Madison Public Schools

Algebra 1

Grades 8-9

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Course Overview

Description

Students in Algebra 1 continue their study of patterns and relationships, formalizing their knowledge, learning to use symbolic notation and connecting their understandings to the real world. Units of study will include linear equations and inequalities, linear, absolute value, quadratic and exponential functions, systems of equations and inequalities, polynomials, radicals, and data analysis. The curriculum is aligned the the Common Core Standards for Mathematics and encourages all learners to take an active part in meeting the goals outlined below.

Goals

This course aims to:

- enable students to make sense of various types of problems and the reasonableness of their answers
- build student confidence with the various approaches to solving a problem and persevere in solving them
- encourage students to become abstract thinkers who make sense of quantities and their relationships in problem situations
- develop students' ability to cooperatively discuss, make conjectures and critique ideas of one another
- use, apply, and model mathematics to solve problems arising in everyday life, society, and the workplace
- consider the variety of available tools when solving a mathematical problem
- communicate mathematical ideas precisely and effectively to others
- determine a pattern or analyze structure within mathematical content to apply to related ideas
- use repeated reasoning to follow a multi-step process through to completion

Materials

Core Materials: Big Ideas Algebra 1
Supplemental Materials:Khan Academy, Various websites related to Algebra 1

Resources

Suggested activities and resources page

Benchmark Assessments

Common Benchmark Assessment are given for each unit with common types of questions across the levels including problems that focus on the main ideas and anchor standards of the course.

Modifications and Adaptations for Special Needs Learners
(Gifted and Talented Students, English Language Learners, Special Education Students, At-Risk Students)

Scope and Sequence
(Pacing Guide)

Unit Number	Topic of Study	Duration (Weeks Taught)
1	Solving Linear Equations	11 Lessons
2	Solving Linear Inequalities	13 Lessons
3	Graphing Linear Functions	14 Lessons
4	Writing Linear Functions	14 Lessons
5	Systems of Equations and Inequalities	14 Lessons
6	Exponential Functions	14 Lessons
7	Polynomials and Factoring	16 Lessons
8	Graphing Quadratic Functions	12 Lessons
9	Solving Quadratic Equations	12 Lessons
10	Unit Title: Data Analysis and Displays	10 Lessons
11	Radical Functions and Inverses	8 Lessons

Unit 1 Overview

Unit Title: Solving Linear Equations

Unit Summary:
This unit will develop further students' ability to apply properties of equality to solve simple equations and multi-step equations. Students will utilize their problem solving skills to make conjectures, write algebraic equations to represent situations, and check for reasonableness of their answers. Connections to geometric ideas will be made to create solvable algebraic equations. Absolute value equations and literal equations will also be explored and connected to real-life scenarios.

Suggested Pacing: 11 lessons

Learning Targets

Unit Essential Questions:

- How does one justify the steps in solving an equation?
- How do you solve an absolute value equation?
- How can a formula be rearranged for ease of use?
- What are situations that would require use of an equation with two variables?
- How does one determine if a solution is a viable or nonviable option?
- What does a solution to an equation represent?

Unit Enduring Understandings:

- Real-life problems can be modeled and solved using linear equations.
- Rearranging formulas to highlight a quantity of interest can make problems easier to solve.
- Relationships between quantities can be represented by using two or more variables.
- Steps followed in solving an equation assume that the original equation has a solution.
- The steps which are followed in solving an equation must maintain equality.

Evidence of Learning

Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, Two Roses and a Thorn, etc...

Summative Assessment:
Click on link:
https://docs.google.com/a/madisonnjps.org/document/d/16kzyZm6u_-zA_nvKJERzOZc3p8xRr4iYhIjvGaAtadE/edit

Objectives (Students will be able to...)	**Essential Content/Skills**	**Suggested Assessments**	**Standards**	**Pacing**
Justify the steps to solve linear equations using the properties of equality. Determine if a solution to an equation is viable or not. Use linear equations to model real-world situations. Solve an equation involving absolute value. Determine if an absolute value equation has extraneous solutions. Transform a formula to represent different measurements.	Content: linear equations, properties of equality, unit analysis, absolute value, solution of a linear equation in one variable, extraneous solutions. Skills: Solve a linear equation with one variable in a single step, multi-steps and with variables on both sides. Model real-life situations with a linear equation. Rewrite a formula. Use unit analysis to model real-life problems. Solve an absolute value equation with one or two absolute values.	Ch. 1 Standards Assessment (Big Ideas) p. 48-49 Students create a foldable representing five types of solving of linear equations: one-step, multi-step, variable on both sides, absolute value and literal equations Quiz question: Describe a situation in which a solution is extraneous. Quiz: Starting with a page of 3 formulas, have students write each property of equality used to transform them.	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.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. A.REI.A.1: Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. A.REI.B.3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. 9.1.12.A.1: Apply critical thinking and problem-solving strategies during structured learning experiences. 8.1.12.F.1 Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs. RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others. NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words	11 lessons

Unit 2 Overview

Unit Title: Solving Linear Inequalities

Unit Summary:
This unit will extend students' ability to apply properties of equality to solve single, multi-step, compound and absolute value inequalities. Students will utilize their problem solving skills to make conjectures, write algebraic inequalities to model situations, and check for reasonableness of their answers. Connections to geometric ideas will be made to create solvable algebraic inequalities. Compound and absolute value inequalities will also be explored graphically and connected to real-life scenarios.

Suggested Pacing: 13 lessons

Learning Targets

Unit Essential Questions:

- In real-world contexts, why would one want to use an inequality instead of an equation?
- What are situations that would require use of an inequality with one variable?
- What are situations that would require use of an inequality with two or more variables?
- How does one determine if a solution is a viable or nonviable option?
- What does a solution to an inequality represent?

Unit Enduring Understandings:

- Constraints must be satisfied or the problem is changed.
- Equations and their corresponding inequalities utilize the same solving process except for one rule.
- The rules needed to solve equations are the same whether pertaining to numbers or letters.

Evidence of Learning

Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, Two Roses and a Thorn, etc…

Summative Assessments:
Common Assessment for Unit 2

Objectives (Students will be able to…)	Essential Content/Skills	Suggested Assessments	Standards	Pacing
Create and solve inequalities in one variable. Use inequalities in one variable to solve problems. Sketch the graph of linear inequalities. Write linear inequalities from graphs. Represent constraints by inequalities. Interpret solutions as viable or nonviable options in a modeling context.	Content: linear inequality, constraint, number line graph, compound inequality, absolute value inequality. Skills: Solve a linear inequality with one variable in a single step or multiple steps. Model real-life situations with linear inequalities. Graph solutions to linear inequalities on a number line. Solve compound inequalities. Solve an absolute value inequality.	Ch. 2 Standards Assessment (Big Ideas) p. 98-99 Students create a foldable representing four types of solving of linear inequalities: one-step, multi-step, compound and absolute value inequalities. Partner Activity: Two lists--one with word problems, other with algebraic inequalities. Have students match the inequality to the word problem it represents. Distribute a page with pre-made inequalities and number lines, slide into a clearboard and have students solve on the clearboard. Assess accuracy of answers, erase on clearboard, then have students take out the paper and redo the problems on the paper. (see EAI Education "SmartPAL" Guide p. 36 and 37 as a resource) Journal Writing: In real-world contexts, why would one want to use an inequality instead of an equation?	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.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. 9.1.12.A.1: Apply critical thinking and problem-solving strategies during structured learning experiences. RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words RI.9-10.1. Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.) and make relevant connections, to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.	13 lessons

Unit 3 Overview

Unit Title: Graphing Linear Functions

Unit Summary:
This unit will explore linear functions in the context of their graphs. Transformations of the linear parent function as well as absolute value functions will include translations, reflections, shrinks and stretches. The effect of each of these transformations on the equation and the graph will be studied. Students will model various real-world scenarios with a linear equation then analyze the associated graph to answer relevant questions. A graphing calculator will be utilized to provide familiarity with its use as well as allow for a visual display of the transformative process of a linear function.

Suggested Pacing: 14 lessons

Learning Targets

Unit Essential Questions:

- What are key features of a graph?
- Why does one want to find the key features of a graph?
- Why does one need to worry about the domain and range of a function?
- For what type of real-world application would the graph of a linear function be helpful?
- What are the transformations that can be performed on a parent linear function?

Unit Enduring Understandings:

- Graphs model the data of an equation, i.e., if a graph is increasing then so are the numerical values associated with the independent variable.
- The domain must be appropriate to the context of the problem.
- The average rate of change is equivalent to the slope of a line.
- Placement of a constant in an equation makes a difference as to how the graph of the parent function gets transformed.
- In the equation, $y = f(x)$, x is the input and y is the output.
- A point (x, y) is a solution to $y = f(x)$ if the equation is true when x and y are substituted for the appropriate variables.

Evidence of Learning

Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, Two Roses and a Thorn, etc...

Summative Assessment:
Common Assessment for Unit 3

Objectives **(Students will be able to…)**	**Essential Content/Skills**	**Suggested Assessments**	**Standards** **(NJCCCS CPIs, CCSS, NGSS)**	**Pacing**
Determine if a relation is a function. Determine if a function is linear or non-linear from tables, graphs, and equations. State the domain and range of a function. Graph linear functions using discrete and continuous data. Write real-life problems to fit data. Evaluate a function at a given value using function notation. Graph linear functions in function notation. Graph linear equations in slope-intercept form and in standard form. Compare and contrast slope-intercept and standard form. Find the x and y-intercepts of a linear function. Find the slope of a line from an equation, a table or a graph. Graph transformations of linear functions and absolute value functions. 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.	Content: Relations, functions, dependent and independent variables, domain, range, discrete and continuous data, slope-intercept form of a linear equation, standard form of a linear equation, function notation, intercepts, translations, reflections, shrink and stretching graphs, combined transformations, families of functions, absolute value functions. **(H):** *increasing or decreasing intervals, relative min and max, symmetries, end behavior, periodicity.* Skills: Determine functions from tables, sets of ordered pairs, mappings, equations. Understand the use of the vertical line test. Find slope using the slope formula. Calculate average rate of change of a function or estimate it from the graph. Identify independent and dependent variables. Use function notation. Recognize horizontal and vertical lines from their equations. Translate and reflect linear and absolute value functions. Stretch and shrink linear and absolute value functions. Graph linear functions and their transformations on a graphing calculator or graphing software such as Desmos.	Ch. 3 Standards Assessment (Big Ideas) p. 170-171 Partner work: Matching Functions with Their Graphs (see Exploration 3 p. 145 "Big Ideas") Quiz Question: Give students a list of transformed linear functions and have then describe, in writing, the transformation from the parent function. Quiz Question: Give student a graph of a linear function…have them provide the equation of the line, the slope of the line, the intercepts, and write a real-life scenario which the line might represent. See "Card-Sorting" idea in Binder. Distribute a sheet with definitions of parent functions, pair students to sort using their definition sheet. Journal Writing: Describe key features of a graph of a linear function (state as many as you can).	F.IF.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$. F.IF.2 Use function notation; evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. F.IF.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; [**(H)** intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity]* F.IF.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.* F.IF.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. F.IF.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. F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). F.BF.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	14 lessons

			illustrate an explanation of the effects on the graph using technology. 8.1.12.F.1 Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others. CRP11. Use technology to enhance productivity. Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks. NJSLSA.R8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.	

Unit 4 Overview

Unit Title: Writing Linear Functions

Unit Summary:
This unit uses students' previously learned skills regarding linear equations to enable students to use given information to write a linear equation. The main focus will be the use of the written equation to determine if lines are parallel or perpendicular, solve real-life problems, and make conclusions about data. Students will create scatterplots and lines of best fit to interpret information. Technology will be used to enhance understanding of the concepts presented. Students will be encouraged to recognize patterns by developing linear equations to represent arithmetic sequences. The unit will conclude with a short introduction to the writing and graphing of piecewise and step functions.

Suggested Pacing: 14 lessons

Learning Targets

Unit Essential Questions:

- What situations have one quantity change at a constant rate per unit interval relative to another?
- For what type of real world application would one want to find an explicit expression?
- What are some situations that can be modeled using explicit expressions?
- How can you describe a function that is represented by more than one equation?

Unit Enduring Understandings:

- The rate with which a function grows determines its characteristics.
- The rate with which a function grows categorizes it.
- Arithmetic sequences grow linearly; therefore, the explicit expression is a linear function.
- Estimation is an important skill to make predictions.
- Not all situations can be described by a single equation.

Evidence of Learning

Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, Two Roses and a Thorn, etc…

Summative Assessment:
Common Assessment for Unit 4

Objectives (Students will be able to…)	Essential Content/Skills	Suggested Assessments	Standards	Pacing
Write a linear equation in slope-intercept form. Write a linear equation using point-slope form. Write linear equations to solve real-life problems. Use slopes to determine if lines are parallel or perpendicular. Write arithmetic sequences using an explicit formula Draw a line of best fit then apply residuals to determine how well a line of fit models data. Distinguish between causation and correlation. Use a graphing calculator to determine the equation of the line of best fit and key features. Describe a function that is represented by more than one equation. (piecewise, step, and absolute value)	Content: slope-intercept form, point-slope form, parallel and perpendicular lines, scatter plots, lines of best fit, interpolations vs. extrapolation, correlation and causation, arithmetic sequences, piecewise and step functions. Skills: Construct and graph linear functions(including arithmetic sequences, absolute value, and piecewise functions) given a graph or two input-output pairs. Use sequences to model situations. Find the equation of a line of best fit and correlation coefficient using a graphing calculator.	Ch. 4 Standards Assessment (Big Ideas) p. 230-231 Complete the PARCC online practice test question called "Brett's Race". It can be found at the link below: http://www.parcconline.org/sites/parcc/files/BRHSSampleItem.pdf Quiz Question: Explain the difference between "causation" and "correlation" then give a real-life example of each. Partner Activity: Have students complete a circuit activity of 6-10 pre-made systems of equations. They must determine if each system is that of parallel or perpendicular lines using slopes. (Write equations in various forms). Activity writing equations of "Parallel and Perpendicular Lines" Go to link: http://map.mathshell.org/materials/lessons.php?taskid=226&subpage=concept	F.BF.1 Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. *(only writing explicit in this unit)* F.BF.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms *(only addressing arithmetic in this unit)* S.ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.* b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association. S.ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. S.ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit. S.ID.9 Distinguish between correlation and causation. *Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.* 9.1.12.B.1: Present resources and data in a format that effectively communicates the meaning of the data and its implications for solving problems, using multiple perspectives. 8.1.12.A.3 Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.	14 lessons

Unit 5 Overview

Unit Title: Systems of Equations and Inequalities

Unit Summary:
In this unit, students will learn three methods to solve a systems of equations: graphing, substitution, and elimination. They will gain an understanding that not all systems have a single ordered pair solution. The graphs of each system leading to various solutions (one, none or infinitely many) will be explored. Students will then extend their newly found knowledge to solve systems of inequalities. They will discover the difference between solutions of a systems of linear equations versus those of a systems of linear inequalities graphically. The ability to model with mathematics using real-life problems will continue as a strand throughout this unit.

Suggested Pacing: 14 lessons

Learning Targets

Unit Essential Questions:

- Why does one need to set two equations equal to each other?
- What is a real-world example where one needs to solve a system of linear inequalities?
- Why does it make sense that equations that have no solution would describe parallel lines?

Unit Enduring Understandings:

- Solutions found by graphing are only approximations.
- Equations can be added or subtracted.
- Multiples of an equation can be used to help solve systems of equations.
- The graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.
- The graph of a solution to a linear inequality in two variables is the infinite set of points in a half-plane bounded by a line.
- The graph of a solution to a system of linear inequalities in two variables is the infinite set of points in the intersection of two or more half- planes bounded by lines.

Evidence of Learning

Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, Two Roses and a Thorn, etc...

Summative Assessment:
Common Assessment for Unit 5

Alternative Assessment: Students will create a multimedia presentation representing the various types of solving of systems of equations: graphing, substitution and elimination

Objectives (Students will be able to…)	Essential Content/Skills	Suggested Assessments	Standards	Pacing
Solve a system of linear equations using graphing, substitution and elimination techniques. Solve systems of linear equations where the two equations describe the same line, i.e., infinitely many solutions. Solve systems of linear equations where the two equations describe parallel lines, i.e., no solution. Graph a system of linear equations in a coordinate plane. Determine if lines are intersecting, parallel or coinciding by comparing their slopes and y-intercepts. Use systems of linear equations to solve real-life problems. Graph the solutions to a linear inequality in two variables as a half plane. Graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. Use of systems of inequalities to model a real-life problem.	Content: Systems of linear equations, graphing, substitution, elimination, systems of linear inequalities, no solution, infinitely many solutions, parallel, intersecting or coinciding lines, boundary lines, half-planes. Skills: Approximate the solution to a system of linear equation by graphing. Apply substitution and elimination methods to solve a system. Graph systems of equations and inequalities in two variables on a coordinate plane. Understand that the intersecting point of two lines is the solution to the system and that the shaded area of a coordinate plane are the solutions to an inequality. Model real-world problems using systems.	Ch. 5 Standards Assessment (Big Ideas) p. 287-287 Partner Activity: Students are given a real-life scenario that they must model with linear inequalities then use their graphs to answer pre-made questions. Students create their own foldable representing the various types of solving of systems of equations: graphing, substitution and elimination Click on link: http://www.teacherspayteachers.com/Product/Solving-Systems-of-Linear-Equations-Foldable-338293 Have students go to Desmos online graphing tool to check a graphing assignment they previously graphed by hand. Click on link: https://www.desmos.com/calculator	A.REI.5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. A.REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. *Focus on the justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines (yielding no solution);* A.REI.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. 9.1.12.A.1: Apply critical thinking and problem-solving strategies during structured learning experiences. 8.1.12.A.3 Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.	14 lessons

Unit 6 Overview

Unit Title: Exponential Functions

Unit Summary:
Students will begin this unit with the study of exponent rules. They will extend their previous knowledge of positive integer exponents to zero, negative, and rational exponents. Exponential functions will be introduced and explored along with their graphs. Exponential growth and decay problems, in the context of the real-world, will be analyzed. Graphing calculators will become an integral tool to examine solutions to exponential equations. The unit will conclude with a continued study of sequences, with a focus on geometric sequences and recursive formulas for both geometric and arithmetic sequences.

Suggested Pacing: 14 lessons

Learning Targets

Unit Essential Questions:

- What is the difference between a rational exponent and an integer exponent?
- How is the root of a number expressed as an exponent?
- What real-world application would involve using rational exponents?
- What are key features of the graph of an exponential function?
- Why does one need to worry about the domain and range of a function?
- For what type of real world application would one want to find an explicit expression for a geometric sequence?
- What are some situations that can be modeled using recursive expressions?
- What are the transformations that can be performed on a parent exponential function?
- Why does the placement of variables and/or exponents have an effect on a graph?

Unit Enduring Understandings:

- Properties of exponents are not affected by whether the exponent is a rational number or an integer.
- Radicals can be expressed by the use of a rational exponent.
- Geometric sequences are examples of exponential functions.
- Graphs model the data of an equation.
- The placement of variables and exponents and the value of the exponents determine what type of function the equation represents.
- Arithmetic sequences grow linearly; therefore, the recursive process will involve addition or subtraction and the explicit expression will be linear.
- Geometric sequences grow exponentially; therefore, the recursive process will involve multiplication or division and the explicit process will be exponential.

Evidence of Learning

Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, Two Roses and a Thorn, etc...

Summative Assessment:

Common Assessment for Unit 6

Objectives (Students will be able to…)	Essential Content/Skills	Suggested Assessments	Standards (NJCCCS CPIs, CCSS, NGSS)	Pacing
Rewrite expressions involving radicals and rational exponents using the properties of exponents. Identify the domain and range of an exponential function. For a function that models a relationship between two quantities, interpret key features of tables in terms of the quantities. Sketch graphs showing key features given a verbal description of the relationship. 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.* Analyze real-world scenarios representing exponential growth or decay. Graph exponential functions, showing intercepts and end behavior. Write a recursive formula for an arithmetic or geometric sequence.	Content: zero, negative, and rational exponents, nth root, radicals, exponential functions, growth and decay, geometric sequences, recursive formulas. Skills: Work with zero, negative, and rational exponents. Simplify non-perfect square radicals. Apply properties of exponents. Determine if data in a table represents a linear or exponential function. Analyze growth and decay problems. Solve exponential equations with like and unlike bases. Recognize geometric sequences from tables. Write explicit formulas for geometric sequences. Write recursive formulas for arithmetic and geometric sequences..	Ch. 6 Standards Assessment (Big Ideas) p. 352-353 Students go to webpage link: http://www.ixl.com/math/algebra-1 x.2 to complete the "Matching Exponential Functions to their graphs" assessment questions. (There are other quiz mods to complete here as well). Students research a real-world situation that can be modeled by a geometric sequence and write a one page report explaining the situation, giving the first 10 terms of the geometric sequence it describes, an explicit and a recursive formula to describe the situation. (can report to class informally or formally). Quiz: Give students a page of exponential functions in various forms (tables, graphs, equations) and have them describe the domain the range of each. Partnered: Students complete a Circuit Activity of 10 exponential equations to solve. Use Parcc EOY Algebra 1 Practice Test # 12 and 22 in Part II found online at parcconline.org	N.RN.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.* N.RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents A.REI.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. (focus here on exponential functions) F.IF.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ³ 1. F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. F.BF.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations and translate between the two forms. F.LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	14 lessons

Unit 7 Overview

Unit Title: Polynomials and Factoring

Unit Summary:
The focus of this unit are the operations performed on Polynomials. Students will gain a working knowledge of the parts of polynomials and different types of polynomials. Addition, subtraction, and multiplication of polynomials will be performed. The Zero-Product Property will be introduced as a method for solving polynomial equations. The emphasis will be on quadratic equations with connections being made from their solutions to their graphs. The factoring methods for differences of squares, perfect square trinomials and polynomials with four terms will be explored. Throughout the unit, all concepts presented will be connected with real-world problems they define.

Suggested Pacing: 16 lessons

Learning Targets

Unit Essential Questions:

- How does one tell the difference between a term, a factor, and a coefficient in an expression?
- What does it mean for a polynomial to be closed under an operation?
- Why does one need to know that polynomials are closed under operations of addition, subtraction, and multiplication?
- Why would one need to use an equivalent form of an expression?
- What information can be given when one finds the zero of a function?

Unit Enduring Understandings:

- Expressions may be broken into separate terms in order to analyze them.
- Expressions can have different forms which are equivalent.
- A different form of an expression can make a problem easier to solve and/or understand.
- Polynomials form a system analogous to integers, namely, they are closed under the operations of addition, subtraction, and multiplication.
- Different forms of quadratic expressions can give important information about the function and its graph.

Evidence of Learning

Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, Two Roses and a Thorn, etc...

Summative Assessment:
Common Assessment for Unit 7

Objectives (Students will be able to…)	Essential Content/Skills	Suggested Assessments	Standards	Pacing
Interpret parts of an expression, such as term. Recognize terms and like terms of an expression. Add polynomials. Subtract polynomials. Multiply polynomials. Understand closure and explain why polynomials are closed under addition, subtraction, and multiplication. Solve polynomial equations using the Zero-Product Property. Explain the connection between factors and zeroes. Factor a quadratic expression to reveal the zeroes it defines. Recognize and factor special products (including differences of squares and perfect square trinomials) Apply factoring by grouping to polynomials with four terms. Factor a polynomial completely.	Content: terms, factors, coefficients, adding/subtracting/ multiplying polynomials, solving polynomial equations, zeros, factoring trinomials, factoring special products, factoring completely, Skills: Know how the parts of an expression (terms, factors, and coefficients relate to the context of the proble. Understand that a monomial is a number, a variable, or a product of a number and one or more variables and that a polynomial is a monomial or sum of monomials. Know that only like terms may be added or subtracted and how to do so. Understand that the exponents of like variables change when polynomials are multiplied. Realize that a zero of a function is the value which makes the function equal to zero and represents the x-intercept of the graph.	Ch. 7 Standards Assessment (Big Ideas) p. 414-415 "I Have, Who Has" factoring game…can be played with class split into two groups, each with their own set of cards. Parcc EOY Algebra 1 Practice Test # 5 and 6 on Part I and #9 on Part II. Go to link: http://www.parcconline.org/sites/parcc/files/Algebra-1-Practice-Test-Answer-and-Alignment-Document-Mathematics-4-6-14.pdf Writing Task/Open-Ended Question: Explain why polynomials are closed under addition, subtraction, and multiplication, but not division. Explain the connection between factors and zeroes. Make a factoring polynomials foldable with all types of factoring and an example of each under each tab. See link: http://www.teacherspayteachers.com/Product/Factoring-Polynomials-Foldable-565932 (there is a $4.00 cost for this template but other freebies can be found online or make your own)	A.SSE.1 Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. 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 depending on P. A.APR.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. *(Focus on polynomial expressions that simplify to forms that are linear or quadratic in a positive integer power of x.)* A.SSE.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). 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. Factor a quadratic expression to reveal the zeros of the function it defines. CRP4 Communicate clearly and effectively and with reason. Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.	16 lessons

Unit 8 Overview

Unit Title: Graphing Quadratic Functions

Unit Summary:
In this unit, students will be introduced to Quadratic Functions and their graphs. Multiple representations of a quadratic equation, including Vertex Form, Standard Form and Intercept Form, will be examined. The graph of the the parent quadratic function f(x) = x^2 will be the starting point from which students will discover the changes to the parent as various parameters are altered. The previous study of linear and exponential equations will be expanded as students compare and contrast various elements of the two functions along with those of quadratic functions. Quadratic Functions will be used as mathematical models for real-life problems presented throughout the unit.

Suggested Pacing: 12 lessons

Learning Targets

Unit Essential Questions:

- What are the transformations that can be performed on a parent quadratic function?
- Why are parameters important in a function?
- Why is it important to know the domain of a function?
- Why would one want to know the average rate of change of a function?
- Why is it important to know characteristics of graphs and equations?
- What characteristics does one know about a graph by looking at an equation?
- What characteristics does one know about an equation by looking at a graph?
- Why would one want to know how a quantity increases (linearly, quadratically, exponentially, or as a polynomial function)?

Unit Enduring Understandings:

- When looking at a symbolic representation of a function, one should recognize it as a parent function with transformations.
- Placement of a constant in an equation makes a difference as to how the graph of the parent function gets transformed.
- Regardless of the type of function, the transformations of a parent function are the same, e.g., f(x) + 2 shifts the function two units up whether it is linear, quadratic, etc.
- The size of parameters affects how the graph increases or decreases and where key points lie on it.
- Linear functions grow differently than do exponential functions.
- The change from one y-value to the next y-value compared to the change from one x-value to the next x-value is what is compared when speaking of growth.
- A quantity increasing exponentially (in graphs and table) eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

Evidence of Learning

Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, Two Roses and a Thorn, etc...

Summative Assessment:
Common Assessment for Unit 8

Objectives (Students will be able to…)	Essential Content/Skills	Suggested Assessments	Standards	Pacing
Identify characteristics of quadratic functions. Graph quadratic functions in standard form. Describe the domain and range of a quadratic function and relate the domain to the graph and the quantitative relationship it describes. Recognize transformations made from the parent quadratic. Convert standard form to vertex form. Determine if a quadratic function is even or odd. Use intercept form to find zeros of functions. Use characteristics to graph and write cubic functions. Choose an appropriate function to model data; linear, quadratic or exponential and explain the use of each. Compare functions using average rates of change.	Content: quadratic functions, parabolas,parameters, increasing and decreasing, max and min values, even and odd functions, vertex form, standard form, intercept form, cubic functions, average rates of change Skills: Graph quadratic functions in standard form. Graph quadratic functions in vertex form. Determine and identify intercepts, maxima and minima, and symmetry of the graph. Analyze the effect of changes to a, b, and c on the graph of f(x) = ax^2 + bx + c. Use technology to display changes to the graph. Recognize even functions from their graphs or from algebraic expressions. Recognize odd functions from their graphs or from algebraic expressions. Find zeros of functions using intercept form (include quadratics and cubics). Compare and contrast linear and/or exponential growth to that of quadratic growth.	Ch. 8 Standards Assessment (Big Ideas) 474-475 Use # 5 and 6 from Part I and # 14 from Part II of PARCC Algebra 1 EOY practice test: http://www.parcconline.org/sites/parcc/files/Algebra-1-Practice-Test-Answer-and-Alignment-Document-Mathematics-4-6-14.pdf Interactive Quiz Questions found at: http://www.mathwarehouse.com/geometry/parabola/standard-and-vertex-form.php Quiz/Test: Give each student in the class an index card with a quadratic equation written on it (either in vertex form or standard form). Students must find their matching partner. Once they pair up, they must graph their parabola, determine the vertex, axis of symmetry, x-intercepts, and whether it is an even or odd function. Assessment Question: Explain how the parameters affect the graph of a quadratic function OR describe the transformations that occur given a quadratic function in relation to the parent function. Students play the "Flyswatter" game to practice recognition of various quadratic form AND create a foldable of all forms. See the link for instructions: http://mathequalslove.blogspot.com/2014/03/different-forms-of-quadratic-function.html	F.IF.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.* F.IF.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.*★ F.IF.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. *Focus on quadratic functions; compare with linear and exponential functions studied in Units 3 and 6.* F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. F.IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. 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. F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For*	12 lessons

			example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum. F.LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. *Compare linear and exponential growth to quadratic growth.* F.IF.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. F.BF.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.* *For F.BF.3, focus on quadratic functions.* 9.1.12.A.1: Apply critical thinking and problem-solving strategies during structured learning experiences.	

Unit 9 Overview

Unit Title: Solving Quadratic Equations

Unit Summary:
This unit will begin by extending students' understanding of radicals by performing the four operations of addition, subtraction, multiplication and division. The main focus of the unit is the solving of quadratic equations in four different ways; by graphing, using square roots, completing the square and the quadratic formula. Graphing skills from the previous unit will be honed and concepts previously learned will be applied. Students will continue to make geometric connections and model real-world situations. Earlier learned methods used to solve linear systems will be applied to solve non-linear systems.

Suggested Pacing: 12 lessons

Learning Targets

Unit Essential Questions:

- Why should one know multiple methods to solve a quadratic equation?
- What are complex solutions? **(H)**
- Why are complex solutions needed? **(H)**
- Why would one have two equations to solve simultaneously?

Unit Enduring Understandings:

- The characteristics and forms of a quadratic equation need to be examined to know which process is most advantageous to use in order to solve it.
- A quadratic equation with solutions that are not real numbers lead us to extend the number system to complex numbers in order to allow for solutions to these equations. **(H)**
- A solution to a system of equations involves finding a point(s) that will make both equations true.
- Systems of equations can have a different number of solutions, including none, one, and infinitely many.

Evidence of Learning

Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, Two Roses and a Thorn, etc...

Summative Assessment:
Common Assessment for Unit 9

Objectives (Students will be able to…)	Essential Content/Skills	Suggested Assessments	Standards	Pacing
Explain that the sum of a rational and an irrational number is irrational and that the product of a nonzero rational number and an irrational number is irrational. Solve quadratic equations in one variable. Solve quadratic equations by graphing. Solve quadratic equations by taking square roots. Solve quadratic equations by completing the square. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2=q$ that has the same solutions. Derive the quadratic formula by completing the square on the standard form. Solve quadratic equations as appropriate to the initial form of the equation: by inspection (e.g., for $x^2 = 49$) Solve quadratic equations by the quadratic formula. Recognize when the quadratic formula gives complex solutions **(H)** write complex solutions as $a \pm bi$ for real numbers a and b **(H)**. Solve systems of non-linear equations by graphing. Solve systems of non-linear equations algebraically. Analyze real-world scenarios using quadratic functions.	Content: properties of radicals, like radicals, rationalizing the denominator, graphs of quadratic functions, x-intercepts,conjugates, solve using radicals, completing the square, quadratic formula, discriminant, non-linear systems. Skills: Add, Subtract, Multiply, Divide Radicals. Recognize solutions of quadratics as x-intercepts on their graph. How to take a square root of each side of an equation. Complete the square to locate zeros. Apply the quadratic formula to find zeros. Interpret the Discriminant. How to use one equation solved for a variable so it can be substituted into another equation to solve them simultaneously. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically. *For example, find the points of intersection between the line $y = –3x$ and the circle $x^2 + y^2 = 3$.* **(H)** Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.	Ch. 9 Standards Assessment (Big Ideas) 538-539 Always/Sometimes/Never question: 1. The sum of a rational and an irrational number is irrational. 2. The product of a nonzero rational number and an irrational number is irrational. Provide examples or counterexamples to support your answer. Quiz Question: Give students one quadratic equation to solve and have them solve graphically, by completing the square and using the quadratic formula. All three ways should produce the same answer. Students should explain the merit of each method and which is most preferred for the given quadratic. Conduct a circuit activity of non-perfect square radicals to simplify. For a real-world situation formative assessment called “Cutting Corners” and all instructions, go to the link: http://map.mathshell.org/materials/download.php?fileid=1512 Provide students with a sheet of non-linear systems to solve algebraically. As they do so, individually use chromebooks or collectively come to smartboard to check graphs on https://www.desmos.com/calculator	RN.B.3 Explain that the sum of a rational and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. A.REI.4 Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. **(H)** Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b. A.REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line $y = –3x$ and the circle $x^2 + y^2 = 3$.* 8.1.12.C.1 Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community. RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words	12 lessons

Unit 10 Overview

Unit Title: Data Analysis and Displays

Unit Summary:
In this unit, students will begin by exploring and finding measures of central tendency and measures of variation in data sets. They will describe and compare data distributions in multiple formats including, tables, box and whisker plots, and histograms. Students will use the shape of a graph to make conclusions about the data. Students will learn how to make and interpret two-way tables. Students will determine if data is quantitative or qualitative then choose and create appropriate data displays. All concepts will be studied in the context of real-world scenarios. The unit will conclude with an analysis of the characteristics of misleading graphs allowing for a better understanding of how statistical data is used in the real-world.

Suggested Pacing: 10 lessons

Learning Targets

Unit Essential Questions:

- Why does one want to use graphical displays of data?
- What type of data would be used in a two-way frequency table?
- How does one determine whether to show data in a table or a graphical display?
- How can one determine if a data display is misleading?

Unit Enduring Understandings:

- The shape of data in a graphical display yields information to help understand trends in and key features of the data.
- Two-way frequency tables relate two variables that each have sub-categories.
- Not all graphs displaying data are drawn appropriately and therefore, may be misleading.

Evidence of Learning

Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, Two Roses and a Thorn, etc...

Summative Assessment:
Common Assessment for Unit 10

Objectives (Students will be able to…)	Essential Content/Skills	Suggested Assessments	Standards	Pacing
Compare the mean, median, and mode of a data set. Find the range and standard deviation of a data set. Identify the effects of transformations on data. Draw and interpret box-and-whisker plots. Use box-and-whisker plots to compare data. Describe the shapes of data distributions and use them to choose appropriate measures. Compare data distributions. Make two-way tables of data. Find and interpret marginal frequencies from two-way tables. Find relative and conditional frequencies. Use two-way tables to recognize associations in data. Classify data as quantitative or qualitative. Choose and create appropriate data displays. Analyze misleading graphs. Explain the effects of outliers.	Content: mean, median, mode, outlier, standard deviation, range, data transformation, box- and- whisker plots, quartiles, interquartile range, five-number summary, histogram, symmetric vs. skewed distributions, two-way tables, Skills: Represent data with histograms on the real number line. Represent data with box plots on the real number line. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) of two or more different data sets. Use statistics appropriate to the shape of the data distribution to compare spread (interquartile range, standard deviation) of two or more different data sets. Interpret differences in shape, center, and spread in the context of data sets. account for possible effects of extreme data points (outliers). Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. Explain why a graph may be misleading.	Ch. 11 Standards Assessment (Big Ideas) p. 628-629 Quiz Questions or Interactive Practice: go to http://www.ixl.com/math/algebra-1 under the titles “Data and Graphs” and “Statistics” Parter Work: Exploration 2 on p. 609 of “Big Ideas”--Making a Two-Way Table Journal Entry: Display 3-4 graphs of data sets and have students write about why each one may be misleading. Discuss. Journal Entry: Display a data set and have students tell which data display they would create for the data and why. Have students find and bring in an example of misleading data and explain how it is misleading. Allow students to use their cell phones to find data which can be used for a double box-and-whisker plot. Once data is agreed upon, have the whole class (individually), draw their box plots and address each of the following: a) Label the “five-number summary of each plot” b) State the interquartile range. c) Identify the shape of each distribution d) Which is more spread out? Explain. This unit can be taught and assessed through the use of a project.	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). *In grades 6-8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristic of the data distribution, such as the shape of the distribution or the existence of extreme data points.* S.ID.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. 9.1.12.B.1: Present resources and data in a format that effectively communicates the meaning of the data and its implications for solving problems, using multiple perspectives. 8.1.12.A.4 Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.	10 lessons

Unit 11 Overview

Unit Title: Radical Functions and Inverses

Unit Summary:
In this final unit, students will explore square root and cube root functions. Transformations will continue to be examined in the context of these new functions. Students will become proficient with solving radical equations and gain an understanding of how to use radical equations in a real-world context. The final section of the unit will focus on the creation of inverse functions graphically and algebraically. Students will use their critical thinking skills to answer questions relating this unit with concepts presented in previous units.

Suggested Pacing: 8 lessons

Learning Targets

Unit Essential Questions:

- What are the transformations that can be performed on square root and cube root functions?
- How does one use average rates of change to compare square root functions or cube root functions?
- How does one recognize extraneous solutions of radical equations?
- How does one find the inverse of a function?
- In what situation would an inverse functions be useful?

Unit Enduring Understandings:

- When looking at a symbolic representation of a function, one should recognize it as a parent function with transformations.
- Regardless of the type of function, the transformations of a parent function are the same, e.g., f(x) + 2 shifts the function two units up whether it is linear, quadratic, etc.
- Real-world scenarios can be modeled and solved using radical equations.
- A function with ordered pair solutions (x,y) may have an inverse function with (y,x) as solutions.

Evidence of Learning

Formative Assessments: A variety of formative assessments will be used throughout the lesson, such as warm-up and closure questions completed on paper and handed in and on Google Classroom, Four Corners, Hand It In, Pass It Out, Self-Evaluation, Think-Pair-Share, Jigsaw, Socrative, Two Roses and a Thorn, etc...

Summative Assessment:
Common Assessment for Unit 11

Alternative Assessment:
Students will create a multimedia presentation demonstrating how to use radical equations in a real-world context.

Objectives (Students will be able to…)	Essential Content/Skills	Suggested Assessments	Standards	Pacing
Graph square root functions. Compare square root functions using average rates of change. Solve real-life problems involving square root functions. Graph cube root functions. Compare cube root functions using average rates of change. Solve radical equations. Identify extraneous solutions. Solve real-life problems involving radical equations. Explore and find inverses of linear and non-linear functions.	Content: Square root function, cube root function, radical function, radical equation, inverse relation, inverse function. Skills: Compare graphs of radical functions. Calculate average rate of change of radical functions. Interpret solutions of radical equations. Apply radical functions to solve real-world problems. Find inverses of linear and non-linear functions.	Ch. 11 Standards Assessment (Big Ideas) p. 580-581 Partner activities: Explorations 1 and 2 p. 543 and p. 551 (Big Ideas) Partner activity: Exploration 1 p. 567 Go to link for assessment tool: http://www.ixl.com/math/algebra-1 "Radical Functions and Equations" Circuit Activity of Radical Equations to solve. Give half of the students in the class an index card with a function on it and the other half of the class their inverse functions. Students must find their partners. Mix up cards and conduct activity as many times as required for mastery.	F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified change from a graph. F.BF.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. F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. *(Limit this unit to square root and cube roots functions).* F.BF.4 Find inverse functions. 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, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.* NJSLSA.L6. Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.	8 lessons