Grade 8 Mathematics Curriculum Guide

Grade Level/Course Title: Grade 8	**Quarter 1**	**Academic Year:** 2018-2019

Grade Level Mathematics Focus:
In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

Essential Questions for this Unit:
1. How can students strategically choose and efficiently implement procedures to solve linear equations in one variable, understanding that when they use the properties of equality and the concept of logical equivalence, they maintain the solutions of the original equation?

Unit (Time)	Standard	Standard Description	Content	Resources (Suggested Number of Days)
Aug - Sept **Expressions and Equations** **(25 days)**	8.EE.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).	Understanding: • Syntax • Equivalence • Bar Models • Algebra Tiles • Decomposition • Zero Pairs • Variables	**Analyze and Solve Linear Equations in one variable.** *Review: Adding Integers w/Decomposition, Subtracting Integers, Multiplying Integers, Dividing Integers (5 days)* *Review: Distributive Property & Combining Like Terms (2 days)* *Review: Solving One-Step Equations using: Inverse Operations, Decomposition, and Algebra Tiles; Addition/Subtraction; Multiplication/Division* *Include equations with fractional coefficients such as ⅙x = 10. (3 days)* *Review and Assessment (2 days)* Lesson 1.1: Solve Simple Equations (2 days) Solve Equations – Multiple Methods [L] Lesson 1.2 Solve Multi-step Equations (2 day) Lesson 1.3: Variables on Each Side (4 days) Solving Equations with Variables on Both Sides [L] Solving Equations with One, No, and Infinitely Many Solutions [L] Clearing Fractions and Decimals from Equations Lesson 1.4: Rewriting Equations for Formulas (3 days) Review and Assessment (2 days)
	8.EE.7b	Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. ****Please Note: This book does not teach the correct syntax for equations. Please refer to the following resource and require students to use the correct syntax:** Syntax - Expressions, Equations, and Inequalities		

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Essential Questions for this Unit:

1. How can students use ideas about distance and angles, how they behave under translations, rotations, reflections, and dilations, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems?

Unit (Time)	Standard	Standard Description	Content	Resources (Suggested Number of Days)
Oct **Geometry** **Part I** **(15 days)**	8.G.1 8.G.1a 8.G.1b 8.G.1c	Verify experimentally the properties of rotations, reflections, and translations: Lines are taken to lines, and line segments to line segments of the same length. Angles are taken to angles of the same measure. Parallel lines are taken to parallel lines.	Understanding: • Transformation • Congruence • Similarity • Slope and Similar Triangles • Area • Translations • Rotations • Reflections • Line of Reflection • Dilation	**<u>Congruence and Similarity Using Physical Models</u>** *<u>Review</u>: Coordinate Grid, Origin, X/Y Axes, Ordered Pairs, Plotting Points 1st-4th Quadrants (2 days)* Lesson 2.1: Congruent Figures (1 day) Lesson 2.2: Translations (1 day) Lesson 2.3: Reflections (2 days) Lesson 2.4: Rotations (1 day) Review and Assessment: 2.1-2.4 (2 days) Lesson 2.5: Similar Figures (1 day) Lesson 2.6 :Perimeters and Areas of Similar Figures (1 day) Lesson 2.7: Dilations (2 days) Review and Assessment (2 days) **Quarterly Assessment #1**
	8.G.2	Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.		
	8.G.3	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.		
	8.G.4	Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.		

Grade 8 Mathematics Curriculum Guide

Grade Level/Course Title: Grade 8	**Quarter** 2	**Academic Year:** 2018-2019

Grade Level Mathematics Focus:
In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

Essential Questions for this Unit:

1. How can students show that the sum of the angles in a triangle is the angle formed by a straight line, and that various configurations of lines give rise to similar triangles because of the angles created when a transversal cuts parallel lines?
2. How can students understand the statement of the Pythagorean Theorem and its converse, and explain why the Pythagorean Theorem holds, for example, by decomposing a square in two different ways?
3. How can students apply the Pythagorean Theorem to find distances between points on the coordinate plane, find lengths, and analyze polygons?

Unit (Time)	Standard	Standard Description	Content	Resources (Suggested Number of Days)
(Oct - Nov) **Geometry** **Part II** **(9 days)**	8.G.5	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so*.	Understanding: • Congruence • Triangles • Distance on a Coordinate Plane • Polygons • Parallel Lines • Angles	**Angles and Triangles** *Review: Adjacent and Vertical Angles; Complementary and Supplementary Angles (3 days)* Lesson 3.1: Parallel Lines and Transversals (1 day) Lesson 3.2: Angels of Triangles (2 days) Performance Task: Street Intersections [IMT] *Lesson 3.3: Angles of Polygons* ***(Optional)*** Lesson 3.4 Using Similar Triangles (1 day) Review and Assessment (2 days)

Grade Level/Course Title: Grade 8	**Quarter** 2	**Academic Year:** 2018-2019

Grade Level Mathematics Focus:
In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

Essential Questions for this Unit:

1. How can students develop understanding of and use linear equations, systems of linear equations, linear functions, and the slope of a line to analyze situations and solve problems?
2. How can students demonstrate their understanding that slope is the graphic representation of a rate of change, and specifically equations for proportions ($y/x = m$ or $y = mx + b$) are special linear equations where the constant of proportionality is the slope, and the line is graphed through the origin?
3. How can students solve systems of two linear equations in two variables and relate the systems to pairs of lines in the plane; these intersect, are parallel, or are the same line?

Unit (Time)	Standard	Standard Description	Content	Resources (Suggested Number of Days)
(Nov - Dec) **Linear Equations in One and Two Variables** **(16 days)**	8.EE.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.	Understanding: • Coordinate Plane • Ordered Pairs • Slope • Rate of Change	**Proportional Relationships, Lines, & Linear Equations** Lesson 4.1: Graphing Linear Equations (2 days) Lesson 4.2: Slope of a Line (2 days) Slope and Similar Triangles (1 day) *Review: Proportional Relationships (1 day)* Lesson 4.3: Graphing Proportional Relationships (2 day) Lesson 4.4: Graphing Linear Equations in Slope-Intercept Form (2 days) Lesson 4.5: Graphing Linear Equations in Standard Form (2 days) Performance Task: Video Streaming [IMT] Lesson 4.6: Writing Equations in Slope-Intercept Form (2 days) *Lesson 4.7: Writing Equations in Point-Slope Form* ***(Optional)*** Review and Assessment (2 days)
	8.EE.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.		

Grade Level/Course Title: Grade 8	**Quarter** 2/3	**Academic Year:** 2018-2019

Grade Level Mathematics Focus:
In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

Essential Questions for this Unit:

4. How can students develop understanding of and use linear equations, systems of linear equations, linear functions, and the slope of a line to analyze situations and solve problems?
5. How can students demonstrate their understanding that slope is the graphic representation of a rate of change, and specifically equations for proportions ($y/x = m$ or $y = mx + b$) are special linear equations where the constant of proportionality is the slope, and the line is graphed through the origin?
6. How can students solve systems of two linear equations in two variables and relate the systems to pairs of lines in the plane; these intersect, are parallel, or are the same line?

Unit (Time)	Standard	Standard Description	Content	Resources (Suggested Number of Days)
(Jan 2019) **Linear Equations in One and Two Variables** **(8 days)**	8.EE.8a	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.	Understanding: • Coordinate Plane • Ordered Pairs • Slope • Rate of Change	**Analyze and Solve pairs of simultaneous linear equations.** Lesson 5.1: Solving Systems of Linear Equations by Graphing (2 days) Solving Systems of Equations [CP] L*esson 5.2: Solving Systems of Linear Equations by Substitution (Optional)* Lesson 5.3: Solving Systems of Linear Equations by Elimination (2 days) Lesson 5.4: Solving Special Systems of Linear Equations (One, None, and Infinitely Many Solutions) (2 days) Solving Linear Equations with One None and Infinite Solutions [L] Review and Assessment (2 days) **Quarterly Assessment #2**
	8.EE.8b	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*.		
	8.EE.8c	Solve real-world and mathematical problems leading to two linear equations in two variables.		

Grade Level/Course Title: Grade 8	**Quarter** 3	**Academic Year:** 2018-2019

Grade Level Mathematics Focus:
In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

Essential Questions for this Unit:

1. How can students grasp the concept of a function as a rule that assigns to each input exactly one output?
2. How can students understand that functions describe situations where one quantity determines another?
3. How can students understand and learn to translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and describe how aspects of the function are reflected in the different representations?

Unit (Time)	Standard	Standard Description	Content	Resources (Suggested Number of Days)
(Jan-Feb) **Functions** **Linear and Non-Linear** **(6 days)**	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.	Understanding: • Multiple Representations • Tables • Graphs • Constraints • Input • Output • Change • Function Notation	**Define, Evaluate, and Compare Functions** Lesson 6.1: Relations and Functions (2 days) Lesson 6.2: Representations of Functions (2 days) Lesson 6.3: Linear Functions (2 days) Performance Task: Foxes and Rabbits [IMT]
	8.F.2	Compare properties 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.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.		

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Grade Level Mathematics Focus:
In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

Essential Questions for this Unit:
1. How can students grasp the concept of a function as a rule that assigns to each input exactly one output?
2. How can students understand that functions describe situations where one quantity determines another?
3. How can students understand and learn to translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and describe how aspects of the function are reflected in the different representations?

Unit (Time)	Standard	Standard Description	Content	Resources (Suggested Number of Days)
(Feb) **Functions** **Linear and Non-Linear Continued** **(6 days)**	8.F.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*.	Understanding: • Multiple Representa-tions • Tables • Graphs • Constraints • Input • Output • Change • Function Notation	**Use Functions to Model Relationships Between Quantities.** Lesson 6.4: Comparing Linear and Nonlinear Functions (2 days) Lesson 6.5: Analyzing and Sketching Graphs (2 days) Review and Assessment (2 days) Resources: Equations - Multiple Representations, What We Know Family of Functions [CP] Interpreting Graphs - Real Life Functions [L] Performance Task: Distance [IMT]
	8.F.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.		

Grade Level/Course Title: Grade 8	**Quarter 3**	**Academic Year:** 2018-2019

Grade Level Mathematics Focus:
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Essential Questions for this Unit:
1. What are the types of numbers in the real number system and where are they located on a number line?
2. What is the mathematical definition of an irrational number and how can you approximate them by using rational numbers?

Unit (Time)	Standard	Standard Description	Content	Resources (Suggested Number of Days)
(Feb-March) **Real Numbers, Exponents, and Roots** **(21 days)**	8.EE.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.	Understanding: • Syntax • Equivalency • Number Line • Exponent Properties • Powers of Ten • Estimation	**Radicals and Integer Exponents** *Review: Simplifying Powers of Monomials w/Decomposition, Dividing Monomials using Decomposition (2 days)* Lesson 10.1:Exponents (1 day) Lesson 10.2 Product of Powers Property (2 days) Lesson 10.3 Quotient of Powers Property (2 days) Quotient of Powers [L] *Review: Using patterns and dividing monomials to explain zero and negative exponents (1 day)* Lesson 10.4 Zero and Negative Exponents (2 days) Review and Assessment (2 days) Lesson 10.5 Reading Scientific Notation (2 day) Lesson 10.6 Writing Scientific Notation (2 day) Lesson 10.7 Operations in Scientific Notation (3 days) Scientific Notation - Performing Operations Using Multiple Methods [L] **Quarterly Assessment #3** Review and Assessment (2 days)
	8.EE.3	Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3 times 10^8 and the population of the world as 7 times 10^9, and determine that the world population is more than 20 times larger*.		
	8.EE.4	Perform operations with numbers expressed in scientific notation, including problems where both decimals and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g. use millimeters per year for seafloor spreading). ~~Interpret scientific notation that has been generated by technology~~.		

Grade Level/Course Title: Grade 8	**Quarter 4**	**Academic Year:** 2018-2019

Grade Level Mathematics Focus:
In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

Essential Questions for this Unit:
1. What are the types of numbers in the real number system and where are they located on a number line?
2. What is the mathematical definition of an irrational number and how can you approximate them by using rational numbers?

Unit (Time)	Standard	Standard Description	Content	Resources (Suggested Number of Days)
April **Real Numbers, Exponents, and Roots (continued)** **(9 days)**	8.EE.2	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.	Understanding: • Syntax • Equivalency • Number Line • Exponent Properties • Powers of Ten • Estimation • Inequality	**Radicals and Integer Exponents** *Review: Finding Simple Square Roots, Finding Square Roots and Cubed Roots Using Decomposition (1 day)* Lesson 7.1: Finding Square Roots (2 days) Square & Square Roots [L] Lesson 7.2: Finding Cube Roots (2 days) Lesson 7.4: Approximating Square Roots (2 days) Compare Real Numbers Real Number Line Development & Venn Diagram [CP] Performance Task: Placing a Square Root on a Number Line [IMT] 7.1 - 7.4 Review and Assessment (2 days)
	8.NS.2	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). *For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations*.		

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Grade Level/Course Title: Grade 8	**Quarter** 3	**Academic Year:** 2018-2019

Grade Level Mathematics Focus:
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Essential Questions for this Unit:

4. How can students show that the sum of the angles in a triangle is the angle formed by a straight line, and that various configurations of lines give rise to similar triangles because of the angles created when a transversal cuts parallel lines?
5. How can students understand the statement of the Pythagorean Theorem and its converse, and explain why the Pythagorean Theorem holds, for example, by decomposing a square in two different ways?
6. How can students apply the Pythagorean Theorem to find distances between points on the coordinate plane, find lengths, and analyze polygons?

Unit (Time)	Standard	Standard Description	Content	Resources (Suggested Number of Days)
(April) **Geometry** **Part III** **(6 days)**	8.G.6	Explain a proof of the Pythagorean Theorem and its converse.	Understanding: • Congruence • Pythagorean Theorem • Pythagorean Triples • Triangles • Distance on a Coordinate Plane • Polygons • Parallel Lines • Angles	**Understand and Apply the Pythagorean Theorem** Lesson 7.3: The Pythagorean Theorem (2 days) Lesson 7.5: Using the Pythagorean Theorem (2 days) Resources: Pythagorean Theorem Activity [L] Pythagorean Theorem and Its Converse [L] Pythagorean Theorem Worksheet [GMR] Performance Task: Running on a Football Field [IMT] Performance Task: A Rectangle in the Coordinate Plane [IMT] Review and Assessment (2 days)
	8.G.7	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.		
	8.G.8	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.		

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Grade Level/Course Title: Grade 8	**Quarter** 4	**Academic Year:** 2018-2019

Grade Level Mathematics Focus:
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Essential Questions for this Unit:
1. How can students complete their understanding and work on volume by solving problems involving cones, cylinders, and spheres?

Unit (Time)	Standard	Standard Description	Content	Resources (Suggested Number of Days)
(May) **Geometry** **Part III** **(8 days)**	8.G.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems	Understanding: • Similarity • Slope and Similar Triangles • Area of a Circle	**Volume of Cylinders, Cones, and Spheres.** *Review: Circumference and Area of a Circle (2 days)* Circle Vocabulary [CP] Area of a Circle [CP] Lesson 8.1: Volume of Cylinders (2 days) • Volume of Prisms, Cylinders, and Cones [CP] Lesson 8.2: Volume of Cones (2 days) Lesson 8.3: Volume of Spheres (1 day) Performance Task: Flower Vases [IMT] Lesson 8.4: Surface Areas and Volumes of Similar Solids (2 days) Review and Assessment (2 days)

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Grade Level/Course Title: Grade 8	**Quarter 4**	**Academic Year:** 2018-2019

Grade Level Mathematics Focus:
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Essential Questions for this Unit:

1. How can students develop understanding of and use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom)? At this grade, fitting the model, and assessing its fit to the data are done informally. Interpreting the model in the context of the data requires students to express a relationship between the two quantities in question and to interpret components of the relationship (such as slope and *y*-intercept) in terms of the situation.

Unit (Time)	Standard	Standard Description	Content	Resources (Suggested # of Days)
Unit 8: (May-Jun) **Probability and Statistics** **Bivariate Data, Descriptive Statistics** **(8 days)**	8.SP.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.	Understanding: • Tables • Measures of Center • Interquartile Range • Mean Absolute Deviation • Equivalence • Number Line • Bar Graphs • Box-n-Whisker • Clusters	**Patterns of Association in Bivariate Data** Lesson 9.1: Scatter Plots (2 days) Interpreting Data in Graphs [L] Lesson 9-2: Lines of Fit (1 day) Performance Task: Animal Brains [IMT] Lesson 9-3: Two-Way Tables (2 days) Performance Task: Music and Sports [IMT] Lesson 9.4: Choosing a Data Display (1day) Review and Assessment (2 days) **Quarterly Assessment #4**
	8.SP.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 by judging the closeness of the data points to the line.		
	8.SP.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.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?*		