Summit Public Schools

Summit, New Jersey

Grade Level 9th and 10th / Content Area: Mathematics

Length of Course: Full Academic Year

Algebra I – Modeling with Functions

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Curriculum

Course Description:

This course offers a deep exploration of the advanced topics of Algebra 1. It has been designed to offer a rigorous and comprehensive foundation that addresses the newly expanded core content standards for Algebra 1. It will also provide students the opportunity to truly master algebraic and mathematics skills that will lead to greater achievement in subsequent courses. Throughout this course students will represent linear functions numerically, algebraically, graphically and verbally and work with and interpret these representations. Students will deepen their understanding of relations and functions and expand their repertoire in working with them. Students will develop insight and understanding of the algebraic properties that govern the manipulation of symbols in expressions, equations, and inequalities. Linear, quadratic, exponential and radical functions will be used as mathematical modeling tools providing students with a versatile and powerful means for analyzing and solving complex, multi-step, real world problems. Students will also learn the appropriate use of technology, such as graphing calculators and spreadsheet utilities to model and analyze a wide range of mathematical relationships. In addition, students will explore right triangle trigonometry, radical expressions and statistics. Among the goals of this course is to explore real-world problems to improve their critical thinking and algebra skills while emphasizing the meaningfulness of algebra in their lives.

Anticipated Timetable for Algebra I – Modeling with Functions

QUARTER 1

Graphing and Writing Linear Equations

Section Title	Days
Functions	½
Linear Functions	½
Functional Notation	1
Graphing Linear Equations in Standard Form	½
Graphing Linear Equations in Slope Intercept Form	½
Quiz	½
Writing Equations in Slope-Intercept Form -given slope and y-intercept -given slope and one point	½ (after quiz)
Writing Equations in Slope-Intercept Form -given two points -applications	1
Writing Equations of Parallel and Perpendicular Lines	1
Review	1
Test	1

Total Number of Days: 8

Systems of Equations

Section Title	Days
Solving Systems by Graphing -"Do Now" by hand -teach graphing calculators	1
Solving Systems by Substitution	1
Solving Systems by Elimination	1
Word problems and systems	2

Quiz	1
Linear Inequalities By hand and with graphing calculator and introduce desmos?	1
Systems of Linear Inequalities	½
Review	1 ½
Test	1

Total Number of Days: 10

Exponential Functions

Section Title	Days
Properties of Exponents	4
Review	1
Quiz	1
Exponential Functions	1
Growth and Decay -identify growth/decay, write equations -word problems including compound interest	3
Review	2
Test	1

Total Number of Days: 13

QUARTER 2

Polynomial Equations and Factoring

Section Title	Days
Adding and Subtracting Polynomials	1
Multiplying Polynomials	1
Special Products of Polynomials	1
Quiz	1

Factoring Trinomials (a=1)	2
Factoring Trinomials (a>1)	3
Factoring Special Products	½
Review	½
Quiz	1
Factoring Completely -gcf -grouping	1 ½
Review	1 ½
Test	1

Total Number of Days: 15

Graphing Quadratic Equations

Section Title	Days
Graphing $f(x)=ax^2$	1
Graphing $f(x)=ax^2+c$ -with graphing calculator and by hand	1
Vertex Form -with graphing calculator and by hand	1
Quiz	½
Graphing $f(x)=ax^2+bx+c$	1 ½
Intercept Form	1
Review	1
Test	1

Total Number of Days: 8

Comparing Function Families

Comparing Functions (Linear, Exponential, and Quadratic)	3

Non-linear Systems (ALL graphing calculator)	1
Quiz	1

Total Number of Days: 5

	Midterm Review	TBD

QUARTER 3

Solving Quadratic Equations

Section Title	Days
Radicals -only numerical radicand (will simplify with variables next chapter)	1
Solving Quadratic Equations by Graphing	1
Solving Quadratic Equations by Factoring	2
Solving Quadratic Equations by Using Square Roots	1
Quiz	1
Solving Quadratic Equations by Completing the Square	2
Solving Quadratic Equation by the Quadratic Formula	2
Quiz	½
Choosing the Best Method	1 ½
Projectile Motion (same worksheets as last year)	2
Review	1
Test 9	1

Total Number of Days: 16

Right Triangles and Radical Expressions

Section Title	Days
Pythagorean Theorem	1
The Distance Formula & The Midpoint Formula	1
Trigonometric Ratios	1 ½
Review	½
Quiz	1
Simplifying Radicals -Variables and Multiplying -Rationalizing	3
Adding and Subtracting Radicals	1
Solving Radical Equations	1
Review	1
Quiz	1
Graphing Square Roots	1
EASY Graphing Cube Roots & EASY Simplifying Cube Roots	1
Review	2
Test Right Triangles and Radical Expressions	1

Total Number of Days: 17

Section Title	Days
PARCC REVIEW	5

QUARTER 4

Rational Expressions and Rational Functions

Section Title	Days
Factoring Review	2
Multiplying Rational Expressions	2
Dividing Rational Expressions	2

Adding and Subtracting Rational Expressions	2
Quiz	1
Graphing Rational Functions	3
Review	1
Test	1

Total Number of Days: 14

Data Analysis and Displays

Section Title	Days
Scatter Plots	1
Lines that Best Fit	2
Quiz (Scatter Plots and Lines that Best Fit)	1
Measures of Center of Variation	1
Box and Whisker Plots (include outliers)	2
Shapes of Distributions	2
Review	1
Test	1

Total Number of Days: 11

Graphing and Writing Linear Equations & System of Linear Equations and Inequalities

Standard: Creating Equations (A-CED) All students will create equations that describe numbers and relationships and use them to solve problems.	
Big Ideas: *Course Objectives / Content Statement(s)* • Write equations in graph-appropriate forms • Graph functions • Solve systems of equations • Graph systems of equations and inequalities	
Essential Questions	**Enduring Understandings**

What provocative questions will foster inquiry, understanding, and transfer of learning?	*What will students understand about the big ideas?*
What is a graph appropriate form for a given function? How are functions graphed based on the form? How are systems of equations solved? How are systems of equations and inequalities graphed?	Students will understand that… The equation of a function can be written in multiple forms. Lines are usually graphed in the form $f(x) = mx + b$ where m and b are the slope and y-intercept respectively. Quadratic functions can be written in the form $f(x) = ax^2 + bx + c$ or $f(x) = a(x-h)^2 + k$ The key graphing components in the equation of a function are based on powers of x (or the appropriate variable) and coefficients of x (or the appropriate variable). Systems of equations can be solved by graphing, by substitution, or by elimination. To graph a system of equations or inequalities, graph each function, equation, or inequality on the same coordinate plane. The solution to the system is the intersection of the graphs.
Areas of Focus: Proficiencies **(Cumulative Progress Indicators)**	**Examples, Outcomes, Assessments**
Students will: ● (A-CED-1) Create equations and inequalities in one variable and use them to solve problems, including linear and quadratic functions. ● (A-CED-2) Create equations in two or more variables to represent	Instructional Focus: 1. Write and graph linear equations. 2. Write and graph linear inequalities. 3. Identify families of functions. 4. Solve and graph systems of equations. 5. Graph systems of inequalities. 6. Solve and graph nonlinear systems. Sample Assessments:

relationships between quantities; graph equations on coordinate axes with labels and scales.	EX: Emma works a maximum of 10 hours combined working at the supermarket and at the library. If she works between 2 and 5 hours at the library, write a system of inequalities that models this situation. Find the maximum profit if Emma makes $6.50 at the supermarket and $5.25 at the library. EX: Solve the system by graphing: $y = x^2 + 4$ $y = -\|x\| + 6$ EX: It costs $2.25 to fax ten pages and $1.65 to fax 6 pages. Write and graph a linear equation that models this data. What do the slope and *y*-intercept represent? EX: The area of a square yard is modeled by $f(x) = x^2$ where x is the length of the yard. Sketch the graph of this equation and justify an appropriate set of axis. Instructional Strategies: Interdisciplinary Connections Students can write equations or functions to model real-world systems, for example, acceleration due to gravity and projectile motion. Technology Integration Students can use CBR (Calculator Based Ranger system) to produce graphs that illustrate equations or functions. Media Literacy Integration Students can analyze different views of graphs and explain their format based on the intentions of the publisher or creator. Global Perspectives
• (A-CED-3) Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.	
• (A-CED-4) Rearrange formulas	
• (A-REI-1) Understand solving equation as a process of reasoning and explain the reasoning	
• (A-REI-3) Solve equations and inequalities in one variable	
• (A-REI-5-7) Solve systems of equations	
• (A-REI-10-12) Represent and solve equations and inequalities graphically	
• (A-FIF1-9 Linear and Quadratic Functions) Understand the concept of a function, use function notation. Interpret functions that arise in applications in terms of context. Analyze functions using different representations.	
• (A-FBF-1-3 Linear and Quadratic Functions) Build a function that models a relationship between two quantities and modeled from existing functions	
• (A-FLE-3) Construct and compare linear, quadratic and exponential models and solve problems	

	Students will discover occupations that rely on the analyses of linear programming problems.

Exponents and Exponential Functions

Standard - Exploring Exponential Growth and Decay Functions **Construct and compare exponential models and solve problems F-LE**	
Big Ideas: ● Compare and contrast exponential functions ● Graph exponential growth functions ● Graph exponential decay functions	
Essential Questions *What provocative questions will foster inquiry, understanding, and transfer of learning?*	**Enduring Understandings** *What will students understand about the big ideas?*
● Create a table for the function $y = 2^x$. What pattern do use see? ● What kind of function is $y = 2^x$ called? What does the graph look like? ● Is $y = \frac{1}{2}^x$ an exponential function? If so, what type? What does the graph look like?	Students will understand that… ● In the functions $y = 2^x$ the y-values double consecutively. ● Exponential functions are functions in which a quantity grows or decreases at a proportional rate. ● The difference between an exponential growth and decay functions. ● Compound interest, bacteria and population are only a few of the many real-life situations that use exponential growth and decay.

• State three real-life situations that involve exponential growth or decay.	
Areas of Focus: Proficiencies **(Cumulative Progress Indicators)**	**Examples, Outcomes, Assessments**
Students will: • (F–LE-2, 3,4,5) explore the exponential patterns. • (F-LE-1c) compare and contrast exponential growth and decay graphs. • (F-LE-1c, 5) discuss the real-life situations that involve exponential functions. • (F-LE-1c, 5) calculate and graph compound interest equations. • (F-LE-1c, 5) solve problems using half-life models.	Instructional Focus: 1. Exploring Exponential Functions 2. Graphing Growth and Decay Functions 3. Solving real-life word problems with exponential growth or decay. Sample Assessments: Ex: Someone offers to double the amount of money you have every day for one month (30 days). You have one penny. On the first day you will have two pennies. On the second day you will have four pennies. How pennies will you have on the 30th day? What expression can you use to solve this problem? Ex. Between 1970 and 2010, the population of a town increased at a rate of 0.34% per year. The population P in the year t is given by $P = 2000(1.0034)^t$, where t= 0 corresponds to 2000. Find the population of the town in 2010, 2000, 1990 and 1980. Ex. The number of students remaining after school can be modeled by the exponential function $n = 1700 \times 0.2^t$. In this equation t is the number of hours at the end of the school day, and n is the number of students remaining in the school building. Graph this equation to find out how long it takes for 1000 students to leave the school. How much time will pass before there are only 10 students left in the building? What factors could explain the shape of the graph?

	Ex. Tear a piece of paper in half and throw one half away. Tear the remaining piece in half and throw half of it away. That fraction of the original paper is left? Continue tearing. Record the fraction of the original paper left after each tear. Write an exponential expression for the amount of paper left after *t* tears. Will the all of the paper ever be thrown away? Instructional Strategies: Interdisciplinary Connections Exponential growth and decay models are used is many real-life situations involving science, history, finance, health care and sports. Ex. Science One of the most common examples of exponential growth deals with bacteria. Bacteria can multiply at an alarming rate when each bacteria splits into two new cells, thus doubling. For example, if we start with only one bacterium, which can double every hour, by the end of one day, we will have over 16 million bacteria. Technology Integration Students will use the website below to compare and contrast the exponential growth and decay graphs. In addition students will use the word problems to connect the interdisciplinary connections. http://regentsprep.org/REgents/math/ALGEBRA/AE7/ExpDecayL.htm Global Perspectives Students will explore that the exponential model is used globally in population. Ex. The pesticide DDT was widely used in the United States until its ban in 1972. DDT is toxic to a wide range of animals and aquatic life, and is suspected to cause cancer in humans. The *half-life* of DDT can be 15 or more years. *Half-life* is the amount of time it takes for half of the amount of a substance to decay. Scientists and environmentalists worry about such substances because these hazardous materials continue to be dangerous for many years after their disposal.

Standard -Properties of Exponents **Use the properties of exponents to transform expressions for exponential functions. A-SSE**	
Big Ideas: ● Multiplying and Dividing Exponents ● Zero and Negative Exponents ● Scientific Notation	
Essential Questions *What provocative questions will foster inquiry, understanding, and transfer of learning?*	**Enduring Understandings** *What will students understand about the big ideas?*
● A rich woman made you the following offer. " I will either give you a million dollars today or I will give you a dollar today, two dollars tomorrow, four dollars the next day and so on for twenty days." Which is a better offer? Explain.	Students will understand that… ● even though the million dollars seems like the better deal at first the second offer is actually more money in end.
● Explain in your own words how you would simply: 4×10^{-2}.	● order of operations is PEMDAS, finding the term with the exponent first before multiplication.
● What effect does the sign of the exponent have on the sign of the simplified fraction?	● the sign of an exponent does not affect the sign of the term.
● Complete a table from -3 to 3 for the equation $y = 3^x$. Does the output of x=0 surprise you? Why or why not?	● the y-value of the equation $y = 3^x$ is increasing at a proportional rate. Students will see that when x=0 and y=1 follows the pattern of the table.

Areas of Focus: Proficiencies **(Cumulative Progress Indicators)**	**Examples, Outcomes, Assessments**
Students will: • (A-SSE-3c) use properties of exponents to multiply and divide exponential expressions. • (A-SSE-3c) evaluate expressions that have zero and negative exponents. • (N-Q-1-3) use scientific notation to represent numbers, to perform operations with numbers, to describe real-life situations, to reason quantitatively and use units to solve problems. • (HS – Modeling) Use exponents to model real-life problems. • (A –SSE-1) Interpret expressions that represent a quantity in terms of its context.	Instructional Focus: 1. Scientific Notation 2. Multiplying and Dividing Exponents 3. Zero and Negative Exponents Sample Assessments: Ex: Last year a large trucking company delivered about 2.4 million loads of goods at an average value of $15,000 per load. What was the total value of goods delivered? Express your answer in scientific notation. Ex. Following is the type of problem often included on a college entrance exam. Explain how you can find the answer quickly. Assume all variables are nonzero. Simplify the expression. $\left(\frac{\left[y^1 z^{-3}\right]^2}{x^{-3}y^6} \cdot \frac{1}{x^{\frac{1}{2}}y}\right)^0$ Ex. Evaluate the expression without using a calculator. a) $\left(5 \times 10^6\right) \cdot \left(9 \times 10^{-3}\right)$ b) $\frac{4a^{-1}b^0}{8a^6b^3}$

c) $\left(\frac{x^{-5}y}{2x^3y^2}\right)^3$

Instructional Strategies:

Interdisciplinary Connection &

Global Perspectives

The Sahara is the world's largest desert. IT extends about 16,896,000 feet from the Atlantic Ocean to the Red Seas and about 5,808,000 feet from the Atlas Mountains and the Mediterranean Sea to the Niger River Valley, an area roughly equal that of the United States. In addition to spreading over all of the Western Sahara and Egypt, the Sahara includes parts of Morocco, Algeria, Tunisia, Libya, Sudan, Chad, Niger, Mali, and Mauritania.

Although most people think the desert as a desolate expanse of sand, sand covers only about 25% of the Sahara. Plateaus rock, areas of gravel, mountains, and oases make up the majority of the landscape. The million people who inhabit the Sahara are mainly nomads with herds of sheep and goats. They use camels to travel between the major oases for water, supplies, and trade.

a) Rewrite the length and the width of the Sahara in scientific notation.
b) Use your answers from *a* to find the approximate area of the Sahara in square feet.
c) Find the area of the Sahara that is covered in sand.
d) Assume that the average depth of the sand is 200 feet. The volume of the sand is equal to the area of sand multiplied by its height. Find the volume of the sand in cubic feet.
e) A grain of sand has a volume of approximately 1.3 x 10^ -9 cubic feet . Use your answer from *d* to estimate how many grains of sand are in the Sahara Desert.

Right Triangles, Trigonometry, and Radical Expressions

Standard - The Pythagorean Theorem **Solve Problems Involving Right Triangles G-SRT**	
Big Ideas: **Students will use the Pythagorean Theorem to find the unknown length of the missing side of the right triangle, solve right triangles in real life problems and use the converse of the Pythagorean Theorem to determine if a triangle is a right triangle.**	
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 you define a triangle by its angles and sides? • How would you define the characteristics of a right triangle? • How would you determine the unknown length of a right triangle? • Given three sides of a triangle, how would you determine if it is a right triangle? • How would you explain when three sides do not create a triangle?	Students will understand that… • Triangles can be classified by acute, obtuse, right, equiangular, equilateral, isosceles and scalene. • A right triangle consists of a hypotenuse and two legs. • The Pythagorean Theorem is useful in determining the unknown length of right triangles. • The Pythagorean Theorem is useful in determining if a triangle is a right triangle. • Not just any three lengths will determine a triangle.

Areas of Focus: Proficiencies **(Cumulative Progress Indicators)**	**Examples, Outcomes, Assessments**
Students will: ● (G-MG-1) recall the different types of triangles. ● (G-SRT-8) use the Pythagorean Theorem to solve for an unknown length of a right triangle. ● (A-REI-2) solve equations with exponents. ● (G-SRT-8) list the Pythagorean Triplets. ● (G-SRT-8) discuss how the Pythagorean Theorem is very useful in solving real-life situations. ● (G-SRT-4) discover that given three lengths of sides does not always create a triangle	Instructional Focus: 1. Pythagorean Theorem 2. Converse of the Pythagorean Sample Assessments: Ex: How would you classify the triangle drawn below? Ex: Given the right triangle has sides 10 and 10. What is the length of the sides? Ex: Can each of the three numbers represent the lengths of the sides of a right triangle? Explain your answers. a. 2, 3, 4 b. 7, 12, 4 Ex: BASEBALL "DIAMOND": The distance between each of the consecutive bases is 90 feet. How far does the catcher have to throw the ball from home plate to 2nd base Instructional Strategies: Interdisciplinary Connections The Pythagorean Theorem is used is many real-life careers. Some of these include architects, surveyors, engineers, and carpenters. Technology Integration Students will use a variety of technology to verify the Pythagorean Theorem and manipulate the calculations using the Geometers Sketchpad or the site:

	http://mste.illinois.edu/dildine/sketches/pythagorean.html Media Literacy Integration Students will use the Geometers Sketchpad to verify the Pythagorean Theorem. Global Perspectives Students will learn that ancient Babylonians and Egyptians used the Pythagorean Theorem and discuss why this theorem is credited to Pythagoras.

Standard -Distance Formula

Use coordinates to compute the perimeters of polygons using the distance formula. G-GPE

Big Ideas:

Students will use the distance and midpoint formulas are applicable to many real-life situations. Students will be able to compute the perimeters of triangles and quadrilaterals using the distance formulas.

Essential Questions *What provocative questions will foster inquiry, understanding, and transfer of learning?*	**Enduring Understandings** *What will students understand about the big ideas?*
• How would you define distance? • Given the points (3, 4) and (1,1), how would you find the distance using a theorem we know already? • How do you find the mid-point of a segment? • How would you find the perimeter of the polygon given the vertices?	Students will understand that… • Distance is the shortest space between two points. • The distance formula can only be used to find the distance between any two points in the coordinate plane. • The coordinates of the midpoint of two points can be found by using the mid-point formula • To find the perimeter of the polygon you would need to find the sum of the distance of each segment of the triangle.

Areas of Focus: Proficiencies (Cumulative Progress Indicators)	Examples, Outcomes, Assessments
Students will: ● (G-GPE-4) discuss the definition of distance	Instructional Focus: 3. Distance Formula 4. Mid-Point Formula Sample Assessments: Ex: Given the points (3, 4) and (1,1), how would you find the distance using a theorem we know already? Ex. Find the distance of (9, 15) and (-3, -1) without graphing the points. Ex. You need to put a fence around your rectangular pool and the outside cement. You are fencing an area that is 20 by 25 feet. How much material do you need for the fence? Ex. You live 4 miles west and 7 miles south of the park. Your friend lives 10 miles east and 3 miles north of the park. Your dog is lost half way in between you and your friend. How far away is your dog from the park? In which direction? How many miles away is your dog from you? Instructional Strategies: Interdisciplinary Connections The distance formula is used is many real-life careers. Some of these include astronomers, architects, surveyors, engineers, and carpenters. Technology Integration Students will use a variety of technology to verify the distance formula and midpoint formula to manipulate the calculations using the Geometers Sketchpad. Global Perspectives
● (G-GPE-4) explain why the distance between two objects are always positive	
● (G-GPE-4) be given two points and asked to how to explain how to find the distance using a Theorem we know already?	
● (G-GPE-7) discuss why the distance formula is useful.	
● (G-GPE-7) solve real-life problems using the distance formula	
● (G-GPE-4) find the mid-point of two coordinate points.	
● (G-GPE-4, 6) learn that the mid-point formula is useful to finding the midpoint of a segment.	
● (G-GPE-7) learn how to find the perimeter of a triangle/quadrilateral given the vertices.	

	Students will use the distance formula and mid-point formulas to compare and contrast the global distances of the world.

Standard -Trigonometric Ratios **Similarity, Right Triangles, and Trigonometry G-SRT**	
Big Ideas: Students will define trigonometric ratios and solve problems involving right triangles. Students will understand that side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. Students will use the trigonometric ratios to solve right triangles in applied problems.	
Essential Questions *What provocative questions will foster inquiry, understanding, and transfer of learning?*	**Enduring Understandings** *What will students understand about the big ideas?*
• How would you explain what you have discovered about right triangles so far? • What are trigonometric ratios? • How would you solve a right triangle given an acute angle and a side of the right triangle? • How are sine, cosine, and tangent defined?	Students will understand that… • Right triangles have two acute angles and one right angle. • Trigonometric ratios describe a relationship between sides and angles of right triangles. • Trigonometric ratios solve for unknown side lengths of right triangles given an acute angle and a side of a right triangle. • Sine, cosine and tangent are ratios that compare different sides of the right triangle.
Areas of Focus: Proficiencies **(Cumulative Progress Indicators)**	**Examples, Outcomes, Assessments**
Students will:	Instructional Focus: 1. Trigonometric Ratios

• (G-SRT-8) explain how they would find the length of the third side given two sides of the right triangle. • (G-SRT-8) be given a length of one side of the right triangle and an angle and be asked to find the unknown lengths of the triangle. • (G-SRT-8) learn that trigonometric ratios solve right triangles given an angle and a side. • (G-SRT-8) solve real-life problems using trigonometric ratios.	Sample Assessments: Ex: Given the AB = 6, BC= 8 and AC = 10, find tangent A, sine A, cosine A. Ex. Find the length of the hypotenuse if the acute angle is 20 degrees and the leg opposite the angle measures 105 feet. Ex. Suppose the angle of elevation between the ground and the top of a cliff is 70 degrees. If the base of the cliff is 25 meters from your current position, how high is the cliff Instructional Strategies: Interdisciplinary Connections Trigonometric ratios are used is many real-life careers. Some of these include astronomers, architects, surveyors, engineers, and carpenters. Technology Integration Students will learn how to use their calculators to solve a right triangle. Students will be asked to solve for the variables below: $\tan A = \frac{3}{5} \quad and \quad \tan 30 = \frac{a}{6}$

Standard - Radicals **Work with radicals and radical equations. A-REI & F-IF**	
Big Ideas: **Students will simplify, add, subtract, multiply, and divide radicals. Students will learn how to graph square root functions. Students will solve simple radical equations in one variable and give examples showing how extraneous solutions may arise.**	
Essential Questions	**Enduring Understandings**

What provocative questions will foster inquiry, understanding, and transfer of learning?	*What will students understand about the big ideas?*
• How would you define the characteristics of a radical? • How many perfect squares can you list? • When is a radical most simplified? • When can you add, subtract, multiply and divide radicals? • How do we add, subtract, multiply and divide radicals? • How do you graph square root functions?	Students will understand… • Radicals contain the characteristics including the radicand, index, coefficient, and the radical. • The first perfect squares are 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196 and 225. • Radicals are most simplified when it does not have any perfect square factors in the radicand. • You can only add and subtract radicals when they have the same index and radicals. You can only multiply and divide radicals when they have the same index. • You add/subtract radicals by keeping the radicand the same and adding/subtracting the coefficients. You multiply/dividing radicals by multiplying /dividing the radicand. • Square root graphs can be graphed by shifts or using a table.
Areas of Focus: Proficiencies **(Cumulative Progress Indicators)**	**Examples, Outcomes, Assessments**
Students will: • (G-SRT-8) solve to find a missing leg of a right	Instructional Focus: 1. Simplifying Radicals 2. Adding, Subtracting, Multiplying and Dividing Radicals

triangle using the Pythagorea	3. Graphing Square Root Graphs 4. Real-Life Applications with Radicals
• (A-NRN-3) Use properties of rational and irrational numbers	Ex: Simplify:
• (A-REI-2) simplify, add, subtract, multiply, divide and rationalize radicals.	A. $\sqrt{27}$
• (A-REI-2) solve radical equations.	B. $\frac{\sqrt{288}}{\sqrt{2}}$
• (A-REI-2) explore why some radical equations have extraneous solutions.	C. $\left(\sqrt{9}\right)^2$
	D. $\sqrt{15}\,\Sigma\sqrt{5}$
• (F-IF-7b, 9) graph a square root functions.	
• (F-IF-7b) discuss how to find the domain of a square root function.	E. $\frac{\sqrt{7}}{\sqrt{3}}$
• (HS-Modeling) relate the square root function with real-life applications.	F. $\sqrt{125} - 3\sqrt{5}$ Ex: Solve: A. $\sqrt{x} + 4 = 12$ B. $\sqrt{10x - 3} = \sqrt{5x + 2}$ C. $x = \sqrt{x + 4}$ Ex. Analyze how the graph of $y = \sqrt{x} + 2$ compares to the graph of $y = \sqrt{x}$. Ex. Graph $y = \sqrt{x + 7}$ and state the domain. Instructional Strategies:

	Interdisciplinary Connections ● Radicals are used is many real-life applications. Some of these include velocity, frequency, energy, right triangle applications, densities and fluid flow through a membrane. Ex. On a roller coaster ride, your speed in a loop depends on the height of the hill you have just come down and the radius of the loop in feet. The equation $v = 8\sqrt{h-2r}$ gives the velocity v in feet per second of a car at the top of the loop. Suppose the loop has a radius of 18 ft. You want the car to have a velocity of 30 ft/s at the top of the loop. How high should the hill be?

Polynomials and Factoring

Standard - Seeing Structure in Expressions (A-SSE) Students should be able to read an expression with comprehension. This involves the analysis of the expression's underlying structure. Students should be able to see that the analysis may suggest a different but equivalent way of writing the expression that exhibits some different aspect of its meaning.	
Big Ideas: *Course Objectives / Content Statement(s)* Students will interpret the structure of expressions. Students will write expressions in equivalent forms to solve problems.	
Essential Questions *What provocative questions will foster inquiry, understanding, and transfer of learning?*	**Enduring Understandings** *What will students understand about the big ideas?*
How can polynomials be combined? How can a polynomial be expressed in different ways based on its structure?	Students will understand that… If two or more polynomials have common terms, the coefficients of common terms can be combined to simplify the expression. Non-prime polynomials can be factored based on the number of terms, common factors, and defining structures.

How can factors be used to solve a problem?	Once a polynomial is factored, if this expression is equivalent to zero, each non-constant factor is also equivalent to zero. Solving each of these equations results in the solution(s) of the original equation. This is known as the Zero Product Property.
Areas of Focus: Proficiencies **(Cumulative Progress Indicators)**	**Examples, Outcomes, Assessments**
Students will: • (A-SSE-1) Interpret expressions that represent a quantity in terms of its context • (A-SSE-2) Use the structure of an expression to identify ways to rewrite it. • (A-SSE-3) Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. • (A-APR-1) Perform arithmetic operations on polynomials	Instructional Focus: 1. Adding and subtracting polynomials 2. Factoring using greatest common factor 3. Factoring difference of squares 4. Factoring by grouping 5. Factoring trinomials 6. Solving equations using the Zero Product Property Sample Assessments: EX: Simplify. a. $\left(2x^3+3x^2-7x\right)-\left(5x^3-4x\right)$ b. $3x^2y\left(2xy-5y^3\right)$ c. $\left(x-4\right)\left(x+5\right)$

	EX: Factor completely with respect to the integers. a. $15x^2 - 5x + 20x^3$ b. $x^2 - x - 12$ c. $2x^2 - 3x - 9$ d. $3x^2 - 75$ EX: Solve. a. $3x^3 - 3x^2 - 36x = 0$ b. $x^2 - 10 = -3x$ c. $x^3 + 3x^2 - 4x - 12 = 0$ EX: The length and width of a patio are $(x+3)$ ft. and $(x+7)$ ft. respectively. If the area of the patio is 1344 square feet, find the length and width. Instructional Strategies: Interdisciplinary Connections Applications to physics include projectile motion and real world situations. EX: A soccer ball is kicked off the ground with an upward initial velocity of 64ft/s. Using $h = -16t^2 + vt + s$, find the time at which the soccer ball returns to the ground. Technology Integration Geogebra (www.geogebra.org) is a web-based applet that students can use to illustrate and manipulate polynomials and their solutions. Media Literacy Integration

	Websites (such as wolframalpha.com) can provide visual representation and alternate representations of factorable and non-factorable polynomials. This can provide students with an opportunity to analyze polynomials from different perspectives. Global Perspectives Polynomial equations and their solutions are used to find information about savings accounts, area, volume, revenue, cost, and profit. EX: For 2000-2010, the total amount spent by Americans for farm foods can be modeled by $A = -0.035t^2 + 15.9t + 267.6$, in billions of dollars, where $t = 0$ represents 2000. The amount (also in billions of dollars) paid to farmers can be modeled by $F = 0.156t^2 + 0.475t + 81.5$. Find a model that represents the amount that was spent on processing, packaging, and marketing the food.

Statistics

Standard - Interpreting Categorical and Quantitative Data (S-ID) Students should be able to gather and display data appropriately to reach conclusions and answer questions.	
Big Ideas: *Course Objectives / Content Statement(s)* Students will summarize, represent, and interpret data on a single count or measurement variable. Students will summarize, represent, and interpret data on two categorical and quantitative variables.	
Essential Questions *What provocative questions will foster inquiry, understanding, and transfer of learning?*	**Enduring Understandings** *What will students understand about the big ideas?*
	Students will understand that…

How can different data displays effect analyses of the data? What are possible correlations for data? How are predictions made?	Based on context, one display may be more appropriate than another to illustrate data. For example, it may be clearer to see the percentage students spend on daily activities in a pie chart rather than a bar graph. If the data show a linear relationship, there can either be a positive or a negative correlation. Also with a linear relationship, a line of best fit can be determined and drawn. Data can also follow a normal distribution curve. Predictions can be based on previously collected data or by performing experiments. Computing expected value can also help in decision-making
Areas of Focus: Proficiencies **(Cumulative Progress Indicators)**	**Examples, Outcomes, Assessments**
Students will: • (S-ID-1) Represent data with plots on the real number line (dot plots, histograms, and box plots). • (S-ID-2) Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. • (S-ID-3) Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). • (S-ID-6) Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. • (S-IC-1) Understand statistics as a process for making inferences about population parameters based on a random sample from that population. • (S-IC-3) Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	Instructional Focus: 1. Construct and interpret line plots. 2. Compute and analyze measures of central tendency and variation. 3. Construct and analyze scatter plots and line of best fit. 4. Compute and analyze standard deviation. 5. Recognize and discuss normal distribution. 6. Use sample data to predict outcomes. 7. Compute weighted averages and expected value. Sample Assessments: EX: Seven students were asked to record the number of hours spent using the internet per week. The hours were {8, 9, 8, 9, 7, 9, 6}. Compute the standard deviation of this data. EX: Describe a set of data that would show a negative correlation. Include a sketch of the graph of the data with a possible line of best fit. EX: In the third quarter, Chris's test average was 84%, quiz average 92%, and classwork 94%. If tests are weighted 60%, quizzes 30%, and

• (A-SID-7-9) Interpret linear models	classwork 10%, compute Chris's final average for the third quarter. EX: A shoe manufacturer wants to check the quality of its shoes. Every hour, 20 pairs of shoes are taken off the assembly line and checked. Is this sample biased or unbiased? Instructional Strategies: Interdisciplinary Connections Students can study the history of statistics as it relates to other mathematics. Compared to many topics that students have learned, statistics will be the youngest branch of mathematics as it has been shaped by technology. Technology Integration Students will use the random integer generator on the graphing calculator to make predictions. Media Literacy Integration Students can explore specific statistics presented in national news reports to discuss how samples can be biased. Global Perspectives Students can research the central limit theorem and its correlation to examples in nature.

Rational Expressions

Big Ideas: *Course Objectives / Content Statement(s)* • **Exploring Rational Expressions**	
Essential Questions	**Enduring Understandings**

What provocative questions will foster inquiry, understanding, and transfer of learning?	*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 are extraneous solutions? How and when do they arise?	Students will understand that… • Graphs of rational functions can produce different types of asymptotes (F.IF.C.7.D) • Like rational numbers, rational expressions can be added, subtracted, multiplied and divided (A.APR.D.7) • Extraneous solutions can arise when solving rational expressions (A.REI.A.2)
Areas of Focus: Proficiencies **(Cumulative Progress Indicators)**	**Examples, Outcomes, Assessments**
Students will: (+) 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. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.	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. • Observe a partner share where students explain the steps in solving rational equations. Have them take note of steps where they disagree. Instructional Strategies: 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. Media Literacy Integration Global Perspectives Culturally Responsive Teaching
The following skills and themes listed to the right should be reflected in the design of units and lessons for this course or content area.	21st Century Skills: Creativity and Innovation Critical Thinking and Problem Solving Communication and Collaboration

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	**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.

problems and persevere in solving them.
CRP9: Model integrity, ethical leadership and effective 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.

Other:

- 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