Plainfield Public Schools
Mathematics
Unit Planning Organizer

Grade /Course	Grade 8
Unit of Study	**Unit 2: Functions**
Pacing	7 weeks

Standard for Mathematical Practices
MP1. Make sense of problems and persevere in solving them. MP2. Reason abstractly and quantitatively. MP3. Construct viable arguments and critique the reasoning of others. MP4. Model with mathematics. MP5. Use appropriate tools strategically. MP6. Attend to precision. MP7. Look for and make use of structure. MP8. Look for and express regularity in repeated reasoning.

UNIT STANDARDS
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. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed* **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.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.** **8.F.2 Compare properties (e.g rate of change, intercept, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.** **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. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.*** **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.C.7 Solve linear equations in one variable

8.EE.C.7.A 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.7. B Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms

8.EE.C.8.A Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously

8.EE.C.8.B Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.

"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
Focus Standard **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. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed***		
Graph	Proportional relationships	2

"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
Focus Standard **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.**		
Use	slope	2

"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
Focus Standard **8.F.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**		
Understand	function	1

"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
Focus Standard **8.F.2 Compare properties (e.g rate of change , intercept, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.**		
Compare	Functions	2

"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
Focus Standard **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. *For example, the function A = s^2 giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line***		
Interpret	Linear function	3

"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
Focus Standard **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.**		
Compare	Functions	2

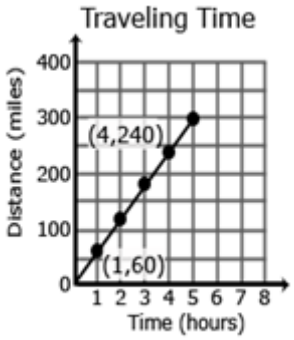
"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
Focus Standard **8.F.B.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.**		
Describe	Functional relationship	1

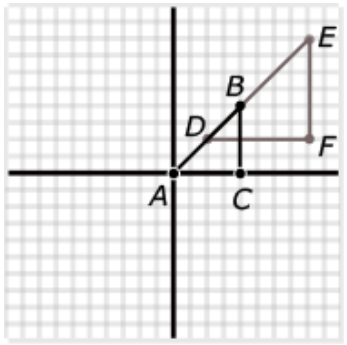
"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
Focus Standard **8.EE.C.7 Solve linear equations in one variable**		
Solve	Linear equation	2

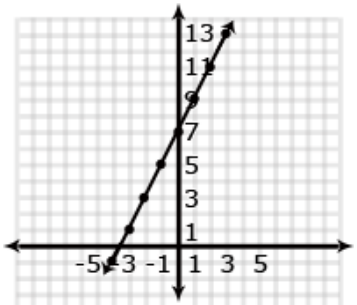
"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
Focus Standard **8.EE.C.7 Solve linear equations in one variable** **8.EE.C.7.A Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. 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)**		
Give examples	Linear equation	2

"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
Focus Standard **8.EE.C.8 Analyze and solve pairs of simultaneous linear equations**		
Analyze solve	linear	3 2

II. Mathematical Standards & Practices Explanations and Examples

Expressions and Equations (EE) **Understand the connections between proportional relationships, lines, and linear equations.**		
Standards *Students are expected to:*	*Mathematical Practices*	*Explanations and Examples*
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. ***For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.***	*8.MP.1.* Make sense of problems and persevere in solving them. *8.MP.2.* Reason abstractly and quantitatively. *8.MP.3.* Construct viable arguments and critique the reasoning of others. *8.MP.4.* Model with mathematics. *8.MP.5*. Use appropriate tools strategically. *8.MP.6.* Attend to precision. *8.MP.7.* Look for and make use of structure. *8.MP.8.* Look for and express regularity in repeated reasoning.	Using graphs of experiences that are familiar to students increases accessibility and supports understanding and interpretation of proportional relationship. Students are expected to both sketch and interpret graphs. **Example**: ● Compare the scenarios to determine which represents a greater speed. Include a description of each scenario including the unit rates in your explanation. Scenario 1: Scenario 2: 

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*.MP.2.* Reason abstractly and quantitatively. *8.MP.3.* Construct viable arguments and critique the reasoning of others. *8.MP.4*. Model with mathematics. *8.MP.5*. Use appropriate tools strategically. *8.MP.7.* Look for and make use of structure. *8.MP.8.* Look for and express regularity in repeated reasoning.	**Example**: ● Explain why ΔACB is similar to ΔDFE, and deduce that $\overline{AB}$ has the same slope as $\overline{BE}$. Express each line as an equation. 

Functions (F) **Define, evaluate, and compare functions.**		
Standards *Students are expected to:*	*Mathematical Practices*	*Explanations and Examples*
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. (Function notation is not required in Grade 8.)	*8.MP.2.* Reason abstractly and quantitatively. *8.MP.6.* Attend to precision.	**Example**: ● The rule that takes x as input and gives x^2+5x+4 as output is a function. Using y to stand for the output we can represent this function with the equation $y = x^2+5x+4$, and the graph of the equation is the graph of the function. Students are not yet expected use function notation such as $f(x) = x^2+5x+4$.
8.F.2 Compare properties (e.g rate of change, intercept, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of	*8.MP.1.* Make sense of problems and persevere in solving them. *8.MP.2.* Reason abstractly and quantitatively. *8.MP.3.* Construct viable arguments and critique the reasoning of others. *8.MP.4.* Model with mathematics. *8.MP.5.* Use appropriate tools	**Examples**: ● Compare the two linear functions listed below and determine which equation represents a greater rate of change. Function 1:  Function 2: The function whose input x and output y are related by $y = 3x + 7$

<table>
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<td>change.</td>
<td>strategically.

8.MP.6. Attend to precision.

8.MP.7. Look for and make use of structure.

8.MP.8. Look for and express regularity in repeated reasoning.</td>
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Compare the two linear functions listed below and determine which has a negative slope.

Function 1: Gift Card

Samantha starts with $20 on a gift card for the book store. She spends $3.50 per week to buy a magazine. Let y be the amount remaining as a function of the number of weeks, x.

<table>
<tr><th>x</th><th>y</th></tr>
<tr><td>0</td><td>20</td></tr>
<tr><td>1</td><td>16.50</td></tr>
<tr><td>2</td><td>13.00</td></tr>
<tr><td>3</td><td>9.50</td></tr>
<tr><td>4</td><td>6.00</td></tr>
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Function 2: Calculator Rental

The school bookstore rents graphing calculators for $5 per month. It also collects a non-refundable fee of $10.00 for the school year. Write the rule for the total cost (c) of renting a calculator as a function of the number of months (m).
Solution:

Function 1 is an example of a function whose graph has negative slope. Samantha starts with $20 and spends money each week. The amount of money left on the gift card decreases each week. The graph has a negative slope of -3.5, which is the amount the gift card balance decreases with Samantha’s weekly magazine purchase. Function 2 is an example of a function whose graph has positive slope. Students pay a yearly nonrefundable fee for renting the calculator and pay $5 for each month they rent the calculator. This function has a positive slope of 5 which is the amount of the monthly rental fee. An equation for Example 2 could be $c = 5m + 10$.

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<td>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. For example, the function $A = s^2$</td>
<td>8.MP.2. Reason abstractly and quantitatively.

8.MP.4. Model with mathematics.

8.MP.5. Use appropriate tools</td>
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Example:

Determine which of the functions listed below are linear and which are not linear and explain your reasoning.

$y = -2x^2 + 3$ non linear
$y = 2x$ linear

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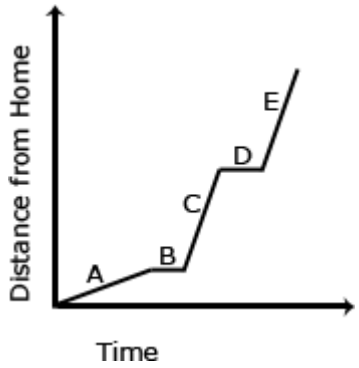
giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.	strategically. *8.MP.6.* Attend to precision. *8.MP.7.* Look for and make use of structure.	o $A = \pi r^2$ non linear o $y = 0.25 + 0.5(x - 2)$ linear

Functions (F)

Use functions to model relationships between quantities.

Standards *Students are expected to:*	*Mathematical Practices*	*Explanations and Examples*
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.MP.1.* Make sense of problems and persevere in solving them. *8.MP.2.* Reason abstractly and quantitatively. *8.MP.3.* Construct viable arguments and critique the reasoning of others. *8.MP.4.* Model with mathematics. *8.MP.5.* Use appropriate tools strategically. *8.MP.6.* Attend to precision. *8.MP.7*. Look for and make use of structure. *8.MP.8.* Look for and express regularity in repeated reasoning.	**Examples**: ● The table below shows the cost of renting a car. The company charges $45 a day for the car as well as charging a one-time $25 fee for the car's navigation system (GPS). Write an expression for the cost in dollars, c, as a function of the number of days, d. Students might write the equation $c = 45d + 25$ using the verbal description or by first making a table. Days (d) | Cost (c) in dollars 1 | 70 2 | 115 3 | 160 4 | 205 Students should recognize that the rate of change is 45 (the cost of renting the car) and that initial cost (the first day charge) also includes paying for the navigation system. Classroom discussion about one time fees vs. recurrent fees will help students model contextual situations. ● When scuba divers come back to the surface of the water, they need to be careful not to ascend too quickly. Divers should not come to the surface more quickly than a rate of 0.75 ft per second. If the divers start at a depth of 100 feet, the equation $d = 0.75t - 100$ shows the relationship between the time of the ascent in seconds (t) and the distance from the surface in feet (d). o Will they be at the surface in 5 minutes? How long will it take the divers to surface from their dive? o Make a table of values showing several times and the corresponding distance of the divers from the surface. Explain what your table shows. How do the values in the table relate to your equation?

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.MP.2.* Reason abstractly and quantitatively. *8.MP.3.* Construct viable arguments and critique the reasoning of others. *8.MP.4.* Model with mathematics. *8.MP.5*. Use appropriate tools strategically. *8.MP.6.* Attend to precision. *8.MP.7.* Look for and make use of structure.	**Example**: ● The graph below shows a student's trip to school. This student walks to his friend's house and, together, they ride a bus to school. The bus stops once before arriving at school. Describe how each part A-E of the graph relates to the story. 

Expressions and Equations (EE) **Analyze and solve linear equations and pairs of simultaneous linear equations.**		
Standards *Students are expected to:*	Mathematical Practices	Explanations and Examples
8.EE.C.7. Solve linear equations in one variable. a. 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). b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	8.MP.2. Reason abstractly and quantitatively. 8.MP.5. Use appropriate tools strategically. 8.MP.6. Attend to precision. 8.MP.7. Look for and make use of structure.	As students transform linear equations in one variable into simpler forms, they discover the equations can have one solution, infinitely many solutions, or no solutions. When the equation has one solution, the variable has one value that makes the equation true as in $12 - 4y = 16$. The only value for y that makes this equation true is -1. When the equation has infinitely many solutions, the equation is true for all real numbers as in $7x + 14 = 7(x+2)$. As this equation is simplified, the variable terms cancel leaving $14 = 14$ or $0 = 0$. Since the expressions are equivalent, the value for the two sides of the equation will be the same regardless which real number is used for the substitution. When an equation has no solutions it is also called an inconsistent equation. This is the case when the two expressions are not equivalent as in $5x - 2 = 5(x+1)$. When simplifying this equation, students will find that the solution appears to be two numbers that are not equal or -2 = 1. In this case, regardless which real number is used for the substitution, the equation is not true and therefore has no solution. **Examples**: ● Solve for x: o $-3(x+7) = 4$ o $3x - 8 = 4x - 8$ o $3(x+1) - 5 = 3x - 2$ ● Solve: o $7(m-3) = 7$

<table>
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<td></td>
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<td>o $\frac{1}{4}-\frac{2}{3}y=\frac{3}{4}-\frac{1}{3}y$</td>
</tr>
<tr>
<td>8.EE.C.8. Analyze and solve pairs of simultaneous linear equations.

a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.

b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6</td>
<td>8.MP.1. Make sense of problems and persevere in solving them.

8.MP.2. Reason abstractly and quantitatively.

8.MP.3. Construct viable arguments and critique the reasoning of others.

8.MP.4. Model with mathematics.

8.MP.5. Use appropriate tools strategically.

8.MP.6. Attend to precision.

8.MP.7. Look for and make use of structure.

8.MP.8. Look for and express regularity in repeated reasoning.</td>
<td>Systems of linear equations can also have one solution, infinitely many solutions or no solutions. Students will discover these cases as they graph systems of linear equations and solve them algebraically.

A system of linear equations whose graphs meet at one point (intersecting lines) has only one solution, the ordered pair representing the point of intersection. A system of linear equations whose graphs do not meet (parallel lines) has no solutions and the slopes of these lines are the same. A system of linear equations whose graphs are coincident (the same line) has infinitely many solutions, the set of ordered pairs representing all the points on the line.

By making connections between algebraic and graphical solutions and the context of the system of linear equations, students are able to make sense of their solutions. Students need opportunities to work with equations and context that include whole number and/or decimals/fractions.

Examples:
● Find x and y using elimination and then using substitution.
o $3x + 4y = 7$
o $-2x + 8y = 10$
● Plant A and Plant B are on different watering schedules. This affects their rate of growth. Compare the growth of the two plants to determine when their heights will be the same.
Let W = number of weeks
Let H = height of the plant after W weeks

<table>
<tr><th colspan="3">Plant A</th></tr>
<tr><td>W</td><td>H</td><td></td></tr>
<tr><td>0</td><td>4</td><td>(0,4)</td></tr>
<tr><td>1</td><td>6</td><td>(1,6)</td></tr>
<tr><td>2</td><td>8</td><td>(2,8)</td></tr>
<tr><td>3</td><td>10</td><td>(3,10)</td></tr>
</table>

<table>
<tr><th colspan="3">Plant B</th></tr>
<tr><td>W</td><td>H</td><td></td></tr>
<tr><td>0</td><td>2</td><td>(0,2)</td></tr>
<tr><td>1</td><td>6</td><td>(1,6)</td></tr>
<tr><td>2</td><td>10</td><td>(2,10)</td></tr>
<tr><td>3</td><td>14</td><td>(3,14)</td></tr>
</table>
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</table>

8.EE.C.8. Analyze and solve pairs of simultaneous linear equations.

c. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.

d. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.*

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8.MP.1. Make sense of problems and persevere in solving them.

8.MP.2. Reason abstractly and quantitatively.

8.MP.3. Construct viable arguments and critique the reasoning of others.

8.MP.4. Model with mathematics.

8.MP.5. Use appropriate tools strategically.

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By making connections between algebraic and graphical solutions and the context of the system of linear equations, students are able to make sense of their solutions. Students need opportunities to work with equations and context that include whole number and/or decimals/fractions.

Examples:

- Find x and y using elimination and then using substitution.
  - $3x + 4y = 7$
  - $-2x + 8y = 10$
- Plant A and Plant B are on different watering schedules. This affects their rate of growth. Compare the growth of the two plants to determine when their heights will be the same.

  Let *W* = number of weeks

  Let *H* = height of the plant after *W* weeks

Plant A		
W	H	
0	4	(0,4)
1	6	(1,6)
2	8	(2,8)
3	10	(3,10)

Plant B		
W	H	
0	2	(0,2)
1	6	(1,6)
2	10	(2,10)
3	14	(3,14)

III. Essential Questions……Corresponding Big Ideas

Essential Questions	Corresponding Big Ideas
What is a function? What kinds of relationships can proportions represent? How can patterns of change between variables be represented and analyzed? What does the slope or the rate of change of a line mean and how is it represented? What is an equal sign? How does it represent an expression (s)? Using two variables, how can you check to see if a linear model is a good fit with? How do the values of y change as the values of x increase? What do you know about a linear model from the correlation coefficient? How do we solve for linear equations? How can we indicate relationships other	Functions provide a tool for describing how variables change together. In a proportional relationship, the ratio of two quantities remain constant as the corresponding values of the quantities change One important way of describing functions is by identifying the rate at which the variables change together. It is useful to group functions into families with similar patterns of change because these functions, and the situations that they model, share certain general characteristics. Functions can be represented in multiple ways—in algebraic symbols, graphs, verbal descriptions, tables, and so on—and these representations, and the links among them, are useful in analyzing patterns of change. Linear functions are characterized by constant rate of change. Reasoning about similarity of "slope triangles "allows deducing that linear function have a constant rate of change and a formula of the type $f(x) = mx+b$ for constant m and b The equals sign can be used in defining or giving a name to an expression or function rule. The equals sign can indicate that two expressions are equivalent. It is often important to find the value(s) of a variable for which two expressions represent the same quantity. Finding the value(s) of a variable for which two expressions represent the same quantity is known as solving an equation. Functions can be represented in various ways, including through algebraic means, graphs, words and descriptions, and tables.

than equality? How can systems of linear equations and inequalities be used to solve problems? Can systems of equations model real-world situations?	Some representation of a function may be more useful than other, depending on context Links between algebraic and graphical representations of functions are especially important in studying relationship and change. Linear equations can be solved by symbolic, graphical and numerical method. A general algorithm exists for solving linear equations. This algorithm is broadly applicable and reasonable efficient. An inequality is another way to describe a relationship between expressions; instead of showing that the values of two expressions are equal, inequalities indicate that the value of one expression is greater than (or greater than or equal to) the value of the other expression. In solving an inequality, multiplying or dividing both expressions by a negative number reverses the sign that indicates the relationships between the two expressions. *Source:* *Cooney, T. J., Beckmann, S., & Lloyd, G.M. (2010). Developing essential understanding of functions grades 9-12. Reston, VA: The National Council of Teachers of Mathematics, Inc.* *Lloyd, G., Herbel-Eisenmann, B., & Star, J.R. (2011). Developing essential understanding of expressions, equations, and functions for teaching mathematics in grades 6-8. Reston, VA: The National Council of Teachers of Mathematics, Inc*

Student Learning Objectives

Student Learning Objective	Concepts/ Skills	Instructional Clarification ***PARCC Assessment Mathematics Test Specifications***	Mathematical Practices
Graph proportional relationships, interpreting slope as unit rate, and compare two proportional relationships, each represented in different ways. 8.EE.B.5	**Concept(s):** • Quantitative relationships can be represented in different ways. **Students are able to:** • Graph proportional relationships. • Interpret unit rate as the slope of a graph. • Compare two different proportional relationships that are represented indifferent ways (table of values, equation, graph, verbal description).	▪ Tasks may or may not contain context.	MP.2 MP.4 MP.5 MP.6 MP.7 MP.8
Derive the equation of a line (y = mx for a line through the origin and the equation y = mx +b for a line intercepting the vertical axis at b) and use similar triangles to explain why the slope (m) is the same between any two points on a non-vertical line in the coordinate plane.	**Concept(s):** No new concept(s) introduced **Students are able to:** • Show, using similar triangles, and explain why the slope, m, is the same between any two distinct points on a non-vertical line. • Derive, from two points, the	▪ Base reasoning on the principle that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane. ▪ Tasks require students to derive the equation y=mx for a line through the origin and the equation y=mx+b for a	MP.2 MP.4 MP.5 MP.6 MP.7 MP.8

8.EE.B.6	equation y = mx for a line through the origin. • Derive, from two points, the equation y = mx + b for a line intercepting the vertical axis at b.	line intersecting the vertical axis at b. ▪ Apply geometric reasoning in a coordinate setting, and/or use coordinates to draw geometric conclusions.	
Define a function as a rule that assigns one output to each input and determine if data represented as a graph or in a table is a function8. F.A.1.	**Concept(s):** • A function is a rule. • If a rule is a function, then for each input there is exactly one output. **Students are able to:** • Use function language. • Describe a function as providing a single output for each input. • Determine whether non-numerical relationships are functions. • Describe a function as a set of ordered pairs. • Read inputs and outputs from a graph. • Describe the ordered pairs as containing an input, and the corresponding output	▪ Tasks do not involve the coordinate plane or the "vertical line test." ▪ Some of functions in tasks are non-numerical	MP.2 MP.5

Compare two functions each represented in a different way (numerically, verbally, graphically, and algebraically) and draw conclusions about their properties (rate of change and intercepts).8. F.A.2	**Concept(s):** • Functions (quantitative relationships) can be represented in different ways. • Functions have properties; properties of linear functions. **Students are able to:** • Analyze functions represented algebraically, as a table of values, and as a graph. • Interpret functions represented by a verbal description. Given two functions, each represented in a different way, compare their properties	▪ Tasks have "thin context" or no context. ▪ Equations can be presented in forms other than y = mx + b, for example, 2x + 2y =7.	MP.5 MP.8
Classify functions as linear or non-linear by analyzing equations, graphs, and tables of values; interpret the equation *y* = *mx* + *b* as defining a linear function. 8. F.A.3	**Concept(s):** • A linear function is defined by the equation *y* = *mx* + *b.* • The graph of a linear function is a straight line. **Students are able to:** • Analyze tables of values, graphs, and equations in order to classify a function as linear or non-linear. • Determine if equations presented in forms other than y = mx + b (for example 3y – 2x = 7) define a linear function.	▪ Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. ▪ Tasks require students to justify whether a given function is linear or nonlinear. ▪ Tasks have "thin context" or no context. ▪ Tasks may require students to give examples of equations that are non-linear	MP.2 MP.3 MP.5

	• Give examples of equations that are non-linear functions. • Show that a function is not linear using pairs of points.	or pairs of points to show a function is non-linear. Students are not required to produce a formal proof.	
Model a linear relationship by constructing a function from two (x,y) values. Interpret the rate of change and initial value of the linear function in terms of the situation it models, and in terms of its graph or a table of values. 8.F.B.4.	**Concept(s):** • As with equations, two (x,y) values can be used to construct a function. **Students are able to:** • Determine the rate of change and initial value of a function from a description of a relationship. • Determine the rate of change and initial value of a function from two (*x*, *y*) values by reading from a table of values. • Determine the rate of change and initial value of a function from two (*x*, *y*) values by reading these from a graph. • Construct a function in order to model a linear relationship. • Interpret the rate of change and initial value of a linear function in contexts		MP.6 MP.2 MP.7

Sketch a graph of a function from a qualitative description and give a qualitative description of a graph of a function. 8. F.B.5	**Concept(s):** No new concept(s) introduced **Students are able to:** • Analyze a graph. • Provide qualitative descriptions of graphs (e.g. where increasing or decreasing, linear or non-linear).given a verbal description, sketch a graph of a function based on the qualitative features described	▪ Tasks may or may not have a context.	MP.1 MP.2 MP.4 MP.5
Apply the distributive property and collect like terms to solve linear equations in one variable that contain rational numbers as coefficients. Use an equivalent equation of the form x = a, a = a, or a = b (where a and b are different numbers) to describe the number of solutions8.EE.7	**Concept(s):** • Linear equations may have an infinite number of solutions. • Linear equations may have no solution or a single solution. **Students are able to:** • give examples of linear equations in one variable with one solution (x = a), infinitely many solutions (a = a), or no solutions (a = b.) • transform a given equation, using the properties of equality, into simpler forms. • transform a given equation until an equivalent equation of the form x = a, a = a, or a = b results (a and b are different numbers). • solve linear equations that	• Tasks do not have a context.	MP.6 MP.7

	have fractional coefficients; include equations requiring use of the distributive property and collecting like terms. .		
Solve systems of linear equations in two variables algebraically and by inspection. Estimate solutions by graphing, explain that points of intersection satisfy both equations simultaneously, and interpret solutions in context.8.EE.8	**Concept(s):** • Simultaneous linear equations may have an infinite number of solutions. • Simultaneous linear equations may have no solution or a single solution. • Solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs. **Students will be able to:** • solve systems of two linear equations in two variables algebraically. • estimate solutions of a linear system of two equations by graphing. • solve simple cases of a linear system of two equations by inspection.	Tasks do not have a context An equal number of tasks have: • a zero coefficient, e.g., as in the system $-s + (3/4)t = 2$, $t = 6$, or; • non-zero whole-number coefficients, and whole-number solutions, or; • non-zero whole-number coefficients, and at least one fraction among the solutions, or; • non-zero integer coefficients (with at least one coefficient negative), or; • non-zero rational coefficients (with at least one coefficient negative and at least one coefficient a non-integer).	MP.2 MP.1 MP.6 MP.7

	• solve real-world and mathematical problems leading to two linear equations in two variables.		

IV. Unit Vocabulary

Unit Vocabulary Terms	
coordinate plane x-coordinate y-coordinate ordered pair line parallel perpendicular slope rise run rate of change relation y-intercept x-intercept	domain (input) independent variable range(output) dependent function ordered pairs coordinate plane coordinate pair constant rate function

VI. Differentiations/ Modifications

Research Based Effective Teaching Strategies	Modifications (how do I differentiate instruction?)	Special Education	Strategies for English Language Learners
Task /Activities that solidifies mathematical concepts Use questioning techniques to facilitate learning Reinforcing Effort, Providing Recognition Practice, reinforce and connect to other ideas within mathematics Promotes linguistic and nonlinguistic representations Cooperative Learning Setting Objectives, Providing Feedback Varied opportunities for students to communicate mathematically Use technological and	**Modifications** Before or after school tutorial program Leveled rubrics Increased intervention Small groups Change in pace Calculators Extended time Alternative assessments Tiered activities/products Color coded notes Use of movements Use any form of technology **Extension** *See Connected Math Program Classroom Differentiating Gifted Students*	Change in pace Calculators Alternative assessments Accommodations as per IEP Modifications as per IEP Use graphic organizer to clarify mathematical functions for students with processing and organizing difficulties'. Constant review of math concepts to strengthen understanding of prior concepts for difficulties recalling facts. Use self-regulations strategies for student to monitor and assess their thinking and performance for difficultly attending to task Cooperative learning (small group, teaming, peer assisted tutoring) to foster communication and strengthen confidence. Use technology and/or hands on devices to: clarify abstract concepts and process for:	*Whiteboards* *Small Group / Triads* *Word Walls* *Partially Completed Solution* *Gestures* *Native Language Supports* *Pictures / Photos* *Partner Work* *Work Banks* *Teacher Modeling* *Math Journals* *See Connected Math Program Classroom Differentiating English Language Learners*

/or physical tools	*Many communities have constructed ramps so that buildings comply with the Americans with Disabilities Act. Have students research the specs for accessible ramps.* *Using more complex graphs, ask students to suggest what each graph might represent in real life and to tell a story that fits the graph. For example, for the piecewise functions included in Graph Pairs 5 and 6, students might explain why a person would be*	1. Difficulty interpreting pictures and diagram. 2.Difficulties with oral communications 3. Difficulty correctly identifying symbols of numeral 4.Difficulty maintaining attentions Simplify and reduces strategies / Goal structure to enhance motivation, foster independence and self-direction for: 1.Difficulty attending to task 2. Difficulty with following a sequence of steps to solution. 3.Difficulty processing and organizing Scaffolding math idea/concepts guided practice and questioning strategies' to clarify and enhance	

21st Century Learning Skills : Teamwork and Collaboration Initiative and Leadership Curiosity and Imagination Innovation and Creativity Critical thinking and Problem Solving Flexibility and Adaptability Effective Oral and Written Communication Accessing and Analyzing Information	*walking, stop, and then start walking again.* *Students could use computer-based motion detector activities and compare the result to their movements.*	understanding of math big ideas for: 1.Difficulty with process and organization 2.Difficulty with oral and written communication Teacher models strategies' and think out aloud strategies to specify step by step process for: 1. Difficulties processing and organization 2. Difficulty attending to tasks. Use bold numbers and/or words to draw students' attention to important information. *See Connected Math Program Classroom Differentiating Special Needs*	

VII. Instructional Resources

<table>
<tr><th colspan="3">Instructional Resources and Materials</th></tr>
<tr><th>Formative Assessment</th><th colspan="2">Print</th></tr>
<tr><td rowspan="3">Short constructed responses
Extended responses
Checks for Understanding
Exit tickets
Teacher observation
Projects
Timed Practice Test – Multiple Choice & Open-Ended Questions
<u>Performance Tasks:</u>

<u>8.F.B.4 Baseball Cards</u>

<u>Inside Mathematics Performance Task " Party " 8.F.5 , 8.EE.C.7a</u>

Additional performance tasks available for class use:

<u>8.F.A.1 Function Rules</u>

<u>8.F.A.3 Introduction to Linear Functions</u>
<u>8.F.B.4 Chicken and Steak, Variation 1</u>

<u>Project (Optional)</u><u>Teach 21 Problem Based Learning Project : Techno Youth and Auto Fleet</u></td><td colspan="2">Connected Math Program 3 Grade 8 Unit :Thinking with Mathematical Models
<u>Scope and Sequence for Thinking with Mathematical Models</u></td></tr>
<tr><td colspan="2">Technology</td></tr>
<tr><td>Resources for teachers
<u>Connected Math Project (Michigan State University)</u>
<u>My Pearson Training : Connected Math Program</u>
<u>Annenberg Learning : Insight into Algebra 1</u>
<u>National Council of Teachers of Mathematics</u>
<u>Mathematics Assessment Projects</u>
<u>Achieve the Core</u>
<u>Illustrative Mathematics</u>
<u>Mathematics Assessment Projects</u>
<u>Get the Math</u>
<u>Webmath.com</u>
<u>sosmath.com</u>
<u>Mathplanet.com</u>
<u>Interactive Mathematics.com</u>
<u>Inside Mathmatics.org</u>
<u>Asia Pacific Economic Cooperation : :Lesson Study Videos</u>
<u>Genderchip.org</u>
<u>Interactive Geometry</u></td><td>Resources for Students
<u>My Math Universe.com</u>
<u>Math is Fun website</u>
<u>Khan Academy</u>
<u>Figure This.org website</u>
<u>Virtual Nerd website</u>
<u>Math Snacks websites</u>

<u>Internet 4 Classroom website</u>
<u>A Maths Dictionary for kids</u></td></tr>
</table>

	Mathematical Association of America *learner.org* *Math Forum : Teacher Place*	