Ohio Mathematics - Extended Learning Standards

Grade 8

The Number System

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

1 Know that real numbers are either rational or irrational. Understand informally that every number has a decimal expansion which is repeating, terminating, or is non-repeating and nonterminating. 8.NS.1

Complexity a

a Identify whether numbers are rational or irrational numbers. 8.NS.1.A

Complexity b

b Identify whether numbers in decimal form are repeating or nonrepeating decimals. 8.NS.1.B

Complexity c

c Identify whether numbers are in the form of whole numbers, fractions or decimals. 8.NS.1.C

Learning Progression

- Recognize that a number in whole number form has no fraction bar or decimal point. 8.NS.1.LP.A
- Recognize a number in decimal form has a point. 8.NS.1.LP.B
- Recognize that a number in fraction number form is two numbers separated by a line. 8.NS.1.LP.C
- Engagement Statements (demonstration of engaged in the topic) 8.NS.1.LP.D
- Interact with fraction models. 8.NS.1.LP.E

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. 8.NS.2

Complexity a

a Estimate which point on a number line a decimal (up to hundredths) is closest to (e.g., given a number line in increments of 1/10, identify which point the decimal 4.13 would be closest to). 8.NS.2.A

Complexity b

b Round decimals to the nearest whole number or tenths and identify the corresponding points on a number line. 8.NS.2.B

Complexity c

c Identify the whole number points on a number line. 8.NS.2.C

Learning Progression

- Recognize numbers. 8.NS.2.LP.A

- Recognize a number line. 8.NS.2.LP.B
- Engagement Statements (demonstration of engaged in the topic) 8.NS.2.LP.C
- Interact with a number line. 8.NS.2.LP.

Expressions and Equations

Work with radicals and integer exponents.

1 Understand, explain, and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3(-5) = 3(-3) = 1/3^3 = 1/27$. 8.EE.1

Complexity a

a Apply properties of integer exponents to generate equivalent numerical expressions (e.g., $42 \times 43 = (4 \times 4) \times (4 \times 4 \times 4) = 45$). 8.EE.1.A

Complexity b

b Identify equivalent numerical expressions with integer exponents; limit exponents to 1–6 (e.g., $34 = 3 \times 3 \times 3 \times 3$). 8.EE.1.B

Complexity c

c Identify equivalent numerical expressions with integer exponents—limit to exponents 1–3 (e.g., $102 = 10 \times 10$). 8.EE.1.C

Learning Progression

- Identify the base and exponent. 8.EE.1.LP.A
- Understand the exponent indicates the number of factors to be multiplied. 8.EE.1.LP.B
- Engagement Statements (demonstration of engaged in the topic) 8.EE.1.LP.C
- Interact with numbers for the example of 5^4 give students a pile of cards with 5's and 4's written on. Have students select the number and types of cards to represent 5^4. 8.EE.1.LP.D

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 it is irrational. 8.EE.2

Complexity a

a Construct a perfect square up to 25 (e.g., 5 squared is 25). 8.EE.2.A

Complexity b

b Create a representation of a perfect square. 8.EE.2.B

Complexity c

c Select the perfect square, given a model. 8.EE.2.C

Learning Progression

- Identify a number represented by array (columns and rows). 8.EE.2.LP.A
- Demonstrate knowledge of a square and a rectangle. 8.EE.2.LP.B
- Engagement Statements (demonstration of engaged in the topic) 8.EE.2.LP.C
- Interact with number models. 8.EE.2.LP.D

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 × 108 ; and the population of the world as 7 × 109 ; and determine that the world population is more than 20 times larger. 8.EE.3

Complexity a

a Identify equivalent expressions of numbers expressed in the form of a single digit times a whole number power of 10 (limit exponent to 1–10) (e.g., What is 3 × 103 ? Answer: 3000 or 3 × 10 × 10 × 10). 8.EE.3.A

Complexity b

b Identify equivalent expressions of multiples of 10 using exponents (limit exponent to 1–10) (e.g., What is 107 ? Answer: 10 × 10 × 10 × 10 × 10 × 10 × 10). 8.EE.3.B

Complexity c

c Identify equivalent expressions of multiples of 10 using exponents (limit exponent to 1–5) (e.g., What is 102 ? Answer: 10 × 10). 8.EE.3.C

Learning Progression

- Identify the base and exponent. 8.EE.3.LP.A
- Understand the exponent indicates the number of factors to be multiplied. 8.EE.3.LP.B
- Engagement Statements (demonstration of engaged in the topic) 8.EE.3.LP.C
- Interact with numbers for the example of 10^2 give students a pile of cards with 10's and 2's written on. Have students select the number and types of cards to represent 10^2. 8.EE.3.LP.D

4 Perform operations with numbers expressed in scientific notation, including problems where both decimal notation 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. 8.EE.4

Complexity a

a Given a real-world context, write a number in scientific notation that best represents the situation. 8.EE.4.A

Complexity b

b Given a real-world context and a selection of numbers written in scientific notation, select the quantity that best represents the situation. 8.EE.4.B

Complexity c

c Interpret scientific notation that has been generated by technology. 8.EE.4.C

Learning Progression

- Identify relevant buttons on a calculator to scientific notation. 8.EE.4.LP.A
- Engagement Statements (demonstration of engaged in the topic) 8.EE.4.LP.B

- Interact with calculator. `8.EE.4.LP.C`

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

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.5

Complexity a

a Identify the slope (unit rate) of a line of a proportional graph represented on a grid that has scales of 1. 8.EE.5.A

Complexity b

b Graph a simple proportion with 3 coordinates. 8.EE.5.B

Complexity c

c Identify if a graph represents a proportional relationship. 8.EE.5.C

Learning Progression

- Identify points on a horizontal number line (scale limited to whole numbers 1-10). 8.EE.5.LP.A
- Identify points on a vertical number line (scale limited to whole numbers 1-10). 8.EE.5.LP.B
- Understand a coordinate grid is formed by a vertical and horizontal number line. 8.EE.5.LP.C
- Recognize the horizontal number line as the x-axis. 8.EE.5.LP.D
- Recognize the vertical number line as the y-axis. 8.EE.5.LP.E
- Recognize the intersection of the x-axis and y-axis as the origin. 8.EE.5.LP.F
- Identify a line. 8.EE.5.LP.G
- Identify the point (0,0) on a graph. 8.EE.5.LP.H
- Engagement Statements (demonstration of engaged in the topic) 8.EE.5.LP.I
- Interact with a graph. 8.EE.5.LP.J

6 Use similar triangles to explain why the slope m is the same between any two distinct points on a nonvertical 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.EE.6

Complexity a

a Identify the slope of a line using a graph (see example below). 8.EE.6.A

Complexity b

b Identify the slope of a line using a graph in the first quadrant (see example below). 8.EE.6.B

Complexity c

c Identify the slope of a line using a graph in the first quadrant when the rise and run are shown on the graph (see example below). 8.EE.6.C

Learning Progression

- Discuss slope represented in every-day life (roof, stairs, ramp, hill, ski slope, road, incline plane, etc.) 8.EE.6.LP.A
- Identify an x, y axis graph (visually or tactually displayed) 8.EE.6.LP.B
- Identify that a graph can show slope 8.EE.6.LP.C
- Identify the x and y axis (horizontal and vertical line) 8.EE.6.LP.D
- Associate slope with graphed triangles 8.EE.6.LP.E
- Identify rise and run. 8.EE.6.LP.F
- Identify that slope is written as a fraction. 8.EE.6.LP.G
- Identify that the rise is the number on top and run is the number on the bottom. 8.EE.6.LP.H
- Engagement Statements (demonstration of engaged in the topic) 8.EE.6.LP.I
- Interact with a graph. 8.EE.6.LP.J

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

7 Solve linear equations in one variable. a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers). b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. 8.EE.7

Complexity a

a Solve a 1-step linear equation (e.g., y + 3 = 5). 8.EE.7.A

Complexity b

b Identify the operation needed to solve a given 1-step linear equation (the inverse operation). 8.EE.7.B

Complexity c

c When given a visual model, the students will correctly identify the missing variable from given choices (select from no more than 3, e.g., given the equation 4 + x = 2, identify that the variable is x). 8.EE.7.C

Learning Progression

- Know that a variable can represent an unknown value. 8.EE.7.LP.A
- Identify a number sentence. 8.EE.7.LP.B
- Recognize that the signs and numbers are not variables. 8.EE.7.LP.C
- Identify numbers. 8.EE.7.LP.D
- Engagement Statements (demonstration of engaged in the topic) 8.EE.7.LP.E
- Interact with no more than 3 answer choices be able to select 1 from different positions. 8.EE.7.LP.F
- Interact with a visual model. 8.EE.7.LP.G

8 Analyze and solve pairs of simultaneous linear equations graphically. a. Understand that the solution to a pair of linear equations in two variables corresponds to the point(s) of intersection of their graphs, because the point(s) of intersection satisfy both equations simultaneously. b. Use graphs to find or estimate the solution to a pair of two simultaneous linear equations in two variables. Equations should include all three solution types: one solution, no solution, and infinitely many solutions. 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. c. Solve real-world and mathematical problems leading to pairs of 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. (Limit solutions to those that can be addressed by graphing.) 8.EE.8

Complexity a

a Identify the coordinate at which two lines intersect. 8.EE.8.A

Complexity b

b Locate the point where two lines intersect. 8.EE.8.B

Complexity c

c Determine whether two lines intersect. 8.EE.8.C

Learning Progression

- Know that a line is not curved. 8.EE.8.LP.A
- Know that when two lines are the same distance apart will not intersect. 8.EE.8.LP.B
- Know that intersect means the lines will cross. 8.EE.8.LP.C
- Know that just because you do not see two lines intersect does not mean they do not. 8.EE.8.LP.D
- Engagement Statements (demonstration of engaged in the topic) 8.EE.8.LP.E
- Interact with real-world examples of lines. 8.EE.8.LP.F

Functions

Define, evaluate, and compare functions.

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.F.1

Complexity a

a Determine if a relation is a function when given in table form. 8.F.1.A

Complexity b

b Determine if a relation is a function when given in graph form. 8.F.1.B

Complexity c

c Identify the inputs and outputs of a function given in table form. 8.F.1.C

Learning Progression

- Know the meaning of the words input and output. 8.F.1.LP.A
- Relate input and output to a function machine. 8.F.1.LP.B
- Understand that a table is made up of columns and rows. 8.F.1.LP.C
- Know that input is in the left column and the output is in right column. 8.F.1.LP.D
- Columns are up and down. 8.F.1.LP.E
- Rows are left and right. 8.F.1.LP.F
- Engagement Statements (demonstration of engaged in the topic) 8.F.1.LP.G
- Interact with tables. 8.F.1.LP.H

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.2

Complexity a

a Compare functions represented in the same form. 8.F.2.A

Complexity b

b Classify graphs of functions as linear or non-linear. 8.F.2.B

Complexity c

c Determine whether a line is increasing, decreasing, or flat (zero slope). 8.F.2.C

Learning Progression

- Know what a line is. 8.F.2.LP.A
- Know you need to read a graph from left to right. 8.F.2.LP.B
- Know that flat means not going up or down. 8.F.2.LP.C
- Know that increasing is up and decreasing is down. 8.F.2.LP.D

- Engagement Statements (demonstration of engaged in the topic) 8.F.2.LP.E
- Interact with real-world examples of lines. 8.F.2.LP.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. 8.F.3

Complexity a

a Match a function to its graph. 8.F.3.A

Complexity b

b Determine whether a function is linear or non-linear given the equation or graph. 8.F.3.B

Complexity c

c Determine whether the slope of the function is positive, negative or zero. 8.F.3.C

Learning Progression

- Identify points on a horizontal number line (scale limited to whole numbers 1-10). 8.F.3.LP.A
- Identify points on a vertical number line (scale limited to whole numbers 1-10). 8.F.3.LP.B
- Understand a coordinate grid is formed by a vertical and horizontal number line. 8.F.3.LP.C
- Recognize the horizontal number line as the x-axis. 8.F.3.LP.D
- Recognize the vertical number line as the y-axis. 8.F.3.LP.E
- Recognize the intersection of the x-axis and y-axis as the origin. 8.F.3.LP.F
- Identify a line. 8.F.3.LP.G
- Represent a numeral with physical objects. 8.F.3.LP.H
- Count physical objects up to 100 by ones and tens. 8.F.3.LP.I
- Demonstrate understanding of the word “equal”. 8.F.3.LP.J
- Recognize that in real-world increasing is adding quantities. For example, buying more objects increases the price. Connecting these situations with the vocabulary of “positive slope”. 8.F.3.LP.K
- Recognize that in real-world decreasing is removing quantities. For example, buying more objects decreases the amount of money you have. Connecting these situations with the vocabulary of “negative slope”. 8.F.3.LP.L
- Recognize that in real-world there are situations where there is no change in the dependent variable. For example, an adult height does not change over time. Connecting these situations with the vocabulary of “zero slope”. 8.F.3.LP.M

- Understand that a graph is read from left to right. 8.F.3.LP.N
- Engagement Statements (demonstration of engaged in the topic) 8.F.3.LP.O
- Interact with real-world examples of lines. 8.F.3.LP.P
- Interacting with physical objects and understanding when you add objects you are increasing the amount and when you remove objects you are decreasing the amount. 8.F.3.LP.Q

Use functions to model relationships between quantities.

4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. 8.F.4

Complexity a

a Graph a linear function on a grid with a scale of 1. 8.F.4.A

Complexity b

b Given a graph representing a linear equation, identify the slope and y-intercept. 8.F.4.B

Complexity c

c Identify two points on a linear graph. 8.F.4.C

Learning Progression

- Identify points on a horizontal number line (scale limited to whole numbers 1-10). 8.F.4.LP.A
- Identify points on a vertical number line (scale limited to whole numbers 1-10). 8.F.4.LP.B
- Understand a coordinate grid is formed by a vertical and horizontal number line. 8.F.4.LP.C
- Recognize the horizontal number line as the x-axis. 8.F.4.LP.D
- Recognize the vertical number line as the y-axis. 8.F.4.LP.E
- Recognize the intersection of the x-axis and y-axis as the origin. 8.F.4.LP.F
- Identify a line. 8.F.4.LP.G
- Identify the point (0,0) on a graph. 8.F.4.LP.H

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.F.5

Complexity a

a Tell a story using the qualitative features of a function. 8.F.5.A

Complexity b

b Identify if a function in graph form is linear or nonlinear. 8.F.5.B

Complexity c

c Identify if a function in graph form is increasing or decreasing or flat. 8.F.5.C

Learning Progression

- Recognize that in real-world increasing is adding quantities. For example, buying more objects increases the price. Connecting these situations with the

vocabulary of “positive slope”. 8.F.5.LP.A

- Recognize that in real-world decreasing is removing quantities. For example, buying more objects decreases the amount of money you have. Connecting these situations with the vocabulary of “negative slope”. 8.F.5.LP.B
- Recognize that in real-world there are situations where there is no change in the dependent variable. For example, an adult height does not change over time. Connecting these situations with the vocabulary of “zero slope”. 8.F.5.LP.C
- Understand that a graph is read from left to right. 8.F.5.LP.D
- Engagement Statements (demonstration of engaged in the topic) 8.F.5.LP.E
- Interact with real-world examples represented by a line. 8.F.5.LP.F

Geometry

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

1 Verify experimentally the properties of rotations, reflections, and translations (include examples both with and without coordinates). a. Lines are taken to lines, and line segments are taken to line segments of the same length. b. Angles are taken to angles of the same measure. c. Parallel lines are taken to parallel lines. 8.G.1

Complexity a

a Show experimentally (e.g., by measuring, overlapping figures, etc.) that congruent shapes have the same angle measures and side lengths. 8.G.1.A

Complexity b

b Identify corresponding parts (angles and sides) on congruent shapes. 8.G.1.B

Complexity c

c Identify congruent line segments and/or congruent angles. 8.G.1.C

Learning Progression

- Same size and shape or equal in measure should be referred to as congruent. 8.G.1.LP.A
- Identify lengths of sides in a simple 2D shape. 8.G.1.LP.C
- Identify the same sized angles in a simple 2D shape. 8.G.1.LP.B
- Recognize there are different types of triangles and quadrilaterals. 8.G.1.LP.D
- Identify a line segment and an angle. 8.G.1.LP.E
- Identify angles and side lengths in a simple 2D shape. 8.G.1.LP.F
- Recognize that the size of an angle depends on the size of an opening not the length of the rays. 8.G.1.LP.G
- Engagement Statements (demonstration of engaged in the topic) 8.G.1.LP.H
- Interact with different length real-world objects, e.g., straws, pencils, pens, by rotating one of the objects from the other. Realize that the length of the “rays” does not make a difference, angles can still be the same size. 8.G.1.LP.I

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 (include examples both with and without coordinates). 8.G.2

Complexity a

a Determine the sequence of transformations (rotation, reflection, translation) that will make a figure congruent to another limit to two transformations in the sequence. 8.G.2.A

Complexity b

b Determine whether a rotation, a reflection or a translation is needed to show whether one figure is congruent to another (limit to 1

transformation). 8.G.2.B

Complexity c

c Determine the direction and how many units a figure must be translated (shifted) to be congruent to another on a coordinate plane (e.g., 3 units to the right). 8.G.2.C

Learning Progression

- Recognize that a translation is a slide. 8.G.2.LP.A
- Recognize that a slide can be a horizontal movement or vertical movement, a vertical movement, or a combination of both. 8.G.2.LP.B
- Count units on a grid. 8.G.2.LP.C
- Counting units on a grid recognizing that youcount spaces between the gridlines and not the intersections of the gridlines. 8.G.2.LP.D
- Understand that congruence means same size and shape or equal in measure. 8.G.2.LP.E
- Engagement Statements (demonstration of engaged in the topic) 8.G.2.LP.F
- Interact with 2D objects on a plane moving them in straight direction until they overlap. 8.G.2.LP.G

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

Complexity a

a Compare the effects of dilations, translations, rotations and reflections (with or without coordinate grids). And/or perform a translation, rotations, and reflection on a grid. 8.G.3.A

Complexity b

b Recognize the effect of rotation (turn), reflection (flip), and translation (slide). 8.G.3.B

Complexity c

c Demonstrate concepts of translation (up, down, right, left) with manipulatives. 8.G.3.C

Learning Progression

- Recognize that a translation is a slide. 8.G.3.LP.A
- Recognize that a slide can be a horizontal movement or vertical movement, a vertical movement, or a combination of both. 8.G.3.LP.B
- Engagement Statements (demonstration of engaged in the topic) 8.G.3.LP.C
- Interact with 2D objects on a plane moving them in straight direction. 8.G.3.LP.D

4 Understand that a twodimensional 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 (include examples both with and without coordinates). 8.G.4

Complexity a

a Perform a dilation on a figure using a scale factor of ½, 2, or 3. 8.G.4.A

Complexity b

b Recognize the effects of dilation on a two-dimensional figure (with or without coordinate grids). For example, recognize that applying a scale factor greater than one creates a bigger image and a scale factor less than one creates a smaller image. 8.G.4.B

Complexity c

c Recognize and identify similar shapes and congruent figures (with or without coordinate grids). For example, if given a sheet of pictures of turtles or stars, recognize that the stretched images are not similar. 8.G.4.C

Learning Progression

- Understand that similar means the same shape but different size. 8.G.4.LP.A
- Understand that congruence means same size and shape or equal in measure. 8.G.4.LP.B
- Identify an image that is stretched equally in both directions with technology. 8.G.4.LP.C
- Identify an image that is stretched in one direction with technology. 8.G.4.LP.D
- Identify names of shapes and/or images. 8.G.4.LP.E
- Engagement Statements (demonstration of engaged in the topic) 8.G.4.LP.F
- Interact with objects (Shrinky Dinks) and/or technology that can show similarity in stretching. 8.G.4.LP.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. 8.G.5

Complexity a

a Given a pair of parallel lines cut by a transversal, identify corresponding angles, alternate interior angles, alternate exterior angles, supplementary angles, and vertical angles. 8.G.5.A

Complexity b

b Know the sum of the interior angles of a triangle equals 180 degrees. 8.G.5.B

Complexity c

c Identify triangles, parallel lines, perpendicular lines, and intersecting lines. 8.G.5.C

Learning Progression

- Recognize that a triangle has 3 angles and 3 sides. 8.G.5.LP.A
- Know that when two lines are the same distance apart they will not intersect. 8.G.5.LP.B
- Know that intersect means the lines will cross. 8.G.5.LP.C
- Know that just because you do not see two lines intersect does not mean they do not. 8.G.5.LP.D
- Know that perpendicular lines are a special type of intersecting lines that form 90 degree angles. 8.G.5.LP.E
- Recognize right angle notation. 8.G.5.LP.F
- Recognize right angle (square corner) is 90 degrees. 8.G.5.LP.G
- Engagement Statements (demonstration of engaged in the topic) 8.G.5.LP.H
- Interact with real-world examples of lines. 8.G.5.LP.I
- Interact with real world examples of triangles 8.G.5.LP.J

Understand and apply the Pythagorean Theorem.

6 Analyze and justify an informal proof of the Pythagorean Theorem and its converse. 8.G.6

Complexity a

a Know that triangles with the side lengths of 3, 4, 5, 6, 8, and 10 are right triangles. 8.G.6.A

Complexity b

b Identify a right triangle when drawn on a coordinate plane. 8.G.6.B

Complexity c

c Identify right triangles from a group of a variety of triangles. 8.G.6.C

Learning Progression

- Recognize that a triangle has 3 angles and 3 sides. 8.G.6.LP.A
- Recognize right angle notation. 8.G.6.LP.B
- Recognize right angle (square corner) is 90 degrees. 8.G.6.LP.C
- Recognize that there are different types of triangles. 8.G.6.LP.D
- Engagement Statements (demonstration of engaged in the topic) 8.G.6.LP.E
- Interact with real world examples of all types of triangles. 8.G.6.LP.F

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.7

Complexity a

a Find the length of the hypotenuse of a right triangle when given the lengths of the legs. 8.G.7.A

Complexity b

b Place the numbers into the Pythagorean Theorem when given legs and hypotenuse of a right triangle. 8.G.7.B

Complexity c

c Identify parts of a right triangle (hypotenuse, legs). 8.G.7.C

Learning Progression

- Recognize that the longest side of a right triangle is opposite the right (square) angle. 8.G.7.LP.A
- Identify right triangles shown in different orientations. 8.G.7.LP.B
- Identify the sides of any triangle. 8.G.7.LP.C
- Identify the length of the sides of triangles. 8.G.7.LP.D
- Differentiate between a side and the side length measure of a side of a triangle. 8.G.7.LP.E
- Engagement Statements (demonstration of engaged in the topic) 8.G.7.LP.F

- Interact with real world examples of all types of triangles. 8.G.7.LP.G

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

Complexity a

a Find the length of vertical and horizontal lines drawn on the coordinate grid. 8.G.8.A

Complexity b

b Identify vertical and horizontal lines of a triangle drawn on the coordinate grid. 8.G.8.B

Complexity c

c Identify vertices of a triangle on the coordinate grid. 8.G.8.C

Learning Progression

- Recognize that a triangle has 3 angles and 3 sides. 8.G.8.LP.A
- Recognize that the pointy part of a shape is a vertex. 8.G.8.LP.B
- Recognize that a shape has more than one vertex. 8.G.8.LP.C
- Understand a coordinate grid is formed by a vertical and horizontal number line. 8.G.8.LP.D
- Recognize the horizontal number line as the x-axis. 8.G.8.LP.E
- Recognize the vertical number line as the y-axis. 8.G.8.LP.F
- Identify a line segment. 8.G.8.LP.G
- Engagement Statements (demonstration of engaged in the topic) 8.G.8.LP.H
- Interact with real world examples of all types of triangles. 8.G.8.LP.I

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

9 Solve real-world and mathematical problems involving volumes of cones, cylinders, and spheres. 8.G.9

Complexity a

a Solve real-world and mathematical problems involving volume of cylinders. 8.G.9.A

Complexity b

b Match the given formula for volume to cones, cylinders and spheres. 8.G.9.B

Complexity c

c Find cones, cylinders, and spheres in the environment. 8.G.9.C

Learning Progression

- Recognize that a cone has a circular base and a comes to a point at the opposite end. 8.G.9.LP.A
- Recognize that a cylinder has two congruent circular bases. 8.G.9.LP.B
- Recognize that a sphere is shaped like a ball. 8.G.9.LP.C
- Recognize that cylinders and spheres have no pointed ends. 8.G.9.LP.D
- Engagement Statements (demonstration of engaged in the topic) 8.G.9.LP.E
- Interact with objects shaped like cylinders, cones and spheres. 8.G.9.LP.F

Statistics and Probability

Investigate patterns of association in bivariate data.

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, negative, or no association; and linear association and nonlinear association. (GAISE Model, steps 3 and 4) 8.SP.1

Complexity a

a Construct a scatter plot for bivariate data using no more than 10 data points. 8.SP.1.A

Complexity b

b Identify if a scatter plot has linear or nonlinear association. 8.SP.1.B

Complexity c

c Identify if the pattern for a scatter plot is increasing or decreasing. 8.SP.1.C

Learning Progression

- Points on a scatter plot represent data. 8.SP.1.LP.A
- The points on a scatter plot are not connected. 8.SP.1.LP.B
- Recognize that in real-world increasing is adding quantities. 8.SP.1.LP.C
- Recognize that in real-world decreasing is removing quantities. 8.SP.1.LP.D
- Recognize that in real-world there are situations where there is no change in the dependent variable. 8.SP.1.LP.E
- Understand that a graph is read from left to right 8.SP.1.LP.F

2 Understand 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. (GAISE Model, steps 3 and 4) 8.SP.2

Complexity a

a Determine which line most closely represents the line of best fit for a given scatterplot. 8.SP.2.A

Complexity b

b Determine whether patterns on a scatter plot are positive, negative, or have no correlation. 8.SP.2.B

Complexity c

c Determine whether a linear graph is increasing, decreasing, or flat. 8.SP.2.C

Learning Progression

- Recognize a linear graph. 8.SP.2.LP.A
- Recognize that in real-world increasing is adding quantities. For example, buying more objects increases the price. Connecting these situations with the vocabulary of “positive slope”. 8.SP.2.LP.B
- Recognize that in real-world decreasing is removing quantities. For example, buying more objects decreases the amount of money you have. Connecting

these situations with the vocabulary of “negative slope”. 8.SP.2.LP.C

- Recognize that in real-world there are situations where there is no change in the dependent variable. For example, an adult height does not change over time. Connecting these situations with the vocabulary of “zero slope”. 8.SP.2.LP.D
- Understand that a graph is read from left to right. 8.SP.2.LP.E
- Recognize a coordinate plane. 8.SP.2.LP.F
- Engagement Statements (demonstration of engaged in the topic) 8.SP.2.LP.G
- Interacting with physical objects and understanding when you add objects you are increasing the amount and when you remove objects you are decreasing the amount. 8.SP.2.LP.H
- Interact with graphs, both increasing and decreasing. 8.SP.2.LP.I

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. (GAISE Model, steps 3 and 4) 8.SP.3

Complexity a

a Given a line of best fit, make a prediction. 8.SP.3.A

Complexity b

b Given several lines on a scatterplot, identify which line most closely represents the line of best fit. 8.SP.3.B

Complexity c

c Determine whether the line of best fit should have a positive, negative, or zero slope. 8.SP.3.C

Learning Progression

- Recognize a linear graph. 8.SP.3.LP.A
- Recognize that in real-world increasing is adding quantities. For example, buying more objects increases the price. Connecting these situations with the vocabulary of “positive slope”. 8.SP.3.LP.B
- Recognize that in real-world decreasing is removing quantities. For example, buying more objects decreases the amount of money you have. Connecting these situations with the vocabulary of “negative slope”. 8.SP.3.LP.C
- Understand that a graph is read from left to right. 8.SP.3.LP.D
- Recognize a coordinate plane. 8.SP.3.LP.E
- Engagement Statements (demonstration of engaged in the topic) 8.SP.3.LP.F
- Interact using technology with e.g., images people of same age and different length. 8.SP.3.LP.G

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? 8.SP.4

Complexity a

a Identify an inside missing value in a table of values using the pattern. 8.SP.4.A

Complexity b

b Find the totals in a two-way frequency table given the sums (outside values in the table). 8.SP.4.B

Complexity c

c Identify the total population in a two-way frequency table (lower right-hand box). 8.SP.4.C

Learning Progression

- Understand what total means 8.SP.4.LP.A
- Count objects. 8.SP.4.LP.B
- Understand where the numbers come from in a simple two-way table, e.g., using the students in the class as the total, split in “Boys and Girls” and “In Choir or Other” 8.SP.4.LP.C
- Engagement Statements (demonstration of engaged in the topic) 8.SP.4.LP.D
- Interact with a table. 8.SP.4.LP.E
- Interact with data. 8.SP.4.LP.F