts of an expression, such as terms, factors, and coefficients.
CCSS.Math.Content.HSA.SSE.A.2
Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.

CCSS.Math.Content.HSA.SSE.B.3
Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
CCSS.Math.Content.HSA.CED.A.1
Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to independently use their learning to…

CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.

CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.

CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.

CCSS.Math.Practice.MP4 Model with mathematics.

CCSS.Math.Practice.MP5 Use appropriate tools strategically.

CCSS.Math.Practice.MP6 Attend to precision.

CCSS.Math.Practice.MP7 Look for and make use of structure.
● Recognize when to apply procedures of equations & inequalities to real world applications.
● Apply abstract reasoning of solving equations to other scenarios, attending to precision, persevere in solving, and recognizing repeated reasoning.
● Create equations that describe numbers or relationships.
● Identify formulas as literal equations and solve for different variables.
● Factor polynomials to find restrictions on the domain.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>UNDERSTANDINGS
Students will understand that…
● There is a specific order of</td><td>ESSENTIAL QUESTIONS
Students will keep considering…</td></tr>
</table>

exponential functions. CCSS.Math.Content.HSA.CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V = IR to highlight resistance R. CCSS.Math.Content.HSA.REI.B.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. CCSS.Math.Content.HSF.IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.	operations that must be followed when simplifying terms and expressions. ● Algebraic expressions can be classified, evaluated for specific values, and combined with other terms. ● Linear equations can be solved following a specific process to give a solution. ● Literal equations are formulas with many variables and can be solved according to the same process as equations with one variable.	● What is the importance of following a specified order of operations? ● How are algebraic operations and notation used to simplify and solve equations and inequalities? ● How do literal equations apply to real-world situations? ● Why do some equations have restrictions on the possible values of the variables?
	Acquisition	
	Students will know… . ● Comparing values (>, <, =). ● The absolute value of a number. ● The process for evaluating and simplifying algebraic expressions and the specific order of operations. ● How to solve a linear and literal equation. ● Steps to solving inequalities and absolute value equations and inequalities and how to graph solutions on a number line. Key terms: Real Numbers & subsets, absolute value, greater than (>),less than (<), variable, algebraic expression, term, evaluate, like terms, coefficient, order of	Students will be skilled at… ● Compare values both on a number line and using inequality symbols. ● Find the absolute value of a number ● Simplify and evaluate algebraic expressions ● Solve linear, literal, and absolute value equations and identify those that have no solution. ● Solve inequalities, compound inequalities, and absolute value inequalities according to specified processes.

	operations (PEMDAS), linear equation, ratio, inequality, compound inequality.	

UNIT 1: Analyzing Equations and Inequalities Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**

TMA M, A T, M, A T, M, A 7	Checklist/Rubric: evaluating clear focus of purpose, thorough understanding of content, clear interpretation and application of concepts, and citation of evidence to support claim. Thorough understanding of vocabulary, order of operations, correct processes to solving. Accurate application of content/process to arrive at correct mathematical solution. Selection of evidence that is relevant to content and standardized test processes.	PERFORMANCE TASK(S): <u>Performance Task 1</u> Use variables to write a formula from a verbal statement that represents a real-world situation and evaluate the formula for certain values. **GOAL**: Determine a person's Daily Caloric Needs based on their Basal Metabolic Rate (BMR). **ROLE**: Student is a physician. **AUDIENCE**: patient **SITUATION:** Physician is calculating a patient's *BMR*. **PRODUCT**: Calculation and analysis of BMR results. **STANDARDS**: Rubric based on understanding, accuracy, communication of results, presentation of evidence to support claim. **TO DIFFERENTIATE:** Provide students with problems at a variety of difficulty levels <u>Performance Task 2</u> **Goal**: To write a system of equations given real-world applications, interpret their graphs, and make logical conclusions based on those equations **Role**: Relocation analyst Audience: Company financial officer **Situation**: Students are given two situations, each dealing with the cost of renting a moving van for employees being transferred across country. Students are to represent each scenario by writing linear equations and sketching their graphs to interpret, y-intercepts, slopes, and the break-even point. **Product**: Students will write an argument for which rental company to hire in order to save the company money based on their findings.

		Standard for Success: Mathematics department scoring rubric
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* ● Monitoring class work through board work, group work, questioning, and walk-arounds. ● Quick homework check to assess common errors to inform future instruction. ● Check for understanding: board and whiteboard activities, or reflections and exit tickets. ● Formative Assessments ● Differentiate through purposeful or flexible grouping, use of diagrams and explanations to demonstrate understanding and active lessons involving discovery, scaffolding, jigsaw activities and use of hands-on manipulatives ● Alternative assessment projects such as ”find the mistakes”, explain the process, posters, and real world applications ● Review of standardized test questions to prep students for the challenge of the SAT and ACT exams ● UNIT Test - to include a variety of DOK level of problems and may include SAT style problems ● “Do Now” questions/opening ● activities ● Questioning ● Self-assessment ● Smartboard activities, (Kahoot, Quizlet, etc.)

UNIT 1: Analyzing Equations and Inequalities Stage 3 – Learning Plan	
Code **M**	**Pre-Assessment** ● Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on graphing on a number line, evaluating absolute values, and simplifying and evaluating algebraic expressions. ● As the lessons progress, students can also be given questions such as “Find the mistakes in simplifying an algebraic expression.” ● Additionally, warm-ups should contain review on previous material covered during the unit to ensure retention and mastery.

	Summary of Key Learning Events and Instruction Student success at transfer meaning and acquisition depends on…	Progress Monitoring
M, A	● Teacher models examples evaluating expressions and solving equations.	● Monitoring class work through board work, group work, questioning,warm ups, entrance and exit tickets, and walk-arounds. ● Strategic Questioning: Ask students higher-order questions such as “how” and “why,” so the teacher can discern the level and extent of the students’ understanding. ● Quick homework check to assess common errors to inform future instruction. ● Formative Assessments
M, A	● Students will work independently practicing evaluating and simplifying algebraic expressions.	
T, M	● Teacher uses TI Emulator software to demonstrate the process of using the graphing calculator to evaluate expressions and to check solutions to equations.	
T, M, A	● Students will practice using the graphing calculator to solve equations and to evaluate expressions.	
M, A	● Teacher models steps to solving algebraic, literal, and fractional equations by hand. Teacher also relates literal equations to formulas and other real-world uses.	
M, A	● Students will work in small groups to solve equations that include basic, fractional, and literal types.	

Suggested Resources:

- Textbook: Charles, Randall et al. *Algebra 2 Common Core*, Boston, MA: Pearson, 2012.
- Supplemental activities from the textbook resources on solving equations and application problems, absolute value equations, and inequalities.
- Teacher-made activities on solving linear and literal equations, applications, and chapter review.
- Graphing calculator TI Emulator software.
- On-line resources such as You Tube, Khan Academy, Desmos, etc.

Subject/Course: **Mathematics/Honors Algebra 2** **UNIT 2: Relations, Functions and Parent Functions**

Time Frame: 4 weeks

UNIT 2: Relations, Functions and Parent Functions **Stage 1 Desired Results**	
ESTABLISHED GOALS CCSS.Math.Content.HSA.REI.D.11 Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.* CCSS.Math.Content.HSF.IF.A.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then $f(x)$ denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation $y = f(x)$. CCSS.Math.Content.HSF.IF.A.2 Use function notation, evaluate	**Transfer** Students will be able to independently use their learning to… ● **CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.** ● **CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.** ● **CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.** ● **CCSS.Math.Practice.MP4 Model with mathematics.** ● **CCSS.Math.Practice.MP5 Use appropriate tools strategically.** ● **CCSS.Math.Practice.MP6 Attend to precision.** ● **CCSS.Math.Practice.MP7 Look for and make use of structure.** ● Understand the concept of a function and use function notation. ● Interpret functions that arise in applications in terms of the context. ● Graphing functions on paper & on the graphing calculator. ● Analyze functions using different representations. ● Build new functions from existing functions. ● Identify the domain of various functions and understand the restrictions on the domain for square root and rational functions. ● Recognize when to apply procedures of functions to real world applications. ● Apply abstract reasoning of solving problems involving functions to other scenarios, attending to precision, persevere in solving, and recognizing repeated reasoning. ● Evaluate functions given the equation or graph.

functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
CCSS.Math.Content.HSF.IF.B.4
For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.[*]

CCSS.Math.Content.HSF.IF.B.5
Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*

Students use technology tools (i.e., calculators, data collection probes, videos, educational software) for problem solving, self-directed learning, and extended learning activities.

- Perform operations with functions.
- Find the inverse of a function.

Meaning

UNDERSTANDINGS Students will understand that…	ESSENTIAL QUESTIONS Students will keep considering…
• Many relations have specific characteristics that result in them being considered functions. • Functions can be represented in several forms including as relations, as a mapping, as a graph, and by using function notation. • Composition of functions combines two different functions into one new function. • An inverse of a function “undoes” what the original function did to a value. • Real-world data that has a linear trend can be represented with a line of best fit. • Parent functions have specific characteristics when graphed, and putting values in specific places will transform (move) the graph in specific ways.	• Why is it important to represent the same relation or function using multiple formats? • How can some data be represented using linear modeling? • How is slope relevant to analyzing trends in data? • How are the characteristics of a linear equation different from a nonlinear equation? • What are some real-world uses of inverse and composite functions? • What does the parent function of various graphs look like, and how do values change the graph?

Acquisition

Students will know…	Students will be skilled at…
• The distinction between relations and functions. • How to find the domain and range of a function	• Determining the domain and range from a relation and represent the relation using a mapping diagram • Deciding if a relation is a function when

Students show graphic representation of data.	● The processes to identify and evaluate functions ● The key features of graphs. To include: intercepts; intervals where the function is positive, or negative, increasing, or decreasing; relative maximums and minimums; symmetries, and end behavior. ● What composition of functions is and how to apply it ● The steps to graphing functions from the parent function. ● Key terms: relation, function, domain, range, mapping, vertical line test, function notation, line of best fit, slope, slope-intercept form, point-slope form, vertical line, horizontal line, parallel, perpendicular, intercepts, composition of functions, inverse, absolute value,	given a set of ordered pairs, a mapping, and a graph ● Evaluating a specific value given the equation or graph of a function (i.e., find f(3) given the graph of f(x)) ● Identifying key features of graphs. ● Composing two functions ● Finding the inverse of a function and graphing it ● Determining key features of a graph (vertex, vertical and horizontal shifts, stretch or compression) based on transformations of its parent function.

UNIT 2: Relations, Functions and Parent Functions		
Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**

T M T, A	Scoring Rubric used to evaluate successful understanding of the process and criteria for a desired outcome. Thorough understanding of vocabulary, and correct graphing of quadratic functions. Accurate application of content/process to arrive at correct mathematical solution. Selection of evidence that is relevant to content and standardized test processes.	PERFORMANCE TASK(S): Students will show that they really understand evidence of… **GOAL**: To find the line of best fit given real-world data **ROLE**: Financial consultant **AUDIENCE:** Business managers for various companies **SITUATION**: Given three different companies (photography, home improvement, and theater), the consultant is asked to provide a cost analysis from given data. **PRODUCT:** Calculated predictions with appropriate explanations **STANDARD**: rubric based on understanding, accuracy, communication of results, presentation of evidence to support claim. **TO DIFFERENTIATE**: Allow students to choose from problems at a variety of difficulty levels.
		OTHER EVIDENCE: Students will show they have achieved Stage 1 goals by… ● Monitoring class work through board work, group work, questioning, and walk-arounds. ● Quick homework check to assess common errors to inform future instruction. ● Check for understanding: board and whiteboard activities, or reflections and exit tickets. ● Differentiate through purposeful or flexible grouping, use of diagrams and explanations to demonstrate understanding and active lessons involving discovery, scaffolding, jigsaw activities and use of hands-on manipulatives ● Alternative assessment projects such as ”find the mistakes”, explain the process, posters, and real world applications

		● Review of standardized test questions to prep students for the challenge of the SAT and ACT exams ● Quizzes ● UNIT Test - to include a variety of DOK level of problems and may include SAT style problems ● “Do Now” questions/opening ● activities ● Questioning ● Self-assessment ● Smartboard activities, (Kahoot, Quizlet, etc.)

UNIT 2: Relations, Functions and Parent Functions **Stage 3 – Learning Plan**		
Code **M**	**Pre-Assessment** ● Teacher checks for prerequisite and prior knowledge via warm-ups and entrance tickets ● Questioning activities, such as basic problems with exponents and radicals. ● As the lessons progress, students can also be given questions such as “Find the mistakes....” ● Warm-ups and skill checks contain review of previous material during the unit to ensure retention and mastery, and check on vertical alignment with prior curriculum.	
	Summary of Key Learning Events and Instruction Student success at transfer meaning and acquisition depends on…	Progress Monitoring
M, A	● Teacher activates prior learning of graphing by giving warm-up exercises on graphing points in the coordinate plane and evaluating expressions.	● Monitoring class work through board work, group work, questioning, and walk-arounds.
A	● Teacher defines relation, domain,range, and function and models examples on how to identify these from given information (data sets, mapping, graph).	● Strategic Questioning: Ask students higher-order questions such as “how” and “why,” so the teacher can discern the level and extent of the students’ understanding.
T, M, A	● Students will work independently to identify domain and range and determine if a relation is a function.	● Quick homework check to assess common errors to inform future instruction.
T, M, A	● Students will also evaluate functions for given values.	

T, A M, A T, M, A T, M, A	● Teacher discusses the real-world application of composition of functions and models the process of composing two functions into one new function. ● Students will complete a practice worksheet on composition of functions and will then compare and discuss their results with a partner. ● Students will use graphing technology to discover how graphs are related to their parent function and what causes them to shift vertically, horizontally, and to stretch or compress. ● Teacher provides an activity for students to discover what an inverse of a function is. Teacher then model steps to finding inverses of given functions. ● Students will work collaboratively to discover the relationship between a function and its inverse and will complete a practice worksheet on finding inverses of functions.	● Formative Assessments

Suggested Resources:

- Textbook: Charles, Randall et al. *Algebra 2 Common Core*, Boston, MA: Pearson, 2012.
- Supplemental activities from textbook resources on evaluating, graphing, functions .
- Teacher-made supplemental activities on evaluating, graphing functions, applications, performance tasks, and chapter review.
- Graphing calculator TI Emulator software.
- On-line resources such as You Tube, Khan Academy, Desmos, etc.

Subject/Course: **Mathematics/Honors Algebra 2** **UNIT 3: Linear Functions & Applications**

Time Frame: 3 weeks

UNIT 3: Linear Functions, Inequalities & Applications **Stage 1 Desired Results**	
ESTABLISHED GOALS CCSS.Math.Content.HSA.CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. CCSS.Math.Content.HSA.CED.A.3 Represent *constraints* by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*. CCSS.Math.Content.HSA.REI.D.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). CCSS.Math.Content.HSA.CED.A.1 Create equations and inequalities	**Transfer** Students will be able to independently use their learning to… **CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.** **CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.** **CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.** **CCSS.Math.Practice.MP4 Model with mathematics.** **CCSS.Math.Practice.MP5 Use appropriate tools strategically.** **CCSS.Math.Practice.MP6 Attend to precision.** **CCSS.Math.Practice.MP7 Look for and make use of structure.** ● Recognize when to apply procedures of linear equations & inequalities to real world applications. ● Apply abstract reasoning using linear equations and systems of inequalities to other scenarios, attending to precision, persevere in solving, and recognizing repeated reasoning. ● Graphing functions on paper & on the graphing calculator. ● Represent and solve equations and inequalities graphically. ● Create equations and inequalities to calculate the line of best fit and solve Linear Programming problems. **Meaning** UNDERSTANDINGS | ESSENTIAL QUESTIONS

in one variable and use them to solve problems. CCSS.Math.Content.HSA.REI.D.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.	Students will understand that… ● Every line contains its own unique slope and y-intercept. ● The slope of a line represents the rate of change of that line. ● Appropriate information about a line can be used to write an equation for that line. ● Two variable inequalities have solution regions when graphed. ● How to model data using linear functions.	Students will keep considering… ● What are the different forms of linear equations, and why is it useful to have them? ● What applications can be represented by linear equations? ● How are inequalities like equations and how are they different? ● What are the similarities and differences between the graphs of linear functions and absolute value functions? ● What real-world situations can be modeled by linear or absolute value inequalities?
	Acquisition	
	Students will know… ● What the slope of a line represents and how to find it ● The different equations of lines and how to graph using the various equations as well as the graphing calculator ● The process to graphing two variable inequalities and absolute value inequalities ● How to use graphing technology to find a line of best fit (linear regression) for a set of data. Key terms: absolute value, greater than	Students will be skilled at… ● Recognizing slope as a rate of change ● Identifying slopes of horizontal, vertical, parallel, and perpendicular lines ● Write and graph equations in point-slope and slope-intercept form ● Solving & graphing inequalities, compound inequalities, and absolute value inequalities according to specified processes. ● Graphing the solution(s) to inequalities and absolute value inequalities on a number line and the coordinate plane ● Using technology tools,(ie graphing calculators, data collection, and

	(>),less than (<), linear equation, inequality, compound inequality, linear regression, line of best fit, linear programming	educational software) for problem solving, self-directed learning, and extended learning activities. ● Graphing an absolute value function by locating its vertex ● Recognizing the solution set to the graph of an inequality and identify the boundary line as being include (solid line) or excluded (dashed line**)** ● Using graphing calculators to find the line of best fit and make predictions

UNIT 3: Linear Functions & Applications **Stage 2 – Evidence**		
Code	**Evaluative Criteria**	**Assessment Evidence**

T M T, A	Scoring Rubric used to evaluate successful understanding of the process and criteria for a desired outcome. Thorough understanding of vocabulary, and correct graphing of quadratic functions. Accurate application of content/process to arrive at correct mathematical solution. Selection of evidence that is relevant to content and standardized test processes.	PERFORMANCE TASK(S): Students will show that they really understand evidence of… **GOAL:** To Analyze the maximum/minimum value given specific constraints **ROLE**: Business Analyst **AUDIENCE:** CO of a company **SITUATION**: Given a specific situation with various constraints, a graph and cost analysis must be completed to find what prices would maximize profits or minimize costs. **PRODUCT**: A poster with the inequalities, graph, and cost analysis completed. **STANDARD:** rubric based on understanding, accuracy, communication of results, presentation of evidence to support claim. **TO DIFFERENTIATE**: Assign students to groups and give each group a level of difficulty based on their strengths/weaknesses .

		OTHER EVIDENCE: Students will show they have achieved Stage 1 goals by… ● Monitoring class work through board work, group work, questioning, and walk-arounds. ● Quick homework check to assess common errors to inform future instruction. ● Check for understanding: board and whiteboard activities, or reflections and exit tickets. ● Differentiate through purposeful or flexible grouping, use of diagrams and explanations to demonstrate understanding and active lessons involving discovery, scaffolding, jigsaw activities and use of hands-on manipulatives ● Alternative assessment projects such as ”find the mistakes”, explain the process, posters, and real world applications ● Review of standardized test questions to prep students for the challenge of the SAT and ACT exams ● Quizzes ● UNIT Test - to include a variety of DOK level of problems and may include SAT style problems ● “Do Now” questions/opening ● activities ● Questioning ● Self-assessment ● Smartboard activities, (Kahoot, Quizlet, etc.)

UNIT 3:Linear Functions & Applications

Stage 3 – Learning Plan

Code	Pre-Assessment	
M	● Teacher checks for prerequisite and prior knowledge via warm-ups and entrance tickets ● Questioning activities, such as definition of slope, different formulas for the equation of a linear function. ● As the lessons progress, students can also be given questions such as “Find the mistakes....” ● Warm-ups and skill checks contain review of previous material during the unit to ensure retention and mastery, and check on vertical alignment with prior curriculum.	
	Summary of Key Learning Events and Instruction Student success at transfer meaning and acquisition depends on…	Progress Monitoring ● Monitoring class work through board work, group work, warm-ups, questioning, and walk-arounds. ● Strategic Questioning: Ask students higher-order questions such as “how” and “why,” so the teacher can discern the level and extent of the students’ understanding. ● Quick homework check to assess common errors to inform future instruction. ● Formative Assessments
M, A	● Teacher activates prior learning by giving practice through homework, warm-ups, and entrance tickets to review linear equations and slope	
A	● Students review and practice writing and graphing linear equations.	
M	● Teacher models graphing 2 variable linear and absolute value inequalities	
T, M, A	● Students work independently to graph inequalities and analyze feasible solutions	
T, A	● Teacher demonstrates how to use graphing technology to find a best fit line for a set of data	
T, A	● Students use real-world data and make predictions based on the line of best fit	
T, A	● Teacher leads students through analyzing problems involving linear programming	
T, A	● Students work together to find the maximum or minimum value for a real-world problem using linear programming.	
M, A	● Teacher leads discussion on inequalities and how they compare to equations and to the values on a number line. Solutions are modeled for linear and compound inequalities.	
T, M, A	● Students will work independently to solve inequalities	

M,A	and will then “think, pair, share” with a partner to compare their solutions. ● Teacher reviews the concept of absolute value as it relates to the number line. Distance interpretation is used as an option to solving absolute value equations and inequalities	

Suggested Resources:

- Textbook: Charles, Randall et al. *Algebra 2 Common Core*, Boston, MA: Pearson, 2012.
- Supplemental activities from the textbook resources on solving linear equations & inequalities and application problems.
- Teacher-made supplemental activities on solving linear and literal equations, applications, performance tasks, and chapter review.
- Graphing calculator TI Emulator software.
- On-line resources such as You Tube, Khan Academy, Desmos, etc.

Subject/Course: **Mathematics/Honors Algebra 2** **UNIT 4: Exponents & Radicals**

Time Frame: 3 weeks

UNIT 4: Exponents & Radicals	**Stage 1 Desired Results**
ESTABLISHED GOALS CCSS.Math.Content.HSN.RN.A.1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to	**Transfer**

those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.* CCSS.Math.Content.HSN.RN.A.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents. CCSS.Math.Content.HSA.REI.A.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	Students will be able to independently use their learning to… **CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.** **CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.** **CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.** **CCSS.Math.Practice.MP4 Model with mathematics.** **CCSS.Math.Practice.MP5 Use appropriate tools strategically.** **CCSS.Math.Practice.MP6 Attend to precision.** **CCSS.Math.Practice.MP7 Look for and make use of structure.** ● Recognize when to apply properties of exponents and radicals to real world applications. ● Apply abstract reasoning of exponential & radical equations to other scenarios, attending to precision, persevere in solving, and recognizing repeated reasoning. ● Represent and solve equations containing exponents & radicals.

Meaning	
UNDERSTANDINGS Students will understand that… ● Exponents and radicals are related to the operation of multiplication; a radical is the inverse of an exponent. ● Simplifying radicals results in a smaller value under the radical while maintaining an exact value. ● Rationalizing the denominator eliminates radical expressions from the denominator. Radical expressions can be combined under the basic operations of addition,	ESSENTIAL QUESTIONS Students will keep considering… ● How are the properties of exponents related to the basic arithmetic operations? ● How do radicals relate to exponents? ● Why is it important to simplify radicals? ● Why is it necessary to rationalize the denominator ? ● How do radical expressions relate to rational exponents? ● How can radical equations be solved? ● Why are some solutions to radical equations rejected?

	subtraction, multiplication, and division following a specific process. ● Rational exponents are another way to express radicals. ● Equations with radicals can be solved using exponents and may result in extraneous solutions.	
	Acquisition	
	Students will know… ● Definition of nth root, radicand, index, and a principal root of a radical ● Steps and processes to simplify a radical expression. ● Properties for multiplying and dividing radical expressions. ● Steps and processes to “Rationalize the Denominator” ● Properties for adding and subtracting radical expressions. ● Steps and processes to multiply and divide binomial radical expressions. ● Alternate form of writing a radical expression. ● Methods and processes to simplify expressions with rational exponents. ● Steps to solving square root and other radical equations. ● Key terms: nth root, real roots, radicand, index, principal root, rational exponent radical equation, square root equation, like radicals,	Students will be skilled at… ● Simplify nth roots. ● Determine all real roots of a real number and the degree of a radical expression. ● Simplify radical expressions. ● Multiply and divide radical expressions. ● Rationalize the denominator of a radical expression. ● Add and subtract radical expressions. ● Multiply and divide binomial radical expressions. ● Rewrite a radical expression using a rational exponent. ● Simplify expressions with rational exponents. ● Solve square root and other radical equations.

	exponential expression, conjugate, midpoint	

UNIT 4: Exponents & Radicals **Stage 2 – Evidence**		
Code	**Evaluative Criteria**	**Assessment Evidence**
T M T, A	Scoring Rubric used to evaluate successful understanding of the process and criteria for a desired outcome.	PERFORMANCE TASK(S): Students will show that they really understand evidence of… **GOAL**: To solve a puzzle that matches expressions with rational exponents with the corresponding radical expression **ROLE**: Students **AUDIENCE**: Classmates **SITUATION**: Students will work in pairs.They will be given a puzzle with various expressions in both radical and exponential form and will match equivalent expressions appropriately to solve the puzzle **PRODUCT**: Presentation to classmates of the successfully solved puzzle. **STANDARD**:rubric based on understanding, accuracy, communication of results, presentation of evidence to support claim. **TO DIFFERENTIATE:** Allow students the option of making their own puzzles for their classmates to solve.

M, A T, M, A T, M, A T, M, A	● Thorough understanding of simplifying radicals, combination of basic operations of adding, subtraction, multiplication, and division. ● Thorough understanding of solving equations with radicals, rational exponents, and rationalizing the denominator. ● Accurate application of content/process to arrive at correct mathematical solution. ● Selection of evidence that is relevant to content and standardized test processes.	OTHER EVIDENCE: Students will show they have achieved Stage 1 goals by… ● Monitoring class work through board work, group work, questioning, and walk-arounds. ● Quick homework check to assess common errors to inform future instruction. ● Check for understanding: board and whiteboard activities, or reflections and exit tickets. ● Differentiate through purposeful or flexible grouping, use of diagrams and explanations to demonstrate understanding and active lessons involving discovery, scaffolding, jigsaw activities and use of hands-on manipulatives ● Alternative assessment projects such as ”find the mistakes”, explain the process, posters, and real world applications ● Review of standardized test questions to prep students for the challenge of the SAT and ACT exams ● Quizzes ● UNIT Test - to include a variety of DOK level problems and may include SAT style problems ● “Do Now” questions/opening ● activities ● Questioning ● Self-assessment ● Smartboard activities, (Kahoot, Quizlet, etc.)

UNIT 4: Exponents & Radicals

Stage 3 – Learning Plan

Code	Pre-Assessment	
M	● Teacher checks for prerequisite and prior knowledge via warm-ups and entrance tickets ● Questioning activities, such as basic problems with exponents and radicals. ● As the lessons progress, students can also be given questions such as “Find the mistakes....” ● Warm-ups and skill checks contain review of previous material during the unit to ensure retention and mastery, and check on vertical alignment with prior curriculum.	
	Summary of Key Learning Events and Instruction Student success at transfer meaning and acquisition depends on…	Progress Monitoring
M, A	● Teacher checks for prior knowledge using common formative assessment (pre-test) on properties of exponents and solving polynomial equations.	● Monitoring class work through board work, group work, questioning, warm-ups, and walk-arounds. ● Strategic Questioning: Ask students higher-order questions such as “how” and “why,” so the teacher can discern the level and extent of the students’ understanding. ● Quick homework check to assess common errors to inform future instruction. ● Formative Assessments ● Check prerequisite knowledge throughout the unit using warm-up problems and questioning activities.
T, M, A	● Students will work independently on a pre-test for the properties of exponential expressions.	
M, A	● Teacher models real roots by writing $y^2 = 64$ on the board to show the number of real nth roots.	
M, A	● Teacher reviews the perfect square factors, perfect cube factors, perfect fourth root factors, etc. to explain the steps for simplifying radical expressions. Teacher reiterates the importance of factoring out the greatest of these types of factors first.	
M, A	● Students work independently to simplify radicals.	
M, A	● Teacher models the properties and steps for multiplying and dividing radical expressions.	
M, A	● Teacher introduces the concept of “Rationalizing the Denominator” as an alternate method to dividing radical expressions when the denominator contains a radical. Teacher defines “like radicals” to model adding and subtracting radical expressions. Emphasis is placed on the need for students to first simplify the radical expression they want to add or subtract.	
M, A	● Students practice the steps to multiplying and dividing radical expressions.	
M, A	● Teacher makes a connection using the FOIL method for	

T, M, A M, A M, A M, A M, A M, A	multiplying binomials to multiplying binomial radical expressions. ● Students work independently to practice on these topics. ● Teacher defines a rational exponent using the analogy that tree roots are below ground and power lines are above ground to help students visualize that a numerator of a rational exponent represents the power of the real number and the denominator represents the root of the radical. ● Students work in pairs to practice the methods to simplifying an exponential expression given a radical expression and simplifying a radical expression given an exponential expression. ● Teacher reviews solving polynomial equations and models similarities to solving square root and other radical equations. ● Teacher introduces the Pythagorean Theorem as a way to lead into the derivation of the distance formula. ● Teacher reviews the midpoint formula, and problems are modeled by the teacher. ● Students apply the distance and midpoint formulas to solve problems. ● Students practice and apply all of the above to real-world situations (where applicable).	

Suggested Resources:

- Textbook: Charles, Randall et al. *Algebra 2 Common Core*, Boston, MA: Pearson, 2012.
- Supplemental activities from the textbook resources on simplifying exponential & radical expressions and application problems.
- Teacher-made supplemental activities on simplifying exponential & radical expressions, applications, performance tasks, and chapter review.

- Graphing calculator TI Emulator software.
- On-line resources such as You Tube, Khan Academy, Desmos, etc.

Subject/Course: **Mathematics/Honors Algebra 2** **UNIT 5: Quadratic Equations & Functions**

Time Frame: 5 weeks

UNIT 5: Quadratic Equations & Functions **Stage 1 Desired Results**	
ESTABLISHED GOALS CCSS.MATH.CONTENT.HSN.CN.C.7 Solve quadratic equations with real coefficients that have complex solutions. CCSS.MATH.CONTENT.HSA.SSE.B.3.A Factor a quadratic expression to reveal the zeros of the function it defines. CCSS.MATH.CONTENT.HSA.SSE.B.3.B Complete the square in a	**Transfer** Students will be able to independently use their learning to… **CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.** **CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.** **CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.** **CCSS.Math.Practice.MP4 Model with mathematics.** **CCSS.Math.Practice.MP5 Use appropriate tools strategically.**

quadratic expression to reveal the maximum or minimum value of the function it defines.

CCSS.MATH.CONTENT.HSA.CED.A.1

Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions*.

CCSS.MATH.CONTENT.HSA.REI.B.4

Solve quadratic equations in one variable.

CCSS.MATH.CONTENT.HSA.REI.B.4.A

Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.

CCSS.MATH.CONTENT.HSA.REI.B.4.B

CCSS.Math.Practice.MP6 Attend to precision.

CCSS.Math.Practice.MP7 Look for and make use of structure.

- Identify complex numbers, and specifically that the value √-1 is an imaginary number.
- Recognize when to apply procedures of quadratic functions to real world applications.
- Apply abstract reasoning of quadratic functions to other scenarios, attending to precision, persevere in solving, and recognizing repeated reasoning.

Meaning

UNDERSTANDINGS Students will understand that…	ESSENTIAL QUESTIONS Students will keep considering…
• The value√-1 can be represented as an imaginary number (i). • Complex numbers combine real and imaginary numbers and can have operations of addition,subtraction, multiplication, and division performed on them. • Quadratic functions are shaped like parabolas and have special properties. • Quadratic equations can be solved using a variety of methods, specifically factoring, the quadratic formula, completing the square,and the square root method.	• Why are some values not considered real numbers? • Where did complex numbers originate, and how do they fit into the algebraic framework? • How can quadratic equations be solved? • What is the importance of finding values such as intercepts and maximum/minimum from a graph? • How do quadratic functions relate to real-world situations? • How can technology be used to represent functions and to verify solutions found manually? • What are the advantages of a quadratic function in vertex form? in standard form? • How are the real solutions of a quadratic equation related to the graph?

Acquisition

Students will know…	Students will be skilled at…

Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b. CCSS.MATH.CONTENT.HSA.REI.C.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$. CCSS.MATH.CONTENT.HSA.REI.D.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).	• Definition of imaginary and complex numbers. • Quadratic functions – definition, equation, graphing form, and how to graph. • The methods and processes to solving a quadratic equation. • The steps to finding the x- and y-intercepts of a quadratic function. • Definition of a maximum/minimum point. • Definition of a discriminant. Key terms: imaginary numbers, complex numbers, quadratic functions, parabola, quadratic equation, complete the square, discriminant, quadratic formula, vertex, axis of symmetry, maxima, minima.	• Identifying and graph complex numbers. • Adding, subtracting, and multiplying complex numbers. • Graphing quadratic functions and identify the vertex, axis of symmetry, direction of opening, maximum or minimum value, x- and y- intercepts, domain, and range. • Completing the square to get a quadratic function in graphing form. • Solving quadratic equations using factoring, quadratic formula, and by completing the square. • Finding the x- and y- intercepts of a quadratic function. • Determining types of solutions of a quadratic function by using the discriminant. • Using technology tools (i.e., calculators, Desmos,educational software) for problem solving, self-directed learning, and extended learning activities. • Showing graphic representation of data.

CCSS.MATH.CONTENT.HSF.IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.* CCSS.MATH.CONTENT.HSF.IF.C.7.A Graph linear and quadratic functions and show intercepts, maxima, and minima. CCSS.MATH.CONTENT.HSF.IF.C.8.A Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. CCSS.MATH.CONTENT.HSF.IF.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic*		

expression for another, say which has the larger maximum.		

UNIT 5: Quadratic Equations & Functions **Stage 2 – Evidence**		
Code	**Evaluative Criteria**	**Assessment Evidence**
T, M, A	Scoring Rubric used to evaluate successful understanding of the process and criteria for a desired outcome.	PERFORMANCE TASK(S): Students will show that they really understand evidence of… <u>Performance Task</u> Find the equation of a quadratic function that models three given data points and then use the model to extend the data. Students develop a problem similar to the following projectile problems. You shoot an arrow at a target. The parabolic path of your arrow passes through the points shown in the table. (30,6), (60,7),(100,4) a. Find a quadratic function in standard form that models the path of your arrow. b. If the y-value represents height above the ground, for what value of x would your arrow hit the ground if you missed the target.

		c. If the target bull's-eye is at x=100, at what height should the bull's-eye be for you to hit it? d. If the target bull's-eye is at height y=2.98, at what value of x should the bull's-eye be for the arrow to hit it? **GOAL**: To find the quadratic regression given real-world data **ROLE**: Archer **SITUATION**: Find the quadratic function that models the given data and extend the data. **PRODUCT**: Calculate predictions with appropriate explanations **STANDARD**: rubric based on understanding, accuracy, communication of results, presentation of evidence to support claim. **TO DIFFERENTIATE:** Provide problems at various difficulty levels from which students can choose.

M, A	Thorough understanding of the vocabulary, and correct graphing of quadratic functions.	OTHER EVIDENCE: Students will show they have achieved Stage 1 goals by… ● Monitoring class work through board work, group work, questioning, warm-ups, and walk-arounds. ● Quick homework check to assess common errors to inform future instruction. ● Check for understanding: board and whiteboard activities, or reflections and exit tickets. ● Differentiate through purposeful or flexible grouping, use of diagrams and explanations to demonstrate understanding and active lessons involving discovery, scaffolding, jigsaw activities and use of hands-on manipulatives ● Alternative assessment projects such as "find the mistakes", explain the process, posters, and real world applications ● Review of standardized test questions to prep students for the challenge of the SAT and ACT exams
T, M, A	Thorough understanding of solving quadratic equations using the 4 different methods and their solutions.	
T, M, A	Accurate application of content/process to arrive at correct mathematical solution.	
T, M, A	Selection of evidence that is relevant to content and standardized test processes.	

		● Quizzes ● UNIT Test - to include a variety of DOK level problems and may include SAT style problems ● “Do Now” questions/opening ● activities ● Questioning ● Self-assessment

UNIT 5: Quadratic Equations & Functions **Stage 3 – Learning Plan**		
Code	**Pre-Assessment** ● Teacher checks for prerequisite and prior knowledge via warm-ups and entrance tickets ● Questioning activities, such as basic problems with exponents and radicals. ● As the lessons progress, students can also be given questions such as “Find the mistakes....” ● Warm-ups and skill checks contain review of previous material during the unit to ensure retention and mastery, and check on vertical alignment with prior curriculum.	
M T M	Summary of Key Learning Events and Instruction Student success at transfer meaning and acquisition depends on… ● Teacher checks for prerequisite and prior knowledge via questioning activities, such as basic review problems on simplifying expressions, factoring, graphing, and solving linear functions ● Students will work independently on a review assessment for simplifying expressions, factoring, graphing, and solving linear functions. ● Teacher gives warm-up questions to lead into the	Progress Monitoring ● Monitoring class work through board work, group work, questioning, and walk-arounds. ● Strategic Questioning: Ask students higher-order questions such as “how” and “why,” so the teacher can discern the level and extent of the students’ understanding. ● Quick homework check to assess common errors to inform future instruction. ● Formative Assessments

	concept of imaginary numbers. Complex numbers are also discussed, and teacher models examples of simplifying and performing operations of addition, subtraction, multiplication, and division with complex numbers.	
T	● Students will give ideas and examples of imaginary and complex numbers.	
T,A	● Students will work as a class and then independently to simplify and perform mathematical operations with complex numbers. Individual students will put up answers to practice problems on the board	
M	● Teacher uses TI Emulator graphing calculator or Smart Board technology to facilitate class discovery of the effect the values a, h, and k have on the graphing form of a quadratic function ($y = a(x-h)^2 + k$).	
T,A	● Students will discover the properties of the graphing form of a quadratic function by observing the changes of the graph of a parabola when different values are inserted. Students will work as a class and in pairs to find the key values of a parabola and to graph it. Students' work will be put on the board as a way to review and monitor progress.	
M	● Teacher uses that discovery to introduce the key features of the graph of a parabola: vertex, axis of symmetry, direction of opening, max/min value, x- and y- intercepts, domain, and range.	
M	● Teacher models, with the help from students, how to graph a parabola from that information.	
M	● Teacher models how to get any quadratic function into graphing form by the method of completing the square.	
T,A	● Students will practice completing the square to get a quadratic function in graphing form by working in teacher created groups.	
M	● Teacher reviews steps to factoring a quadratic equation	

	and discusses the need for alternate methods for solving quadratic equations. Modeling of examples that do not factor should be used to show the methods of completing the square and the quadratic formula. Ample time and practice of each method are given.	
T,A	● Students will solve quadratic equations using the methods of factoring, quadratic formula, and completing the square. Students will verbally state the quadratic formula from memory and use song as a way of stating it.	
M	● Teacher uses song as a means to memorize the quadratic formula. Teacher models the value of the discriminant to explain the type and number of solutions for a quadratic function	
T,A	● Students will determine the type and number of solutions in a quadratic equation given its discriminant.	

Suggested Resources:

- Textbook: Charles, Randall et al. *Algebra 2 Common Core*, Boston, MA: Pearson, 2012.
- Supplemental activities from the textbook resources on operations with complex and imaginary numbers, solving quadratics by completing the square, solving quadratics by the quadratic formula, solving quadratics by graphing, and solving quadratics by factoring.
- Teacher made supplemental activities on operations with complex and imaginary numbers, solving quadratic equations by various methods, quadratic functions (finding critical values and graphing), applications, performance tasks, and chapter review
- Graphing calculator
- TI Emulator software
- On-line resources such as You Tube, Khan Academy, Desmos, etc.

Subject/Course: **Mathematics/Honors Algebra 2** **UNIT 6: Exploring Polynomial Equations & Functions**

Time Frame: 4 weeks

UNIT 6: Exploring Polynomial Equations & Functions **Stage 1 Desired Results**	
ESTABLISHED GOALS CCSS.MATH.CONTENT.HSA.APR.B.2 Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$. CCSS.MATH.CONTENT.HSA.APR.B.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. CCSS.MATH.CONTENT.HSA.APR.A.1	**Transfer** Students will be able to independently use their learning to… **CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.** **CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.** **CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.** **CCSS.Math.Practice.MP4 Model with mathematics.** **CCSS.Math.Practice.MP5 Use appropriate tools strategically.** **CCSS.Math.Practice.MP6 Attend to precision.** **CCSS.Math.Practice.MP7 Look for and make use of structure.** ● Identify and apply the properties of exponents to simplify expressions. ● Perform operations with polynomials ● Factor polynomials as a means to find solutions. ● Use various methods to solve quadratic equations. ● Recognize the distinguishing behaviors of polynomial graphs

Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. CCSS.MATH.CONTENT.HSA.APR.C.5 (+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of $x$and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle CCSS.MATH.CONTENT.HSA.REI.D.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line) CCSS.MATH.CONTENT.HSA.APR.D.6 Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the	● Analyze graphs and find the domain, range, intercepts, maximum and minimum values, and intervals where the graph is increasing, decreasing, and constant. ● Model real-world situations as polynomial functions, and solve problems involving these functions.	
	Meaning	
	UNDERSTANDINGS Students will understand that… ● Values, expressions, and polynomials can be simplified using a specific process. ● Exponents are related to the operations of addition and multiplication. ● Negative exponents represent reciprocals of values. ● Polynomials can be added, subtracted, and multiplied to make a more simplified expression. ● Polynomials can be broken up into products of more simplified terms by factoring. ● Quadratic and other polynomial equations can be solved using factoring. ● Graphs of Polynomial functions can be used to find domain, range, and intercepts and to tell the nature of the function(increasing, decreasing, constant , maxima, minima) ● A polynomial function has distinguishing behaviors. You can look at its algebraic form and know	ESSENTIAL QUESTIONS Students will keep considering… ● How are the properties of exponents related to the basic arithmetic operations? ● How are polynomial expressions combined using operations of addition, subtraction, and multiplication? ● How does a negative exponent change a value? ● Why does factoring “work” as a method of solving quadratic and polynomial equations? ● What are some real-world applications that involve polynomial modeling? ● Why do some some functions have restricted values? ● How do you find the degree of a polynomial function? ● What does the degree of a polynomial tell you about its related polynomial function? ● For a polynomial function, how are factors, zeros, and x-intercepts related? ● For a polynomial equation, how are factors and roots related?

degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system	something about its graph. You can look at its graph and know something about its algebraic form.	
	Acquisition	
	Students will know… ● Properties of exponents ● Degree of a monomial and polynomial ● Definition of an algebraic term ● Addition, subtraction, and multiplication processes of polynomials ● Steps and processes to factoring polynomials ● Methods and processes to solving a polynomial equation ● A polynomial function is classified by degree. ● The degree of a polynomial determines the possible number of turning points in its graph and the end behavior of the graph. ● A turning point is a relative maximum or relative minimum of a polynomial function. ● What constitutes even vs. odd multiplicity when the function is in its algebraic form. Key terms: exponent, polynomial, monom ial, binomial, trinomial, degree, coefficient, factor, greatest common factor, difference of squares, sum/difference of cubes, grouping	Students will be skilled at… ● Simplifying expressions using the rules of exponents ● Identifying the degree of a monomial and polynomial ● Classifying a polynomial by the number of terms ● Performing the operations of Addition, subtraction, and multiplication of polynomials ● Factoring polynomial expressions ● Solving polynomial equations by factoring or graphing methods ● Graphing polynomials and Identifying intercepts, points of relative maxima and minima, intervals where the function is increasing, decreasing, or constant, as well as find specific values from the graph of a function ● Recognize from a graph the key features of a polynomial such as the factors, zeros, relative minimums, relative maximums. ● Using technology tools (i.e., calculators, videos,educational software) for problem solving, self-directed learning, and extended learning activities.

UNIT 6: Exploring Polynomial Equations & Functions Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T,M,A	Scoring Rubric used to evaluate successful understanding of the process and criteria for a desired outcome.	PERFORMANCE TASK(S): Students will show that they really understand evidence of… **Goal:** To apply the skills of polynomial functions in the design of roller coaster rides. **Role:** Roller Coaster Engineer **Audience**: Amusement Park Manager **Situation**: Given three different polynomial functions that model roller coasters, the student is asked to graph each function, find the heights at different independent variables (time), and evaluate the function at a given independent variable. **Product:** Demonstration of a clear and in depth understanding of polynomial functions, such as sketching and analyzing graphs of polynomial functions, determining zeros of a polynomial function, and determining polynomial function behavior. **Standard for Success**: rubric based on understanding, accuracy, communication of results, presentation of evidence to support claim. **To differentiate:** Provide different problems with different levels of difficulty from which students can choose.

M, A	Thorough understanding of polynomial behavior, evaluation of functions, and modeling of polynomials.	OTHER EVIDENCE: Students will show they have achieved Stage 1 goals by… ● Monitoring class work through board work, group work, questioning, and walk-arounds. ● Quick homework check to assess common errors to inform future instruction. ● Check for understanding: board and whiteboard activities, or reflections and exit tickets. ● Quizzes ● UNIT Test - to include a variety of DOK level of problems and may include SAT style problems ● “Do Now” questions/opening ● activities ● Differentiate through purposeful or flexible grouping, use of diagrams and explanations to demonstrate understanding and active lessons involving discovery, scaffolding, jigsaw activities and use of hands-on manipulatives ● Alternative assessment projects such as ”find the mistakes”, explain the process, posters, and real world applications ● Review of standardized test questions to prep students for the challenge of the SAT and ACT exams ● Questioning ● Self-assessment ● Smartboard activities, (Kahoot, Quizlet, etc.)
T, M, A	Thorough understanding of vocabulary, application of functions, and correct graphing of functions.	
T, M, A	Accurate application of content/process to arrive at correct mathematical solution.	
T, M, A	Selection of evidence that is relevant to content and standardized test processes.	

UNIT 6: Exploring Polynomial Equations & Functions
Stage 3 – Learning Plan

Code	Pre-Assessment	
M	● Teacher checks for prerequisite and prior knowledge via warm-ups and entrance tickets ● Questioning activities, such as basic problems with exponents and radicals. ● As the lessons progress, students can also be given questions such as “Find the mistakes....” ● Warm-ups and skill checks contain review of previous material during the unit to ensure retention and mastery, and check on vertical alignment with prior curriculum.	
		Progress Monitoring
M	● Teacher checks for prerequisite and prior knowledge via warm-ups on solving and graphing linear functions	● Monitoring class work through board work, group work, questioning, and walk-arounds.
T	● Students will work independently and as a class solving equations and graphing linear equations both manually and on graphing calculators.	● Strategic Questioning: Ask students higher-order questions such as “how” and “why,” so the teacher can discern the level and extent of the students’ understanding.
M	● Teacher introduces the properties of exponents by using visual representations to what exponents mean (e.g., $x^2 \cdot x^3 = x5$ since $x^2 = x \cdot x$ and $x^3 = x \cdot x \cdot x$ giving us a result of 5 x’s).	● Quick homework check to assess common errors to inform future instruction.
T, M	● Students will work independently simplifying exponential expressions and then share results in a teacher created pairing.	● Formative Assessments
M	● Teacher models the addition, subtraction, and multiplication of polynomials.	
M, T	● Students will verbally explain the process of adding, subtracting, and multiplying polynomials. Students will explain what FOIL means in the multiplication of polynomials.	
M	● Teacher explains factoring of a polynomial expression beginning with GCF and grouping on day one, then the difference of squares and the sum and difference of cubes, and lastly trinomials.	
T	● Teacher allows students several opportunities for independent practice and teacher-created groups throughout this topic. Supplemental worksheets and	

	board problems should be used to assess mastery of this concept.	
T,A	● Students will use smartboard to practice factoring polynomial expressions. Students will work in pairs on a mixed review assessment on factoring to explain which method of factoring should be used.	
M	● Teacher uses flow chart to help students determine which method of factoring should be used to factor a polynomial.	
T,M	● Students will describe the factoring methods for solving polynomial equations and practice this method in teacher assigned groups.	
M	● Teacher highlights for students that no matter what a polynomial looks like, the process of factoring always starts with factoring out a GCF if possible. Teacher illustrates method for solving polynomial equation via factoring by hand and by graphing calculator.	
M,A	● Students will solve polynomial equations having a degree greater than two by entering the linear portion in Y1 in their graphing calculators and the rest of the equation in Y2 of their graphing calculators. Students will then use the intersect feature to find the x-values at that point of intersection.	

Suggested Resources:

- Textbook: Charles, Randall et al. *Algebra 2 Common Core*, Boston, MA: Pearson, 2012.
- Supplemental activities from the textbook resources on solving polynomial equations and application problems.
- Teacher-made supplemental activities on solving polynomial equations, word problems, performance tasks, and chapter review.
- Graphing calculator TI Emulator software.
- On-line resources such as You Tube, Khan Academy, Desmos, etc.

Subject/Course: **Mathematics/Honors Algebra 2** **UNIT 7: Exponential & Logarithmic Equations & Functions**

Time Frame: 6 weeks

<table>
<tr><th colspan="2">UNIT 7: Exponential & Logarithmic Equations & Functions
Stage 1 Desired Results</th></tr>
<tr><td rowspan="2">ESTABLISHED GOALS
CCSS.MATH.CONTENT.HSF.IF.C.7.E
Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
CCSS.MATH.CONTENT.HSF.BF.A.1
Write a function that describes a relationship between two quantities.*
CCSS.MATH.CONTENT.HSF.BF.B.5
(+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.</td><td>Transfer</td></tr>
<tr><td>Students will be able to independently use their learning to…

CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.

CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.

CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.

CCSS.Math.Practice.MP4 Model with mathematics.

CCSS.Math.Practice.MP5 Use appropriate tools strategically.

CCSS.Math.Practice.MP6 Attend to precision.
CCSS.Math.Practice.MP7 Look for and make use of structure.
● Change expressions to have the same base in order to solve exponential equations.
● Change expressions from exponential form to logarithmic form and vice-versa.
● Evaluate logarithmic expressions.
● Apply the properties of logarithm to solve logarithmic equations.
● Use common logarithms to solve exponential equations that do not have a common base.
● Identify a natural logarithm as log base e
● Solve real-world problems using logarithms.
Meaning</td></tr>
</table>

	UNDERSTANDINGS Students will understand that… ● Exponential equations can be solved by getting a common base or by using logarithms. ● Logarithms are used to represent exponents, which could not be solved. ● The properties of logarithms relate to the properties of exponents.	ESSENTIAL QUESTIONS Students will keep considering… ● What is the value of an exponential equation in the real-world? ● What does a logarithm represent? ● How does the relationship between exponential and logarithmic functions help us? ● What are some real-world applications of logarithmic and exponential functions?
	Acquisition	
	Students will know… ● The process to solving exponential equations by getting a common base and by using logarithms. ● A logarithm is a way to represent exponents. ● The properties of logarithms. Key terms: exponential equation, base, logarithm	Students will be skilled at… ● Changing expressions to have the same base in order to solve exponential equations. ● Changing expressions from exponential form to logarithmic form and vice-versa. ● Evaluating logarithmic expressions. ● Apply the properties of logarithms to solve exponential equations.

UNIT 7: Exponential & Logarithmic Equations & Functions Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T,M,A	Scoring Rubric used to evaluate successful understanding of the process and criteria for a desired outcome.	PERFORMANCE TASK(S): Students will show that they really understand evidence of… **GOAL**: Students will apply concepts of exponential equations in order to calculate continuous versus yearly compounded interest. **Role**: Students will take on the role of a financial analyst **Audience**: Business Manager **Situation**: Students are given different scenarios that they will compare the two different types of interest rates. **Product:** Analysis of the different scenarios.

		Standard for Success: rubric based on understanding, accuracy, communication of results, presentation of evidence to support claim. **To differentiate:** Provide students with a choice of problems with various levels of difficulty.
M, A T, M, A T, M, A T, M, A	Thorough understanding of the vocabulary, and correct graphing of exponential and logarithmic functions. Thorough understanding of solving exponential and logarithmic equations. Accurate application of content/process to arrive at correct mathematical solution. Selection of evidence that is relevant to content and standardized test processes.	OTHER EVIDENCE: Students will show they have achieved Stage 1 goals by… ● Monitoring class work through board work, group work, questioning,warm-ups, and walk-arounds. ● Quick homework check to assess common errors to inform future instruction. ● Check for understanding: board and whiteboard activities, or reflections and exit tickets. ● Differentiate through purposeful or flexible grouping, use of diagrams and explanations to demonstrate understanding and active lessons involving discovery, scaffolding, jigsaw activities and use of hands-on manipulatives ● Alternative assessment projects such as ”find the mistakes”, explain the process, posters, and real world applications ● Review of standardized test questions to prep students for the challenge of the SAT and ACT exams ● Quizzes ● UNIT Test - to include a variety of DOK level of problems and may include SAT style problems ● “Do Now” questions/opening ● activities ● Questioning ● Self-assessment ● Smartboard activities, (Kahoot, Quizlet, etc.)

UNIT 7: Exponential & Logarithmic Equations & Functions Stage 3 – Learning Plan		
Code	**Pre-Assessment** ● Teacher checks for prerequisite and prior knowledge via warm-ups and entrance tickets ● Questioning activities, such as basic problems with exponents and radicals. ● As the lessons progress, students can also be given questions such as “Find the mistakes....” ● Warm-ups and skill checks contain review of previous material during the unit to ensure retention and mastery, and check on vertical alignment with prior curriculum.	
	Summary of Key Learning Events and Instruction Student success at transfer meaning and acquisition depends on…	Progress Monitoring ● Monitoring class work through board work, group work, questioning, and walk-arounds. ● Strategic Questioning: Ask students higher-order questions such as “how” and “why,” so the teacher can discern the level and extent of the students’ understanding. ● Quick homework check to assess common errors to inform future instruction. ● Formative Assessments
A	● Teacher uses independent/guided practice via supplemental worksheets to review simplifying expressions with exponents.	
M, A	● Students will work independently and in teacher created groups to complete practice problems that review exponents.	
M, A	● Teacher walks around and monitors student progress, assists individual students, and models examples when needed for the class.	
M	● Teacher gives a warm-up question on exponents as a way to lead in to solving exponential equations.	
T, M, A	● Students will use think-pair-share to compare and discuss their answers.	
M, A	● Teacher models different examples of exponential equations that have the same base and the process to solving them.	
M, A	● Students will complete problems on solving exponential equations.	

M, A M, A T, M, A M, A	● Teacher has the class graph the equation y = 2x and its inverse as a way of introducing the graph of an exponential equation and a logarithm. ● Students will volunteer their solutions and will explain the process they used. ● Teacher models how to solve and evaluate logarithmic equations and expressions by changing to exponential form and by applying the properties of logarithms. ● Students will practice evaluating and solving logarithmic expressions and equations by various activities such as independent practice, board work, think-pair-share and/or use of whiteboards.	

Suggested Resources:

- Textbook: Charles, Randall et al. *Algebra 2 Common Core*, Boston, MA: Pearson, 2012.
- Supplemental activities from the textbook resources on solving exponential & logarithmic equations and application problems.
- Teacher-made supplemental activities on solving exponential & logarithmic equations, applications, performance tasks, and chapter review.
- Graphing calculator TI Emulator software.
- On-line resources such as You Tube, Khan Academy, Desmos, etc.

Subject/Course: **Mathematics/Honors Algebra 2** **UNIT 8: Rational Equations & Functions**

Time Frame: 4 weeks

UNIT 8: Rational Equations & Functions

Stage 1 Desired Results

ESTABLISHED GOALS

CCSS.Math.Content.HSA.SSE.B.3
Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

CCSS.Math.Content.HSA.APR.D.7
(+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract,multiply, and divide rational expressions.

CCSS.Math.Content.HSA.CED.A.1
Create equations and inequalities in one variable and use them to solve problems.Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

CCSS.Math.Content.HSA.REI.A.2
Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

CCSS.MATH.CONTENT.HSA.REI.B.4
Solve quadratic equations in one variable

Transfer

Students will be able to independently use their learning to…

CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.

CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.

CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.

CCSS.Math.Practice.MP4 Model with mathematics.

CCSS.Math.Practice.MP5 Use appropriate tools strategically.

CCSS.Math.Practice.MP6 Attend to precision.

CCSS.Math.Practice.MP7 Look for and make use of structure.

- Identify and describe inverse and direct variation functions.
- Graph asymptotes of rational functions.
- Identify whether a rational function has an asymptote.
- Differentiate between vertical, horizontal, and oblique asymptotes.
- Define the domains of simplified rational expressions to make them equivalent to the originals.

Meaning

UNDERSTANDINGS
Students will understand that…

- In a direct variation, two positive quantities either increase together or decrease together. In an inverse variation, as one quantity increases the other decreases.
- Transformations of the parent reciprocal function include stretches,

ESSENTIAL QUESTIONS
Students will keep considering…

- Are two quantities inversely proportional if an increase in one corresponds to a decrease in the other?
- What kinds of asymptotes are possible for a rational function?
- Are a rational expression and its simplified form equivalent?

CCSS.MATH.CONTENT.HSA.REI.B.4.A Use the method of completing the square to transform any quadratic equation in *x into* an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. CCSS.MATH.CONTENT.HSA.REI.B.4.B Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b CCSS.MATH.CONTENT.HSA.REI.C.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the	compressions, reflections, and horizontal and vertical translations. ● A rational function is a ratio of polynomial functions. If ia rational function is in simplified form and the polynomial in the denominator is not constant, the graph of the rational function features asymptotic behavior. It looks quite different from the graph of either of its polynomial components. ● You can use much of what you know about multiplying and dividing fractions to multiply and divide rational expressions. ● To operate with rational expressions, you can use much of what you know about operating with fractions. To add or subtract rational expressions, you first find a common denominator - preferably the least common multiple of the denominators. ● To solve an equation containing rational expressions, first multiply each side by the least common denominator of the rational expressions. Doing this, however, can introduce extraneous solutions.	
	Acquisition	
	Students will know… ● Restrictions on the domain of a rational expression. ● Steps and processes to simplifying,	Students will be skilled at… ● Identifying values that are restricted from the domain of a rational expression. ● Writing a rational expression in simplest

line $y = -3x$ and the circle $x^2 + y^2 = 3$. CCSS.MATH.CONTENT.HSA.SSE.B.3.B Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines CCSS.MATH.CONTENT.HSN.CN.C.7 Solve quadratic equations with real coefficients that have complex solutions. CCSS.MATH.CONTENT.HSA.REI.D.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line)	multiplying, and dividing rational expressions. ● Methods and processes to adding and subtracting rational expressions. ● Steps and processes to simplifying complex rational expressions. ● Process to solving rational equations. ● Representations and steps to solving real-world application problems involving rational equations. Key terms: rational expression, factors, least common denominator, complex fraction, replacement set (restrictions)	form. ● Multiplying and divide rational expressions by factoring. ● Adding and subtracting rational expressions. ● Simplifying complex rational expressions. ● Solving rational equations. ● Solving real-world problems using methods listed above. ● Using technology tools (i.e., calculators, videos,educational software) for problem solving, self-directed learning, and extended learning activities.

UNIT 8: Rational Equations & Functions

Stage 2 – Evidence

Code	Evaluative Criteria	Assessment Evidence
T,M,A	Scoring Rubric used to evaluate successful understanding of the process and criteria for a desired outcome.	PERFORMANCE TASK(S): Students will show that they really understand evidence of… **Goal:** To identify correct and incorrect steps for simplifying rational expressions **Role**: Teacher Audience: Student who solved the problem **Situation**: Students are given a problem set with specific steps shown as a solution. Students then identify if each step is correct or incorrect and explain why. **Product**: Corrected problem to include feedback and explanation. **Standard for Success**: rubric based on understanding, accuracy, communication of results, presentation of evidence to support claim. **To Differentiate:** Allow students to choose from problems at a variety of difficulty levels.

M, A	Thorough understanding of identifying values that are restricted from the domain, simplifying a rational expression, types of polynomials.	OTHER EVIDENCE: Students will show they have achieved Stage 1 goals by… ● Monitoring class work through board work, group work, questioning, and walk-arounds. ● Quick homework check to assess common errors to inform future instruction. ● Check for understanding: board and whiteboard activities, or reflections and exit tickets.. ● Differentiate through purposeful or flexible grouping, use of diagrams and explanations to demonstrate understanding and active lessons involving discovery, scaffolding, jigsaw activities and use of hands-on manipulatives ● Alternative assessment projects such as ”find the mistakes”, explain the process, posters, and real world applications ● Review of standardized test questions to prep students for the challenge of the SAT and ACT exams ● Quizzes ● UNIT Test - to include a variety of DOK level of problems and may include SAT style problems ● “Do Now” questions/opening ● activities ● Questioning ● Self-assessment ● Smartboard activities, (Kahoot, Quizlet, etc.)
T, M, A	Thorough understanding of steps and processes to simplify, multiply divide,add,subtract, and solve rational expressions.	
T, M, A	Accurate application of content/process to arrive at correct mathematical solution.	
T, M, A	Selection of evidence that is relevant to content and standardized test processes.	

UNIT 8: Rational Equations & Functions

Stage 3 – Learning Plan

Code	Pre-Assessment	
M	● Teacher checks for prerequisite and prior knowledge via warm-ups and entrance tickets ● Questioning activities, such as basic problems with exponents and radicals. ● As the lessons progress, students can also be given questions such as “Find the mistakes....” ● Warm-ups and skill checks contain review of previous material during the unit to ensure retention and mastery, and check on vertical alignment with prior curriculum.	
	Summary of Key Learning Events and Instruction Student success at transfer meaning and acquisition depends on…	Progress Monitoring ● Monitoring class work through board work, group work, questioning, and walk-arounds. ● Strategic Questioning: Ask students higher-order questions such as “how” and “why,” so the teacher can discern the level and extent of the students’ understanding. ● Quick homework check to assess common errors to inform future instruction. ● Formative Assessments
M	● Teacher activates prior knowledge via pre-assessment worksheets on the adding/subtracting of rational numbers, simplifying exponential expressions, factoring polynomials, and solving polynomial equations.	
M,,A	● Students will work independently and as a class factoring polynomial expressions and solving polynomial equations.	
M	● Teacher introduces concept of simplifying rational expressions as being dependent on factoring polynomials.	
M, A	● Students will use the white boards to practice simplifying rational expressions.	
M	● Teacher models multiplying and dividing rational expressions.	
M, A	● Students will explain in writing whether or not terms can be cancelled in a rational expression and why.	
M, A	● Students will recite the meaning of “Keep-Change-Flip” for dividing rational expressions	
M	● Teacher makes connections to the similarities in the process used in adding/subtracting rational expressions verses basic fractions.	
M	● Teacher invites a volunteer to write the steps for adding a fraction similar to ½ + ⅝ on the board.	

M, A	● Students will verbally explain the process of finding the least common denominator (LCD) in order to add and subtract rational expressions.	
M, A	● Students will practice simplifying complex rational expressions as a class and independently.	
M,A	● Students will solve rational equations by cross-multiplication or by setting the LCDs equal to each other.	
M,A	● Teacher suggests changing a complex fraction to a division problem in the form of (N) ÷ (D) where N and D are the expressions in the numerator and denominator of the complex fraction.	
T, M,A	● Supplemental worksheets and board problems should be used to assess mastery of the process.	
T,M, A	● Teacher models rational equations via real-world application problems.	
T,M,A	● Students will solve real-world application problems involving rational equations.	

Suggested Resources:

- Textbook: Charles, Randall et al. *Algebra 2 Common Core*, Boston, MA: Pearson, 2012.
- Supplemental activities from the textbook resources on solving rational equations and application problems.
- Teacher-made supplemental activities on solving rational equations, applications, performance tasks, and chapter review.

- Graphing calculator TI Emulator software.
- On-line resources such as You Tube, Khan Academy, Desmos, etc.

Subject/Course: **Mathematics/Honors Algebra 2** **UNIT 9: Exploring Trigonometric Functions**

Time Frame: 7 weeks

UNIT 9: Exploring Trigonometric Functions **Stage 1 Desired Results**	
ESTABLISHED GOALS CCSS.MATH.CONTENT.HSF.IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.* CCSS.MATH.CONTENT.HSF.IF.C.7.E Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	**Transfer** Students will be able to independently use their learning to… **CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.** **CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.** **CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.** **CCSS.Math.Practice.MP4 Model with mathematics.** **CCSS.Math.Practice.MP5 Use appropriate tools strategically.** **CCSS.Math.Practice.MP6 Attend to precision.** **CCSS.Math.Practice.MP7 Look for and make use of structure.** ● Recognize when to apply procedures of trigonometric functions to real world applications.

<table>
<tr>
<td rowspan="6">CCSS.MATH.CONTENT.HSF.TF.A.1

Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

CCSS.MATH.CONTENT.HSF.TF.A.2

Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

CCSS.MATH.CONTENT.HSF.TF.A.3

(+) Use special triangles to determine geometrically the values of sine, cosine, tangent for π/3, π/4 and π/6, and use the unit circle to express the values of sine, cosine, and tangent for x, π + x, and 2π - x in terms of their values for x, where x is any real number

CCSS.MATH.CONTENT.HSG.SRT.C.8

Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied</td>
<td colspan="2">● Apply abstract reasoning of trigonometric functions to other scenarios, attending to precision, persevere in solving, and recognizing repeated reasoning.</td>
</tr>
<tr>
<td colspan="2">Meaning</td>
</tr>
<tr>
<td>UNDERSTANDINGS
Students will understand that…
● Similar right triangles will have the same relationships between specific pairs of sides (i.e., opposite: hypotenuse).
● Right triangle trigonometry has many uses and applications in the real-world.
● Right triangle trigonometry has many uses and applications.
● The unit circle can represent angles of any measure, in degrees or radians, and is cyclic.
● The trigonometric functions of specific angles relate to specific points and values on the unit circle.
● The graphs of the trigonometric functions are cyclic with certain traits.
● Sine and cosine graphs produce “waves.”</td>
<td>ESSENTIAL QUESTIONS
Students will keep considering…
● Why do the trigonometric ratios hold for all right triangles with the same angle measures?
● How can the use of right triangles, trigonometric functions, and the Pythagorean Theorem be used to solve real-world problems?
● How can the use of right triangles, trigonometric functions, and the Pythagorean Theorem be used to solve real world problems?
● What is the unit circle and why is it important in trigonometry?
● Why do the graphs of trigonometric functions look the way they do?
● How do the graphs of sine and cosine apply to real life applications?
● What are the uses of inverse trigonometric functions?</td>
</tr>
<tr>
<td colspan="2">Acquisition</td>
</tr>
<tr>
<td>Students will know…
● Pythagorean Theorem
● Definitions of the six trigonometric functions
● Radian measures
● Angles, points, and trigonometric values on the unit circle
● Reference angles
● Methods to graphing sine, cosine,</td>
<td>Students will be skilled at…
● Use the Pythagorean Theorem and right triangle trigonometry to solve right triangles
● Define the six trigonometric functions
● Construct a unit circle and identify angles in both degree and radian measures
● Convert degrees to radians (and vice versa)</td>
</tr>
</table>

problems.* CCSS.MATH.CONTENT.HSG.SRT.C.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. CCSS.MATH.CONTENT.HSA.REI.A.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise Students show graphic representation of data. CCSS.MATH.CONTENT.HSA.CED.A.1 Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions*. CCSS.MATH.CONTENT.HSA.REI.D.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be	tangent, cosecant, and secant, and their general behaviors ● Inverse trigonometric functions **and the restrictions on their ranges** ● **Compositions of trigonometric functions** ● Key Terms: Pythagorean Theorem, trigonometric ratios, (sine, cosine, tangent),sine, cosine, tangent, cosecant, secant, cotangent, radian, degree, coterminal, complementary, supplementary, unit circle, angle in standard position, cyclic, reference angle, amplitude, period, phase shift, vertical shift, inverse trigonometric functions	● Identify specific points on the unit circle ● Define the trigonometric functions as related to the x and y coordinates and radius on the unit circle ● Use reference angles and definitions of the trigonometric functions to find the specific values on the unit circle. ● Fill in the trigonometric table for values of special and quadrantal angles ● Graph sine, cosine, tangent, cosecant, and secant functions and identify special characteristics such as amplitude, period, phase shift, and vertical shift ● Identify the domain and range of inverse trigonometric functions ● Find the exact values of inverse trigonometric functions and composite trigonometric functions ● Use graphing calculators to check graphs of trigonometric values and to find approximate solutions to problems ● Solve real-world applications involving right triangle trigonometry.

a line) Students use technology tools (i.e., calculators, data collection probes, videos) for problem solving, self-directed learning, and extended learning activities.		

UNIT 9: Exploring Trigonometric Functions **Stage 2 – Evidence**		
Code	**Evaluative Criteria**	**Assessment Evidence**
T, M A	Scoring rubric: used to evaluate a correct method of calculation, accurate collection of data, and calculation of solution.	PERFORMANCE TASK(S): Students will show that they really understand evidence of… You can use a function to model real-world situations based on data from the situation. **<u>Performance Task 1</u>** **Goal:** To use right triangle trigonometry to solve real-world application problems **Role:** Surveyor **Audience:** Land development company **Situation:** Given various situations, you are to calculate unknown distances to report to the land development company for construction purposes . **Product:** Calculated distances with work shown. **Standards for Success:** Mathematic department scoring rubric **To Differentiate:** Allow students to choose from problems at a variety of difficulty levels.

		<u>Performance Task 2</u> **Goal:** To calculate your personal biorhythm chart for the current month **Role:** Social scientist **Audience:** School staff **Situation:** You are to convince school staff whether or not your personal academic performance will be stronger or weaker based on your biorhythm **Product:** Your completed biorhythm **Standards for Success:** Mathematics department scoring rubric **<u>Performance Task 3</u>** In one year on the Arctic and Antarctic Circles, the amount of daylight each day varies from 0 h to 24 h. Let *Ar(d)* and *An(d)* represent the amount of daylight as a function of the day of the year *d* at the two locations, respectively. Things to think about: ● If *Ar(d) =24, what does the value of An(d) have to be?* ● *What will the values for Ar(d) and An(d) sum to for a given value of d?* Product: ● Describe the graph of one of the functions. ● Tell how the graph of the other function relates to the first graph. ● Do the graphs resemble patterns you have seen elsewhere? If so, what patterns? ● How could you predict the future behavior of these functions?

		OTHER EVIDENCE: Students will show they have achieved Stage 1 goals by… ● Monitoring class work through board work, group work, questioning, and walk-arounds. ● Quick homework check to assess common errors to inform future instruction. ● Check for understanding: board and whiteboard activities, or reflections and exit tickets. ● Differentiate through purposeful or flexible grouping, use of diagrams and explanations to demonstrate understanding and active lessons involving discovery, scaffolding, jigsaw activities and use of hands-on manipulatives ● Review of standardized test questions to prep students for the challenge of the SAT and ACT ● Alternative assessment projects such as ”find the mistakes”, explain the process, posters, and real world applications ● Quizzes ● UNIT Test - to include a variety of DOK level of problems and may include SAT style problems ● “Do Now” questions/opening ● activities ● Questioning ● Self-assessment ● Smartboard activities, (Kahoot, Quizlet, etc.)

UNIT 9: Exploring Trigonometric Functions Stage 3 – Learning Plan		
Code	**Pre-Assessment** ● Teacher checks for prerequisite and prior knowledge via warm-ups and entrance tickets ● Questioning activities, such as basic problems with exponents and radicals. ● As the lessons progress, students can also be given questions such as “Find the mistakes....” ● Warm-ups and skill checks contain review of previous material during the unit to ensure retention and mastery, and check on vertical alignment with prior curriculum.	
M	Summary of Key Learning Events and Instruction Student success at transfer meaning and acquisition depends on…	Progress Monitoring ● Monitoring class work through board work, group work, questioning, and walk-arounds.
M	● Teacher reviews the Pythagorean Theorem and right triangle trigonometry.	● Strategic Questioning: Ask students higher-order questions such as “how” and “why,” so the teacher can discern the level and extent of the students’ understanding.
M, A	● Students will practice solving right triangles using trigonometry by working in teacher created groups.	● Quick homework check to assess common errors to inform future instruction.
T, M, A	● Teacher gives review and practice problems as class work to find missing sides and angles. Lesson leads into the introduction of the three reciprocal trigonometric functions, and applications of trigonometry will be discussed.	● Formative Assessments
T, M, A	● Students will also identify the values of the reciprocal functions and will use their calculators to find specific values.	
M, A	● Teacher introduces the concept of the Unit Circle by first discussing radian measure as a representation of the length of the arc on the circle.	
M, A	● Teacher leads class through the discovery of the relationship between degrees and radians and how to convert degrees to radians and radians to degrees.	
M, A	● Students will work independently on changing measures from degrees to radians and radians to	

	degrees.	
M, A	● Teacher continues to demonstrate the relations on the Unit Circle to points on the circle and angle measures.	
T, M, A	● After a review of special right triangles, teacher models how to find specific points given particular reference angles.	
T, M, A	● Students will complete the Unit Circle chart with specific degree measure, radian measure, and the coordinate of the associated points. Students may collaborate with a partner on their solutions.	
T, M	● Teacher prepares materials (garland, laminated color coded cards with degree measures, radian measures, and coordinates of points) for the Unit Circle activity where students physically construct a model of the Unit	
T, M	Circle.	
	● Students will work cooperatively as a group to construct the Unit Circle in the rotunda using garland and laminated values on the circle.	
T, M, A	● Students will then use the Unit Circle and reference angles to fill in the trigonometric table. Students will then play the “Move It” game where they must move to a specific value on the circle.	
M, A	● Teacher reviews the relationships of trigonometric functions in right triangles and then shows the connection with the x, y, and r values of the Unit Circle. Lesson leads into applications of the trigonometric functions to any point in the coordinate plane, which the teacher models and explains.	
T, M, A	● Students will apply the definitions of the trigonometric functions to the Unit Circle. Students will then find the values of the trigonometric functions at any value.	
M, A	● With the help of the graphing calculator, teacher leads class through graphing the sine and cosine curves. Discussion on the general shape of the curves, their	

	periodic behavior, and their amplitude, period, phase shift, and vertical shift occurs.	
M, A	● Teacher leads class through examples on how to graph sine and cosine functions.	
T, M, A	● Students will work at the board to practice graphing sine and cosine functions, identifying the amplitude, period, phase shift, and vertical shift.	
M, A	● Teacher has class make a t-table to graph the tangent curve. The general shape of the curve and its period will be discussed.	
M, A	● Teacher models how to graph the secant and cosecant functions by using the sine and cosine graphs as "helpers."	
M, A	● Students will graph y=tanx as well as various cosecant and secant curves by working in teacher created groups.	
M, A	● Teacher models how to use the graphing calculator and trigonometric table to find approximate and exact values of inverse trigonometric functions. Teacher also explains how to find composite trigonometric values.	
T, M, A	● Students will work in pairs to find inverse and composite trigonometric functions using their calculators and the trigonometric table.	
M, A	● Teacher determines cooperative groups for various activities during this unit.	

Suggested Resources:

- Textbook: Charles, Randall et al. *Algebra 2 Common Core*, Boston, MA: Pearson, 2012.
- Supplemental activities from the textbook resources on solving trigonometric equations and application problems.
- Teacher-made supplemental activities on solving trigonometric equations, applications, performance tasks, and chapter review.
- Graphing calculator TI Emulator software.
- On-line resources such as You Tube, Khan Academy, Desmos, etc.