The Number System

Standard	Basic: Conceptual "Understand"	Standard: Procedural "Doing"	Expanded: Application
8.NS.A.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.	Classify the real numbers. $-\sqrt{49}$ 16π	Convert $.\overline{45}$ into a fraction. Convert -2.$\overline{7}$ into a mixed number.	If you were the teacher, how would you explain the difference between a rational and irrational number? Describe the method of converting a repeating decimal into a fraction. And now why is this a rational number?

Grade 8 Math Question Stem Bank: Common Core State Standards

Standards for Mathematical Practice

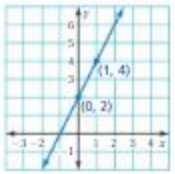
8.NS.A.2 Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π2).	Estimate the square root to the nearest tenth and nearest integer. $-\sqrt{24}$ $\sqrt{8}$	Which is greater? $\sqrt{5}$ *or* $2\frac{2}{3}$ Then graph to two numbers on a number line to prove your answer.	The distance you can see with a periscope is $1.17\sqrt{h}$, where *h* is the height of a periscope above the water. Can you see twice as far with a periscope that is 6 feet above the water than with a periscope that is 3 feet above the water? Explain.

Expressions & Equations

Standard	Basic: Conceptual "Understand"	Standard: Procedural "Doing"	Expanded: Application
8.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions.	Write the product using exponents. ⅓ x ⅓ x ⅓ Simplify the expression. $\frac{2^{15}}{2^3 \cdot 2^5}$	Find the value of x that makes this expression true. $\frac{8^{3x}}{8^{2x+1}} = 8^9$ Describe and correct the error in evaluating the expression. $(4)^{-3} = (-4)(-4)(-4)$ = -64	Consider the equation: $\frac{9^m}{9^n} = 9^2$ Describe the number of solutions that satisfy the equation. Explain your reasoning. How can you write the number 1 as 2 to a power? Why is the expression $\frac{1}{0}$ considered undefined? Write two different powers with negative exponents that have the same value.
8.EE.A.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	Find the square root(s). $\pm\sqrt{196}$ $-\sqrt{2.25}$ $\sqrt{\frac{1}{961}}$ Find the cube root. $\sqrt[3]{-27}$ $\sqrt[3]{\frac{1}{64}}$	Find the dimensions of a square if its area is 441 square centimeters. Can the square of an integer be a negative number? Explain why or why not. The area of a triangular sail is 40.5 square feet. The base and height of the sail are equal. What is the height of the sail (in feet)? Evaluate the expression: $(\sqrt[3]{-64})^3 + 43$	Is the product of two perfect squares always a perfect square? Explain your reasoning by showing examples and writing. How is the cube root of a number different than the square root of a number?

that √2 is irrational.			
8.EE.A.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.	Write 3.22×10^{-4} in standard form. Order the numbers from least to greatest 1.2×10^{8}, 1.19×10^{8}, 1.12×10^{8}	Is 12×10^{4} written in scientific notation? Explain. A googol is 1.0×10^{100} How many zeros are in a googol?	Describe how the value of a number written in scientific notation changes when you increase the exponent by 1.
8.EE.A.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate	Find each sum or difference. Write your answers in both standard form and scientific notation. $(8.2 \times 10^{2}) + (3.41 \times 10^{-1})$ $(7.8 \times 10^{-5}) - (4.5 \times 10^{-5})$	A grain of rice weighs about 3^{3} milligrams. About how many grains of rice are in one scoop if a scoop weighs about 3^{9} milligrams. From 1978 to 2008, the amount of lead allowed in the air in the United States was 1.5×10^{-6} gram per cubic meter. In 2008, the amount allowed was reduced by 90%. What is the new amount of lead allowed in the air?	Write a rule you can use to add numbers written in scientific notation where the powers of 10 are the same. Then test your rule on….

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.			
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.	Graph the linear equation. $y = -\frac{1}{2}x + 2$ $y = -3$ $x = 7$	You have $100 in your savings account and plan to deposit $12.50 each month. How many months will it take you to save enough money to buy…. The distance *y* (in meters) that a four-person ski lift travels in *x* seconds is represented by $y = 2.5x$. The graph shows the distance that a two-person ski lift travels. Which ski lift is faster? 	A tropical storm becomes a hurricane when wind speeds are at least 74 mph. The current wind speed *y* (in miles per hour) of a tropical storm is $y = 2x + 66$, where *x* is the number of hours after the storm enters the Gulf of Mexico. Graph the equation and then determine when the storm becomes a hurricane. Give a real life example of two quantities that are in a proportional relationship. Write this equation and then sketch its graph.
8.EE.B.6 Use similar triangles to explain why the slope m is the same	Find the slope of the line that goes through the ordered pairs (-2,6) and (2,4). What is the slope and y-intercept of the	The number *y* of hours of cello lessons that you take after *x* weeks is represented by $y = 3x$. Graph the equation and interpret its slope. A skydiver parachutes to the ground. The height *y* in	Determine if the lines $y = -1$ and $x = 1$ are parallel or perpendicular or neither. Explain your reasoning. Does the graph of every linear equation have an x-intercept? Explain your

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*.	equation $\frac{1}{2}x + y = -5$	feet of the skydiver after *x* seconds is $y = -10x + 3000$. Graph the equation and interpret both the x- and y-intercepts. Compare the slope of the line of the following graph using 2 different sets of ordered pairs. 	reasoning and include an example.
8.EE.C.7 Solve linear equations in one variable.	Solve for the unknown variable. $8x - 6x - 25 = -35$ $5 + 1.5(2d - 1) = 0.5$	You scored 88, 92 and 87 on three tests. Write and solve an equation to find the score you need on the fourth test so that your mean test score is 90. Describe and correct the error in solving the following equation. $-2(7 - y) + 4 = -4$ $-14 - 2y + 4 = -4$ $-10 - 2y = -4$ $-2y = 6$ $y = -3$	Write and solve an equation having only ONE solution. (or infinitely many solutions or no real solutions.) Give an example for when it would be useful to rewrite a formula in terms of another variable. (Solving Literal Equations)
8.EE.C.8 Analyze and solve pairs of simultaneous linear equations.	Solve the system of equations using all 3 methods: graphing, substitution and elimination. $y = 2x + 5$ *and* $y = -4x - 1$	A kicker on a football team scores 1 point for making an extra point and 3 points for making a field goal. The kicker makes a total of 8 extra points and field goals in a game and scores 12 points. Write and solve a system of linear equations to find the number *x* of extra points and the number *y* of field goals. The cost C (in dollars) for the care and maintenance of a horse and carriage is $C = 15x + 2000$, where *x* is the number of rides and it costs $35 per ride. Write an equation for the revenue in terms of the number of rides.	Is it possible for a system of two linear equations to have exactly two solutions? Explain your reasoning and give examples.

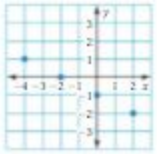
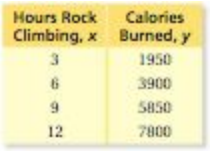
		How many rides are needed to break even?	

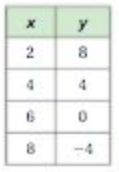
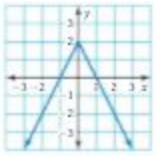
Functions

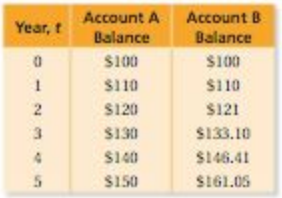
Standard	Basic: Conceptual "Understand"	Standard: Procedural "Doing"	Expanded: Application
8.F.A.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the correspondi ng output.	What is the range of the function $y = 6x + 2$ if the domain is -1, 0, 1 and 2? How can you use a vertical line test to determine if a graph is a function?	The function $y = -4x + 14$ gives the number of *y* avocados you have left after making *x* batches of guacamole. First, identify the independent and dependent variables. Then, if the domain is 0, 1, 2, and 3, what is the range?	Describe two real-life examples of functions: one with a discrete domain and one with a continuous domain.

Grade 8 Math Question Stem Bank: Common Core State Standards

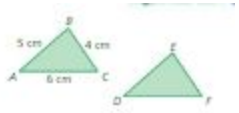
Standards for Mathematical Practice

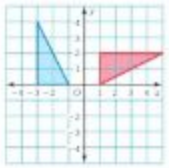
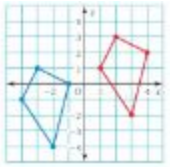
8.F.A.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions)	Graph the function $g(x) = -2x + 3$. Compare it to the graph of $f(x) = -2x$.	The function $C(x) = 25x + 50$ represents the labor cost for Jones Remodeling to build a deck, where *x* is the number of hours. Costs for Smith Remodeling are shown in the table.  Which cost function has the greater rate of change? What does the rate of change represent? Which cost function has the greater y-intercept? Interpret that y-intercept? Which company would you hire if the job is estimated to take 8 hours?	The graph of $y = x + 4$ is a translation 4 units up of the graph of $y = x$. How can you obtain the graph of $y = x + 4$ from the graph of $y = x$ using a horizontal translation? Justify your answer.
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.	What is the slope intercept form of the line that has a slope of -½ and a y-intercept of 7? Use the graph to write a linear function that relates y to x. 	Graph the data in the table.  Write a linear function that relates x to y. How many calories do you burn in 5.5 hours? Is a vertical line a linear function? Why or why not?	Describe two real life patterns: one that is linear and one that is nonlinear.
8.F.B.4 Construct a function to model a linear relationship between two quantities. Determine	The graph shows the height *y* (in feet) of a flag *x* seconds after you start raising it up a flagpole.  Find and interpret the slope.	List three different rates that can be represented by slopes in real-life problems. The amount *y* (in gallons) of gasoline remaining in a gas tank after driving *x* hours is $y = -2x + 12$. Graph the equation. Interpret the x- and y-intercepts. After how many hours	Describe a real life problem that has the given rate and intercepts. Draw a line that represents them. Rate: -30 feet per second y-intercept: 150 feet x-intercept: 5 seconds

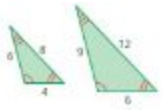
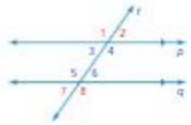
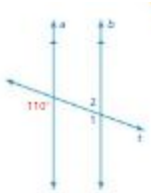
the rate of change and initial value of the function from a description of a relationship or from two (*x, y*) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.	Write an equation of the line.	are there 5 gallons left?	
8.F.B.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the	Does the table or graph represent a linear or nonlinear function?  	Which equation represents a nonlinear function and why? a. $y = 4.7$ b. $y = \pi x$ c. $y = \frac{4}{x}$ d. $y = 4(x - 1)$ Account A earns simple interest. Account B earns compound interest. The table shows the balances for 5 years. Graph the data and compare the graphs.	

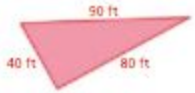
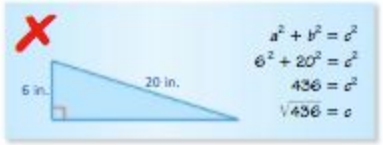
function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.		 Year, t / Account A Balance / Account B Balance 0 / $100 / $100 1 / $110 / $110 2 / $120 / $121 3 / $130 / $133.10 4 / $140 / $146.41 5 / $150 / $161.05	

Geometry

Standard	Basic: Conceptual "Understand"	Standard: Procedural "Doing"	Expanded: Application
8.G.A.1 Verify experimentally the properties of rotations, reflections, and translations	Which transformation *turns* a figure? Which transformation is a mirror image?	Reflect this figure over first the x-axis and then the y-axis. 	Design your own tessellation. Explain why any parallelogram can be translated to make a tessellation.
8.G.A.2 Understand that a two-dimensional figure is congruent to another if the second can be	Which angle of *DEF* corresponds with angle C? What is the perimeter of *DEF*?  	A clockwise rotation of 90 degrees is equivalent to a counterclockwise rotation of how many degrees? Describe two different sequences of transformations in which the blue figure is the image of the red figure.	

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.A.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.	What transformation is the blue figure to the red figure? 	The vertices of a triangle are *A(2,5), B(1,2), and C(3,1)*. Reflect the triangle in the x-axis, and then rotate the triangle 90 degrees counterclockwise about the origin. What are the coordinates of the image? Describe the translation from the red figure to the blue figure. 	

8.G.A.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.	Tell whether the two figures are similar and explain your reasoning.  Tell whether the blue figure is a dilation of the red figure. Explain your reasoning. 	The vertices of a triangle are *A(2,4), B(1,2), and C(3,1)*. Dilate the triangle using a scale factor of 2. Then translate the triangle (x-2,y+1). What are the coordinates of the image? The figures are similar. Find the missing measure. 	Draw a rectangle on a coordinate plane. Choose a scale factor of 2, 3, 4, or 5, and then dilate the rectangle. How many times greater is the area of the image than the area of the pre-image? How could you determine that without graphing?
8.G.A.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles	Identify the parallel lines, the transversal line, how many angles are formed by the transversal and which of the angles are congruent.  What is the sum of the interior angles of a triangle?	Find the measure of angle 1 and angle 2.  Find the value of x.	Describe two real life situations that use parallel lines. The figure shows the angles used to make a double bank shot in an air hockey game. Find the value of x. Can you still get the red puck in the goal when x is increased by a little? By a lot? Explain.

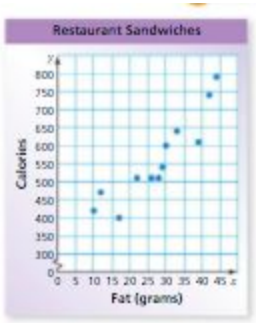
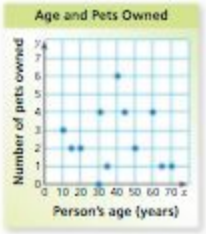
created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.	How would you find the exterior angle if you know the measure of the two nonadjacent interior angles?	 The interior angles of a regular polygon each measure 165 degrees. How many sides does the polygon have?	 Can a pentagon have interior angles that measure 120, 105, 65, 150 and 95 degrees? Explain.
8.G.B.6 Explain a proof of the Pythagorean Theorem and its converse.	Find the length of the hypotenuse.  Tell whether the triangle is a right triangle or not. 	Describe and correct the error in finding the missing length of the triangle. 	What kinds of problems do you think the converse of the Pythagorean Theorem can help you solve? Give 2 examples.
8.G.B.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems		Televisions are advertised by the lengths of their diagonals. Approximate the length of the diagonal of the TV to the nearest inch. 	

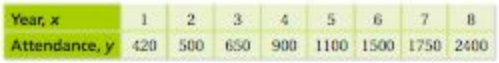
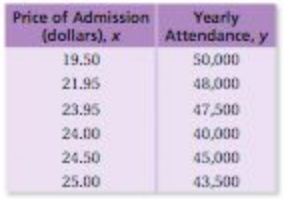
in two and three dimensions.		The center of the tripod forms a 90 degree angle with the ground. Find the length of the support leg to the nearest tenth of an inch. 	
8.G.B.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	Find the distance between (-3,5) and (2,-1) using the Pythagorean Theorem.	Plot the points (-1,-2), (2,1), and (-3,6) in a coordinate plane. Are the points the vertices of a right triangle? Explain.	Draw a map of an overnight camp with the base camp located at (0,0). Plot the fire tower at (0,7), the cabin at (-3,0) and the lake at (5,0). Create a story that asks how far one is from the other. Can any of the distances form right triangles? Etc.
8.G.C.9 Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.	What is the formula for the volume of…. Find the volume of a cylinder with a height of 6 meters and a radius of 3 meters. Find the volume of a cone with height of 10 inches and diameter of 2 meters.	If the volume of a cylinder is 314 cubic inches and the diameter is 10 inches, what is the height? A cylinder has a surface area of 1850 square meters and a radius of 9 meters. Estimate the volume to the nearest integer. The inside of each glass is shaped like a cone. Which glass can hold more liquid? How much more?	How does the volume of a cylinder change when its diameter is halved? Explain.

Statistics & Probability

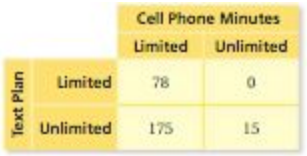
Standard	Basic: Conceptual "Understand"	Standard: Procedural "Doing"	Expanded: Application

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.	A sandwich has 650 calories. Based on the scatter plot, how many grams of fat would you expect the sandwich to have? Explain.  What type of relationship does the scatter plot show?  	Make a scatter plot of the data. Tell what type of relationship the data shows. Study Time (min), x: 30, 20, 60, 90, 45, 10, 30, 75, 120, 80 Test Score, y: 87, 74, 92, 97, 85, 62, 83, 90, 95, 91	Describe a set of real-life data that has a negative relationship. (Or positive or no relationship) Have groups of students create a life-size model of the 3 types of relationships. Give 2 students string to represent each axis. Then have students place themselves on the "grid" to model a positive relationship, then a negative, then none. (Can extend activity by having 2 students show a line of fit with string from each relationship.)
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	What is a line of best fit?	The table shows the number of people who have attended a neighborhood festival over an 8-year period. Year, x: 1, 2, 3, 4, 5, 6, 7, 8 Attendance, y: 420, 500, 650, 900, 1100, 1500, 1750, 2400 Make a scatter plot of the data and draw a line of fit. Write an equation for the line of fit.	(See above in 8.SP.A.1) Is it possible to find a line of fit for the data that has no relationship? Explain.

straight line, and informally assess the model 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.		The table shows the number of people who have attended a neighborhood festival over an 8-year period.  Interpret the slope of the line of fit. Predict the number of people who will attend the festival in year 10. The table shows the prices of admission to a local theater and the attendance for several years.  Identify the outlier. How does the outlier affect the line of fit? Make a scatter plot and draw the line of fit. Use the line of fit to predict the attendance when the admission cost is $27.	
8.SP.A.4 Understand that patterns of association	Find and interpret the marginal frequencies of this two-way table.	Create a two-way table to represent this information.	

Year, x	1	2	3	4	5	6	7	8
Attendance, y	420	500	650	900	1100	1500	1750	2400

Price of Admission (dollars), x	Yearly Attendance, y
19.50	50,000
21.95	48,000
23.95	47,500
24.00	40,000
24.50	45,000
25.00	43,500

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.			

Grade 8 Math Common Core State Standards

The Number System

Know that there are numbers that are not rational, and approximate them by rational numbers.

CCSS.MATH.CONTENT.8.NS.A.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which

repeats eventually into a rational number.
CCSS.MATH.CONTENT.8.NS.A.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., π2). *For example, by truncating the decimal expansion of √2, show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations*.

Expressions & Equations

Expressions and Equations Work with radicals and integer exponents.

CCSS.MATH.CONTENT.8.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, 32 × 3-5 = 3-3 = 1/33 = 1/27.
CCSS.MATH.CONTENT.8.EE.A.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 √2 is irrational.
CCSS.MATH.CONTENT.8.EE.A.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 108 and the population of the world as 7 times 109, and determine that the world population is more than 20 times larger*.
CCSS.MATH.CONTENT.8.EE.A.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal 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.

Understand the connections between proportional relationships, lines, and linear equations.

CCSS.MATH.CONTENT.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.
CCSS.MATH.CONTENT.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*.

Analyze and solve linear equations and pairs of simultaneous linear equations.

CCSS.MATH.CONTENT.8.EE.C.7 Solve linear equations in one variable.
CCSS.MATH.CONTENT.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).

CCSS.MATH.CONTENT.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.

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

CCSS.MATH.CONTENT.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.

CCSS.MATH.CONTENT.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*.

CCSS.MATH.CONTENT.8.EE.C.8.C Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair*.

Functions

Define, evaluate, and compare functions.

CCSS.MATH.CONTENT.8.F.A.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.[1]

CCSS.MATH.CONTENT.8.F.A.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*.

CCSS.MATH.CONTENT.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*.

1 Function notation is not required for Grade 8.

Use functions to model relationships between quantities.

CCSS.MATH.CONTENT.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.

CCSS.MATH.CONTENT.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.

Geometry

Understand congruence and similarity using physical models, transparencies, or geometry software.

CCSS.MATH.CONTENT.8.G.A.1 Verify experimentally the properties of rotations, reflections, and translations:
- CCSS.MATH.CONTENT.8.G.A.1.A Lines are taken to lines, and line segments to line segments of the same length.
- CCSS.MATH.CONTENT.8.G.A.1.B Angles are taken to angles of the same measure.
- CCSS.MATH.CONTENT.8.G.A.1.C Parallel lines are taken to parallel lines.

CCSS.MATH.CONTENT.8.G.A.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.

CCSS.MATH.CONTENT.8.G.A.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

CCSS.MATH.CONTENT.8.G.A.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.

CCSS.MATH.CONTENT.8.G.A.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*.

Understand and apply the Pythagorean Theorem.

CCSS.MATH.CONTENT.8.G.B.6 Explain a proof of the Pythagorean Theorem and its converse.

CCSS.MATH.CONTENT.8.G.B.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

CCSS.MATH.CONTENT.8.G.B.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

CCSS.MATH.CONTENT.8.G.C.9 Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Statistics & Probability

Investigate patterns of association in bivariate data.

CCSS.MATH.CONTENT.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.
CCSS.MATH.CONTENT.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 by judging the closeness of the data points to the line.
CCSS.MATH.CONTENT.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*.
CCSS.MATH.CONTENT.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?*