Hillsborough Township Public Schools
Mathematics Department
Algebra 2 Curriculum Map

Essential Questions	Enduring Understandings	Domain	Cluster	Standard	Learning Targets	Assessment Formative and Summative	Inter-disciplinary Connections	21st Century Connections
Linear Functions **Pacing: CP - 14 days** **H - 12 days**						Common Unit Assessment		
What are the characteristics of some of the basic parent functions?	Patterns and relationships can be represented graphically, numerically, symbolically or verbally.	Building Functions MP6 - Attend to precision	Build new functions from existing functions	F-BF.B.3 - Identify the effect on the graph of replacing f(x) by f(x) + k, kf(x) … f(x+k) for specific values of k (both positive and negative); … Experiment with cases and illustrate an explanation on the effects on the graph using technology...	Identify families of functions, describe transformations of parent functions, and describe combinations of transformations.	Describe how the function g(x) is transformed from its parent function f(x). $f(x) = x^2$ $g(x) = -4(x - 3)^2+5$		CRP8 - Utilize critical thinking to make sense of problems and persevere in solving them.
How do the graphs of $y = f(x) + k$, $y = f(x-h)$ and $y = -f(x)$ compare to the graph of the parent function f?					Write functions representing translations and reflections, write functions representing stretches and shrinks, write functions representing combinations of transformations	Rewrite the function $f(x) = \|x\|$ so that it is a vertical stretch of 4 units, reflected over the x-axis, shifted left 7 units and moved up 3 units.		
How can you use a linear function to model and analyze a real-life situation?	Algebraic representations can be used to generalize patterns and relationships.	Creating equations. MP4 - Model with mathematics	Create equations that describe numbers or relationships.	A-CED.A.2 - Create equations in two … variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	Find lines of fit and lines of best fit.	Create a table of values where their heights (in inches) are the x-values and the length of their feet (in inches) are the y-values. Create a scatter-plot and then draw a line of best fit to make predictions.	RST.11-12.7 - Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically	9.3.ST-SM.1 - Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.

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							(e.g., in an equation) into words.	
	Patterns and relationships can be represented graphically, numerically, symbolically or verbally.	Creating Equations SMP – Construct viable arguments and critique the reasoning of others.	Analyze functions using different representations.	F-IF.C.9 - Compare properties of two functions, each represented in a different way (algebraically, numerically in tables, or by verbal descriptions.	Write equations of linear functions using points and slopes.	Using the equation created, input x-values into the equation that were are on the table already. How close are the predictions to the actual measurements?		CRP4 - Communicate clearly and effectively and with reason.
How can you determine the number of solutions of a linear system?	Algebraic representations can be used to generalize patterns and relationships.	Creating Equations SMP 4 – Model with mathematics	Create equations that describe numbers or relationships.	A.CED.A.3 - Represent constraints by equations . . . and by systems of equations. . .and interpret solutions. . . in a modeling context.	Visualize solutions of systems of linear equations in three variables. Solve systems of linear equations in three variables algebraically. Solve real-life problems.	A theater charges $75 for a seat in section A, $55 for each seat in section B, & $30 for a lawn seat. There are three times as many seats in section B as in section A. The revenue for selling 23,000 seats is $870,000. How many seats in each section?	RST.11-12.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.	CRP8 - Utilize critical thinking to make sense of problems and persevere in solving them.
Quadratic Functions **Pacing: CP - 12 days** **H - 10 days**						Common Unit Assessment		
How do the constants a, h, and k affect the graph of the quadratic function $g(x) = a(x-h)^2 + k$?	Patterns and relationships can be represented graphically, numerically,	Interpreting Functions SMP 3 - Construct viable arguments and	Analyze functions using different representations.	F-IF-C-7c - Graph polynomial functions.	Graph quadratic functions.	Graph the function and identify the vertex. $f(x)= 3(x+4)^2 - 6$		

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	symbolically or verbally.	critique the reasoning of others.						
		Building Functions SMP 2 – Reason abstractly and quantitatively	Build new functions from existing functions.	F-BF.B.3 - Identify the effect on the graph of replacing f(x) by f(x) + k, kf(x) … f(x+k) for specific values of k (both positive and negative); … Experiment with cases and illustrate an explanation on the effects on the graph using technology.	Describe transformations of quadratic functions. Write transformations of quadratic functions.	Describe the transformation of the graph and identify the vertex. $f(x)= -4(x+1)^2 - 5$	RST.11-12.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.	CRP8 - Utilize critical thinking to make sense of problems and persevere in solving them.
What type of symmetry does the graph of $f(x) = a(x - h)^2 + k$ have?	Patterns and relationships can be represented graphically, numerically, symbolically or verbally.	Interpreting Functions SMP 3 – Construct viable arguments and critique the reasoning of others. SMP 8 – Look for and express regularity in repeated reasoning.	Interpret functions that arise in applications in terms of the context	F-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.	Explore properties of parabolas. Find maximum and minimum values of quadratic functions.	Graph the function. Label the vertex and axis of symmetry. Identify the domain and range of the function. Will there be a maximum or minimum? How do you know? Describe where the function is increasing and decreasing. $f(x) = 2(x+5)^2 +3$	RST.11-12.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.	
		Creating Equations	Analyze functions using	F-IF.C.7c - Graph polynomial functions, identifying zeros when	Graph quadratic functions using x-intercepts.	Graph the function. Label the vertex and axis of symmetry.		

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		SMP – 2 Reason abstractly and quantitatively	different representations	suitable factorizations are available.		f(x) = -5(x+5)(x+1)		
		Building Functions SMP 4 – Model with mathematics. SMP 6 – Attend to precision.	Build a function that models a relationship between two quantities	F-IF-C.9 - Compare properties of two functions, each represented in a different way (algebraically, graphically, … or by verbal descriptions).	Explore properties of parabolas. Solve real-world problems.	The engine torque y (in foot-pounds) of one model car is given by $y = -3.75x^2 + 23.2x + 38.8$, where x is the speed (in thousands of revolutions per minute) of the engine. Find the engine speed that maximizes torque. What happens to the engine torque as the speed of the engine increases?	RST.11-12.3 - Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing tasks; analyze specific results based on explanations in the text.	9.3.ST-SM.2 - Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
	How can we use mathematical models to describe physical relationships?	Arithmetic with polynomials and rational expressions. SMP 4 – Model with mathematics. SMP 8 – Look for and express regularity in repeated reasoning.	Understand the relationship between zeros and factors of polynomials.	A-APR.B.3 - Identify zeros of polynomials when suitable factorizations are available, and use zeros to construct a rough graph of the function described by the polynomial.	Explore properties of parabolas. Graph quadratic functions using x-intercepts.	The path of a basketball thrown at an angle of 45 degrees can be modeled by y = -.02x2 +x + 6, where x represents time in seconds and y is the height of the ball. After how many seconds will the ball hit the ground?		9.3.ST-SM.2 - Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
How can you use a quadratic	Algebraic representations	Creating Equations	Create equations that	A-CED.A.2 - Create equations in two ...	Write equations of quadratic functions	A rocket is launched from a platform 65		9.3.ST-SM.1 - Apply science and

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function to model real-life situations?	can be used to generalize patterns and relationships.	SMP 4 – Model with mathematics.	describe numbers of relationships.	variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	using vertices, points and x-intercepts.	feet high. After 2.5 seconds it reaches a maximum height of 130 feet. Write and equation that models the height of the rocket as a function of time.		mathematics to provide results, answers and algorithms for engineering and technological activities.
	Patterns and relationships can be represented graphically, numerically, symbolically or verbally.	Creating Equations SMP 4 – Model with mathematics.	Create equations that describe numbers or relationships.	F-IF.B.6 - Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.	Write quadratic equations to model data sets.	Write an equation of a parabola in standard form given a vertex of (3,2) and passing through a point (13, 8).	RST.11-12.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts.	CRP8 - Utilize critical thinking to make sense of problems and persevere in solving them.
Quadratic Equations and Complex Numbers **Pacing: CP - 18 days** **H - 18 days**						Common Unit Assessment		
How can you use the graph of a quadratic equation to determine the number of real solutions of the equation?	One representation may sometimes be more helpful than another; used together, multiple representations give a fuller	Seeing Structure in Expressions SMP 5 - Use appropriate tools strategically.	Interpret the structure of expressions.	A-SSE.A.2 - Use the structure of an expression to identify ways to rewrite it.	Solve quadratic equations algebraically.	Find all of the zeros. $f(x) = 4x^2 + 28x + 49$		

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	understanding of a problem.	Reasoning with equations and inequalities SMP 2 – Reason abstractly and quantitatively.	Solve equations and inequalities in one variable.	A-REI.B.4b - Solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, . . . and factoring, as appropriate to the initial form on equation. . .	Solve quadratic equations by graphing, solve quadratic equations algebraically.	Solve the equation by graphing. $3x = ¼ x^2 + 5$	RST.11-12.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.	
	Patterns and relationships can be represented graphically, numerically, symbolically or verbally.	Creating Equations SMP 4 – Model with mathematics.	Analyze functions using different representations.	F-IF.C.8a - Use the process of factoring . . . in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.	Solve real-life problems.	When an object is dropped, its height h (in feet) above the ground after t seconds can be modeled by the function $h= -16t^2 + h_0$, where h_0 is the initial height. If a seashell is dropped from a height of 40 ft, write an equation that models the height above water. how long is the seashell in the air?		9.3.ST-SM.2 - Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
What are the subsets of the set of complex numbers?	Numeric fluency includes both the understanding	The Complex Number System	Perform arithmetic operations with complex numbers.	N-CN.A.1 - Know there is a complex number *i* such that $i^2 = -1$, and every complex	Define and use the imaginary unit *i.*	Solve the equation $x^2+16=0$		

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	of and the ability to appropriately use numbers.	SMP 2 – Reason abstractly and quantitatively.		number has the form a + b*i* with a and b real.				
	Computational fluency includes understanding the meaning and the appropriate use of numerical operations.	The Complex Number System SMP 8 – Look for and express regularity in repeated reasoning.	Perform arithmetic operations with complex numbers.	N-CN.A.2 - Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract and multiply complex numbers.	Add, subtract, and multiply complex numbers.	Simplify the expression $(2-3i)^2 - (4 +5i)$.		
What are the subsets of the set of complex numbers?	Algebraic and numeric procedures are interconnected and build on one another to produce a coherent whole.	The Complex Number System SMP 7 – Look for and make use of structure.	Use complex numbers in polynomial identities and equations.	N-CN.C.7 - Solve quadratic equations with real coefficients that have complex solutions.	Find complex solutions and zeros.	Find the zeros of the function. $f(x)= -½ x^2 - 24$		9.3.ST-SM.2 - Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
					Solve quadratic equations using square roots.	Solve the equation. $(x-7)^2 = 9$		
	Patterns and relationships can be represented graphically, numerically, symbolically, or verbally.	Creating equations SMP 3 – Construct viable arguments and critique the reasoning of others.	Analyze functions using different representations.	F-IF.C.8a - Use the process of … 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.	Solve quadratic equations by completing the square. Write quadratic equations in vertex form.	a) Solve the equation by completing the square. What must happen to a before you can complete the square? $2x^2 + 4x - 3 = 0$ b) Convert the function to vertex form. $f(x) = 3x^2 - 12x +5$	RST.11-12.3 - Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on	

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							explanations in the text.	
How can you derive a general formula for solving a quadratic equation?	Algebraic and numeric procedures are interconnected and build on one another to produce a coherent whole.	The Complex Number System SMP 7 – Look for and make use of structure.	Use complex numbers in polynomial identities and equations.	N-CN.C.7 - Solve quadratic equations with real coefficients that have complex solutions.	Solve quadratic equations using the Quadratic Formula. Analyze the discriminant to determine the number and type of solutions. Solve real-life problems.	Determine the nature of the roots. Then solve for the zeros/roots using the quadratic formula. $-7x + 12 = -x^2$		9.3.ST-SM.1 - Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.
How can you solve a nonlinear system of equations?	Algebraic representation can be used to generalize patterns and relationships.	Creating Equations SMP 3 – Construct viable arguments and critique the reasoning of others	Create equations that describe numbers or relationships.	A-CED.A.3 - Represent constraints by equations … and interpret solutions as viable or nonviable options in a modeling context.	Solve systems of nonlinear equations.	Solve the system: $y = x^2 + 2x + 1$ $y = -x^2 + x + 2$		
	Patterns and relationships can be represented graphically, numerically, symbolically or verbally.	Reasoning with Equations and Inequalities SMP 3 – Construct viable arguments and critique the reasoning of others	Represent and solve equations and inequalities graphically.	A-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 equations $f(x) = g(x)$; find the solutions approximately, e.g. using technology to graph the functions, make tables of values, . . . include cases	Solve quadratic equations by graphing.	Solve the system by graphing. $y = x + 2$ $y = ½ (x + 2)^2$	RST.11-12.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context in grades 11-12 texts and topics.	9.3.ST-SM.1 - Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.

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				where f(x) and/r g(x) are linear, polynomial, … functions.				
How can you solve a quadratic inequality?	The symbolic language of algebra is used to communicate and generalize the patterns of mathematics.	Creating Equations SMP 4 – Model with mathematics.	Create equations that describe numbers or relationships.	A-CED.A.1 - Create equations and inequalities in one variable and use them to solve problems, include equations arising from linear and quadratic functions ...	Solve quadratic inequalities in one variable.	A rectangular parking lot must have a perimeter of 440 feet and an area of at least 8000 square feet. Describe the possible lengths of the parking lot.		CRP8 - Utilize critical thinking to make sense of problems and persevere in solving them.
	Algebraic representations can be used to generalize patterns and relationships.	Creating Equations SMP 4 – Model with mathematics.	Create equations that describe numbers or relationships.	A-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.	Graph quadratic inequalities in two variables.	A wire rope can safely support a weight W (in pounds) provided $W \leq 8000d^2$, where d is the diameter (in inches) of the rope. Graph the inequality and interpret the solution.	RST.11-12.7 - Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.	
Polynomial Functions **Pacing: CP - 17 days** **H - 18 days**						Common Unit Assessment		
What are some common characteristics of the graphs of cubic and quartic	Patterns and relationships can be represented graphically, numerically,	Interpreting Functions SMP 3 – Construct viable	Interpret functions that arise in applications in terms of the context.	F-IF.B.4 - For a function that models a relationship between two quantities, interpret key features of graphs and tables in	(Honors Only) Identify polynomial functions.	Describe the end behavior. $f(x)= -5x^4+7x^3-9x$ $g(x)= 12 - 6x + x^5$	RST.11-12.4 - Determine the meaning of symbols, key terms, and other	CRP4 - Communicate clearly and effectively and with reason.

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polynomial functions?	symbolically or verbally.	arguments and critique the reasoning of others.		terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.			domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.	
		Creating Equations SMP 5 - Use appropriate tools strategically.	Analyze functions using different representations.	F-IF.C.7c - Graph polynomial functions...showing end behavior.	(Honors Only) Graph polynomial functions using tables and end behavior.	Graph the polynomial function. $f(x) = x^3 + x + 3$		
How can you cube a binomial?	Algebraic and numeric procedures are interconnected and build on one another to produce a coherent whole.	Arithmetic with Polynomials and Rational Expressions SMP 2 – Reason abstractly and quantitatively.	Perform arithmetic operations on polynomials.	A-APR.A.1 - 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.	Add and subtract polynomials.	Simplify the polynomial expression. $(3x^2-6x+8) + (x^3+5x - 9)$		
	Algebraic representations can be used to generalize patterns and relationships.	Rational Expressions SMP 7 – Look for and make use of structure.	Use polynomial identities to solve problems.	A-APR.C.4 - Prove polynomial identities and use them to describe numerical relationships. *For example, the difference of two squares, the sum and difference of two cubes, the polynomial identity* $(x^2 + y^2)^2 = (x^2 – y^2)^2 + (2xy)^2$ *can be*	Multiply polynomials.	Simplify the expression. $(x^2 - 8)(x-9)$		9.1.12.A.1 - Apply critical thinking and problem-solving strategies during structured learning experiences.

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				used to generate Pythagorean triples.				
		Arithmetic with Polynomials and Rational Expressions SMP 8 – Look for and express regularity in repeated reasoning.	Use polynomial identities to solve problems.	A-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.	Use Pascal's Triangle to expand binomials.	Expand the binomial: $(x+2)^5$		
How can you use the factors of a cubic polynomial to solve a division problem involving the polynomial?	How can we use mathematical models to describe physical relationships?	Arithmetic with Polynomials and rational expressions SMP 2 – Reason abstractly and quantitatively.	Understand the relationship between zeros and factors of polynomials.	A-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) = 0 if and only if (x - a) is a factor of p(x).	Use the remainder theorem.	Find the value of f(5) using synthetic substitution given $f(x)=4x^4+3x^2-x+5$		CRP8 - Utilize critical thinking to make sense of problems and persevere in solving them.
	Algebraic and numeric procedures are interconnected and build on one another to produce a coherent whole.	Rational Expressions SMP 4 – Model with mathematics.	Rewrite rational expressions.	A-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 degree of b(x), using inspection, long division, ...	Use synthetic division to divide polynomials by binomials of the form (x - k). Use long division to divide polynomials by other polynomials.	The volume of a rectangular prism is given $V=2x^3+17x^2+46x+40$ with a height of (x+2) and a width of (x+4). Find the length of the prism.	RST.11-12.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades	9.3.ST-SM.1 - Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.

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							11-12 texts and topics.	
How can you factor a polynomial?	One representation may sometimes be more helpful than another, used together, multiple representations give a fuller understanding of a problem.	Seeing Structure in Expressions SMP – Look for and make use of structure.	Interpret the structure of expressions.	A-SSE.A.2 - Use the structure of an expression to identify ways to rewrite it.	Factor polynomials.	Factor completely: a) a^3+27 b) x^3+4x^2-x-4		
	How can we use mathematical models to describe physical relationships?	Arithmetic with Polynomials and Rational Expressions SMP 3 – Construct a viable argument and critique the reasoning of others.	Understand the relationship between zeros and factors of polynomials.	A-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) = 0 if and only if (x - a) is a factor of p(x).	Use the Factor Theorem.	Is (x-2) a factor of (x^3-8)?		CRP8 - Utilize critical thinking to make sense of problems and persevere in solving them.
				A-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.	Factor polynomials.	Identify the zeros of the polynomial. $f(x)=x(x-3)(x-6)(x+1)$		
How can you determine whether a polynomial equation has a repeated solution?					Find the solutions of polynomial equations and zeros of polynomial functions. Use the Rational Root Theorem. Use the Irrational Conjugates Theorem.	List the possible rational roots of the polynomial and then find all the real zeros. $h(x)=x^3+10x^2+31x+30$		

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How can you determine whether a polynomial equation has imaginary solutions?	How can we use mathematical models to describe physical relationships?	Arithmetic with Polynomials and Rational Expressions SMP 3 – Construct a viable argument and critique the reasoning of others.	Understand the relationship between zeros and factors of polynomials.	A-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.	(Honors Only) Use the Fundamental Theorem of Algebra.	Find all the zeros and construct a graph. $g(x)=x^4-x^2-6$	RST.11-12.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.	
Rational Exponents and Radical Functions **Pacing: CP - 17 days** **H - 19 days**						Common Unit Assessment		
How can you use a rational exponent to represent a power involving a radical?	Relationships can be described and generalizations made for mathematical situations that have numbers or objects that repeat in predictable ways.	The Real Number System. SMP 6 - Attend to precision.	Extend the properties of exponents to rational exponents.	N-RN.A.1 - Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.	Find nth roots of numbers. Solve equations using nth roots.	Solve for x. $x^3=125$ $x^2-64=0$ $x^4=81$		
	The same pattern can be found in many different forms.	The Real Number System SMP 2 – Reason abstractly and quantitatively.	Extend the properties of exponents to rational exponents.	N-RN.A.2 - Rewrite expressions involving radicals and rational exponents using the properties of exponents.	Evaluate expressions with rational exponents.	Simplify the expression. $(27)^{2/3}$		
How can you use properties of exponents to simplify					Use properties of rational exponents to simplify	Simplify. $\frac{6xy^{3/4}}{3x^{1/2}y^{1/2}}$		

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products and quotients of radicals?					expressions with rational exponents. Use properties of radicals to simplify and write radical expressions in simplest form.			
How can you identify the domain and range of a radical function?	Patterns and relationships can be represented graphically, numerically, symbolically or verbally.	Interpreting Functions SMP 7 – Look for and make use of structure.	Analyze functions using different representations.	F-IF.C.7b - Graph square root, cube root, and piecewise-defined functions and absolute value functions.	Graph radical functions.	Graph f(x)=$\sqrt[3]{x}$ State the domain and range of the graph.		CRP8 - Utilize critical thinking to make sense of problems and persevere in solving them.
		Building Functions SMP 2 – Reason abstractly and quantitatively.	Build new functions from existing functions.	F-BF.B.3 - Identify the effect on the graph of replacing f(x) by f(x) + k, kf(x) … f(x+k) for specific values of k (both positive and negative); … Experiment with cases and illustrate an explanation on the effects on the graph using technology.	Graph transformations of radical functions.	Graph f(x)=$\sqrt[3]{x}$ Shift the graph two units left and four units down. Write the equation for the new graph.		
How can you solve a radical equation?	Algebraic and numeric procedures are interconnected and build on one another to produce a coherent whole.	Reasoning with Equations and Inequalities SMP 2 – Reason abstractly and quantitatively.	Understand solving equations as a process of reasoning and explain the reasoning.	A-REI.A.2 - Solve simple...radical equations in one variable, and give examples showing how extraneous solutions may arise.	Solve equations containing radicals and rational exponents. Solve radical inequalities.	Solve for x. $\sqrt{44-2x} = x-10$		
How can you sketch the	One representation	Creating Equations	Create equations that	A-CED.A.4 -	Explore inverses of functions.	Find the inverse of f(x) and determine if	RST.11-12.7 - Translate	

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graph of the inverse of a function?	may sometimes be more helpful than another; multiple representations give a fuller understanding of a problem.	SMP 8 – Look for and express regularity in repeated reasoning.	describe numbers or relationships.	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.		it is a function. Draw f(x) and its inverse on the same coordinate plane. State the domain and range of each. f(x)=$\sqrt{x-2}+3$	quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.	
	Patterns and relationships can be represented graphically, numerically, symbolically or verbally.	Building Functions SMP 4 – Model with mathematics.	Build new functions from existing functions.	F-BF.B.4a - Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse.	Find and verify inverses of nonlinear functions. Solve real-life problems using inverse functions.	The maximum hull speed v (in knots) of a boat with a displacement hull can be approximated by v=1.34$\sqrt{l}$, where l is the waterline length (in feet) of the boat. Find the inverse function. What waterline is needed to achieve a maximum speed of 7.5 knots?		9.3.ST-SM.2 - Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
Mid-Term **Pacing: 1 Day**								
Exponential and Logarithmic Functions **Pacing: CP - 24 days** **H - 20 days**						Common Unit Assessment		
What are some of the characteristics of the graph of	Patterns and relationships can be represented	Interpreting Functions	Analyze functions using different representations.	F-IF.C.7e - Graph exponential...functions , showing intercepts and end behavior.	Graph exponential growth and decay functions.	Graph y=(½)^x		

Essential Questions	Enduring Understandings	Domain	Cluster	Standard	Learning Targets	Assessment Formative and Summative	Inter-disciplinary Connections	21st Century Connections
an exponential function?	graphically, numerically, symbolically, or verbally.	SMP 8 - Look for and express regularity in repeated reasoning.				Does the graph represent exponential growth or decay?		
		Creating Equations SMP 4 – Model with mathematics.	Analyze functions using different representations.	F-IF.C.8b - Use the properties of exponents to interpret expressions for exponential functions.	Use exponential models to solve real-life problems.	You deposit $9000 in an account that pays 1.46 % annual interest. Find the balance after three years when the interest is compounded quarterly.	RST.11-12.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.	9.1.12.B.2 - Compare strategies for saving and investing and the factors that influence how much should be saved or invested to meet financial goals.
What is the natural base?	Patterns and relationships can be represented graphically, numerically, symbolically, or verbally.	Interpreting Functions SMP 4 – Model with mathematics.	Analyze functions using different representations.	F-IF.C.7e - Graph exponential...functions , showing intercepts and end behavior.	Define and use the natural base e. Graph natural base functions. Solve real-life problems.	You deposit $4250 in an account that earns 5% annual interest compounded continuously. How much money will be in the account after ten years?		
What are some of the characteristics of the graph of a logarithmic function?		Interpreting Functions SMP 6 – Attend to precision.	Analyze functions using different representations.	F-IF.C.7e - Graph exponential...functions , showing intercepts and end behavior.	Graph logarithmic functions.	Graph $y=\log_2 x$ State the domain and range of the graph.	RST.11-12.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific	

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							scientific or technical context relevant to grades 11-12 texts and topics.	
	Patterns and relationships can be represented graphically, numerically, symbolically, or verbally.	Building Functions SMP 6 – Attend to precision.	Build new functions from existing functions.	F-BF.B.4a - Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse.	Use inverse properties of logarithmic and exponential functions.	Rewrite the equation as a logarithm. $y=0.3^x$		
	One representation may sometimes be more helpful than another, used together, multiple representations give a fuller understanding of a problem.	Linear and Exponential Models SMP 6 – Attend to precision.	Construct and compare linear and exponential models and solve problems.	F-LE.A.4 - Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.	Define and evaluate logarithms.	Evaluate the logarithm without a calculator. a. $\log_5 625$ b. $\log_8 512$ c. $\log_7 7$ d. $\log_6 1$		
How can you transform the graphs of exponential and logarithmic functions?	Patterns and relationships can be represented graphically, numerically, symbolically, or verbally	Interpreting Functions SMP 3 – Construct viable arguments and critique the reasoning of others.	Analyze functions using different representations.	F-IF.C.7e - Graph exponential and logarithmic functions, showing intercepts and end-behavior, ...	Write transformations of graphs of exponential functions.	Graph $y=3^x$ and $y=3^{x+1}-7$ on the same coordinate plane. Describe how the second graph is transformed from the first. Include the domain and range of each.	RST.11-12.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context	CRP8 - Utilize critical thinking to make sense of problems and persevere in solving them.

Hillsborough Township Public Schools
Mathematics Department
Algebra 2 Curriculum Map

Essential Questions	Enduring Understandings	Domain	Cluster	Standard	Learning Targets	Assessment Formative and Summative	Inter-disciplinary Connections	21st Century Connections
							relevant to grades 11-12 texts and topics.	
	Patterns and relationships can be represented graphically, numerically, symbolically, or verbally.	Building Functions SMP 3 – Construct viable arguments and critique the reasoning of others.	Build new functions from existing functions.	F-BF.B.3 - Identify the effect on the graph of replacing f(x) by f(x) + k, kf(x) … f(x+k) for specific values of k (both positive and negative); … Experiment with cases and illustrate an explanation on the effects on the graph using technology.	Transform graphs of exponential functions. Transform graphs of logarithmic functions.	$f(x)= \log_4 x$ $g(x)=\log_4(x-5)+3$ Describe the transformation of f(x) represented by g(x). Then graph each function.		
How can you use properties of exponents to deride properties of logarithms?	One representation may sometimes be more helpful than another; used together, multiple representations give a fuller understanding of a problem.	Seeing Structure in Expressions SMP 8 – Look for and express regularity in repeated reasoning.	Interpret the structure of Expressions.	A-SSE.A.2 - Use the structure of an expression to identify ways to rewrite it.	Use the properties of logarithms to expand or condense logarithmic expressions.	Write the expression as a single logarithm. $4\log_5 y-\log_5 3-\log_5 x$		
		Linear and Exponential Models SMP 6 – Attend to precision.	Construct and compare linear and exponential models and solve problems.	F-LE.A.4 - Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where *a*, *c*, and *d* are numbers and the base *b* is 2, 10, or *e*; evaluate the logarithm using technology.	Use the properties of logarithms to evaluate logarithms. Use the change-of-base formula to evaluate logarithms.	Evaluate the logarithm without a calculator using the properties of logarithms. $\log_3 6-\log_3 2$		CRP8 - Utilize critical thinking to make sense of problems and persevere in solving them.
How can you solve exponential and	One representation may sometimes be more helpful than another;	Linear and Exponential Models	Construct and compare linear and exponential models and solve problems.		Solve exponential equations. Solve logarithmic equations.	Solve for x. $3^x=7$		

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logarithmic equations?	used together, multiple representations give a fuller understanding of a problem.	SMP 2 – Reason abstractly and quantitatively.			Solve exponential and logarithmic inequalities.	$\log_3(x-9)+\log_3(x-3)=2$ $10^{2x-6}>3$		
How can you recognize polynomial, exponential and logarithmic models?	Algebraic representation can be used to generalize patterns and relationships.	Creating Equations SMP 7 – Look for and make use of structure.	Create equations that describe numbers or relationships.	A-CED.A.2 - Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	Classify data sets. Write exponential functions. Use technology to find exponential and logarithmic models.	Present students with various types of data tables. Have them plot the data and decide which type of function would best fit the data. Have students write an equation for the data set.	RST.11-12.9 - Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.	CRP11 - Use technology to enhance productivity.
Rational Functions **Pacing: CP - 15 days** **H - 15 days**						Common Unit Assessment		
How can you recognize when two quantities very directly or inversely?	The symbolic language of algebra is used to communicate and generalize the patterns in mathematics.	Creating Equations. SMP 6 - Attend to precision.	Create equations that describe numbers or relationships.	A-CED.A.1 - Create equations … in one variable and use them to solve problems.	Classify direct and inverse variations.	Ask students to give examples of two quantities that vary directly and two that vary directly.		CRP6 - Demonstrate creativity and innovation.
	Algebraic representation can be used to generalize patterns and relationships.	Creating Equations SMP 2 – Reason	Create equations that describe numbers or relationships.	A-CED.A.2 - Create equations in two or more variables to represent relationships between quantities.	Write inverse variation equations.	Y varies inversely with x. y= 15 when x=5. Write an equation. What is y when x=8?		

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		abstractly and quantitatively.						
		Creating Equations SMP 1 – Make sense of problems and persevere in solving them.	Create equations that describe numbers or relationships.	A-CED.A.3 - Represent constraints by equations, and interpret solutions as viable or nonviable options in modeling context.	Solve real-life problems.	It takes two people 10 days to paint a house. It takes 4 people 5 days to paint a house. If the number of days varies inversely with the number of people, how long would it take 6 people to paint the house?		9.3.ST-SM.2 - Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
What are some of the characteristics of the graph of a rational function?	Algebraic and numeric procedures are interconnected and build on one another to produce a coherent whole.	Rational Expressions SMP 6 – Attend to precision.	Rewrite rational expressions.	A-APR.D.6 - Rewrite simple rational expressions in different forms; write a(x)/b(x) in forms q(x) + r(x)/b(x), where a9x), b(x), q(x) and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using long division.	Graph other rational functions. (Honors Only)	Graph the function and state the domain and range. f(x)=$\frac{2x+1}{x-3}$	RST.11-12.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.	
	Patterns and relationships can be represented graphically, numerically, symbolically or verbally.	Building Functions SMP 6 – Attend to precision.	Build new functions from existing functions.	F-BF.B.3 - Identify the effect on replacing f(x) by f(x) + k, kf(x), and f(x + k) for specific values of k (both positive and negative). Experiment with cases and illustrate an explanation of the	Graph simple rational functions. Translate simple rational functions.	Graph the function and state the domain and range. y=$\frac{1}{x-1}$+5		

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				effects on the graph using technology.				
How can you determine the excluded values in a product or quotient of two rational expressions?	Algebraic and numeric procedures are interconnected and build on one another to produce a coherent whole.	Rational Expressions SMP 2 – Reason abstractly and quantitatively.	Rewrite rational expressions.	A-APR.D.6 - Rewrite simple rational expressions in different forms; write a(x)/b(x) in forms q(x) + r(x)/b(x), where a9x), b(x), q(x) and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, or the for the more complicated example, a computer algebra system.	Divide rational expressions.	Find the quotient. $\frac{4x}{5x-20} \div \frac{x^2-2x}{x^2-6x+8}$		
		Building Functions SMP 6 – Attend to precision.	Build new functions from existing functions.	A-APR.D.7 - Understand that rational expressions form a system analogous to the rational numbers, closed under multiplications, and division by a nonzero rational expression; multiply, and divide rational expressions.	Multiply rational expressions. Simplify rational expressions.	Find the product. $\frac{x^2-3x}{x-2} \cdot \frac{x^2+x-6}{x}$		
How can you determine the domain of the sum or difference of two rational expressions?	Algebraic and numeric procedures are interconnected and build on one another to produce a coherent whole.	Rational Expressions SMP 6 – Attend to precision.	Rewrite rational expressions.	A-APR.D.6 - Rewrite simple rational expressions in different forms; write a(x)/b(x) in forms q(x) + r(x)/b(x), where a9x), b(x), q(x) and r(x) are polynomials	Simplify complex fractions.	Simplify the complex fraction. $\frac{15-\frac{2}{x}}{\frac{x}{5}+4}$		

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				with the degree of r(x) less than the degree of b(x), using inspection.				
		Building Functions SMP 6 – Attend to precision.	Build new functions from existing functions.	A-APR.D.7 - Understand that rational expressions form a system analogous to the rational numbers, closed under multiplications, and division by a nonzero rational expression; multiply, and divide rational expressions.	Add and subtract rational expressions.	Find the sum. State any restrictions on x. $\frac{9}{x-3}+\frac{2x}{x+1}$		CRP8 - Utilize critical thinking to make sense of problems and persevere in solving them.
How can you solve a rational equation?	One representation may sometimes be more helpful than another; multiple representations give a fuller understanding of a problem.	Creating Equations SMP 4 – Model with mathematics.	Create equations that describe numbers or relationships.	A.CED.A.4 - Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.	Use inverses of functions.	The function $c=\frac{50m+1000}{m}$ represents the average cost c (in dollars) of making m models using a 3-D printer. How many models must be printed for the average cost c to be $90?		9.3.ST-SM.2 - Apply science and mathematics concepts to the development of plans processes and projects that address real world problems.
	Algebraic and numeric procedures are interconnected and build on one another to produce a coherent whole.	Reasoning with Equations and Inequalities SMP 2 – Reason abstractly and quantitatively.	Understand solving equations as a process of reasoning and explain the reasoning.	A-REI.A.1 - Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a	Solve rational equations by cross-multiplying. Solve rational equations by using the least common denominator.	Solve for x. $\frac{4}{x}=\frac{5}{x+6}$		

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				solution. Construct a viable argument to justify a solution method.				
		Reasoning with Equations and Inequalities SMP 2 – Reason abstractly and quantitatively.	Understand solving equations as a process of reasoning and explain the reasoning.	A-REI.A.2 Solve simple rational equations in one variable, and give examples showing how extraneous solutions may arise.	Solve rational equations by cross-multiplying. Solve rational equations by using the least common denominator.	Solve for x. $\frac{2}{x-3} - \frac{1}{x} = \frac{x-1}{x-3}$		
Sequences and Series **Pacing: CP - 24 days** **H - 18 days**						Common Unit Assessment		
How can you write a rule for the nth term of a sequence?	Patterns and relationships can be represented graphically, numerically, symbolically or verbally.	Interpreting Functions. SMP 5 - Use appropriate tools strategically.	Interpret functions that arise in applications in terms of the context.	F-IF.A.3 - Recognize that sequences are functions whose domain is a subset of the integers.	Use sequence notation to write terms of sequences. Write a rule for the nth term of a sequence. Sum the terms of a sequence to obtain a series and use summation notation.	Describe the pattern, write the next term, graph the first five terms, and write a rule for the nth term. 3, 8, 15, 24, ...		
How can you recognize an arithmetic sequence from its graph?		Interpreting Functions SMP 3 – Construct viable arguments and critique thee reasoning of others.	Interpret functions that arise in applications in terms of the context.	F-IF.A.3 - Recognize that sequences are functions whose domain is a subset of the integers.	Identify arithmetic sequences.	How can you determine if a sequence is arithmetic?	RST.11-12.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or	

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		Building Functions SMP 6 – Attend to precision.	Build a function that models a relationship between two quantities.	F-BF.A.2 - Write arithmetic sequences with an explicit formula, use them to model situations.	Write rules for arithmetic sequences. Find sums of finite arithmetic series.	$\sum_{k=1}^{12}(7k+2)$ Write out the first 5 terms of the sequence above. What is the common difference? Calculate the sum.	technical context relevant to grades 11-12 texts and topics.	
How can you recognize a geometric sequence from its graph?	One representation may sometimes be more helpful than another; used together, multiple representations give a fuller understanding of a problem	Seeing Structure in Expressions SMP 8 – Look for and express regularity in repeated reasoning.	Write expressions in equivalent forms to solve problems.	A-SSE.B.4 - Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.	Identify geometric sequences. Write rules for geometric sequences. Find the sums of finite geometric series.	Write the explicit form of the geometric sequence 12, -48, 192, -768. . ., then find the sum of the first 8 terms.		
How can you find the sum of an infinite geometric series?					Find partial sums of infinite geometric series. Find sums of infinite geometric series.	Find the sum. $\sum_{i=1}^{10} 4(\frac{3}{4})^{i-1}$ For the sequence above, would it be possible to find the infinite sum? Explain your answer.		CRP4 - Communicate clearly and effectively and with reason.
How can you define a sequence recursively?	Patterns and relationships can be represented graphically, numerically, symbolically, or verbally.	Interpreting Functions SMP 6 – Attend to precision.	Interpret functions that arise in applications in terms of the context.	F-IF.A.3 - Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.	Evaluate recursive rules for sequences.	Given $a_1=7$ and $a_n=a_{n-1}+3$, write the first 5 terms of the sequence.		
		Building Functions SMP 8 – Look for and express	Build a function that models a relationship between two quantities.	F-BF.A.1a - Determine an explicit expression, a recursive process, or steps for	Write recursive rules for sequences.	Write a recursive rule for the sequence. 2,14, 98, 686, 4802, ...		

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		regularity in repeated reasoning.		calculation from context.				
		Building Functions SMP 8 – Look for and express regularity in repeated reasoning.	Build a function that models a relationship between two quantities.	F-BF.A.2 - Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate them between two forms.	Translate between recursive and explicit rules for sequences. Use recursive rules to solve real-life problems.	Write a recursive rule for the sequence. Then write an explicit rule and find the 25th term of the sequence. 5, 9, 13, 17, 21, ...		
Trigonometric Ratios and Functions **Pacing: CP - 22 days** **H - 33 days**						Common Unit Assessment		
How can you find a trigonometric function of an acute angle?	Patterns and relationships can be represented graphically, numerically, symbolically, or verbally	Trigonometric Functions. SMP 2 - Reason abstractly and quantitatively.	Extend the domain of trigonometric functions using the unit circle.	F-TF.A.1 - Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	Evaluate trigonometric functions of acute angles.	In a right triangle, θ is an acute angle and $\sin\theta=\frac{4}{7}$. Evaluate the other five trigonometric functions of θ.		
		Trigonometric Functions SMP 4 – Model with mathematics.	Understand the radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	F-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 measure of angles traversed counterclockwise around the unit circle.	Evaluate trigonometric functions of acute angles.	A parasailer is attached to a boat with a rope 72 feet long. The angle of elevation from the boat to the parasailer is 28°. Estimate the parasailer's height in feet above the boat?		9.3.ST-SM.2 - Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
	How can we use mathematical models to	Trigonometric Functions	Model periodic phenomena with	F-TF.B.5 - Choose trigonometric functions to model periodic phenomena	Solve real-life problems.	You measure the angle of elevation from the ground to the top of a building		9.3.ST-SM.2 - Apply science and mathematics concepts to the

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	describe physical relationships?	SMP 1- Make sense of problems and persevere in solving them.	trigonometric functions.	with specified amplitude, frequency, and midline.		as 32^o. When you move 50 meters closer to the building the angle of elevation is 53^o. What is the height of the building?		development of plans, processes and projects that address real world problems.
	Reasoning and/or proof can be used to verify or refute conjectures or theorems in algebra.	Trigonometric Functions SMP 1- Make sense of problems and persevere in solving them.	Prove and apply trigonometric identities.	F-TF.C.8 - Prove the Pythagorean identify $\sin^2(x) + \cos^2(x) = 1$ and use it to find sin(x), cos(x) or tan(x) given the sin(x), cos(x) or tan(x) and the quadrant of the angle.	Find unknown side lengths and angle measures of right triangles.	To measure the width of a river, you plant a stake on one side of the river, directly across from a boulder. You then walk 100 meters to the right of the stake and measure a 79^o angle between the boulder and the stake. What is the width of the river?		9.3.ST-SM.2 - Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
How can you find the measure of an angle in radians?	Patterns and relationships can be represented graphically, numerically, symbolically, or verbally.	Trigonometric Functions SMP 5 – Use the appropriate tools strategically.	Extend the domain of trigonometric functions using the unit circle.	F-TF.A.1 - Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	Draw angles in standard position. Find coterminal angles. Use radian measure.	Sketch the angle in standard position, 230^o. Find one positive and one negative coterminal angle. Then convert the angle to radians.	RST.11-12.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.	
How can you use the unit circle to define		Trigonometric Functions	Understand the radian measure of an angle as	F-TF.A.2 - Explain how the unit circle in the coordinate plane	Evaluate trigonometric	Evaluate the function without using a calculator.		

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the trigonometric functions of any angle?		SMP 2 – Reason abstractly and quantitatively.	the length of the arc on the unit circle subtended by the angle.	enables the extension of trigonometric functions to all real numbers, interpreted as radian measure of angles traversed counterclockwise around the unit circle.	functions of any angle. Find and use reference angles to evaluate trigonometric functions.	a. sec 135° b. cot $(\frac{-8\pi}{3})$		
What are the characteristics of the graph of the sine and cosine function?	Patterns and relationships can be represented graphically, numerically, symbolically or verbally.	Creating Equations SMP 2 – Reason abstractly and quantitatively.	Analyze functions using different representations.	F-IF.C.7e - Graph trigonometric functions, showing period, midline and amplitude.	Explore characteristics or sine and cosine functions.	Find the amplitude and period of the function. Then graph. y=⅓ cos ½x		
		Building Functions SMP 6 – Attend to precision.	Build new functions from existing functions.	F-BF.B.3 - Identify the effect on the graph of replacing f(x) by f(x) + k, kf(x), f(kx) and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.	Stretch and shrink graphs of sine and cosine functions. Translate graphs of sine and cosine functions. Reflect graphs of sine and cosine functions.	Given y = sin x, write the equation with an amplitude of 5, moved up 3 units and reflected over the x-axis.		CRP8 - Utilize critical thinking to make sense of problems and persevere in solving them.
What are the characteristics of the graph of the tangent functions?	Patterns and relationships can be represented graphically, numerically,	Creating Equations SMP 2 - Reason abstractly and quantitatively.	Analyze functions using different representations.	F-IF.C.7e - Graph trigonometric functions, showing period, midline and amplitude.	Explore characteristics of tangent and cotangent functions. (Honors Only)	Using a graphing utility, graph y=tan x and y=cot x. Have students describe what they see.		CRP11 - Use technology to enhance productivity.

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	symbolically or verbally.	Building Functions SMP 3 – Construct viable arguments and critique the reasoning of others.	Build new functions from existing functions	F-BF.B.3 - Identify the effect on the graph of replacing f(x) by f(x) + k, kf(x), f(kx) and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.	Graph tangent and cotangent functions. Graph secant and cosecant functions. (Honors Only)	Describe how the graph of g(x) is a transformation of its parent function. g(x)=2csc2x		
How can you verify a trigonometric identity?	Patterns and relationships can be represented graphically, numerically, symbolically or verbally.	Creating Equations SMP 2 - Reason abstractly and quantitatively.	Analyze functions using different representations.	F-TF.C.8 - Prove the Pythagorean identify $\sin^2(x) + \cos^2(x) = 1$ and use it to find sin(x), cos(x) or tan(x) given the sin(x), cos(x) or tan(x) and the quadrant of the angle.	Use trigonometric identities to evaluate trigonometric functions and simplify trigonometric expressions. Verify trigonometric identities.	Simplify the expression: cos x - cos x $\sin^2$x		CRP8 - Utilize critical thinking to make sense of problems and persevere in solving them.
Data Analysis and Statistics **Pacing: CP - 15 days** **H - 15 days**						Common Unit Assessment		
In a normal distribution, about what percent of the data lies with one, two and three standard deviations of the mean?	The message conveyed by the data depends on how the data is collected, represented and summarized.	Interpreting Categorical and Quantitative. SMP 4 - Model with mathematics.	Summarize, represent, and interpret data on a single count or measurement variable.	S-ID.A.4 - Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which	Calculate probabilities using normal distributions. Use z-scores and the standard normal tables to find probabilities.	A study finds that the weights of infants at birth are normally distributed with a mean of 3270 grams and a standard deviation of 600 grams. An infant is randomly chosen.		

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				such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.	Recognize data sets that are normal.	What is the probability that the infant weighs 4170 grams or less?		
How can you test theoretical probability using sample data?	The results of a statistical investigation can be used to support or refute an argument.	Making Inferences and Justifying Conclusions SMP 4 - Model with mathematics.	Understand and evaluate random processes underlying statistical experiments.	S-IC.A.2 - Decide if a specified model is consistent with results from a given data-generating process, e.g. using simulation.	Distinguish between populations and samples.	Identify the population and the sample. *A survey of 4464 shoppers in the United States found that they spent an average of $407.02 from Thursday through Sunday during a recent Thanksgiving holiday.*		
		Making Inferences and Justifying Conclusions SMP 3 – Construct viable arguments and critique the reasoning of others.	Understand and evaluate random processes underlying statistical experiments.	S-IC.A.1 - Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	Analyze hypotheses.	Two simulations are performed. The first uses 20 random samples and the second uses 400 random samples. Histograms are created for each simulation. Which simulation should be used to accurately analyze a hypothesis? Explain.	RST.11-12.9 - Synthesize information from a range of sources e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.	9.3.ST-SM.4 - Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.
What are some considerations when undertaking a	The results of a statistical investigation can be used to				Identify types of sampling methods in statistical studies.	If the high school's student council wanted to know how many students will		

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statistical study?	support or refute an argument.					attend the homecoming dance, identify a method for selecting the sample.		
		Making Inferences and Justifying Conclusions SMP 2 – Reason abstractly and quantitatively.	Make inferences and justify conclusions from sample surveys, experiments, and observational studies.	S-IC.B.3 - Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	Recognize bias in sampling. Analyze methods of collecting data. Recognize bias in survey questions.	Identify the type of sample and any bias. *A town council wants to know whether residents support having an off-leash area for dogs in the town park. Eighty dog owners are surveyed at the park.*		
How can you use an experiment to test a conjecture?	The results of a statistical investigation can be used to support or refute an argument.	Making Inferences and Justifying Conclusions SMP 3 – Construct viable arguments and critique the reasoning of others.	Understand and evaluate random processes underlying statistical experiments.	S-IC.A.1 - Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	Describe experiments.	Describe the experiment. *A company's researchers want to study the effects of adding shea butter to their existing hair conditioner. They monitor the hair quality of 30 randomly selected customers using their regular conditioner and 30 randomly selected customers using the new shea butter conditioner.*		
	The results of a statistical investigation can be used to support or	Making Inferences and Justifying Conclusions	Make inferences and justify conclusions from sample	S-IC.B.3 - Recognize the purposes of and differences among sample surveys, experiments, and	Recognize how randomization applies to experiments and	Explain whether the following research topic is best investigated through		CRP4 - Communicate clearly and effectively and with reason.

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	refute an argument.	SMP 3 – Construct viable arguments and critique the reasoning of others.	surveys, experiments, and observational studies.	observational studies; explain how randomization relates to each.	observational studies.	an experiment or observational study. *You want to know whether vigorous exercise in older people results in longer life.*		
	The message conveyed by the data depends on how the data is collected, represented, and summarized.	Making Inferences and Justifying Conclusions SMP 3 – Construct viable arguments and critique the reasoning of others.	Make inferences and justify conclusions from sample surveys, experiments, and observational studies.	S-IC.B.6 - Evaluate reports based on data.	Analyze experimental designs.	Describe how the research topic is best investigated and design a plan. *A farmer wants to know whether a new fertilizer affects the weight of the fruit produced by a strawberry plant.*		
How can you use a sample survey to infer a conclusion about a population?	The results of a statistical investigation can be used to support or refute an argument.	Making Inferences and Justifying Conclusions SMP 1 – Make sense of problems and persevere in solving them.	Understand and evaluate random processes underlying statistical experiments.	S-IC.A.2 - Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.	Analyze population parameters.	In a survey of 1028 people in the U.S., 87% reported using the Internet. Give an interval that is likely to contain the exact percent of all people in the U.S. who use the Internet.		
	The message conveyed by the data depends on how the data is collected, represented,	Making Inferences and Justifying Conclusions SMP 1 – Make sense of problems and	Make inferences and justify conclusions from sample surveys, experiments, and	S-IC.B.4 - Use data from a sample survey to estimate a population mean or proportion; develop a margin or error through the use of	Estimate population parameters. Find margins of error for surveys.	A national polling company claims that 54% of U.S. adults are married. You survey 50 people and find that 31 are married. What is the margin of error?		9.3.ST-SM.4 - Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret

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	and summarized.	persevere in solving them.	observational studies.	simulation models for random sampling.		Does the polling company's result fit within the likely interval?		and summarize research and statistical data
How can you use an experiment to test a conjecture?	The results of a statistical investigation can be used to support or refute an argument.	Making Inferences and Justifying Conclusions SMP 6 – Attend to precision.	Understand and evaluate random processes underlying statistical experiments.	S-IC.A.2 - Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.	Make inferences about a treatment.	Have students design an experiment with two groups. One group should be the control group and one group can be the treatment group.		CRP6 - Demonstrate creativity and innovation.
How can you use a sample survey to infer a conclusion about a population?		Making Inferences and Justifying Conclusions SMP 6 – Attend to precision.	Understand and evaluate random processes underlying statistical experiments.	S-IC.B.5 - Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.	Organize data from an experiment with two samples. Resample data using a simulation to analyze a hypothesis.	Using the data collected from the two groups, students should create tables and histograms to compare results.	RST.11-12.9 - Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.	
Final Exam **Pacing: 1 Day**								