NEW MILFORD PUBLIC SCHOOLS

New Milford, Connecticut

Advanced Algebra and Trigonometry

March 2023

BOE Approved June 2023

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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.

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Advanced Algebra and Trigonometry

Grade 11-12

Advanced Algebra and Trigonometry is a full year course designed for students who have completed a full year of Algebra 2. Topics in this course include a study of polynomial, trigonometric, exponential and logarithmic functions, graphing techniques, complex numbers, and topics in analytic geometry. A graphing calculator (TI-83+/TI-84+) is required for this course and is used throughout the year.

Vision of a Graduate

Advanced Algebra and Trigonometry is a course that promotes problem solving, critical thinking, and a positive growth mindset. Throughout this course, students create a plan to solve a problem that follows a set procedure. Students will use effective reasoning to seek alternative and creative methods to find a solution. Students are expected to communicate verbally and through written expression how they arrived at their solution and what the solution means in the context of an application. Students will improve their skills through self-reflection and perseverance.

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Pacing Guide

Unit 1: Algebra Prerequisite Review	7-8 weeks
Unit 2: Graphs and Functions	4-6 weeks
Unit 3: Polynomial and Rational Functions	7-8 weeks
Unit 4: Exponential and Logarithmic Functions	3-4 weeks
Unit 5: Trigonometric Functions	7-8 weeks
Unit 6: Additional Topics in Trigonometry	1-2 weeks

ESTABLISHED GOALS

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.

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.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.

Transfer

Students will be able to independently use their learning to…

Make sense of a problem by initiating a plan and persevere in solving
Model with mathematics by using the appropriate method
Reason abstractly
Justify reasoning or understanding by explaining techniques to solving
Attend to precision

Meaning

UNDERSTANDINGS

Students will understand that…

- Exponents and radicals are related to the operation of addition and multiplication; a radical is the inverse of an exponent.
- Simplified radicals result 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, subtraction, multiplication, and division following a specific process.
- 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

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 are polynomial expressions combined using operations of addition, subtraction, and multiplication?
- 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?
- What is an extraneous solution for a rational

	factoring. ● The degree of a polynomial is the greatest exponent among its monomial terms. ● Rational functions are a ratio of polynomial functions. If a 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. ● Multiplication and division of rational expressions uses much of what you know about multiplying and dividing fractions. ● Operations of rational expressions 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. ● Equations containing rational expressions must be solved by first multiplying each side by the least common denominator of the rational expressions. Doing this, however, can introduce extraneous solutions. ● Linear equations and inequalities 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. ● Quadratic and other polynomial equations can be solved using factoring.	function? ● Are a rational expression and its simplified form equivalent? ● 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? ● For a polynomial equation, how are factors and roots related?

	Acquisition	
	Students will know…	*Students will be skilled at…*
	● Properties of exponents ● 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. ● Methods and processes to simplify expressions with rational 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 ● Restrictions on the domain of a rational expression. ● Steps and processes to simplifying,multiplying, and dividing rational expressions. ● Methods and processes for adding and subtracting rational expressions. ● Steps and processes to simplifying complex rational expressions. ● Process to solving rational equations. ● Comparing values (>, <, =). ● The absolute value of a number. ● The process for evaluating and	● Simplifying expressions using the rules of exponents ● Simplifying nth roots. ● Determining all real roots of a real number and the degree of a radical expression. ● Simplifying radical expressions. ● Multiplying and dividing radical expressions. ● Rationalizing the denominator of a radical expression. ● Adding and subtracting radical expressions. ● Multiplying and dividing binomial radical expressions. ● 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 ● Identifying values that are restricted from the domain of a rational expression. ● Writing a rational expression in simplest form. ● Multiplying and dividing rational expressions by factoring. ● Adding and subtracting rational expressions. ● Simplifying complex rational expressions. ● Solving rational equations. ● Comparing values both on a number line and using inequality symbols. ● Finding the absolute value of a number ● Simplifying and evaluate algebraic expressions

	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. ● Methods and processes to solving a polynomial equation	● Solving linear, literal, and absolute value equations and identifying those that have no solution. ● Solving inequalities, compound inequalities, and absolute value inequalities according to specified processes. ● Solving polynomial equations by factoring

STAGE 2

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 solving linear/rational/quadratic equations 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.

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…*
M	Thorough understanding of identifying values that are restricted from the domain, simplifying a rational expression, types of polynomials.	● 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 ● “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 equations.	
T, M, A	Accurate application of content/process to arrive at the correct mathematical solution.	
T, M, A	Selection of evidence that is relevant to content and standardized test processes.	

stage 3

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. ● Homework check to assess common errors to inform future instruction. ● Check prerequisite knowledge throughout the unit using warm-up problems and questioning 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 ● Check for understanding: board and whiteboard activities, or reflections and exit tickets. ● 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 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 multiplying binomials to multiplying binomial radical expressions.	
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 charts to help students determine which method of factoring should be used to factor a polynomial.	
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.	
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 the 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 canceled 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 versus 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.	
M, A	● Teacher models examples evaluating expressions and solving equations.	
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.	
T, M	● Students will describe the factoring methods for solving polynomial equations and practice this method in teacher assigned groups.	
	Resources:	

	All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval. ● Textbook: Blitzer, Robert. Precalculus Second Edition, Upper Saddle River, NJ: Pearson, 2004. ● Supplemental activities from the textbook resources ● Teacher-made supplemental activities on applications, performance tasks, and chapter review ● Graphing calculator TI Emulator software. ● On-line resources such as YouTube, Khan Academy, Desmos, EdPuzzle, Kahoot, etc.	

UbD Template 2.0 UNIT 2: Graphs and Functions

ESTABLISHED GOALS Include any national/state/or school goals (Power standards). 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.HSF.IF.A.1 Understand that a function from one set (called the domain) to another set (called the range)	***Transfer*** *Students will be able to independently use their learning to…* Make sense of a problem by initiating a plan and persevere in solving Model with mathematics by using the appropriate method Reason abstractly Justify reasoning or understanding by explaining techniques to solving Attend to precision	
	Meaning	
	UNDERSTANDINGS *Students will understand that…*	ESSENTIAL QUESTIONS *Students will keep considering…*

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 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	● A line contains its own unique slope and y-intercept. ● The slope of a line represents the rate of change of that line. ● Information about a line can be used to write an equation for that line. ● 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. ● Parent functions have specific characteristics when graphed, and putting values in specific places will transform (move) the graph in specific ways.	● What are the different forms of linear equations, and why is it useful to have them? ● What applications can be represented by linear equations? ● What are the similarities and differences between the graphs of linear functions and absolute value functions? ● Why is it important to represent the same relation or function using multiple formats? ● 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… ● What the slope of a line represents and how to find it ● The distinction between relations and functions. ● How to find the domain and range of a function ● 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	*Students will be skilled at…* ● Recognizing slope as a rate of change ● Identifying slopes of horizontal, vertical, parallel, and perpendicular lines ● Writing and graph equations in point-slope and slope-intercept form ● Determining the domain and range from a relation and represent the relation using a mapping diagram ● Deciding if a relation is a function when ● given a set of ordered pairs, a mapping, and a graph

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.	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.	● 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.

STAGE 2

Code	Evaluative Criteria	Assessment Evidence
T, M, A	Further information: 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 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 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.

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…*
M	Thorough understanding of identifying values that are restricted from the domain, simplifying a rational expression, types of polynomials.	● 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 ● “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 equations.	
T, M, A	Accurate application of content/process to arrive at the correct mathematical solution.	
T, M, A	Selection of evidence that is relevant to content and standardized test processes.	

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 activates prior learning by giving practice through homework, warm-ups, and entrance tickets to review linear equations and slope	● Monitoring class work through board work, group work, questioning, warm-ups, and walk-arounds. ● Homework check to assess common errors to inform future instruction. ● Check prerequisite knowledge throughout the unit using warm-up problems and questioning activities.
A	● Students review and practice writing and graphing linear equations.	
M, A	● Teacher activates prior learning of graphing by giving warm-up exercises on graphing points in the coordinate	

	plane and evaluating expressions.	● 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 ● Check for understanding: board and whiteboard activities, or reflections and exit tickets. ● 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.
A	● Teacher defines relation, domain,range, and function and models examples on how to identify these from given information (data sets, mapping, graph).	
T, M, A	● Students will work independently to identify domain and range and determine if a relation is a function.	
T, M, A	● Students will also evaluate functions for given values.	
T, A	● Teacher discusses the real-world application of composition of functions and models the process of composing two functions into one new function.	
M, A	● Students will complete a practice worksheet on composition of functions and will then compare and discuss their results with a partner.	
T, M, A	● 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.	
T, M, A	● Teacher provides an activity for students to discover what an inverse of a function is. Teacher then models steps to find inverses of given functions.	
T, M, A	● 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.	
	<u>Resources:</u> All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval. ● Textbook: Blitzer, Robert. Precalculus Second Edition, Upper Saddle River, NJ: Pearson, 2004. ● Supplemental activities from the textbook resources	

	● Teacher-made supplemental activities on applications, performance tasks, and chapter review ● Graphing calculator TI Emulator software. ● On-line resources such as YouTube, Khan Academy, Desmos, EdPuzzle, Kahoot, etc.	

<table>
<tr><td rowspan="4">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 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition,</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to independently use their learning to…

Make sense of a problem by initiating a plan and persevere in solving
Model with mathematics by using the appropriate method
Reason abstractly
Justify reasoning or understanding by explaining techniques to solving
Attend to precision</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>UNDERSTANDINGS
Students will understand that…

● 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, completing the square, and Quadratic</td><td>ESSENTIAL QUESTIONS
Students will keep considering…

● How are polynomial expressions combined using operations of addition, subtraction, and multiplication?
● 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 functions have restricted values?</td></tr>
</table>

subtraction, and multiplication; add, subtract, and multiply polynomials. 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 ± bi for real numbers a and b 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)	Formula. ● 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) ● Rational functions are a ratio of polynomial functions. If a 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.	● 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? ● Writing a rational expression in simplest form. ● What kinds of asymptotes are possible for a rational function?
	Acquisition	
	Students will know… ● 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.	*Students will be skilled at…* ● 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 ● Recognizing from a graph the key features of a polynomial such as the factors, zeros, relative minimums, relative maximums.

	● Steps and processes to simplifying, multiplying, and dividing rational expressions. ● Restrictions on the domain of a rational expression.	● Identifying values that are restricted from the domain of a rational expression. ● Writing a rational expression in simplest form.

STAGE 2

Code	Evaluative Criteria	Assessment Evidence
T, M, A	Further information: 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	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…* ● 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 ● “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 equations.	
T, M, A	Accurate application of content/process to arrive at the correct mathematical solution.	
T, M, A	Selection of evidence that is relevant to content and standardized test processes.	

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 T M	● Teacher checks for prerequisite and prior knowledge via warm-ups on solving and graphing linear functions ● Students will work independently and as a class solving equations and graphing linear equations both manually and on graphing calculators. ● 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).	● Monitoring class work through board work, group work, questioning, warm-ups, and walk-arounds. ● Homework check to assess common errors to inform future instruction. ● Check prerequisite knowledge throughout the unit using warm-up problems and questioning activities. ● Differentiate through purposeful or flexible grouping, use of diagrams and explanations to

T, M	● Students will work independently simplifying exponential expressions and then share results in a teacher created pairing.	demonstrate understanding and active lessons involving discovery, scaffolding, jigsaw activities and use of hands-on manipulatives
M	● Teacher models the addition, subtraction, and multiplication of polynomials.	● Check for understanding: board and whiteboard activities, or reflections and exit tickets.
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.	● 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 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 charts 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 a method for solving polynomial equations by factoring by hand and by graphing calculators.	
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. 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 ● Teacher models how to identify the asymptotes and holes to graph a rational function. M, A ● Students will work independently and as a class graphing rational functions. T, M, A ● Supplemental worksheets and board problems should be used to assess mastery of the process in graphing a rational function. <u>Resources:</u> All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval. ● Textbook: Blitzer, Robert. Precalculus Second Edition, Upper Saddle River, NJ: Pearson, 2004. ● Supplemental activities from the textbook resources ● Teacher-made supplemental activities on applications, performance tasks, and chapter review ● Graphing calculator TI Emulator software. ● On-line resources such as YouTube, Khan Academy, Desmos, EdPuzzle, Kahoot, etc.	

ESTABLISHED GOALS

CCSS.Math.Content.HSA.SSE.B.3.c Use the properties of exponents to transform expressions for exponential functions.

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.IF.C.8.b Use the properties of exponents to interpret expressions for exponential functions.

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.

Transfer

Students will be able to independently use their learning to…

Make sense of a problem by initiating a plan and persevere in solving
Model with mathematics by using the appropriate method
Reason abstractly
Justify reasoning or understanding by explaining techniques to solving
Attend to precision

Meaning

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.
- Properties of logarithms relate to the properties of exponents.
- Interest on banking accounts is modeled with exponential functions as well as archaeology, oceanography, and manufacturing applications to name a few.

ESSENTIAL QUESTIONS

Students will keep considering…

- What is the value of an exponential equation in the real-world?
- How are exponents and logarithms related?
- 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 of solving exponential equations by getting a common base and

Students will be skilled at…

- Changing expressions to have the same base in order to solve exponential

	by using logarithms. ● A logarithm is a way to represent exponents. ● The properties of logarithms.	equations. ● Changing expressions from exponential form to logarithmic form and vice-versa. ● Evaluating logarithmic expressions. ● Applying the properties of logarithms to solve exponential equations.

STAGE 2

Code	Evaluative Criteria	Assessment Evidence
T, M, A	Further information: 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 different problems with different levels of difficulty from which students can choose.

M	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…* ● 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 ● “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 equations.	
T, M, A	Accurate application of content/process to arrive at the correct mathematical solution.	
T, M, A	Selection of evidence that is relevant to content and standardized test processes.	

Code	***Pre-Assessment***	
M	● Teacher checks for prerequisite and prior knowledge via warm-ups and entrance tickets on simplifying rational exponents,evaluating expressions and using linear models. ● Questioning activities, such as basic problems with simplifying expressions with exponents. ● 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	● Teacher uses independent/guided practice via supplemental worksheets to review simplifying expressions with exponents.	● Monitoring class work through board work, group work, questioning, warm-ups, and walk-arounds.
T,A	● Students work independently and in teacher created groups to complete practice problems that review exponents. Students will use think-pair-share to compare and discuss their answers	● Homework check to assess common errors to inform future instruction. ● Check prerequisite knowledge throughout the unit using warm-up problems and questioning activities.
M	● Teacher walks around and monitors student progress,	● Differentiate through purposeful or flexible

	assists individual students, and models examples when needed for the class.	grouping, use of diagrams and explanations to demonstrate understanding and active lessons involving discovery, scaffolding, jigsaw activities and use of hands-on manipulatives
T,A	● Students will individually complete problems on solving exponential equations. Students will volunteer their solutions and will explain the process they used.	● Check for understanding: board and whiteboard activities, or reflections and exit tickets.
M	● Teacher gives warm-up questions on exponents as a way to introduce exponential equations.	● 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 models different examples of exponential equations that have the same base and the steps to solving them.	
M,T	● 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.	
M	● Teacher models how to solve and evaluate logarithmic equations and expressions by changing to exponential form and by applying the properties of logarithms.	
T, A	● Students will practice evaluating and solving logarithmic expressions and equations by various activities such as independent activities such as independent practice, board work, think-pair-share, and/or use of white boards.	
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ESTABLISHED GOALS

CCSS.MATH.CONTENT.HSF.TF.A.1 Understand the 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

Transfer

Students will be able to independently use their learning to…

Make sense of a problem by initiating a plan and persevere in solving
Model with mathematics by using the appropriate method
Reason abstractly
Justify reasoning or understanding by explaining techniques to solving
Attend to precision

Meaning

UNDERSTANDINGS

Students will understand that…

- Right triangles, which are similar, 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.
- Trigonometric functions of specific angles relate to specific points and values on the unit circle.
- Graphs of the trigonometric functions are cyclic with certain traits.
- Sine and Cosine graphs produce "waves."

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?

	Acquisition	
	Students will know…	*Students will be skilled at…*
	● 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, tangent, cosecant, and secant, and their general behaviors ● Inverse trigonometric functions and the restrictions on their ranges ● Compositions of trigonometric functions	● Using the Pythagorean Theorem and right triangle trigonometry to solve right triangles ● Defining the six trigonometric functions ● Constructing a unit circle and identify angles in both degree and radian measures ● Converting degrees to radians (and vice versa) ● Identifying specific points on the unit circle ● Defining the trigonometric functions as related to the x and y coordinates and radius on the unit circle ● Using reference angles and definitions of the trigonometric functions to find the specific values on the unit circle. ● Filing in the trigonometric table for values of special and quadrantal angles ● Graphing sine, cosine, tangent, cosecant, and secant functions and identify special characteristics such as amplitude, period, phase shift, and vertical shift ● Identifying the domain and range of inverse trigonometric functions ● Finding the exact values of inverse trigonometric functions and composite trigonometric functions ● Using graphing calculators to check graphs of trigonometric values and to find approximate solutions to problems ● Solving real-world applications involving right triangle trigonometry.

Code	Evaluative Criteria	Assessment Evidence
	Further information:	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…*
T, M, A	Scoring Rubric used to evaluate successful understanding of the process and criteria for a desired outcome.	Task 1: Goal: To use right triangle trigonometry to solve real-world application problems Role: Students will take on the role of a 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. 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. Task 2: Goal: To calculate your personal biorhythm chart for the current month Role: Students will take on the role of a 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: rubric based on understanding, accuracy, communication of results, presentation of evidence to support claim.

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…*
M	Thorough understanding of identifying values that are restricted from the domain, simplifying a rational expression, types of polynomials.	● 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 ● “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 equations.	
T, M, A	Accurate application of content/process to arrive at the correct mathematical solution.	
T, M, A	Selection of evidence that is relevant to content and standardized test processes.	

Code	***Pre-Assessment***
M	● Teacher checks for prerequisite and prior knowledge via warm-ups and entrance tickets ● Questioning activities, such as basic problems with right triangle trigonometry and simplifying 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	● Teacher reviews the Pythagorean Theorem and right triangle trigonometry.	● Monitoring class work through board work, group work, questioning, warm-ups, and walk-arounds. ● Homework check to assess common errors to inform future instruction. ● Check prerequisite knowledge throughout the unit using warm-up problems and questioning 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 ● Check for understanding: board and whiteboard activities, or reflections and exit tickets. ● 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.	
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.	
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 the 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, the 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 Circle.	
T, M	● Students will work cooperatively as a group to construct the Unit Circle in the rotunda using garland and laminated	

T, M, A	values on the circle. ● 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, the teacher leads the 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 the 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 the 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.	
T, 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.	
	● Students will work in pairs to find inverse and composite	

M, A	trigonometric functions using their calculators and the trigonometric table. ● Teacher determines cooperative groups for various activities during this unit. <u>Resources:</u> All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval. ● Textbook: Blitzer, Robert. Precalculus Second Edition, Upper Saddle River, NJ: Pearson, 2004. ● Supplemental activities from the textbook resources ● Teacher-made supplemental activities on applications, performance tasks, and chapter review ● Graphing calculator TI Emulator software. ● On-line resources such as YouTube, Khan Academy, Desmos, EdPuzzle, Kahoot, etc.	

ESTABLISHED GOALS

CC 9-12 G-SRT.11 (+)
Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

CC 9-12 N-Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Transfer

Students will be able to independently use their learning to…

Make sense of a problem by initiating a plan and persevere in solving
Model with mathematics by using the appropriate method
Reason abstractly
Justify reasoning or understanding by explaining techniques to solving
Attend to precision

Meaning

UNDERSTANDINGS
Students will understand that…

- The Law of Sines and Law of Cosines apply to non-right triangles and can be used to find missing lengths or angles.

ESSENTIAL QUESTIONS
Students will keep considering…

- How can the use of trigonometric functions be extended to solve word problems and triangles with no right angles?

Acquisition

Students will know…

- Law of Sines
- Law of Cosines
- Applications of the Law of Sines and Law of Cosines

Students will be skilled at…

- Solving a triangle for missing sides or angles using the Law of Sines and the Law of Cosines
- Applying the ambiguous of the Law of Sines to determine if there are none, one, or two possible triangles

Code	Evaluative Criteria	Assessment Evidence
	Further information:	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…*
T, M, A	Scoring Rubric used to evaluate successful understanding of the process and criteria for a desired outcome.	Goal: To find unknown values in specific real-world situations Role: Students will take on the role of a surveyor Audience : Land development company Situation : Given various situations, use the Laws of Sines and Cosines to calculate values that are otherwise non-measurable (e.g., calculate the distance between two landmarks that have a lake between them). Product: Calculated distances with work shown. 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.
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…*
M	Thorough understanding of identifying values that are restricted from the domain, simplifying a rational expression, types of polynomials.	● 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 ● “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 equations.	
T, M, A	Accurate application of content/process to arrive at the correct mathematical solution.	

T, M, A	Selection of evidence that is relevant to content and standardized test processes.	

Code	***Pre-Assessment***	
M	● Teacher checks for prerequisite and prior knowledge via warm-ups and entrance tickets ● Questioning activities, such as basic problems with trigonometry. ● 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 introduces the Law of Sines by having students solve a right triangle. Discussion takes place about solving a non-right triangle, and the teacher gives the formula for the Law of Sines and models some examples.	● Monitoring class work through board work, group work, questioning, warm-ups, and walk-arounds. ● Homework check to assess common errors to inform future instruction.
M, A	● Teacher leads the class through discovery of the relationship between angles and sides in using the Law of Sines in different cases (AAS, ASA, SSA).	● Check prerequisite knowledge throughout the unit using warm-up problems and questioning activities.
M, A	● Students will work as a whole group to practice some examples on the Law of Sines (non ambiguous case).	● 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
M, A	● Teacher reviews the ambiguous case for the Law of Sines and demonstrates why there are possibly no triangles, one triangle, or two triangles.	● Check for understanding: board and whiteboard activities, or reflections and exit tickets.
M, A	● Teacher models examples of using the Law of Sines equation with no triangle and with two triangles.	● 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 practice examples of the ambiguous case of the Law of Sines by working in small teacher created groups.	
M, A	● Teacher leads the class through discovery of the relationship between angles and sides in using the Law of Cosines and discusses when to use it (SSS, SAS cases).	

M, A T, M, A T, M, A	● Teacher models an example where a side should be found first, and then one where an angle should be found first. ● Students will solve triangles using the Law of Cosines and will compare their answers with a partner. ● Students will work independently to complete the performance task related to applications with the Law of Sines and Law of Cosines. <u>Resources:</u> All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval. ● Textbook: Blitzer, Robert. Precalculus Second Edition, Upper Saddle River, NJ: Pearson, 2004. ● Supplemental activities from the textbook resources ● Teacher-made supplemental activities on applications, performance tasks, and chapter review ● Graphing calculator TI Emulator software. ● On-line resources such as YouTube, Khan Academy, Desmos, EdPuzzle, Kahoot, etc.	