New York State Assessment Mathematics

Lessons and Activities

Grade 8

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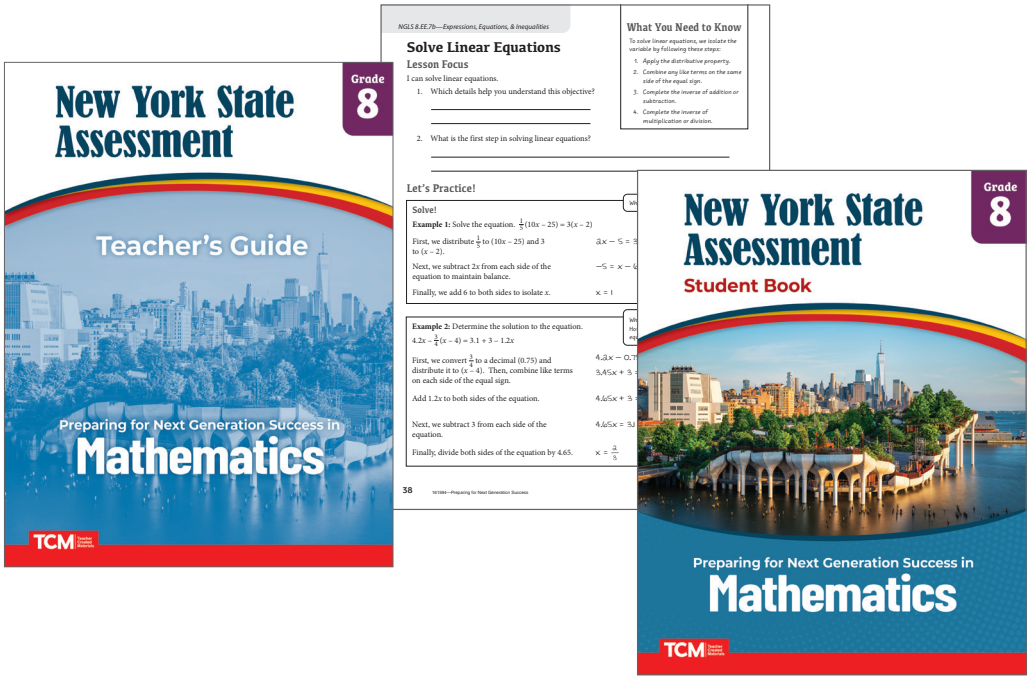

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Grade 8

New York State Assessment

Student Book

Preparing for Next Generation Success in

Mathematics

TCM Teacher Created Materials

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Solve Linear Equations

Lesson Focus

I can solve linear equations.

1. Which details help you understand this objective?

_____

_____

2. What is the first step in solving linear equations?

_____

_____

What You Need to Know

To solve linear equations, we isolate the variable by following these steps:

1. Apply the distributive property.
2. Combine any like terms on the same side of the equal sign.
3. Complete the inverse of addition or subtraction.
4. Complete the inverse of multiplication or division.

Let's Practice!

Solve!

What is the distributive property?

Example 1: Solve the equation. $\frac{1}{5}(10x - 25) = 3(x - 2)$

First, we distribute $\frac{1}{5}$ to $(10x - 25)$ and 3 to $(x - 2)$.	$2x - 5 = 3x - 6$
Next, we subtract $2x$ from each side of the equation to maintain balance.	$-5 = x - 6$
Finally, we add 6 to both sides to isolate x.	$x = 1$

What is the decimal equivalent of $\frac{3}{4}$? How does it help you solve the equation?

Example 2: Determine the solution to the equation.

$4.2x - \frac{3}{4}(x - 4) = 3.1 + 3 - 1.2x$

First, we convert $\frac{3}{4}$ to a decimal (0.75) and distribute it to $(x - 4)$. Then, combine like terms on each side of the equal sign.	$4.2x - 0.75x + 3 = 3.1 + 3 - 1.2x$ $3.45x + 3 = 6.1 - 1.2x$
Add $1.2x$ to both sides of the equation.	$4.65x + 3 = 6.1$
Next, we subtract 3 from each side of the equation.	$4.65x = 3.1$
Finally, divide both sides of the equation by 4.65.	$x = \frac{2}{3}$

Independent Practice

Directions: Choose the correct answer for each problem.

1 What is the solution to the equation?

$$\frac{4}{5}x - 8 = 9 - \frac{1}{3}x$$

A $x = \frac{17}{15}$

B $x = 15$

C $x = \frac{3}{8}$

D $x = 1$

2 What is the solution to the equation?

$$18x + 14 = 3(5x + 6) - 8$$

A $x = -\frac{1}{3}$

B $x = -4$

C $x = -\frac{2}{3}$

D $x = -\frac{4}{3}$

3 What is the value of x?

$$\frac{3}{8}x - 4 = 5$$

A $x = 24$

B $x = 8$

C $x = -4$

D $x = 4$

4 What is the solution to the equation?

$$-3(2x - 2) + 5x = -4x$$

A $x = -3$

B $x = -\frac{1}{2}$

C $x = -2$

D $x = -\frac{7}{2}$

5 What is the solution to the equation?

$$-\frac{1}{2}(4y - 8) + 6 = \frac{1}{2}y - 8$$

A $y = -\frac{1}{5}$

B $y = \frac{36}{5}$

C $y = 5$

D $y = \frac{2}{5}$

6 What is the value of w?

$$3(w - 2) + 2(w + 4) = 6(w - 8)$$

A $w = 5$

B $w = \frac{1}{5}$

C $w = 15$

D $w = 50$

Systems of Linear Equations

Lesson Focus

I can determine if a point on a graph is a solution to a system of linear equations and decide how many solutions a system of linear equations has.

1. What are we focusing on in today's lesson?

_____

_____

2. What is a solution to a system of linear equations?

_____

_____

What You Need to Know

When solving a system of linear equations, you are finding a point (x, y) that makes both equations true. If one ordered pair makes both true, the system has one solution. If no ordered pair makes both true, the system has no solution. If all the ordered pairs that work for one equation also work for the other, the system has infinitely many solutions.

Let's Practice!

How Many Solutions?

What is a system of equations?

Example 1: Is the point (–1, 1) a solution to the system of equations?

$2x + y = -1$ $\quad y - 2x = 3$

To determine if the point is a solution to both equations, we can substitute –1 for x and 1 for y into both equations. If both equations are true, then the point is a solution. If only one equation or neither equation is true, the point is not a solution.

$2(-1) + (1) = -1$ $\quad 1 - 2(-1) = 3$

$-2 + 1 = -1$ $\quad 1 - (-2) = 3$

$-1 = -1$ $\quad 3 = 3$

Both equations are true. So, point (–1, 1) is a solution to the system of equations.

How can you tell how many solutions a system of equations has?

Example 2: How many solutions does the system of equations have?

$6x + 3y = 18$ $\quad 2x + y = 6$

First, we write each equation in slope-intercept form.

$6x + 3y = 18$ $\quad 2x + y = 6$

$3y = -6x + 18$ $\quad y = -2x + 6$

$y = -2x + 6$

Now we can see that they are the same equation. There is an infinite number of solutions.

Independent Practice

Directions: Choose the correct answer for each problem.

1 Which point is a solution to the system of equations?

$$3x + y = -6$$
$$y - 2x = -1$$

A (1, –3)
B (2, –1)
C (1, 3)
D (–1, –3)

2 How many solutions does the system of equations have?

$$4x - 2y = 8$$
$$2x - y = 4$$

A no solution
B exactly 1 solution
C exactly 2 solutions
D infinite solutions

3 Which point is a solution to the system of equations?

$$3x + 2y = 4$$
$$y = -\frac{1}{2}x + 3$$

A (1, 3)
B $(-1, \frac{7}{2})$
C (–1, –1)
D (4, 1)

4 How many solutions does the system of equations have?

$$2x + 4y = 12$$
$$y = -\frac{1}{2}x + 7$$

A no solution
B exactly 1 solution
C exactly 2 solutions
D infinite solutions

5 Which point is a solution to the system of equations?

$$8x + 2y = 16$$
$$y = -2x + 2$$

A (2, –1)
B (3, –4)
C (1, –3)
D (–2, –2)

6 How many solutions does the system of equations have?

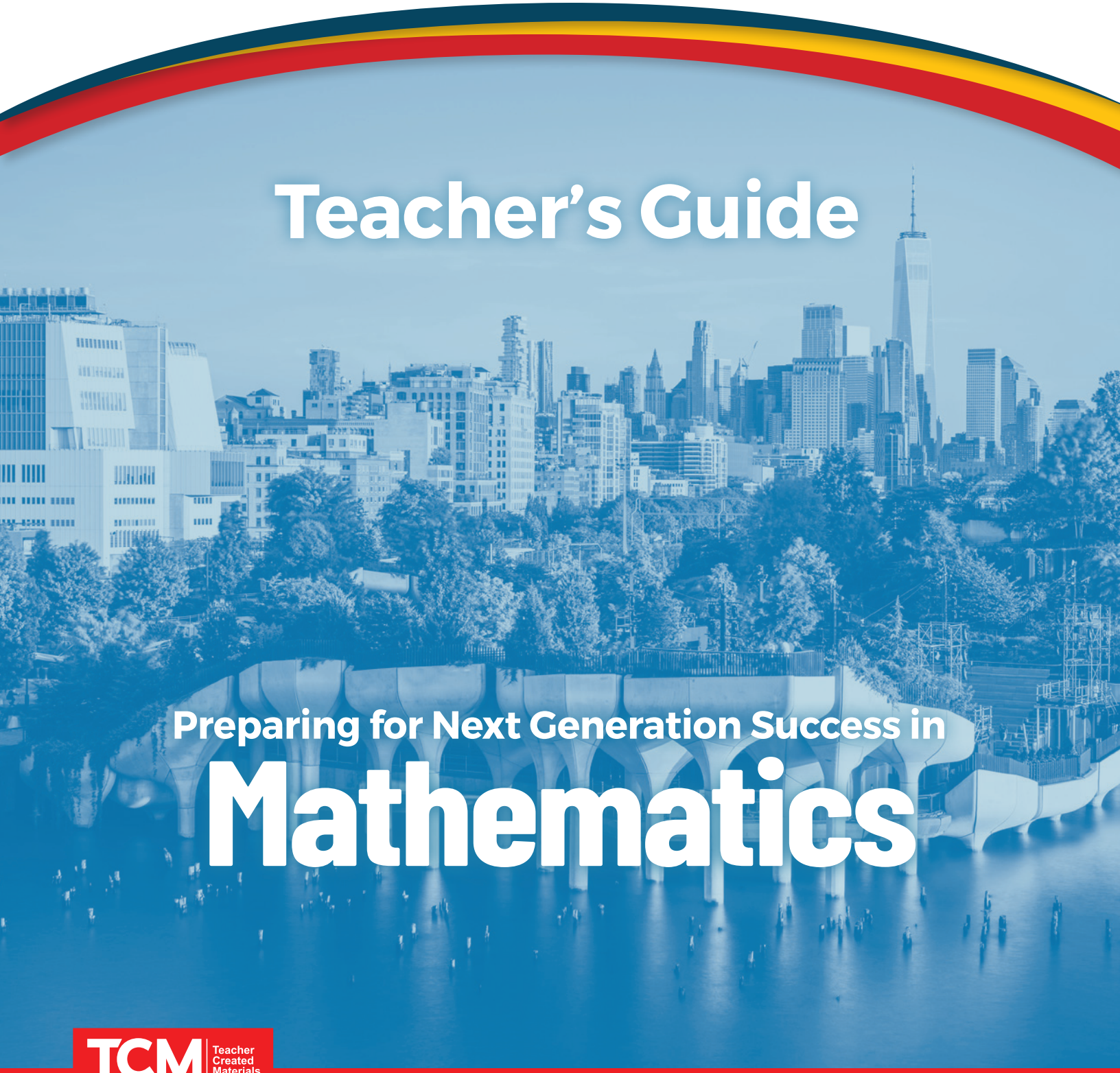
$$4x + 3y = 12$$
$$y = \frac{2}{3}x + 6$$

A no solution
B exactly 2 solutions
C exactly 1 solution
D infinite solutions

New York State Assessment

Grade 8

Teacher's Guide



Preparing for Next Generation Success in Mathematics

TCM Teacher Created Materials

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Pacing Plan

The following eight-week pacing plan is designed to provide students with standards-based mathematics practice every day. Lessons in the student book appear in this order. You should customize this pacing plan according to students' needs. Each lesson requires 30–45 minutes and spans five instructional days.

	Day 1	Day 2	Day 3	Day 4	Day 5
Rational & Irrational Numbers	Decimal Expansion for Rational Numbers (8.NS.1)	Decimal Expansion for Irrational Numbers (8.NS.2)	Compare Irrational Numbers (8.NS.2)	Irrational Numbers on a Number Line (8.NS.2)	Estimate Values of Expressions (8.NS.2)
Exponents	Equivalent Expressions (8.EE.1)	Square and Cube Roots (8.EE.2)	Integer Exponents (8.EE.3)	Multiplication of Scientific Notation (8.EE.4)	Division of Scientific Notation (8.EE.4)
Slope	Graphs (8.EE.5)	Unit Rate as Slope (8.EE.5)	Comparing Relationships (8.EE.5)	Similar Triangles (8.EE.6)	Slope Equations (8.EE.6)
Linear Equations & Systems of Linear Equations	Solutions of Linear Equations (8.EE.7a)	Solve Linear Equations (8.EE.7b)	Systems of Linear Equations (8.EE.8a)	Solve Systems of Equations in Multiple Ways (8.EE.8b)	Solve Systems of Linear Equations (8.EE.8c)
Functions	Function Rules (8.F.1)	Compare Functions (8.F.2)	Linear vs. Nonlinear Functions (8.F.3)	Construct Functions (8.F.4)	Analyze Functions on a Graph (8.F.5)
Rotations, Reflections, Translations, & Dilations	Transformations (8.G.1)	Tranformation Relationships (8.G.1a–c)	Congruent Figures (8.G.2)	Transformations Using Coordinates (8.G.3)	Similarity in 2D Figures (8.G.4)
Triangles, Pythagorean Theorem, & Volume	Angle Relationships/ Triangle Similarity (8.G.5)	Pythagorean Theorem (8.G.6)	Unknown Side Lengths (8.G.7)	Distance Between Two Points (8.G.8)	Volume (8.G.9)
Bivariate Data	Construct Scatter Plots (8.SP.1)	Interpret Scatter Plots (8.SP.1)	Patterns in Scatter Plots (8.SP.1)	Line Association in Scatter Plots (8.SP.2)	Solve Problems (8.SP.3)
Practice Tests	Test 1	Test 1 Review	Test 2	Test 2 Review	Celebration

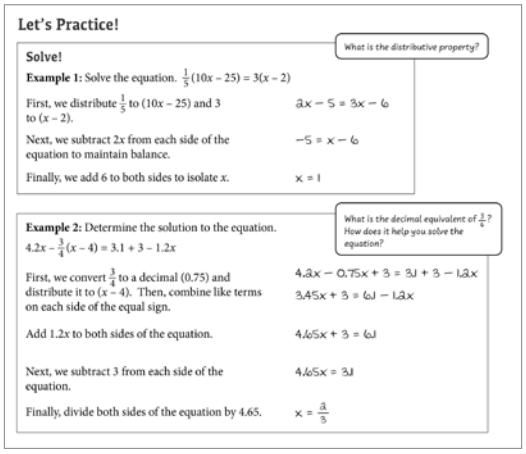
Solve Linear Equations

This lesson guides students as they work on pages 38–39.

Teacher Tip

Remind students that to solve equations, we complete the following steps in order: Apply the distributive property, combine any like terms on the same side of the equal sign, complete the inverse of addition or subtraction, and then the inverse of multiplication or division.

Explain each step in the first example. Remind students that we must complete the same steps on both sides of the equation to keep the equation balanced.



Let's Practice!

Solve!

Example 1: Solve the equation. $\frac{1}{5}(10x - 25) = 3(x - 2)$

What is the distributive property?

First, we distribute $\frac{1}{5}$ to $(10x - 25)$ and 3 to $(x - 2)$.	$2x - 5 = 3x - 6$
Next, we subtract $2x$ from each side of the equation to maintain balance.	$-5 = x - 6$
Finally, we add 6 to both sides to isolate x.	$x = 1$

Example 2: Determine the solution to the equation. $4.2x - \frac{3}{4}(x - 4) = 3.1 + 3 - 1.2x$

What is the decimal equivalent of $\frac{3}{4}$? How does it help you solve the equation?

First, we convert $\frac{3}{4}$ to a decimal (0.75) and distribute it to $(x - 4)$. Then, combine like terms on each side of the equal sign.	$4.2x - 0.75x + 3 = 3.1 + 3 - 1.2x$ $3.45x + 3 = 6.1 - 1.2x$
Add $1.2x$ to both sides of the equation.	$4.65x + 3 = 6.1$
Next, we subtract 3 from each side of the equation.	$4.65x = 3.1$
Finally, divide both sides of the equation by 4.65.	$x = \frac{2}{3}$

For this example, remind students that it is easier to calculate when numbers are in the same form. Students should convert fractions to decimals to work with decimals only.

Answers for page 39—
1. B; 2. D; 3. A; 4. C; 5. B; 6. D

For additional practice, have students solve: $3(2x - 6) + 3x - 2(x - 1) = 2(x - 4)$. $(x = \frac{8}{5})$

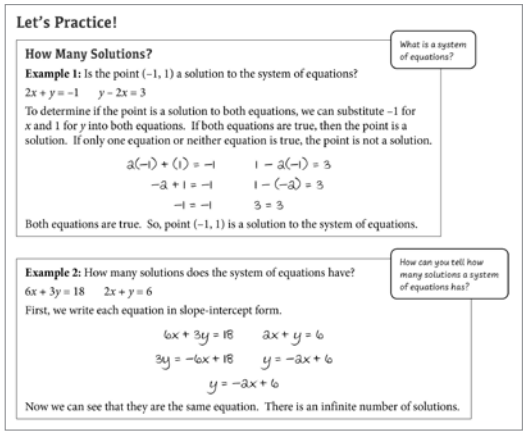
Systems of Linear Equations

This lesson guides students as they work on pages 40–41.

Teacher Tip

Systems of equations can have one solution, no solution, or an infinite number of solutions.

Explain each step in the first example. Remind students to substitute the first number in the ordered pair for x and the second number for y into both equations to determine if it is a solution.



Let's Practice!

How Many Solutions?

Example 1: Is the point $(-1, 1)$ a solution to the system of equations?

$2x + y = -1 \qquad y - 2x = 3$

What is a system of equations?

To determine if the point is a solution to both equations, we can substitute -1 for x and 1 for y into both equations. If both equations are true, then the point is a solution. If only one equation or neither equation is true, the point is not a solution.

$2(-1) + (1) = -1 \qquad 1 - 2(-1) = 3$

$-2 + 1 = -1 \qquad 1 - (-2) = 3$

$-1 = -1 \qquad 3 = 3$

Both equations are true. So, point $(-1, 1)$ is a solution to the system of equations.

Example 2: How many solutions does the system of equations have?

$6x + 3y = 18 \qquad 2x + y = 6$

How can you tell how many solutions a system of equations has?

First, we write each equation in slope-intercept form.

$6x + 3y = 18 \qquad 2x + y = 6$

$3y = -6x + 18 \qquad y = -2x + 6$

$y = -2x + 6$

Now we can see that they are the same equation. There is an infinite number of solutions.

For this example, have students write both equations in slope-intercept form so they can see the equations are equal and therefore have an infinite number of solutions.

Answers for page 41—
1. D; 2. D; 3. B; 4. A; 5. B; 6. C

For additional practice, have students determine if $(-3, 1)$ is a solution to the system of equations. (yes)

$x + y = -2 \qquad y = \frac{1}{3}x + 2$

Performance Level Descriptors Correlations

Each lesson strategy corresponds with a Performance Level Description (PLD) as outlined by the NYSED. The strategies in each lesson are written to align with the highest PLD for each standard.

Lesson Title	Standard	Performance Level Descriptor
Decimal Expansion for Rational Numbers	8.NS.1	Understand informally that every number has a decimal expansion; for rational numbers, show that the decimal expansion eventually repeats. Know that other numbers that are not rational are called irrational.
Decimal Expansion for Irrational Numbers	8.NS.2	Distinguish between real numbers and non-real or imaginary numbers.
Compare Irrational Numbers	8.NS.2	Use rational approximations of irrational numbers to compare the size of irrational numbers.
Irrational Numbers on a Number Line	8.NS.2	Use rational approximations of irrational numbers to locate them approximately on a number line.
Estimate Values of Expressions	8.NS.2	Use rational approximations of irrational numbers to estimate the value of expressions.
Equivalent Expressions	8.EE.1	Apply two or more properties of integer exponents within a real-world context.
Square and Cube Roots	8.EE.2	Use square root and cube root symbols to represent solutions to equations in the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Know square roots of perfect squares up to 225 and cube roots of perfect cube roots up to 125. Know that the square root of a nonperfect square is irrational.
Integer Exponents	8.EE.3	Estimate very large and very small quantities and determine how many times as large one number is in relation to another when numbers are expressed in scientific and decimal notation. Interpret scientific notation in context.
Multiplication of Scientific Notation	8.EE.4	Perform multiplication with numbers expressed in scientific notation and standard decimal form, with and without technology.
Division of Scientific Notation	8.EE.4	Perform division with numbers expressed in scientific notation and standard decimal form, with and without technology. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities. Interpret scientific notation that has been generated by technology.
Graphs	8.EE.5	Graph proportional relationships and interpret the unit rate in terms of the context.
Unit Rate as Slope	8.EE.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph.
Comparing Relationships	8.EE.5	Compare two different proportional relationships represented in different ways.

Performance Level Description Correlations *(cont.)*

Lesson Title	Standard	Performance Level Descriptor
Similar Triangles	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.
Slope Equations	8.EE.6	Derive the equation $y = mx + b$ for a line that has a y-intercept as well as x-intercept.
Solutions of Linear Equations	8.EE.7a	Recognize when linear equations in one variable have one solution, infinitely many solutions, or no solutions. Give examples and show which of these possibilities is the case by successively transforming the given equation into simpler forms.
Solve Linear Equations	8.EE.7b	Solve a multi-layered linear equation in one variable algebraically. Solve linear equations in one variable, with rational number coefficients, including those that require use of the distributive property and/or combining like terms.
Systems of Linear Equations	8.EE.8a	Understand that solutions to a system of linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. Recognize when the system has one solution, no solution, or infinitely many solutions.
Solve Systems of Equations in Multiple Ways	8.EE.8b	Solve systems of two linear equations in two variables with integer coefficients: graphically, numerically using a table, and algebraically. Solve simpler cases by inspection.
Solve Systems of Linear Equations	8.EE.8c	Solve real-world and mathematical problems involving systems of two linear equations in two variables with integer coefficients.
Function Rules	8.F.1	Define a function as a relation that assigns to each element from one set, called the domain, exactly one element of another set, called the range. Know that one-to-one, many-to-one, many-to-many are functions and/or not functions. Know and solve real-life applications by using functions.
Compare Functions	8.F.2	Compare properties of more than two functions represented in different ways.
Linear vs. Nonlinear Functions	8.F.3	Distinguish between linear and non-linear functions given an algebraic expression, a table, a verbal description, and/or a graph.

Performance Level Description Correlations *(cont.)*

Lesson Title	Standard	Performance Level Descriptor
Construct Functions	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.
Analyze Functions on a Graph	8.F.5	Describe qualitatively the functional relationship between two quantities by analyzing a graph. Sketch a graph that exhibits the qualitative features of a function that has been described in a real-world context.
Transformations	8.G.1	Verify experimentally that lines are mapped to lines, and line segments to line segments of the same length; angles are mapped to angles of the same measure, and parallel lines are mapped to parallel lines.
Transformation Relationships	8.G.1a–c	Verify experimentally that lines are mapped to lines, and line segments to line segments of the same length; angles are mapped to angles of the same measure, and parallel lines are mapped to parallel lines.
Congruent Figures	8.G.2	Know that a two-dimensional figure is congruent to another if the corresponding angles are congruent and the corresponding sides are congruent. Equivalently, two two-dimensional figures are congruent if one is the image of the other after a sequence of rotations, reflections, and translations. Given two congruent figures, describe a sequence that maps the congruence between them on the coordinate plane.
Transformations Using Coordinates	8.G.3	Use coordinates to describe the effect of a sequence of transformations on a two-dimensional figure.
Similarity in 2D Figures	8.G.4	Know that a two-dimensional figure is similar to another if the corresponding angles are congruent and the corresponding sides are in proportion.
Angle Relationships/Triangle Similarity	8.G.5	Determine the measurements of angles formed by two parallel lines cut by two transversals.
Pythagorean Theorem	8.G.6	Explain a proof of the Pythagorean Theorem and its converse.
Unknown Side Lengths	8.G.7	Use the Pythagorean Theorem to solve and model multi-step problems involving two-and/or three-dimensional contexts (cones, diagonals of rectangular prisms, etc.).
Distance Between Two Points	8.G.8	Extend the Pythagorean Theorem to drive the distance formula. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Performance Level Description Correlations *(cont.)*

Lesson Title	Standard	Performance Level Descriptor
Volume	8.G.9	Derive the formulas for prisms, pyramids, cylinders, and/or spheres and show the relationships among them.
Construct Scatter Plots	8.SP.1	Construct scatter plots for bivariate measurement data to investigate patterns of association.
Interpret Scatter Plots	8.SP.1	Analyze patterns of association between two quantities and use data to make and justify predictions.
Patterns in Scatter Plots	8.SP.1	Describe patterns such as clustering, outliers, positive and negative association, linear association, and nonlinear association.
Line Association in Scatter Plots	8.SP.2	Determine the equation for a line of best fit. Informally assess the model fit by judging the closeness of the data points to the line.
Solve Problems	8.SP.3	Determine the equation for a line of best fit and use the equation to make and justify predictions.