Summit Public Schools

Summit, New Jersey

Grade Level 10-12/ Content Area: Mathematics

Length of Course: Full Academic Year

Curriculum:
Algebra 2

Course Description: The course is a continuation of work begun in Algebra I. It emphasizes facility with algebraic expressions and forms, especially linear and quadratic forms, powers and roots, and functions based on these concepts. Students study exponential, logarithmic, polynomial, trigonometric, and other special functions both for their abstract properties and as tools for modeling real-world situations. Geometric ideas are utilized throughout, and applications of statistical analysis are examined. Students will utilize graphing technologies throughout the course.

Revised (2017) by:
Adam Leaman

Unit 1: Analyzing Equations and Inequalities/Prerequisites

Topic	Section In Text	Time Frame	SWBAT
Sets of Real Numbers	1.2 (A)	1	
Solving Formulas/Literal Equations	1.4 (A)	1	• Solve a linear equation for a numerical value of "x" (see harder e • Manipulate a literal equation and solve for a specified variable
Functions Domain, Range, introduce Interval Notation	2.1 (B)	1	• Define function • Recognize a function given a table, mapping diagram, graph (ap of ordered pairs • Use function notation • Identify domain and range and define each/use interval notation
Solving Absolute Value Equations	1.5 (A)	1	• Solve an absolute value equations by first transforming it into tw • Graph the solution set to an absolute value inequality on a numb
Solving Compound Inequalities with Absolute Value	1.7 (A)	1	• Solve an absolute value inequality by first transforming it into a c • Graph the solution set to an absolute value inequality on a numb
Graphing Absolute Value with Transformations	Supp a	2	• Graph the parent function of an absolute value function • Graph absolute value functions with rigid transformations (up/do Understand how f(x+k), f(x) + k and –f(x) transform the graphs. • Find the domain and range in INTERVAL NOTATION of these gr • Write an absolute value function given a graph
Review / Quest		2	
	Total	9 +3 (extra time/quizzes) =12 days	

UNIT 1 STANDARDS ADDRESSED

A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from line simple rational and exponential functions.

A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordina

A.CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret sol options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations

A.CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, highlight resistance R.

CCSS.MATH.CONTENT.HSF.IF.C.7.B
Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

CCSS.MATH.CONTENT.HSF.BF.B.3
Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and neg the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizi from their graphs and algebraic expressions for them.

UNIT 2: SYSTEMS

Topic	Section In Text	Time Frame	SWBAT
Solving Systems by Graphing/Sub/Elim	3.1 (C)	1	● Solve a system of linear equations graphically ● Recognize when a system has no solution or infinitely many ba same line) ● Solve systems of linear equations by finding intersections on g ● Be able to solve word problems involving systems of linear equ and elimination ● Recognize when a system will have no solution or infinitely ma patterns (0=9, no solution, 9=9 infinitely many)
Systems of Equations with Three Variables using RREF	3.7 (C)	2	● Solve a system of linear equations in three variables algebraica ● Solve a system of linear equations in three variables using mat graphing calculator

Word Problems involving linear systems in 2 and 3 variables	Supp b (see 3.7 for 3 variable word problems) (C)	2	● Set up and solve a word problem involving systems of linear e ● Use the calculator to solve such problems.
Linear Programming	3.5/3.6 (C)	2	● Minimize and maximize an objective quantity
Review 3.1-3.7		1	
Quest Unit 2		1	
	Total	9 +2(for additional time or quizzes) 11 days	

UNIT 2 STANDARDS ADDRESSED

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 coordina curve (which could be a line).

CCSS.MATH.CONTENT.HSA.REI.D.11

Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tab successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute val logarithmic functions.*

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

Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case graph the solution set to a system of linear inequalities in two variables as the intersection of the correspond

Unit 3: Quadratics

Topic	Section In Text	Time Frame	SWBAT
Complex Numbers	5.9 (D,E)	2	● Recognize when and in what context an imaginary numbe ● Apply arithmetic operations to complex numbers. ● Raise "i" to "high powers" (i^13) ● Graph complex numbers on the complex plane
Factoring/ Solving Quadratics by Factoring (with imaginary solutions)	6.2 (E)	2	● Factor GCF ● Factor difference of squares ● Factor trinomials when a=1 and when a≠1
Graphing Parabolas in Standard and Vertex Form	6.1 6.6 (vertex form) (E)	2	● Graph quadratic functions in both standard and vertex for ● Identify max and min values, x-intercepts, domain and ran
Completing the Square (with imaginary solutions)	6.3 (E)	2	● Use completing the square as a method of solving quadra ● Use completing the square to convert quadratics from sta
The Quadratic Formula (with imaginary)	6.4 (E)	2	● Use quadratic formula to solve quadratics (not involving im ● Use the discriminant to justify whether a quadratic will hav
Quadratic Formula and Word Problems (projectile motion) Use graphing calculator	Supp c (E)	2	● Use the quadratic formula to solve word problems (vertica
Review 6.1-6.7		1	

Test Unit 6		1	
	Total	14 +4 (for additional time/quizzes) 18 days	

UNIT 3 STANDARDS ADDRESSED

CCSS.MATH.CONTENT.HSA.SSE.A.1
Interpret expressions that represent a quantity in terms of its context.*

CCSS.MATH.CONTENT.HSA.SSE.A.1.A
Interpret parts of an expression, such as terms, factors, and coefficients.

CCSS.MATH.CONTENT.HSA.SSE.A.2
Use the structure of an expression to identify ways to rewrite it. For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing it as a differ
factored as (x2 – y2)(x2 + y2).

CCSS.MATH.CONTENT.HSF.IF.C.8.A
Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the gr
a context.

CCSS.MATH.CONTENT.HSF.IF.C.7.A
Graph linear and quadratic functions and show intercepts, maxima, and minima.

CCSS.MATH.CONTENT.HSF.IF.C.9
Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal d
graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

CCSS.MATH.CONTENT.HSF.BF.B.3
Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); fi
Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd fur
algebraic expressions for them.

CCSS.MATH.CONTENT.HSN.CN.A.1
Know there is a complex number has such that i2 = -1, and every complex number has the form a + bi with a and b real.

CCSS.MATH.CONTENT.HSN.CN.A.2
Use the relation i2 = -1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

CCSS.MATH.CONTENT.HSN.CN.C.7
Solve quadratic equations with real coefficients that have complex solutions.

CCSS.MATH.CONTENT.HSN.CN.C.8
(+) Extend polynomial identities to the complex numbers. For example, rewrite x2 + 4 as (x + 2i)(x – 2i).

CCSS.MATH.CONTENT.HSN.CN.C.9
(+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

Unit 4: Functions

Topic	Section In Text	Time Frame	SWBAT
Operations with Functions (with compositions)	Supp d (8.7 is composi tions)	2	● Perform operations with functions, state the domain of the resu of sets for rational functions, etc..) ● Perform a composition of two functions
Inverses	8.8	1	● Find the inverse of a function graphically and algebraically ● Perform the horizontal line test
Even/Odd Functions	Supp d (G)	1	● Recognize whether a function is even, odd, or neither based or ● Algebraically show that a function is even, odd, or neither
Piecewise/Step Functions	Supp d	2	● Graph step and piecewise functions
Nonlinear Systems/ Intersecting Functions	Supp d	1	● Solve systems of nonlinear (limit to abs, quadratic, simple ratior calculator, or by recognizing that if there is no intersection poin
Review 7		1	
Test 7		1	
	Total	9 +3 (for additional time/quizzes) 12 days total	
UNIT 4 STANDARDS ADDRESSED			

CCSS.MATH.CONTENT.HSF.IF.C.7
Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more c

CCSS.MATH.CONTENT.HSF.IF.C.7.B
Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

CCSS.MATH.CONTENT.HSF.BF.B.3
Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); fi
graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and
and algebraic expressions for them.

CCSS.MATH.CONTENT.HSF.BF.B.4
Find inverse functions.

CCSS.MATH.CONTENT.HSF.BF.B.4.A
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. For example, f(
1.

CCSS.MATH.CONTENT.HSF.BF.B.4.B
(+) Verify by composition that one function is the inverse of another.

CCSS.MATH.CONTENT.HSA.REI.D.11
Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equ
approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases
polynomial, rational, absolute value, exponential, and logarithmic functions.*

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,
features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decrea
relative maximums and minimums; symmetries; end behavior; and periodicity.*

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

Unit 5: Radicals/Rational Exponents/Powers/Roots

Topic	Section In Text	Time Frame	SWBAT
Properties of Exponents	5.1 (D)	2	• Simplify using all properties of exponents

Fractional Roots	5.7 (D)	2	● Evaluate nth roots of real numbers using radical notation a both by hand and with a calculator
Simplifying Radical Expressions Multiplying Radical Expressions Dividing Radical Expressions (including binomial denominators and with i)	5.6/5.10 (D)	3	● Multiply and divide radicals ● Simplify radicals using absolute value where appropriate ● Define radicand, index, like radicals ● Add and subtract radicals ● Rationalize denominators using conjugate (also complex c
Solving Radical Equations	5.8 (D)	2	● Solve radical equations ● Find extraneous solutions and reason about what it means
Graph Cubic/Cube Root/Square root Functions	Supp e	1	● Graph cubic functions with transformations ● Find domain and range of cubic functions in interval notati ● Connect inverses ● Justify whether certain cubic graphs are even, odd, or neit
Review 5.6-5.10		1	
Test Unit 5		1	
	Total	12 +3 (for additional time/quizzes) 15 days	

UNIT 5 STANDARDS ADDRESSED

CCSS.MATH.CONTENT.HSA.REI.A.2
Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may aris

CCSS.MATH.CONTENT.HSN.RN.A.1
Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those valu radicals in terms of rational exponents. For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so

CCSS.MATH.CONTENT.HSN.RN.A.2
Rewrite expressions involving radicals and rational exponents using the properties of exponents.

CCSS.MATH.CONTENT.HSN.RN.B.3
Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irratio
nonzero rational number and an irrational number is irrational.

CCSS.MATH.CONTENT.HSF.IF.C.7.B
Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

Unit 6 : Inferences and Conclusions from Data

Topic	Section in Text	Time Frame	SWBAT
Review of Statistics	Suppf	2	● Find measures of central tendency ● Find measures of spread ● Find the five number summary ● Find and reason with outliers ● Create a box and whisker on calculator
Designing a study/bias/randomness	Suppf	2	● Classify studies ● Identifying bias in studies
Distributions of data	Suppf	2	● Create a histogram ● Describe the shape (skew) of distribution of box and whisker

The Normal Distribution	Supp f	2	● Set up a normal distribution, and use the empirical rule to rea probabilities relating to the data.
Review/Test		2	
	Total	10 days	

UNIT 6 STANDARDS ADDRESSED

CCSS.MATH.CONTENT.HSS.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. data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas unde

CCSS.MATH.CONTENT.HSS.IC.A.1
Understand statistics as a process for making inferences about population parameters based on a random sample from th

CCSS.MATH.CONTENT.HSS.IC.A.2
Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For exar spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?

CCSS.MATH.CONTENT.HSS.IC.B.3
Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how ra

CCSS.MATH.CONTENT.HSS.IC.B.4
Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of random sampling.

CCSS.MATH.CONTENT.HSS.IC.B.5
Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between para

CCSS.MATH.CONTENT.HSS.IC.B.6
Evaluate reports based on data.

CCSS.MATH.CONTENT.HSS.MD.B.6
(+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).

CCSS.MATH.CONTENT.HSS.MD.B.7
(+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at

Unit 7: Logarithms

Topic	Section In Text	Time Frame	SWBAT
Graphs of Exponential Functions	10.1 (F)	1	● Graph exponential functions ● Find the domain and range in interval notation
Exponential Equations not requiring logs	10.1 (F)	1	● Solve exponential equations both with like and unlike bases t
Logarithms	10.2 (F)	2	● Switch between logarithmic and exponential form ● Evaluate logarithms without the calculator ● Evaluate logarithms using the change of base formula and th ● Graph logarithmic functions
Properties of Logarithms	10.3 (F)	2	● Use properties to expand and condense logarithms
Solving Equations Using Logarithms	10.6 (F)	2	● Solve logarithmic equations and exponential equations requi
Solving Equations Using Natural Logarithms	10.6 (F)	2	● Evaluate, expand, and condense logarithms of base e
Word Problems with Logarithms	10.7 (F)	2	● Solve word problems related to logarithms (compound intere problems
Review / Test		2	
		14 +3 (for additional time/ quizzes)	

	17 days	

UNIT 7 STANDARDS ADDRESSED

CCSS.MATH.CONTENT.HSA.SSE.A.1.B
Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)n as
not depending on P.

CCSS.MATH.CONTENT.HSF.IF.C.7.E
Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing p

CCSS.MATH.CONTENT.HSF.IF.C.8.B
Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of ch
$(1.02)^t$, $y = (0.97)^t$, $y = (1.01)12^t$, $y = (1.2)^t/10$, and classify them as representing exponential growth or decay.

CCSS.MATH.CONTENT.HSF.BF.B.5
(+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems invo
exponents.

CCSS.MATH.CONTENT.HSF.LE.A.4
For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2
logarithm using technology.

Unit 8: Exploring Polynomial Functions

Topic	Section In Text	Time Frame	SWBAT
Monomials/Polynomials/ Classifying Polynomials	5.2 (D)	1	● Recognize characteristics of a polynomial (degree, leading coefficie binomial, trinomial, etc…) ● Add, subtract, and multiply polynomials
Factoring/solving above degree 2 – Sum/Diff of Cubes	5.4 (D)	2	● Factor polynomials over the reals (certain polynomials may need to ● Solve polynomials using the Zero-Product property ● Sum/Difference of cubes
Long Division of Polynomials	5.3 (D)	1	● Divide polynomials using long and synthetic division ● Recognize when to use synthetic division over long division
Synthetic Division of Polynomials	5.3 (D)	1	See above
Polynomial Functions	8.1, 8.3 (G)	2	● Find # of max turns (degree-1) ● Find relative extrema on calculator ● Describe end behavior
The Remainder and Factor Theorems	8.2 (G)	2	● Use the remainder theorem to evaluate polynomials ● Use the factor theorem
Roots and Zeros/The Rational Zero Theorem	8.4/8.5 (G)	2	● Apply the rational zero test and synthetic division to find all rationa ● Define multiplicity ● Describe how zeros, factors, and solutions are related ● Use the Fundamental Theorem of Algebra to determine the numbe a connection to the linear factorization theorem ● Find all (real and complex) zeros of a polynomial
Graphing Polynomials Using the Rational Zero Theorem	Supp	2	● Graph polynomials
Review /Test		2	
	Total	15 +3 (for additional time/quizzes) 18 days	

UNIT 8 STANDARDS ADDRESSED

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 ad multiplication; add, subtract, and multiply polynomials.

CCSS.MATH.CONTENT.HSA.SSE.A.1.A
Interpret parts of an expression, such as terms, factors, and coefficients.

CCSS.MATH.CONTENT.HSA.SSE.A.2
Use the structure of an expression to identify ways to rewrite it. For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing that can be factored as (x2 – y2)(x2 + y2).

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), is a factor of p(x).

CCSS.MATH.CONTENT.HSF.IF.C.8
Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the fu

CCSS.MATH.CONTENT.HSF.IF.C.8.A
Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symme these in terms of a context.

CCSS.MATH.CONTENT.HSF.IF.C.7.C
Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

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 polynomial.

CCSS.MATH.CONTENT.HSA.APR.C.4
Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity (x2 + y2 used to generate Pythagorean triples.

Unit 9: Trigonometric Functions

Topic	Section in Text	Time Frame	SWBAT
Introduction to Trigonometry	13.1	2	● Evaluate all trigonometric functions (sin, cos, tan, csc, sec, without the calculator
Angles and Angle Measure	13.2	3	● Extend the unit circle beyond acute angles ● Decide whether angles are coterminal ● Find coterminals angles ● Rewrite radian measures as degree and degree as radian ● Draw angles of rotation

Trigonometric Functions of General Angles (+)	13.3	3	• Find reference angles • Evaluate all trig functions of any angle
Review/Quest		2	
Graphing Trigonometric Functions (14.1A is graphing with technology)	14.1 A 14.1	4	• Define amplitude and period and find each for sin and cos f • Graph sin and cos functions • Graph vertical and horizontal shifts and reflections of sin an •
Verify Trigonometric Identities	14.2	4	• Verify identities using reciprocal and Pythagorean identities.
Review/Unit Test		2	
	Total	20	

UNIT 9 STANDARDS ADDRESSED

CCSS.MATH.CONTENT.HSF.TF.A.1
Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

CCSS.MATH.CONTENT.HSF.TF.A.2
Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, inte
angles traversed counterclockwise around the unit circle.

CCSS.MATH.CONTENT.HSF.TF.B.5
Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.*

CCSS.MATH.CONTENT.HSF.TF.C.8
Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find sin(θ), cos(θ), or tan(θ) given sin(θ), cos(θ), or tan(θ) an

CCSS.MATH.CONTENT.HSF.IF.C.7.E
Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing p
amplitude.

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 un 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.

Unit 10: Rational Expressions

Topic	Section in Text	Time Frame	SWBAT
Direct, Inverse, Joint Variation	9.2 (H)	2	● Create and use real life models involving variation
Multiplying and Dividing Rational Expressions	9.3 (H)	1	● Simplify, multiply and divide rational expressions ● Simplify complex fractions
Adding and Subtracting Rational Expressions	9.4 (H)	3	● Add and subtract rational expressions ● Simplify complex fractions
Solving Rational Equations	9.5 (H)	2	● Solve rational equations ● Identify extraneous solutions ● Solve complex fraction equations
Graphing Rational Functions	9.1 (H)	2	● Graph rational functions, identifying all asymptotes (horizonta and holes.
Unit Review/Test		2	
	Total	12 +2(extra time and quizzes) 14 days	

UNIT 10 STANDARDS ADDRESSED

CCSS.MATH.CONTENT.HSA.APR.D.6
Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x
degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a compu

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

CCSS.MATH.CONTENT.HSA.REI.A.2
Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may aris

CCSS.MATH.CONTENT.HSF.IF.C.7.D
(+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end

CCSS.MATH.CONTENT.HSF.IF.B.6
(done with direct variation)
Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified inter
from a graph.*

Unit 1: Analyzing Equations and Inequalities/Prerequisites

<table>
<tr><th colspan="2">Creating Equations</th></tr>
<tr><td colspan="2">Big Ideas: Course Objectives / Content Statement(s)
Number Types: Rational, Irrational, Integers, Whole, and Natural Numbers
Solving Equations
Solving Absolute Value Equations and Inequalities</td></tr>
<tr><th>Essential Questions
What provocative questions will foster inquiry, understanding, and transfer of learning?</th><th>Enduring Understandings
What will students understand about the big ideas?</th></tr>
<tr><td>How do we apply properties of real numbers to simplify expression and solve equations?
Why do absolute value equations usually have two solutions?</td><td>Students will understand that…
Properties of real numbers help to simplify expressions and make it easier to find the solutions to even the most complicated equations.
Absolute value represents the distance from zero and thus, x can have two solutions.</td></tr>
<tr><th>Areas of Focus: Proficiencies (Cumulative Progress Indicators)</th><th>Examples, Outcomes, Assessments</th></tr>
<tr><td>Students will:
A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A.CED.3 Represent constraints by equations or inequalities, and</td><td>Instructional Focus (2 weeks):
This unit review Algebra I and Foundations skills.
Number Types: Students should be able to simplify using order of operations and then classify that number by the highest order that the number falls into
Solving Formulas: This section is geared towards application of mathematics in terms of science topics. Students do not need to be able to factor to solve for a certain variable, but there should be distribution techniques used and combining like terms.
Absolute Value Equations/Inequalities: Relate this topic to distance. Example: A person is on the parkway at exit 140 an is 10 miles away from their destination. What</td></tr>
</table>

by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. A.CED.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.HSF.IF.C.7.B Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. CCSS.MATH.CONTENT.HSF.BF.B.3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(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. Include recognizing even and odd functions from their graphs and algebraic expressions for them.	exit is he or she at? Students should see that there are two answers and thus absolute value has two answers. Assessments ● 1 unit quest Instructional Strategies: ● Use of graphic organizers to learn properties of real numbers ● Use of venn-diagrams to understand number types ● Use of worksheets and stations to practice skills Interdisciplinary Connections/Media Literacy Integration/Global Perspectives The formula below allows students to find the day of the week for which an important date took place $w = d + 2m + \left[\frac{3(m+1)}{5}\right] + y + \left[\frac{y}{4}\right] - \left[\frac{y}{100}\right] + \left[\frac{y}{400}\right] + 2$ d = day of the month m = month March (3) September (9) April (4) October (10) May (5) November (11) June (6) December (12) July (7) January (13) August (8) February (14) y = the year *Note: January and February are considered the 13th and 14th months of the previous year. Example: Feb 22, 1996 is (14/22/95)* Have students research a famous date from another country (suggestion-independence dates, beginning of wars,…) and have students figure out what day of the week these occurred on.

	Technology Integration Show students how to use the STO> button on their TI-83 calculator to help solve complicated substitution problems.

Unit 2: Systems

Reasoning with Equations & Inequalities & Creating Equations	
Big Ideas: Course Objectives / Content Statement(s) ● Solve Systems by graphing, elimination, and substitution ● Solve systems with word problems ● Solve systems of three variables ● Use technology to solve systems	
Essential Questions What provocative questions will foster inquiry, understanding, and transfer of learning?	Enduring Understandings What will students understand about the big ideas?
● How many solutions can exist given a system of equations? ● How can solutions to linear help with cost effectiveness?	Students will understand that… ● A system of equations can have one solution (ie. there is exactly one point that each line shares). ● A system of equations can have an infinite number of solutions (ie. the linear functions share all points because the lines share a common slope and y-intercept). ● A system of equations can have no solution (ie. the lines share no common points because the lines share a common slope but a different y-intercept).
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	Examples, Outcomes, Assessments

Students will:	Instructional Focus (3 weeks):
CCSS.MATH.CONTENT.HSA.REI.D.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). CCSS.MATH.CONTENT.HSA.REI.D.11 Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.* CCSS.MATH.CONTENT.HSA.REI.D.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.	● Find the solution(s) given a system of equations. Sample Problems: Systems of Equations ● Solve the system by elimination, substitution and graphically $4x - 3y = 18$ $3x + y = 7$ ● The school that Lisa attends is selling tickets to the annual talent show. On the first day of ticket sales the school sold 4 senior citizen tickets and 5 student tickets for a total of $102. The school took in $126 on the second day by selling 7 senior citizen tickets and 5 student tickets. What is the price each of one senior citizen ticket and one student ticket? ● A plane traveled 580 miles to Ankara and back. The trip there was with the wind. It took 5 hours. The trip back was into the wind. The trip back took 10 hours. Find the speed of the plane in still air and the speed of the wind. Linear Programming ● A farmer has 25 days to plant cotton and soybeans. The cotton can be planted at a rate of 9 acres per day, and the soybeans at a rate of 12 acres per day. The farm has 275 acres available. If the profit for cotton is $25 per acre and $18 per acre, how many of each should be planted to maximize profit?

	Using Matrices to Solve Systems ● This section is meant to introduce students to matrices and an application for which to use them. Assessments ● 2 sectional quizzes ● 1 unit test Problem Solving Activity ● One day, while repairing a watch, a watchmaker removed the hour and minute hands. But, she put the hands back on the opposite spindles. When the customer picked up the watch, the time correctly showed 2:00pm. When is the next time the watch showed the correct time? ● Solve using a table. ● Solve using a system (Hint: Let (D) represent the distance the minute hand moves on the watch and (d) represent the distance the hour hand moves on the watch. Write two equations, one for the wrong watch and one for a correct watch. Technology Integration Have students use their graphing calculator to find a solution to a system of equations. Students can also use their graphing calculators to solve systems with matrices. Interdisciplinary Connection A portion of the subway in Washington DC heads out of the main part of town in the northwesterly direction. It goes under New Hampshire Ave as shown at the right. If the distances are measured in kilometers, the path of the subway can be represented by the equation $y = -2.5x + 2.5$ and the path of New Hampshire Ave can be represented by the equation y = x. What are the coordinates of the

	point at which the subway goes under New Hampshire Ave. Media Literacy Have students research real life scenarios for systems of equations.

Unit 3: Quadratics

<table>
<tr><th colspan="2">Interpreting Functions & Reasoning with Equations and Inequalities
& Seeing Structure in Expressions</th></tr>
<tr><td colspan="2">Big Ideas: Course Objectives / Content Statement(s)
Students with be able to find the solutions to a quadratic function by graphing, factoring, completing the square and using the quadratic equation
Complex numbers</td></tr>
<tr><th>Essential Questions
What provocative questions will foster inquiry, understanding, and transfer of learning?</th><th>Enduring Understandings
What will students understand about the big ideas?</th></tr>
<tr><td>What does it mean to be a root to a quadratic equation?
What are ways we can find roots?
How many roots does a quadratic equation have?
What is an imaginary number and how do they form the set of complex numbers?</td><td>Students will understand that…
Roots are solutions to a quadratic equation. They are also known as zeros.
A root can be found where the quadratic function crosses the x-axis.
A quadratic function can have 0, 1 or 2 real roots. If a function has zero real roots, then the roots to the function are, in fact, imaginary.</td></tr>
<tr><th>Areas of Focus: Proficiencies
(Cumulative Progress Indicators)</th><th>Examples, Outcomes, Assessments</th></tr>
<tr><td>CCSS.MATH.CONTENT.HSA.SSE.A.1
Interpret expressions that represent a quantity in terms of its context.*

CCSS.MATH.CONTENT.HSA.SSE.A.1.A
Interpret parts of an expression, such as terms, factors, and coefficients.

CCSS.MATH.CONTENT.HSA.SSE.A.2
Use the structure of an expression to identify ways to rewrite it. For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2).

CCSS.MATH.CONTENT.HSF.IF.C.8.A
Use the process of factoring and completing the</td><td>Instructional Focus (3 weeks):
Solve a quadratic equation by using square roots, factoring, competing the square or by the quadratic formula.
Sample Problems:
Graph. $f(x)=2x^2+4x-6$

State the vertex and approximate the solutions.</td></tr>
</table>

square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. CCSS.MATH.CONTENT.HSF.IF.C.7.A Graph linear and quadratic functions and show intercepts, maxima, and minima. CCSS.MATH.CONTENT.HSF.IF.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum. CCSS.MATH.CONTENT.HSF.BF.B.3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(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. Include recognizing even and odd functions from their graphs and algebraic expressions for them. CCSS.MATH.CONTENT.HSN.CN.A.1 Know there is a complex number has such that i2 = -1, and every complex number has the form a + bi with a and b real. CCSS.MATH.CONTENT.HSN.CN.A.2 Use the relation i2 = -1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. CCSS.MATH.CONTENT.HSN.CN.C.7 Solve quadratic equations with real coefficients that have complex solutions. CCSS.MATH.CONTENT.HSN.CN.C.8 (+) Extend polynomial identities to the complex numbers. For example, rewrite x2 + 4 as (x + 2i)(x – 2i). CCSS.MATH.CONTENT.HSN.CN.C.9 (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.	Solve by factoring $x^2 + 2x - 35 = 0$ $64x^2 - 169 = 0$ Solve by completing the square $x^2 - 12x - 10 = 0$ Solve by the quadratic formula $-x^2 - 6x - 1 = 0$ Write an quadratic equations with the following roots $5 \& -\frac{7}{2}$ Solve the quadratic inequality. $-x^2 - 2x + 15 \geq 0$ Assessments ● 2 sectional quizzes ● 1 unit test Technology Use a graphing calculator to check solutions. Show students how to find estimate zeros using upper and lower bounds Media Literacy The game Angry Birds has become a nation wide phenomenon that uses parabolas and projectile motion to win the game. Have students research the questions: What is projectile motion? Are there any other games that use parabolas? Interdisciplinary Connection

	Physics: A ball is thrown up with an initial velocity of 56 feet per sec. The height of the ball t seconds after it is thrown is given by the equation $h(t) = 56t - 16t^2$. ● What is the height of the ball after one second? ● What is the maximum height? ● After how many seconds will it return to the ground?

Unit 4: Functions

Standard F-IF, F-BF, F-TF & A-REI Interpreting Function, Building Functions, Trigonometric Functions & Reasoning with Equations and Inequalities	
Big Ideas: Course Objectives / Content Statement(s) ● Functions ● Domain and Range ● Operations with Functions ● Inverse Functions ● Piecewise Functions ● Absolute Value, Step, Parabolic, Square Root, Cube Root, and Periodic Functions ● Intersecting Functions	
Essential Questions	Enduring Understandings What will students understand about the big ideas?

What provocative questions will foster inquiry, understanding, and transfer of learning?	
• What is domain and range? Are there ever any values that cannot be in the domain of a function? • What is vertex form and how can it be applied to functions.	Students will understand that… • Domain refers to x values where as the range refers to the y values. Yes, rational functions and square root functions are the most notable functions that have restricted domains. • Using parent graphs and rules of vertex form, any function can be manipulated to be easily graphed
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	Examples, Outcomes, Assessments
Students will: CCSS.MATH.CONTENT.HSF.IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.* CCSS.MATH.CONTENT.HSF.IF.C.7.B Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. CCSS.MATH.CONTENT.HSF.BF.B.3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(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. Include recognizing even and odd functions from their graphs and algebraic expressions for them. CCSS.MATH.CONTENT.HSF.BF.B.4 Find inverse functions. CCSS.MATH.CONTENT.HSF.BF.B.4.A 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. For example, f(x) =2 x3 or f(x) = (x+1)/(x-1) for x ≠ 1. CCSS.MATH.CONTENT.HSF.BF.B.4.B	Instructional Focus (4 weeks): • Students should receive an intense exposure to functions. Functions: Students should work with operations of functions. They should be able to add, subtract, multiply, divide, simplify and compose functions. They should be able to identify the domain of any function, both algebraically and graphically. Special Types of Functions: Students should use parent graphs to graph special function types. Include Absolute Value, Step, Parabolic, Square Root, Cube Root, and Periodic Functions. Piecewise Functions: Students should graph linear piecewise functions. Expose students to real life scenarios of piecewise functions. Intersecting Functions: The calculator should be a dominant tool in this section. Students should work with rational, parabolas, lines and other types of polynomials. Real life problem/Interdisiplinary:

(+) Verify by composition that one function is the inverse of another. CCSS.MATH.CONTENT.HSA.REI.D.11 Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.* CCSS.MATH.CONTENT.HSF.IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* CCSS.MATH.CONTENT.HSF.IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*	The minimum payment on a credit card is based on the total amount owed. A credit card company uses the following rules: For a bill less than $10 the entire amount is due. For a bill of at least $10 but less than $500, the minimum due is $10. There is a minimum of $30 due on a bill of at least $500 but less than $1000, a minimum of $50 due on a bill of at least $1000, but less than $1500, and a minimum of $70 is due on bills $1500 or more. Find the function f that describes the minimum payment due on a bill of x dollars. Graph the function. Technology: http://www.analyzemath.com/Calculators/Parabola_Line.html http://www.mathsisfun.com/data/function-grapher.php

Unit 5: Radicals/Rational Exponents/Powers/Roots

The Real & Complex Number System & Reasoning with Equations	
Big Ideas: Course Objectives / Content Statement(s) ● Radical Expressions ● Fractional Roots ● Solving Radical Equations	
Essential Questions What provocative questions will foster inquiry, understanding, and transfer of learning?	Enduring Understandings What will students understand about the big ideas?
● Why is $\sqrt{125} = 5\sqrt{5}$? ● Why is it necessary for roots to "match" in order to add or subtract radicals? ● Why can we rationalize that $\sqrt{x} = x^{\frac{1}{2}}$? ● What does i represent?	Students will understand that… ● Both $\sqrt{125}$ and $5\sqrt{5}$ have the same approximate decimal value. They will then, notice that 125 is equivalent to the perfect square, 25, times the non perfect square, 5, thus making the two radical expression equivalent. ● Just like variables must be alike to combine like terms, so must radicals as they too are two numerical values being multiplied together. They will see the relationship $3x + 4y - 2x + y$ & between $3\sqrt{2} + 4\sqrt{3} - 2\sqrt{2} + \sqrt{y}$ ● Power rules can be applied to radicals. Since $\sqrt{x^2} = x$ and $\left(x^2\right)^{\frac{1}{2}} = x$, a ½ power must be the same operation as a square root. ● $i = \sqrt{-1}$.
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	Examples, Outcomes, Assessments

Students will:	Instructional Focus (3 weeks):
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.HSN.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. For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5. CCSS.MATH.CONTENT.HSN.RN.A.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents. CCSS.MATH.CONTENT.HSN.RN.B.3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. CCSS.MATH.CONTENT.HSF.IF.C.7.B Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.	● Simplify expressions with radicals and rational roots. Sample Problems: ● Simplifying radicals $-\left(\sqrt{10}+\sqrt{6}\right)\left(\sqrt{30}-\sqrt{18}\right)$ $-\sqrt{\frac{1}{18}}$ ● Rational Exponents $\left(-64\right)^{\frac{2}{3}}$ ● Solving radical expressions $5+\sqrt{x+4}=1$ $-(x+6)^{\frac{1}{3}}=2$ ● Complex Numbers $2\sqrt{-50}\cdot\frac{1}{8}\sqrt{-2}$ $2\sqrt{-18}+3\sqrt{-2}$ $(2-4i)^2$ $\left(1-i^5\right)\left(1+i^5\right)$ $\frac{-3i}{5+4i}$ Assessments ● 2 sectional quizzes

- 1 unit test

Instructional Strategies:

- To help students see the difference between $\sqrt{x^2}$ and $\left(\sqrt{x}\right)^2$, have students warm up by filling in the chart below.

x	$\left(\sqrt{x^2}\right)$	$\left(\sqrt{x}\right)^2$	$\left(\sqrt[3]{x^3}\right)$	$\left(\sqrt[3]{x}\right)^3$
1				
-1				
64				
-64				

- Police officers use formulas to investigate crime. One formula that is used often deals with a driver's speed. $s = 2\sqrt{5l}$ is a formula that relates skid marks to speed traveled by a driver. A police officer was investigating a crime in which the driver claimed that she was only traveling 40 miles/hr. The police officer measured the skid marks to be 120ft. Was she lying?

Interdisciplinary Connection
Physics: Find the time that it takes a pendulum to complete a swing it its length is 10inches. Use the formula $T = 2\pi\sqrt{\frac{L}{38}}$ where T represents time in second and L represents the length of the pendulum in inches.

	Media Literacy Have students research the Mandelbrot set and explain how imaginary numbers are used to create these fractals. Technology Integration http://www.youtube.com/watch?v=gEw8xpb1aRA

Unit 6: Inferences and Conclusions from Data

Big Ideas: Course Objectives / Content Statement(s) ● Randomization and Normal Distribution ● Simulating Sampling Variability ● Analyzing Decisions and Strategies	
Essential Questions What provocative questions will foster inquiry, understanding, and transfer of learning?	Enduring Understandings What will students understand about the big ideas?

• How do statistics and probability guide our everyday lives? • How can we properly collect and evaluate data? • What is normal distribution? • What is randomization? • What are simulations?	Students will understand that… • Probability and statistics can be used to make informed decisions. • Random samples can be used to make inferences about a larger population • Some data can be fit to normal distribution where estimates of population percentages can be evaluated.
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	Examples, Outcomes, Assessments
Students will: . CCSS.MATH.CONTENT.HSS.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 such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. CCSS.MATH.CONTENT.HSS.IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. CCSS.MATH.CONTENT.HSS.IC.A.2 Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For	Instructional Focus: • Normal Distribution/Standard Deviation • Samples and bias • Simulations • Decision Analysis Sample Assessments: • Have students write a letter to the editor of a newspaper or magazine examining an advertisement that they see could contain bias. For example, how is it possible that 9 out of 10 dentists prefer Brand A of toothpaste but 9 out of 10 dentists also prefer Brand B of toothpaste? Do advertisers use bias in statistics to sell product? • Have students collect data from around the school or community and use it to create a histogram (i.e. how many days do you walk to school?). Can you make a prediction of the general population of the school based on this sample? Instructional Strategies: Interdisciplinary Connections • BIOLOGY: The Punnett square can be used to find probabilities of genetic traits.

example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model? CCSS.MATH.CONTENT.HSS.IC.B.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. CCSS.MATH.CONTENT.HSS.IC.B.4 Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. CCSS.MATH.CONTENT.HSS.IC.B.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. CCSS.MATH.CONTENT.HSS.IC.B.6 Evaluate reports based on data. CCSS.MATH.CONTENT.HSS.MD.B.6 (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). CCSS.MATH.CONTENT.HSS.MD.B.7 (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a	Technology Integration ● Use the TI-83 has a probability simulator or online simulation websites (http://www.shodor.org/interactivate/activities/ExpProbability/) that can run experiments hundreds of time. Do the experimental probabilities get closer to the theoretical over time? Media Literacy Integration ● Have students collect data from a news source to look for instances of surveys, observational studies, and bias. ● Analyze margins of error from poll data from elections.

hockey goalie at the end of a game).	

Unit 7: Logarithms

Standard F-LE & F-BF Linear, Quadratic, and Exponential Models & Building Functions	
Big Ideas: Course Objectives / Content Statement(s) ● Graphs of Exponential and Logarithmic Functions ● Logarithms and their Properties ● Natural Logarithms ● Word Problems with Logarithms	
Essential Questions What provocative questions will foster inquiry, understanding, and transfer of learning?	Enduring Understandings What will students understand about the big ideas?
● What is a logarithm and what is it used for? ● How are properties of exponents applied to logarithms? ● What is the importance of logarithms in real life data?	Students will understand that… ● A logarithm is a function that allows one to find the solution to a variable exponential value. ● The summation of logarithms is derived from multiplying values with like bases, subtraction from division, and multiplication from power rules. ● Since logarithms can solve for exponential variables, it is often used to solve for rate and time in Interest problems.
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	Examples, Outcomes, Assessments
Students will: CCSS.MATH.CONTENT.HSA.SSE.A.1.B Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)n as the product of P and a factor not	Instructional Focus (3 weeks): ● Exploring Logarithms. Sample Problems: Evaluate.

depending on P. 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. For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)12^t$, $y = (1.2)^t/10$, and classify them as representing exponential growth or decay. 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. CCSS.MATH.CONTENT.HSF.LE.A.4 For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.	$\log_7 \frac{1}{49}$ $\log_4 x = \frac{3}{2}$ $2\log x + \log 3 = \log 27$ $\log_2 6 - \log_2 (x+4) = 3$ $-3 \cdot 11^x - 6 = -22$ $\ln 5x + \ln x = 7$ Assessments ● 1 sectional quiz ● 1 unit test Technology Use a graphing calculator to relate $f(x) = 10^x$ & $f(x) = \log x$ What relationship is seen between the two functions? Interdisciplinary Connection How many days will it a take a culture of bacteria to increase from 2000 to

	50,000 if the growth rate per day is 93.2%? Carl plans to invest $500 at and interest rate of 8.25%, compounded continuously. How long will it take him to have $2000 in his account? Media Literacy/Global Studies Have students explore the internet to the change in interest rates over the past 10 years, both in interest charged and interest earned. How can this effect an investment of $10,000? Now have students look at the current interest rates around the world and compare them with our… Are they better or worse? Be sure to convert all units to dollars during the comparisons.

Unit 8a: Exploring Polynomial Functions

Arithmetic with Polynomials and Rational Expressions & Seeing Structure in Expressions	
Big Ideas: Course Objectives / Content Statement(s) ● Monomial Expressions ● Polynomials ● Polynomial Division ● Factoring	
Essential Questions	Enduring Understandings

What provocative questions will foster inquiry, understanding, and transfer of learning?	What will students understand about the big ideas?
• Where are the power rules for monomials derived from? • How can we apply the distributive property to polynomial multiplication? • What is synthetic division and why is it useful? Why must we include zeros for missing powers • What is factoring and what is the relationship between a polynomial and it's factors	Students will understand that… • That the rules for powers are derived from basic concepts adding powers: $(x^2)(x^3)=(x\cdot x)(x\cdot x\cdot x)=x^5$ subtracting powers: $\frac{x^3}{x^4}=\frac{x\cdot x\cdot x}{x\cdot x\cdot x\cdot x}=\frac{1}{x}$ negative exponents: $\frac{1}{x}=\frac{x^3}{x^4}=x^{-1}$ zero power: $1=\frac{x^3}{x^3}=x^0$ multiplying powers: $(x^3)^2=(x^3)(x^3)=(x\cdot x\cdot x)(x\cdot x\cdot x)=x^6$ • A polynomial times another polynomial is simply the act of distributing the terms in the first polynomial to the terms in the other polynomial. We sometimes use "FOIL" for a binomial times a binomial • Synthetic division is a quick way to divide two polynomials without using long division. We must include zeros for missing powers in synthetic division because each position represents a power of the variable. If you do not put in zeros, then an expression such as x^4+x^2+2 will be written as 1 1 2, but this represents x^2+x+2. We would, instead, enter 1 0 0 1 2. • Factoring is the process of breaking down a polynomial into the multiplication of two or more polynomial or monomial expressions. Similar to a number that can be factored into it's prime factors, a polynomial can be factored into it's composite terms.

Areas of Focus: Proficiencies (Cumulative Progress Indicators)	Examples, Outcomes, Assessments
Students will: 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, subtraction, and multiplication; add, subtract, and multiply polynomials. CCSS.MATH.CONTENT.HSA.SSE.A.1.A Interpret parts of an expression, such as terms, factors, and coefficients. CCSS.MATH.CONTENT.HSA.SSE.A.2 Use the structure of an expression to identify ways to rewrite it. For example, see x4 - y4 as (x2)2 - (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 - y2)(x2 + y2).	Instructional Focus (3 weeks): ● Add, subtract, multiply, divide and factor polynomials. Sample Problems: ● Simplify Monomials. (No negative powers) $\left(\frac{2^3 m^2 n^{-2}}{p^{-4}}\right)^2$ ● Polynomial Multiplication $(2a-1)(8a-5)$ $(4p-1)^2$ $(6n^2-6n-5)(7n^2+6n-5)$ $\left(x^{-2}\right)^3 \cdot \left(x^2 y^3\right)^4$ ● Factoring GCF : $x+x^2y+x^3y^2$ Grouping : $12p^3-21p^2+28p-49$ a = 1 : x^2+5x-6 a > 1 : $6x^2+5x-6$ diff of squares : $4a^2-25$ ● Polynomial Division Long Division: $\left(2x^3+5x^2-2x-15\right) \div (2x-3)$ Synthetic Division(Finding remaining factors):

	$(x^3 - 13x^2 + 24x + 108) \div (x + 2)$ Problem Solving Activity (Dividing Polynomials) ● Choose any number. Multiply that number by 3. Add the sum of your number and 8 to the number you got when you multiplied. Now divide by the sum of your number and 2. Is your answer 4? Why does this work? - Choose any # x - Multiply by 3 3x - Add the sum of your number and 8 to the previous result. 3x + (x + 8) or 4x + 8 - Divide this result by your number plus 2. $\frac{4x+8}{x+2}$ Have students use long division or factoring and reducing to simplify and discover that regardless of what number is chosen for x, the expression simplify to a value of 4. Assessments ● 2 sectional quizzes ● 1 unit test Interdisciplinary Connection Connect the concept of Punnett Squares from biology to polynomial multiplication.

	Media Literacy http://www.youtube.com/user/WSHSmath#p/u/2/OFSrlNhfNsQ Show students the factoring video and assign them the task of creating their own video about a concept in this chapter.

Unit 8b: Exploring Polynomial Functions

<table>
<tr><th colspan="2">Arithmetic with Polynomials and Rational Expressions & Interpreting Functions & Building Functions</th></tr>
<tr><td colspan="2">Big Ideas: Course Objectives / Content Statement(s)
● The Remainder and Factor Theorem
● Graphing Polynomials
● Quadratic Techniques</td></tr>
<tr><th>Essential Questions
What provocative questions will foster inquiry, understanding, and transfer of learning?</th><th>Enduring Understandings
What will students understand about the big ideas?</th></tr>
<tr><td>● What are roots to polynomial equations?
● What types of roots exist for polynomial equations?
● What are the differences between even and odd polynomials graphically?
● How do you compose functions?</td><td>Students will understand that…
● Roots are where the polynomial equation equals zero. Real zeros cross or touch the x-axis.
● There are rational, irrational, and imaginary roots in polynomial equations. Number of real and imaginary roots always equals the degree of the polynomial.
● In an even polynomial, the end behaviors of the polynomial either both increase or both decrease, whereas in an odd polynomial, one will increase while the other will decrease.
● Composition of functions is a form of substitution. It is where one function is substituted into the other function.</td></tr>
<tr><th>Areas of Focus: Proficiencies (Cumulative Progress Indicators)</th><th>Examples, Outcomes, Assessments</th></tr>
<tr><td>Students will:

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).</td><td>Instructional Focus (3 weeks):
● Examining polynomials.

Sample Problems:
Find the remaining factors
$x^4+14x^3+51x^2+54x\ ;\ x+9$</td></tr>
</table>

CCSS.MATH.CONTENT.HSF.IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. CCSS.MATH.CONTENT.HSF.IF.C.8.A Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. CCSS.MATH.CONTENT.HSF.IF.C.7.C Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. 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.C.4 Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity (x2 + y2)2 = (x2 - y2)2 + (2xy)2 can be used to generate Pythagorean triples.	Find the zeros to the polynomial. Then sketch a graph. $f(x) = x^4 + 2x^3 - 8x^2 - 18x - 9$ Use quadratic techniques to solve. $x^4 + x^2 - 20 = 0$ $x^{\frac{1}{2}} - 4x^{\frac{1}{4}} + 3 = 0$ Assessments ● 2 sectional quizzes ● 1 unit test Technology Project: The Birthday Polynomial Students will use the numerical date of their birthday to create a polynomial. Students will then need to find an appropriate window to display their polynomial and mathematically describe the polynomial (ie. How many real and imaginary roots exist? Is it even or odd? …) Media Literacy The game Angry Birds has become a nation wide phenomenon that uses parabolas and projectile motion to win the game. Have students research the questions: What is projectile motion? Are there any other games that use parabolas? Interdisciplinary Connection Biology: The intensity of light emitted by a firefly can be determined by the polynomial function $L(t) = 10 + 0.3t + 0.4t^2 - 0.01t^3$, where t is the temperature in Celsius and L (t) is

	the light intensity in lumens. If the temperature is 30°C, find the light intensity. Global Perspective The British Isles, located northwest of the European mainland, consists of two large islands, Great Britain and Ireland, and many smaller islands. Northern Ireland has it's own currency. Given that the currency exchange rate for American dollars is given by the equation: $B(a) = 0.6252$ (where a is American dollars) And British pounds to Irish punts is given by the equation: $P(b) = 0.9731$ (where b is British pounds) Use composition of function to find the conversion rate for American dollars to Irish punts.

Unit 9: Trigonometric Functions

Big Ideas: Course Objectives / Content Statement(s): ● Exploring Trigonometric Functions ● Using Trigonometric Graphs and Identities	
Essential Questions What provocative questions will foster inquiry, understanding, and transfer of learning?	Enduring Understandings What will students understand about the big ideas?
● How are the six basic trig functions related? ● How are radian and degree measures used in real-world settings? ● What is a periodic function?	Students will understand that… ● There are six trigonometric functions ● Angles can be measured in radians and degrees. ● Trigonometric functions can be extended to all real numbers, using the unit circle (CCSS HSF.TF.A.2)

	● Trigonometric functions are periodic ● Trigonometric expressions can be simplified and verified using identities
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	Examples, Outcomes, Assessments
Students will: CCSS.MATH.CONTENT.HSF.TF.A.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. CCSS.MATH.CONTENT.HSF.TF.A.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. CCSS.MATH.CONTENT.HSF.TF.B.5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.* CCSS.MATH.CONTENT.HSF.TF.C.8 Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle. 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.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	Instructional Focus: ● An introduction to trigonometry ● Angles and angle measure ● Trigonometric Functions of General angles ● Graphing Trigonometric Functions ● Trigonometric Identities ● Verifying Trigonometric Identities Sample Assessments: ● Have students create and use diagrams to model examples of the terms: arc, standard position, radian, and coterminal angles. Display these in the classroom as a visual. ● Students create a tessellation using their knowledge of angles gained from this unit (see p. 873 in text). Instructional Strategies: Interdisciplinary Connections ● PHYSICS: Have students refer to a physics text and look through the section on waves, especially light and sound. They should focus on the meanings of period and amplitude Technology Integration ● Students use their graphing calculators or online graphing applets to visualize the effect of changing the period and

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.	amplitude of a trigonometric graph vs. its parent function. Global Perspectives/Culturally Responsive Teaching ● Sundials use a shadow falling on a calibrated scale to tell time. In some primitive regions of Egypt, sundials are still used to tell time. *(See Chapters 13 and 14 for extensions of these ideas)

Unit 10: Rational Expressions

Big Ideas: Course Objectives / Content Statement(s) ● Exploring Rational Expressions	
Essential Questions What provocative questions will foster inquiry, understanding, and transfer of learning?	Enduring Understandings What will students understand about the big ideas?
● What is domain and range? Are there ever any values that cannot be in the domain or range of a function? ● What does it mean to be "closed" under addition, subtraction, multiplication and division? ● What are extraneous solutions? How and when do they arise?	Students will understand that… ● Graphs of rational functions can produce different types of asymptotes (CCSS HSF.IF.C.7.D) ● Like rational numbers, rational expressions can be added, subtracted, multiplied and divided (CCSS HSA.APR.D.7) ● Extraneous solutions can arise when solving rational expressions (CCSS HSA.REI.A.2)
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	Examples, Outcomes, Assessments
Students will: CCSS.MATH.CONTENT.HSA.APR.D.6 Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system. CCSS.MATH.CONTENT.HSA.APR.D.7 (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.	Instructional Focus: ● Graphing Rational Functions ● Direct, Inverse and Joint Variation ● Multiplying and Dividing Rational Expressions ● Adding and Subtracting Rational Expressions ● Solving Rational Equations Sample Assessments: ● Have students graph rational functions on large graph paper, displaying important values (asymptotes, intercepts, end behavior). Display in classroom. ● Using examples, have students write a sentence or two explaining any procedural differences between multiplying and dividing rational expressions.

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.HSF.IF.C.7.D (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. CCSS.MATH.CONTENT.HSF.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.*	● Observe a partner share where students explain the steps in solving rational equations. Have them take note of steps where they disagree. Instructional Strategies: Interdisciplinary Connections ● Most students are familiar with variation from Chemistry. Use examples involving Chemistry gas laws (Boyle's Law). Technology Integration ● The TI-83+ graphing calculator will be used extensively for variation as well as graphing rational functions. Introduce graphing on the calculator so that students can visualize what happens at an asymptote. *(See Chapter 9 for extensions of these ideas).

Curricular Addendum

Career-Ready Practices **CRP1**: Act as a responsible and contributing citizen and employee. **CRP2**: Apply appropriate academic and technical skills. **CRP3**: Attend to personal health and financial well-being. **CRP4**: Communicate clearly and effectively and with reason. **CRP5**: Consider the environmental, social and economic impacts of decisions. **CRP6**: Demonstrate creativity and innovation. **CRP7**: Employ valid and reliable research strategies. **CRP8**: Utilize critical thinking to make sense of problems and persevere in solving them. **CRP9**: Model integrity, ethical leadership and effective	**Interdisciplinary Connections** ● Close Reading of works of art, music lyrics, videos, and advertisements ● Use Standards for Mathematical Practice and Cross-Cutting Concepts in science to support debate/inquiry across thinking processes **Technology Integration** Ongoing: ● Listen to books on CDs, Playaways, videos, or podcasts if available. ● Use document camera or overhead projector for shared reading of texts. Other:

management.
CRP10: Plan education and career paths aligned to personal goals.
CRP11:. Use technology to enhance productivity.
CRP12: Work productively in teams while using cultural global competence.

- Use Microsoft Word, Inspiration, or SmartBoard Notebook software to write the words from their word sorts.
- Use available technology to create concept maps of unit learning.

Instructional Strategies:
Supports for English Language Learners:

Sensory Supports	Graphic Supports	Interactive Supports
Real-life objects (realia)	Charts	In pairs or partners
Manipulatives	Graphic organizers	In triads or small groups
Pictures & photographs	Tables	In a whole group
Illustrations, diagrams, & drawings	Graphs	Using cooperative group
Magazines & newspapers	Timelines	structures
Physical activities	Number lines	With the Internet (websites) or software programs
Videos & films		In the home language
Broadcasts		With mentors
Models & figures		

from https://wida.wisc.edu

Media Literacy Integration

- Use multiple forms of print media (including books, illustrations/photographs/artwork, video clips, commercials, podcasts, audiobooks, Playaways, newspapers, magazines) to practice reading and comprehension skills.

Global Perspectives

- The Global Learning Resource Library

Differentiation Strategies:

Accommodations	Interventions	Modifications
Allow for verbal responses	Multi-sensory techniques	Modified tasks/ expectations
Repeat/confirm directions	Increase task structure (e.g., directions, checks for understanding, feedback)	Differentiated materials
Permit response provided via computer or electronic device	Increase opportunities to engage in active academic responding (e.g., writing, reading aloud, answering questions in class)	Individualized assessment tools based on student need
Audio Books	Utilize prereading strategies and activities: previews, anticipatory guides, and semantic mapping	Modified assessment grading