Summit Public Schools

Summit, New Jersey

Grade Level 8/ Content Area: Mathematics

Length of Course: Full Academic Year

Curriculum: Foundations of Algebra

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2017

Course Description: This course represents the first part of a two-year course. It has been designed to offer a rigorous and comprehensive foundation that addresses the newly adopted New Jersey Student Learning Standards for Mathematics for Grade 8. It will also provide students the opportunity to truly master algebraic and mathematics skills that will lead to greater achievement in subsequent courses. Students will create and use numerical, algebraic, graphical, and verbal representations and analyze sophisticated patterns, relations, and functions. They will represent linear functions numerically, algebraically, graphically and verbally and work with and interpret these representations. They 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. Functions will be introduced 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.

Texts and Resources:
Big Ideas Math: Algebra 1 (Big Ideas Learning. ©2016)

Standards:
New Jersey Student Learning Standards (2016)
(http://www.state.nj.us/education/cccs/2016/math/)

Anticipated Timetable for Foundations of Algebra
Quarter 1

Unit 1

Topic Solving Linear Equations	**Time Frame**
Solving one-step equations including word problems	1
Two-step equations and combining like terms	1
Distributive Property in multi-step equations	1
Word problems practice with multi-step equations	1
Equations with variables on both sides including grouping symbols	1
Identity and No Solution Equations	1
Word problem practice	1
Quiz Review	1
Quiz	1
Solving Absolute Value Equations	1
Solving Absolute Value Equations with operations outside of Absolute Value symbol and word problems with Absolute Values	1
Absolute Value Equations with two Absolute Values and with special solutions	1
Solving literal equations for different variables	2
Using formulas for area and volume	1
Unit review	2
Unit Test	1
Total	18 days

Unit 2

Topic Solving Linear Inequalities	**Time Frame**
Writing and graphing simple inequalities and testing a solution	1
Solving Inequalities with Addition and Subtraction including word problems	1
Solving Inequalities with Multiplication or Division including word problems	1
Two step and variables on both sides inequalities	1
Inequalities with distributive property and word problems	1
Quiz Review	1
Quiz	1
Writing compound inequalities and solving “and” inequalities	1
Solving and graphing “and” & “or” inequalities	1
Solving absolute value inequalities that result in “and” & “or” solutions	1

Solving absolute value inequalities that result in special solutions	1
Word problems and absolute deviation	1
Chapter review	2
Chapter Test	1
Total	15 days

Quarter 2

Unit 3

Topic Graphing Linear Functions	**Time Frame**
Determining if a relations is a function with tables and mapping	1
Determining if a relation is a function with graphs & define and identify Domain and Range of a function	1
Identify the independent and dependent variables	1
Identifying linear functions from tables, graphs, and equations	1
Checking solutions to linear equations and continuous vs. discrete domains	1
Writing equations in function notation and evaluating a function for a given domain	1
Solve and graph using function notation	1
Quiz review	1
Quiz	1
Introducing Standard Form, graphing using a table, x&y intercepts	1
Horizontal and Vertical lines	1
Writing Equations from word problems, graphing using x&y intercepts, interpreting graphs	1
Finding slope and y-intercept of a line or slope from two coordinates	1
Finding slope from a table and writing equations in slope intercept form	1
Solving for y to write in slope-intercept and graphing using slope-intercept	1
Make a table to graph absolute value functions with a vertex at the origin	1
Introduction of vertex form of an absolute value function	1
Quiz review	1
Quiz	1
Chapter review	2
Chapter Test	1
Total	22

Unit 4

Topic Writing Linear Functions	**Time Frame**
Writing equations in slope-intercept form given the slope and y-intercept, or given a graph	**1**
Writing equations in slope-intercept form given two points	1
Linear models to solve problems	1
Writing in point-slope form and converting from point-slope to slope-intercept form of a linear equation	2
Writing equations of parallel lines	1
Writing equations of perpendicular lines	1
Quiz Review	1
Quiz	1
Making a scatter plot and identifying a correlation	1
Drawing a line of fit and writing the equation for that line	1
Correlation coefficient, linear regression, and residuals	1
Chapter Review	2
Chapter Test	1
Total	15 days

Quarter 3

Unit 5

Topic Solving Systems of Linear Equations	**Time Frame**
Introduction of a system of equations, solution of a system, and solving by graphing	1
Determining if a coordinate is a solution and solving by graphing equations in different forms	1
Solving by substitution when one variable is isolated	1
Solving by substitution by isolating a variable as the first step	1
Solving word problems using substitution	1
Solving by elimination with opposite coefficients	1
Multiplying equations to use elimination	1
Solving word problems using elimination	1
No solution and infinitely many solution systems	1

Quiz review	1
Quiz	1
Graphing Linear inequalities and using a test point to determine solutions	1
Graphing systems of linear inequalities	1
Special solutions to systems of linear inequalities	1
Chapter review	2
Chapter test	1
Total	17 days

Unit 6

Topic Exponents	**Time Frame**
Multiplying expressions with like bases and power of a power	1
Dividing expressions with like bases	1
Power of a product and power of a quotient	1
Zero and negative exponents	1
Simplifying expressions with zero and negative exponents	1
Quiz review	1
Quiz	1
Writing large numbers using scientific notation	1
Writing small numbers using scientific notation	1
Multiplying and dividing expressions written in scientific notation	1
Perfect square and perfect cube roots	1
Approximating irrational square and cube roots to the nearest tenth	1
Solving simple equations using square and cube roots	1
Determining if a triangle is right using pythagorean theorem and use Pythagorean theorem to find the missing side of a right triangle	1
Use Pythagorean theorem to model and solve word problems	1
Use Pythagorean theorem to find the distance between two points on the coordinate system	1
Quiz review	2
Quiz Scientific Notation, Square and Cube Roots, and Pythagorean Theorem	1
Chapter review	2
Chapter test	1
Total	22 days

Quarter 4

Unit 7

Topic Transformational and Plane Geometry	**Time Frame**
Translations	1
Rotations	1
Reflections	1
Dilations	1
Verifying congruence of lines and shapes after transformations	1
Quiz review	2
Quiz	1
Parallel Lines cut by a transversal	1
Solve for missing angles formed by parallel lines cut by a transversal	1
Angle sum of triangles and exterior angles of a triangle	1
Chapter review	2
Chapter test	1
.Total	14

Unit 8

Topic Three-Dimensional Geometry	Time Frame
Review of Volume of Prisms and Cylinders	1
Volume of Pyramids, Cones, and Spheres	1
Solving word problems using Volume of three-dimensional shapes	1
Chapter Review	2
Chapter Quiz	1
Total	6 days

Unit 9

Topic Data Analysis and Displays	Time Frame
Measures of Center and Variation	2
Box and Whisker Plots	2
Shapes of Distribution	2
Quiz Review	1
Quiz	1
Two-Way Tables	2
Choosing a Data Display	1
Chapter review	2
Chapter test	1
Total	14

Unit 1: Solving Linear Equations

Big Ideas: *Course Objectives / Content Statement(s)*

- Solve single variable linear equations using the order of operations and inverse operations.
- Identify equations with infinite or no solutions.

Essential Questions	**Enduring Understandings**
● How does one apply the order of operations in complex, multi-step problems? ● How can one model real life situations with equations?	*What will students understand about the big ideas?* Students will understand that… ● The Order of Operations can be applied to more complex problems. ● Inverse operations can be used to keep and equation balanced and isolate a variable. . ● Some equations will have an infinite number of solutions ● Some equations will have no solution. .
Areas of Focus: Proficiencies (Cumulative Progress Indicators) Students will: ● **8.EE.C.7a** Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers) ● **8.EE.C.7b** Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	**Examples, Outcomes, Assessments** Instructional Focus: Solving simple equations ● Solving multi-step equations ● Solving equations with variables on both sides ● Solving absolute value equations ● Rewriting equations and formulas Sample Assessments: ● Solve the equation: $40 = -\frac{1}{3}(9x + 30) + 2$ ● Sample ECR Item: You are a contractor and charge $45 for a site visit plus an additional $24 per hour for each hour you spend working at the site. Write and solve an equation to determine how many total hours you have to work to earn $810 working at two separate work sites. . ● 1 unit quiz ● 1 unit test

	Instructional Strategies: ● Use digital resources to aid in visualizing steps to solving equations.. ● Use mnemonic devices to memorize the order of cancelling operations using inverses Technology Integration ● Use a scientific calculator to explore multi-step problems. Introduce advanced functions (grouping symbols and memory functions). ● Digital textbook for instruction and support outside of classroom

Unit 2: Solving Linear Inequalities

Big Ideas: *Course Objectives / Content Statement(s)*

- Understand the meaning of inequalities and the mathematical rules that govern them.
- Identify when the solution set is inclusive of the boundary and how to show that visually and graphically. .
- Identify similarities and differences when solving equations and inequalities.
- Understand the differences between the different types of compound inequalities.
- Relate absolute value inequalities and compound inequalities.
- Relate the solutions to any simple or compound inequality to a graph or number line

Essential Questions	**Enduring Understandings** *What will students understand about the big ideas?* Students will understand that…
● What does an inequality represent? ● How can we determine if the boundary is included in the solution set? ● How can we use mathematical models to represent inequalities? ● What is the difference between the different types of compound inequalities? ● How can the different types of compound inequalities' solution sets be displayed on a number line? ● How are absolute value inequalities related to compound inequalities?	● Inequalities follow a similar structure and order as equations. ● Solutions to inequalities represent a boundary and may be infinite.. ● Compound inequalities allow for more than one boundary and may be a representation of a union or intersection of the solution sets.

Areas of Focus: Proficiencies (Cumulative Progress Indicators) Students will: (*Enter NJCCCS or Common Core CPI's here)* ● A.REI.A1 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.	**Examples, Outcomes, Assessments** *(see note below about the content of this section)* Instructional Focus: Solving inequalities (including compound inequalities) ● Solving multi-step inequalities ● Solving compound inequalities ● Solving absolute value inequalities ● Modeling real life situations with inequalities Sample Assessments: ● 1 Unit Quiz and 1 Unit Test ● Solve the inequality and graph the solution: $-3y > 9$ *or* $2y - 6 > 2$  ● You are planning a school carnival. The equipment costs $180 to rent. You are planning to charge $4.00 per ticket. You would like to have a profit of at least $500. Write and solve an inequality that represents the number of tickets you need to sell. Instructional Strategies: Interdisciplinary Connections ● Use inequalities to model polling data for political elections ● Use inequalities to model the time frames associated with the phases of the moon Technology Integration ● Internet based question sets to model inequalities and the graphs of their solutions ● Use of SmartBoard to create drag and drop number lines to model solution sets

Unit 3: Graphing Linear Functions

Big Ideas: *Course Objectives / Content Statement(s)*

- Define and identify functions
- Write equations using function notation
- Calculate the slope of a line
- Graph linear functions from a variety of equation forms

Essential Questions *What provocative questions will foster inquiry, understanding, and transfer of learning?* ● What characteristics of a relation makes it a function? ● How can you identify a function when given a table, graph, or equation? ● How can you calculate the slope of a line? ● What does the slope of the line represent? ● How do the different parts of a linear equation translate to a graph or table?	**Enduring Understandings** *What will students understand about the big ideas?* Students will understand that… ● Functions have specific characteristics, that each element of the domain has one matching element of the range. ● Functions can be represented as equations, tables, or graphs. ● The slope of the line represents a constant rate of change. ● Linear equations can be used to model a variety of real life situations.
Areas of Focus: Proficiencies (Cumulative Progress Indicators) Students will: (*Enter NJCCCS or Common Core CPI's here)* ● 8.F.A.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.1 ● 8.F.A.2 Compare properties (e.g. rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). ● 8.F.A.3 Interpret the equation y = mx + b as defining a linear	**Examples, Outcomes, Assessments** *(see note below about the content of this section)* Instructional Focus: ● Define a function. ● Identify a function in different forms. ● Use function notation to write a linear equation. ● Calculate slope of a line. ● Graph linear functions using slope intercept form. ● Graph vertical and horizontal lines ● Graph linear functions using standard form. ● Use linear functions to model and solve real life problems Sample Assessments:

function, whose graph is a straight line; give examples of functions that are not linear.

- 8.F.B.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values
- 8.F.B.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
- 8.EE.B.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.

- 2 Unit quizzes, 1 Unit Test
- Determine whether the relation is a function. **Explain.**

Input, *x*	9	7	5	3	1
Output, *y*	1	2	2	3	4

- The elevation h (in Feet) of a submersible is modeled by the function h(t)=550t-11,000, where t is the time (in minutes) since the submersible began to ascend. Identify and interpret the slope and y-intercept.

Instructional Strategies:

Interdisciplinary Connections

- Make a model of the relationship between Celsius and Fahrenheit temperatures. Represent the relationship as an equation, and check the equation against two known data points – 0 degrees C = 32 degrees F and 100 degrees C = 212 degrees F. Use the equation to convert between Celsius and Fahrenheit temperatures.

Technology Integration

- Using spreadsheet software, examine variables as a set of objects and find the image of a set of objects using a function to gain an output For example, the corresponding values of $f(n) = 3n$ are examined by using a single number substituted for n in the function, next by using the set of natural numbers less than or equal to 50 under this function, and finally to considering the variable n as the set of real numbers. Students identify a real world situation where a continuous function using the set of real numbers versus a single number may occur (e.g. the gravitational force on an object of a particular mass as it moves to higher

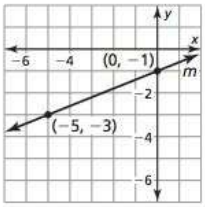
	altitudes which might include either mountain climbing or a space shuttle trip; the height of a candle as it burns over time). Global Perspectives ● Compare and contrast populations of various nations to determine % growth or decay. Students will determine other environmental or political factors that affect the population changes and determine of growth or decay is an example of a linear function.

Unit 4: Writing Linear Functions

Big Ideas: *Course Objectives / Content Statement(s)*

- Write equations in slope intercept
- Convert equations into slope intercept form
- Know the characteristics and write equations of parallel and perpendicular lines
- Use linear equations to model trends in scatterplots

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 are the slope and y-intercept of a linear function represented on a graph? ● How are the slope and y-intercept of a linear function represented in an equation? ● How are the different forms of linear equations related? ● What are the advantages and disadvantages of each form of linear equations? ● How can linear equations be used to model trends in sets of data? ● What are the common characteristics of parallel and	● The slope of a line represents a rate of change, and controls the steepness of its graph. ● Linear equations can be manipulated using inverse operations to convert between formats. ● The y-intercept of a linear graph occurs when the x-value is 0 and is a common starting point for real life problems. ● Trend lines of scatter plots can often be represented by linear equations. ● Trend lines of scatter plots can be used to predict and draw conclusions from data.

perpendicular lines when using graphs or equations?	
Areas of Focus: Proficiencies (Cumulative Progress Indicators) Students will: (*Enter NJCCCS or Common Core CPI's here)* ● 8.EE.B.6 Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b. ● 8.F.A.2 Compare properties (e.g. rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). ● 8.F.A.3 Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. ● 8.F.B.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. ● 8.SP.A.1 Construct and interpret scatter plots for bivariate measurement data to investigate	**Examples, Outcomes, Assessments** *(see note below about the content of this section)* Instructional Focus: ● Write equations in slope-intercept form ● Convert equations from point-slope or standard form into slope intercept ● Write equations of parallel and perpendicular lines ● Create a scatter plot to model a set of data ● Use a trend line to model patterns in a scatter plot Sample Assessments: ● Write the equation of the line represented by the given graph:  ● Determine of any of the following lines are parallel or perpendicular. Explain your conclusion: Line *a*: (1, 5) and (−2, −4) Line *b*: (3, 2) and (1, −4) Line *c*: (6, 1) and (−4, 2) ● Tell whether the data in the table can be modeled by a linear equation. Explain. If possible, write a linear equation that represents *y* as a function of *x*. | *x* | 3 | 5 | 12 | 20 | | *y* | 7 | 10 | 16 | 26 | Instructional Strategies: Interdisciplinary Connections

patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. ● 8.SP.A.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit (e.g. line of best fit) by judging the closeness of the data points to the line. ● 8.SP.A.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept	● Science: Use a scatterplot to represent growth of plants. Use a trend line to determine if growth patterns are linear. Technology Integration ● Use a graphing calculator or software to graph linear equations. Compare and contrast the slopes in the equations and how they affect the graphs. Global Perspectives ● Use linear equations to model the GDP growth or decay of a variety of countries. Determine if the linear models are appropriate for the situations.