Plainfield Public Schools
Mathematics
Unit Planning Organizer

Grade	8th
Unit of Study	**Unit 2 : Functions**
Pacing	7 weeks ;2 weeks for re-teaching and enrichment
Dates	November 7 – January 20, 2017

Standards for Mathematical Practice
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.

Hyperlinks are noted underlined in italics.

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. SP.A.1Construct and interpret scatter plots for bivariate measurement data to investigate patterns of**

Hyperlinks are noted underlined in italics.

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. For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.

8.SP.A.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?

Hyperlinks are noted underlined in italics.

"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

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"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 = s² 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

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"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. SP.A.1Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association**		
Construct interpret	Bivariate measurement data	2 3

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"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
FOCUS STANDARD: **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.**		
know	Quantitative variables	1

"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
FOCUS STANDARD: **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. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.***		
use	Bivariate measurement data	2

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"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
FOCUS STANDARD: **8.SP.A.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?**		
Understand Construct Interpret	Bivariate categorical data	1 2 3

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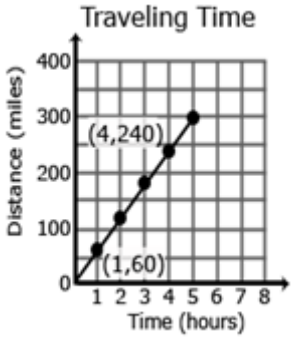
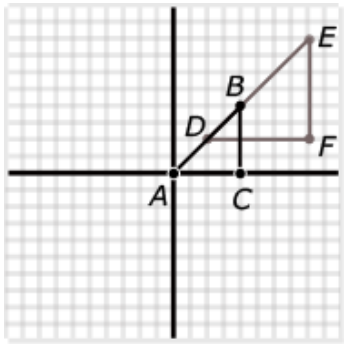
II NJSLS Standards & Practices

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: 

Hyperlinks are noted underlined in italics.

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. 

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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.A.2. Compare properties **(e.g., rate of change, intercept, domain and range)** of two	*8.MP.1.* Make sense of problems and persevere in solving them.	**Examples**: ● Compare the two linear functions listed below and determine which equation represents a greater rate of change.

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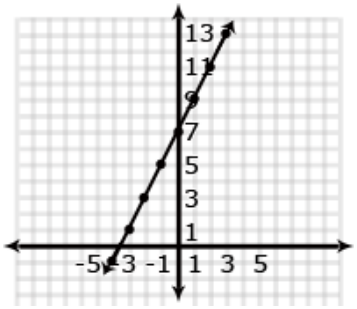
functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which*	*8.MP.2.* Reason abstractly 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

Function 1:



Function 2:
The function whose input x and output y are related by

$$y = 3x + 7$$

Hyperlinks are noted underlined in italics.

<table>
<tr>
<td>function has the greater rate of 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>
<td>

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>
</table>
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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</tr>
<tr>
<td>8.F.A.3. Interpret the equation $y = mx + b$ as defining a linear</td>
<td>8.MP.2. Reason abstractly and quantitatively.</td>
<td>Example:

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

</td>
</tr>
</table>

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.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.	your reasoning. o $y = -2x^2 + 3$ non linear o $y = 2x$ linear o $A = \pi r^2$ non linear o $y = 0.25 + 0.5(x - 2)$ linear

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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

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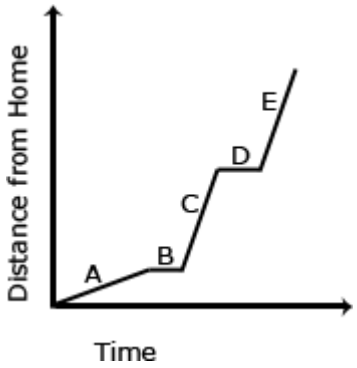
		relate to your equation?

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. 

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Statistics and Probability (SP)

Investigate patterns of association in bivariate data.

Standards *Students are expected to:*	*Mathematical Practices*	*Explanations and Examples*
8.SP.A.1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	*8.MP.2.* Reason abstractly and quantitatively. *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.	Students build on their previous knowledge of scatter plots examine relationships between variables. They analyze scatterplots to determine positive and negative associations, the degree of association, and type of association. Students examine outliers to determine if data points are valid or represent a recording or measurement error. Students can use tools such as those at the National Center for Educational Statistics to create a graph or generate data sets. (http://nces.ed.gov/nceskids/createagraph/default.aspx) **Examples**: ● Data for 10 students' Math and Science scores are provided in the table below. Describe the association between the Math and Science scores.

Student	1	2	3	4	5	6	7	8	9	10
Math	64	50	85	34	56	24	72	63	42	93
Science	68	70	83	33	60	27	74	63	40	96

● Data for 10 students' Math scores and the distance they live from school are provided in the table below. Describe the association between the Math scores and the distance students live from school.

Student	1	2	3	4	5	6	7	8	9	10
Math score	64	50	85	34	56	24	72	63	42	93
Dist from school (miles)	0.5	1.8	1	2.3	3.4	0.2	2.5	1.6	0.8	2.5

● Data from a local fast food restaurant showing the number of staff members and the average time for filling an order are provided in the table below. Describe the association between the number of staff and the average time for filling an order.

Number of staff	3	4	5	6	7	8
Average time to fill order (seconds)	180	138	120	108	96	84

● The table below lists the life expectancy in years for people in the United States every five years from 1970 to 2005. What would you expect the life expectancy of a person in the United States to be in 2010, 2015, and 2020 based upon this data? Explain how you

Hyperlinks are noted underlined in italics.

<table>
<tr>
<td></td>
<td></td>
<td>determined your values.
<table>
<tr><td>Date</td><td>1970</td><td>1975</td><td>1980</td><td>1985</td><td>1990</td><td>1995</td><td>2000</td><td>2005</td></tr>
<tr><td>Life Expectancy (in years)</td><td>70.8</td><td>72.6</td><td>73.7</td><td>74.7</td><td>75.4</td><td>75.8</td><td>76.8</td><td>77.4</td></tr>
</table>
</td>
</tr>
<tr>
<td>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.</td>
<td>8.MP.2. Reason abstractly and quantitatively.

8.MP.4. Model with mathematics.

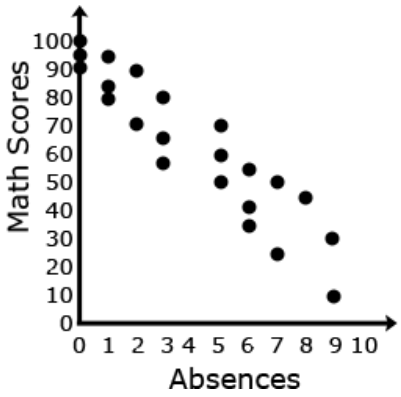
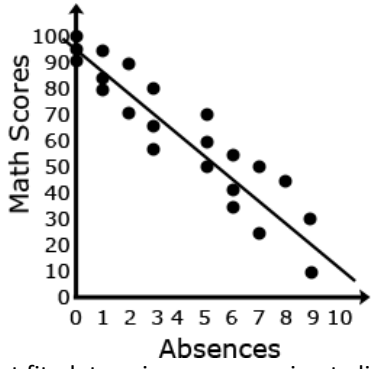
8.MP.5. Use appropriate tools strategically.

8.MP.6. Attend to precision.

8.MP.7. Look for and make use of structure.</td>
<td>Examples:

● The capacity of the fuel tank in a car is 13.5 gallons. The table below shows the number of miles traveled and how many gallons of gas have been used. Describe the relationship between the variables. If the data is linear, determine a line of best fit. Do you think the line represents a good fit for the data set? Why or why not? What is the average fuel efficiency of the car in miles per gallon?
<table>
<tr><td>Miles Traveled</td><td>0</td><td>75</td><td>120</td><td>160</td><td>250</td><td>300</td></tr>
<tr><td>Gallons Used</td><td>0</td><td>2.3</td><td>4.5</td><td>5.7</td><td>9.7</td><td>10.7</td></tr>
</table>
</td>
</tr>
</table>

Hyperlinks are noted underlined in italics.

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. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height*.	*8.MP.2.* Reason abstractly and quantitatively. *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.	**Examples**: ● Given data from students' math scores and absences, make a scatterplot. | Absences	Math Scores
---	---
3	65
5	50
1	95
1	85
3	80
6	34
5	70
3	56
0	100
7	24
8	45
2	71
9	30
0	95
6	55
6	42
2	90
0	92
5	60
7	50
9	10
1	80	  *Continued on next page* o Draw a line of best fit, paying attention to the closeness of the data points on either side of the line.  o From the line of best fit, determine an approximate linear equation that models the

		given data (about y = $-\frac{25}{3}x+95$) o Students should recognize that 95 represents the y intercept and $-\frac{25}{3}$ represents the slope of the line. o Students can use this linear model to solve problems. For example, through substitution, they can use the equation to determine that a student with 4 absences should expect to receive a math score of about 62. They can then compare this value to their line.

Hyperlinks are noted underlined in italics.

<table>
<tr>
<td>8.SP.A.4. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?</td>
<td>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.</td>
<td>Example:
● The table illustrates the results when 100 students were asked the survey questions: “Do you have a curfew?” and “Do you have assigned chores?” Is there evidence that those who have a curfew also tend to have chores?

<table>
<tr><td></td><td></td><td>Curfew</td><td></td></tr>
<tr><td></td><td></td><td>Yes</td><td>No</td></tr>
<tr><td>Chores</td><td>Yes</td><td>40</td><td>10</td></tr>
<tr><td></td><td>No</td><td>10</td><td>40</td></tr>
</table>

Solution: Of the students who answered that they had a curfew, 40 had chores and 10 did not. Of the students who answered they did not have a curfew, 10 had chores and 40 did not. From this sample, there appears to be a positive correlation between having a curfew and having chores.</td>
</tr>
</table>

Hyperlinks are noted underlined in italics.

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)	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

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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? What are categorical variables and what do they measure?	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. 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. Data about two variables from real-world observations or experiments can be collected and represented in graphs and tables. These representations are useful for analyzing relationships among data, including the variability in the data. Data may show a pattern or association between the variables. Sometimes you can fit a line to data, find the equation of the line, and measure how well the line fits the data pattern. This is useful for making predictions about data points not observed. Categorical data must be analyzed in different ways than numerical data including using 2-way tables to analyze relative frequencies 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

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Student Learning Objective

Student Learning Objective	Concepts/ Skills	Instructional Clarification *PARCC Assessment Mathematics Test Specifications*	Mathematical Practices
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.	▪ Tasks do not involve the coordinate plane or the "vertical line test." ▪ Some of functions in tasks are non-numerical	MP.2 MP.5.

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	• Describe the ordered pairs as containing an input, and the corresponding output		
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).	**Concept(s):** • Functions (quantitative relationships) can be represented in different ways. • Functions have properties; properties of linear functions. **Students are able to:**	▪ 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

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	• 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		
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	▪ 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 or pairs of points to show a function is non-linear. Students are not required to produce a formal	MP.2. MP.3 MP.5

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	other than y = mx + b (for example 3y – 2x = 7) define a linear function. • Give examples of equations that are non-linear functions. • Show that a function is not linear using pairs of points.	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		MP.6 MP.2 MP.7.

Hyperlinks are noted underlined in italics.

	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		
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	▪ Tasks may or may not have a context.	MP.1 MP.2. MP.4 MP.5

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	described		
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	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.	▪ 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 line intersecting the vertical axis at b.	MP.2 MP.4. MP.5 MP.6 MP.7. MP.8

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between any two points on a non-vertical line in the coordinate plane. 8.EE.B.6	• Derive, from two points, the 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.*	▪ Apply geometric reasoning in a coordinate setting, and/or use coordinates to draw geometric conclusions.	

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IV. Unit Vocabulary

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

Hyperlinks are noted underlined in italics.

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	**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*	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.	*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*

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mathematically Use technological and /or physical tools	*Students* *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,*	Use technology and/or hands on devices to: clarify abstract concepts and process for: 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	

Hyperlinks are noted underlined in italics.

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	*students might explain why a person would be walking, stop, and then start walking again.* *Students could use computer-based motion detector activities and compare the result to their movements.*	Scaffolding math idea/concepts guided practice and questioning strategies' to clarify and enhance 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*	

Hyperlinks are noted underlined in italics.

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="2">Short constructed responses
Extended responses
Checks for Understanding
Exit tickets
Teacher observation
Projects
Timed Practice Test – Multiple Choice & Open-Ended Questions

Performance Tasks:
8.F.A.2 Battery Charging

Additional Mathematical Performance Tasks for Classroom Use

8.F.A.1 Function Rules
8.F.A.3 Introduction to Linear Functions
8.F.B.4 Chicken and Steak, Variation 1
8.F.B.4 Baseball Cards
8.SP.A.1 Texting and Grades 1</td><td colspan="2">Connected Math Program 3 Grade 8 Unit :Thinking with Mathematical Models
Scope and Sequence for Thinking with Mathematical Models</td></tr>
<tr><td colspan="2">Technology</td></tr>
<tr><td>Resources for teachers
Connected Math Project (Michigan State University)
My Pearson Training : Connected Math Program
Annenberg Learning : Insight into Algebra 1
National Council of Teachers of Mathematics
Mathematics Assessment Projects
Achieve the Core
Illustrative Mathematics
Mathematics Assessment Projects
Get the Math
Webmath.com
sosmath.com
Mathplanet.com
Interactive Mathematics.com
Inside Mathmatics.org
Asia Pacific Economic Cooperation : :Lesson Study Videos
Genderchip.org</td><td>Resources for Students
My Math Universe.com
Math is Fun website
Khan Academy
Figure This.org website
Virtual Nerd website
Math Snacks websites

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

Hyperlinks are noted underlined in italics.

8.SP.A.2 Animal Brains *8.SP.A.3 US Airports* *8.SP.A.4 What's Your Favorite Subject* *8.SP.A.4 Music and Sports* *8.F.B.4 Delivering the Mail* **Summative Assessment**: Unit 2 Assessment for Grade 8	*Interactive Geometry* *Mathematical Association of America* *learner.org* *Math Forum : Teacher Place* *Shmoop /common core math*	

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