GO Math Unit 5
Ch. 11-12

Book Pages

Are YOU Ready?

Complete these exercises to review skills you will need for this module.

Personal Math Trainer
Online Assessment and Intervention.

Evaluate Expressions

EXAMPLE Evaluate $8(3+2) - 5^2$

$8(3+2) - 5^2 = 8(5) - 5^2$ Perform operations inside parentheses first.

$= 8(5) - 25$ Evaluate exponents.

$= 40 - 25$ Multiply.

$= 15$ Subtract.

Evaluate the expression.

1. $4(5 + 6) - 15$ _____

2. $8(2 + 4) + 16$ _____

3. $3(14 - 7) - 16$ _____

4. $6(8 - 3) + 3(7 - 4)$ _____

5. $10(6 - 5) - 3(9 - 6)$ _____

6. $7(4 + 5 + 2) - 6(3 + 5)$ _____

7. $2(8 + 3) + 4^2$ _____

8. $7(14 - 8) - 6^2$ _____

9. $8(2 + 1)^2 - 4^2$ _____

Connect Words and Equations

EXAMPLE The product of a number and 4 is 32.

The product of x and 4 is 32. Represent the unknown with a variable.

$4 \times x$ is 32. Determine the operation.

$4 \times x = 32$. Determine the placement of the equal sign.

Write an algebraic equation for the word sentence.

10. A number increased by 7.9 is 8.3. _____

11. 17 is the sum of a number and 6. _____

12. The quotient of a number and 8 is 4. _____

13. 81 is three times a number. _____

14. The difference between 31 and a number is 7. _____

15. Eight less than a number is 19. _____

LESSON 11.1 **Writing Equations to Represent Situations**

COMMON CORE 6.EE.7
Solve…problems by writing… equations of the form $x + p = q$ and $px = q$…. Also 6.EE.5, 6.EE.6

? ESSENTIAL QUESTION

How do you write equations and determine whether a number is a solution of an equation?

EXPLORE ACTIVITY **COMMON CORE** 6.EE.5

Determining Whether Values Are Solutions

An **equation** is a mathematical statement that two *expressions* are equal. An equation may or may not contain variables. For an equation that has a variable, a **solution** of the equation is a value of the variable that makes the equation true.

An expression represents a single value.

An equation represents a relationship between two values.

	Expression	Equation
Numerical	$5 + 4$	$5 + 4 = 9$
Words	a number *plus* 4	A number *plus* 4 *is* 9.
Algebraic	$n + 4$	$n + 4 = 9$

An equation relates two expressions using symbols for *is* or *equals*.

EXAMPLE 1 Determine whether the given value is a solution of the equation.

A $x + 9 = 15; x = 6$

Substitute 6 for x.

$\boxed{} + 9 \overset{?}{=} 15$

Add.

$\boxed{} \overset{?}{=} 15$

6 is/is not a solution of $x + 9 = 15$.

B $\frac{y}{4} = 32; y = 8$

Substitute 8 for y.

$\frac{\boxed{}}{4} \overset{?}{=} 32$

Divide.

$\boxed{} \overset{?}{=} 32$

8 is/is not a solution of $\frac{y}{4} = 32$.

C $8x = 72; x = 9$

Substitute 9 for x.

$8\left(\boxed{}\right) \overset{?}{=} 72$

Multiply.

$\boxed{} \overset{?}{=} 72$

9 is/is not a solution of $8x = 72$.

Math on the Spot

Personal Math Trainer
Online Assessment and Intervention.
Interactive Example

EXPLORE ACTIVITY (cont'd)

YOUR TURN

Q Determine whether the given value is a solution of the equation.

1. $11 = n + 6; n = 5$

2. $y - 6 = 24; y = 18$

_____

3. $\frac{x}{9} = 4; x = 36$

4. $15t = 100; t = 6$

_____

Personal Math Trainer
Online Assessment and Intervention.
Your Turn

Writing Equations to Represent Situations

You can represent some real-world situations with an equation. Making a model first can help you organize the information.

EXAMPLE 2   Real World

6.EE.6

Mark scored 17 points for the home team in a basketball game. His teammates as a group scored p points. Write an equation to represent this situation.

HOME PERIOD GUEST
46   4   42
0:00

Mark's points	+	Teammates' points	=	Total points
17	+	p	=	46

YOUR TURN

Q Write an equation to represent each situation.

5. Marilyn has a fish tank that contains 38 fish. There are 9 goldfish and f other fish.

_____

6. Juanita has 102 beads to make n necklaces. Each necklace will have 17 beads.

_____

7. Craig is c years old. His 12-year-old sister Kaitlin is 3 years younger than Craig.

_____

8. Kim rented skates for h hours. The rental fee was $2 per hour and she paid a total of $8.

_____

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Writing an Equation and Checking Solutions

You can substitute a given value for the variable in a real-world equation to check if that value makes sense for the situation.

EXAMPLE 3   Real World

6.EE.7

Sarah used a gift card to buy $47 worth of groceries. Now she has $18 left on her gift card. Write an equation to represent this situation. Use your equation to determine whether Sarah had $65 or $59 on the gift card before buying groceries.

STEP 1 Write a word equation based on the situation.

Amount on card	−	Amount spent	=	Amount left on card

STEP 2 Rewrite the equation using a variable for the unknown quantity and the given values for the known quantities.

Let x be the amount on the card.

Amount on card	−	Amount spent	=	Amount left on card
x	−	47	=	18

The amount spent and the amount left on the card are the known quantities. Substitute those values in the equation.

STEP 3 Substitute 65 and 59 for x to see which equation is true.

$x - 47 = 18$ $x - 47 = 18$

$65 - 47 \overset{?}{=} 18$ $59 - 47 \overset{?}{=} 18$

$18 \overset{?}{=} 18$ $12 \overset{?}{=} 18$

The amount on Sarah's gift card before she bought groceries was $65.

Reflect

9. What If? Suppose Sarah has $12 left on her gift card. How would this change the equation and the final answer?

_____

_____

YOUR TURN

10. On Saturday morning, Owen earned $24. By the end of the afternoon he had earned a total of $62. Write an equation represent the situation. Determine whether Owen earned $38 or $31 on Saturday afternoon.

_____

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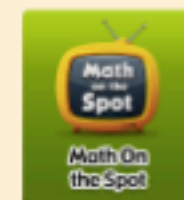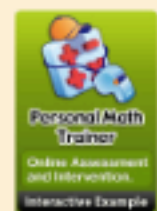
Guided Practice

Determine whether the given value is a solution of the equation. (Explore Activity Example 1)

1. $23 = x - 9; x = 14$

$23 \stackrel{?}{=} \boxed{} - 9$

$23 \stackrel{?}{=} \boxed{}$

2. $\frac{n}{13} = 4; n = 52$

$\dfrac{\boxed{}}{13} \stackrel{?}{=} 4$

$\boxed{} \stackrel{?}{=} 4$

3. $14 + x = 46; x = 32$

4. $17y = 85; y = 5$

5. $25 = \frac{k}{5}; k = 5$

6. $2.5n = 45; n = 18$

7. $21 = m + 9; m = 11$

8. $21 - h = 15; h = 6$

9. $d - 4 = 19; d = 15$

10. $5 + x = 47; x = 52$

11. $w - 9 = 0; w = 9$

12. $5q = 31; q = 13$

13. Each floor of a hotel has *r* rooms. On 8 floors, there are a total of 256 rooms. Write an equation to represent this situation. (Example 2)

Number		Number of rooms		
	×		=	

14. In the school band, there are 5 trumpet players and *f* flute players. There are twice as many flute players as there are trumpet players. Write an equation to represent this situation. (Example 2)

15. Pedro bought 8 tickets to a basketball game. He paid a total of $208. Write an equation to determine whether each ticket cost $26 or $28. (Example 3)

16. The high temperature was 92 °F. This was 24 °F higher than the overnight low temperature. Write an equation to determine whether the low temperature was 62 °F or 68 °F. (Example 3)

? ESSENTIAL QUESTION CHECK-IN

17. Tell how you can determine whether a number is a solution of an equation.

11.1 Independent Practice

COMMON CORE   6.EE.5, 6.EE.6, 6.EE.7

18. Andy is one-fourth as old as his grandfather, who is 76 years old. Write an equation to determine whether Andy is 19 or 22 years old.

19. A sleeping bag weighs 8 pounds. Your backpack and sleeping bag together weigh 31 pounds. Write an equation to determine whether the backpack without the sleeping bag weighs 25 or 23 pounds.

20. Halfway through a bus route, 23 students have been dropped off and 48 students remain on the bus. Write an equation to determine whether there are 61 or 71 students on the bus at the beginning of the route.

21. Write an equation that involves multiplication, contains a variable, and has a solution of 5. Then write another equation that has the same solution and includes the same variable and numbers but uses division.

22. **Vocabulary** How are expressions and equations different?

23. **Multistep** Alan has partially completed a table showing the distances between his town, Greenville, and two other towns.

Distance between Greenville and Nearby Towns (miles)	
Parker	29
Hadley	?

a. The distance between Hadley and Greenville is 13 miles less than the distance between Parker and Greenville. Write two equations that compare the distance between Hadley and Greenville and the distance between Parker and Greenville. Tell what your variable represents.

b. Alan says the distance from Hadley to Greenville is 16 miles. Is he correct? Explain.

24. **Explain the Error** A problem states that Ursula earns $9 per hour. To write an expression that tells how much money Ursula earns for *h* hours, Joshua wrote $\frac{9}{h}$. Sarah wrote 9*h*. Whose expression is correct and why?

Going Further 11.1

Expressions and Equations

6.EE.2a
Write, read, and evaluate expressions in which letters stand for numbers. Also 6.EE.2b

? ESSENTIAL QUESTION

How can you identify parts of equations and expressions using mathematical terms?

EXPLORE ACTIVITY   6.EE.2b

Using Vocabulary

Match the term on the left to the correct expression on the right.

1. sum _____   A. a number that is multiplied by the variable in an algebraic expression

2. term _____   B. a number that is multiplied by another number to get a product

3. product _____   C. the result of subtracting one number from another

4. factor _____   D. a part of an expression that is added to or subtracted from another part of an expression

5. quotient _____   E. the result when two or more numbers are multiplied

6. coefficient _____   F. the result when one number is divided by another

7. difference _____   G. the result when two or more numbers are added

Understanding an Expression

An expression represents mathematical operations using signs and symbols. Expressions can also be written with words. There is usually more than one way to describe an expression.

EXAMPLE 1   6.EE.2b

Describe each expression using the vocabulary from the Explore Activity. Examine each part of the expression and the expression as a whole.

A $5(3 + 7)$

$3 + 7$ the sum of 3 and 7

$5(3 + 7)$ the product of 5 and the sum of 3 and 7

B $4u \div 2$

$4u$ the product of the factors u and 4

$4u \div 2$ the quotient of the terms 4 times u and 2

Writing a Multi-Step Equation

You can solve real-world problems by writing an equation.

EXAMPLE 2 Real World   6.EE.2a

Write an equation to represent the real-world situation. Show how the parts of the equation match the real-world situation.

A A plumber charges a $25 service fee plus an additional hourly rate of $85. What is the total cost of hiring the plumber?

service fee + hourly rate × hours worked = total cost

$25 + 85h = c$

B A school theater group sells both adult and student tickets for each play it puts on. Adult tickets cost $8 each and student tickets cost $3 each. How much will the theater group earn for one performance?

cost for one adult ticket × number of adult tickets sold + cost for one student ticket × number of student tickets sold = amount earned for one performance

$8a + 3s = p$

Practice

Describe each expression using the terms *sum, difference, product, quotient, factor, term,* and *coefficient*.

1. $\frac{c}{5} + 10$

_____

2. $3f - 7$

_____

Write an equation to represent the real-world situation. Show how the parts of the equation match the real-world situation.

3. An amusement park charges an entrance fee of $7.50 plus $2.50 per ride. Calculate the amount spent at the amusement park in one day for five students if all students ride the rides together.

Getting Ready 11.2

Addition Equations

? ESSENTIAL QUESTION

How can you model solving an addition equation?

EXPLORE ACTIVITY 1 COMMON CORE **6.EE.7**

Looking for Patterns

A simple equation can sometimes be solved just by noticing patterns and equivalent values.

A Determine the value of x in the equation $x + 2x = 2x + 5$.

Circle the term repeated on both sides of the equation. $x + 2x = 2x + 5$

The variable x will have the same value everywhere it appears in the equation, so $2x$ on the left side will have the same value as $2x$ on the right side. Rewrite the equation with $2x$ removed from both sides.

$$x = \underline{}$$

B Determine the value of $4t$ in the equation $4t + 3t = 3t + 8$.

Circle the term repeated on both sides of the equation. $4t + 3t = 3t + 8$

The variable t will have the same value everywhere it appears in the equation, so $3t$ on the left side will have the same value as $3t$ on the right side. Rewrite the equation with $3t$ removed from both sides.

$$4t = \underline{}$$

Reflect

1. **Analyze Relationships** Identify the terms that could be removed from both sides of the equation. Explain your reasoning. $5g + 15 = 2g + 5g$

_____

_____

_____

2. **Analyze Relationships** Would you be able to use this method for determining the value of $3x$ in the equation $3x + 6x = 5x + 15$? Explain.

_____

_____

Practice

Find the value of the variable in each equation.

1. Determine the value of x in the equation $x + 5x = 5x + 7$.

   $x = \underline{}$

2. Determine the value of $4p$ in the equation $4p + 2p = 2p + 3$.

   $4p = \underline{}$

3. Can you determine the value of y in the equation $2y + y = 5y + 7$ by removing a term from each side? Why or why not?

   _____

   _____

   _____

Solve each equation by crossing out an equal number of the same shape on each side of the scale. Write the solution in the space provided.

4. $7 = p + 6$

   $p = \underline{}$

5. $b + 4 = 10$

   $b = \underline{}$

6. $2 + c = 5$

   $c = \underline{}$

7. $x + 1 = 2$

   $x = \underline{}$

Solve each equation by modeling the equation on the blank scale and crossing out an equal number of the same shape on each side. Write the solution in the space provided.

8. $x + 3 = 5$

$x = $ _____

9. $9 = c + 5$

$c = $ _____

10. $6 = z + 1$

$z = $ _____

11. $t + 4 = 5$

$t = $ _____

Solve each equation. Write the solution in the space provided.

12. $x + 20 = 27$ $x = $ _____

13. $17 + r = 30$ $r = $ _____

14. $45 = m + 22$ $m = $ _____

15. $32 = 15 + p$ $p = $ _____

LESSON 11.2 Addition and Subtraction Equations

COMMON CORE 6.EE.7

Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ .... Also 6.EE.5, 6.EE.6

? ESSENTIAL QUESTION

How do you solve equations that contain addition or subtraction?

EXPLORE ACTIVITY Real World   COMMON CORE 6.EE.6, 6.EE.7

Modeling Equations

A puppy weighed 6 ounces at birth. After two weeks, the puppy weighed 14 ounces. How much weight did the puppy gain?

Let x represent the number of ounces gained.

| Weight at birth | $+$ | Weight gained | $=$ | Weight after 2 weeks |

$$6 \quad + \quad x \quad = \quad 14$$

To answer this question, you can solve the equation $6 + x = 14$.

Algebra tiles can model some equations. An equation mat represents the two sides of an equation. To solve the equation, remove the same number of tiles from both sides of the mat until the x tile is by itself on one side.

A Model $6 + x = 14$.

B How many 1 tiles must you remove on the left side so that the x tile is by itself? _____
Cross out these tiles on the equation mat.

$6 + x$ 14

C Whenever you remove tiles from one side of the mat, you must remove the same number of tiles from the other side of the mat. Cross out the tiles that should be removed on the right side of the mat.

D How many tiles remain on the right side of the mat? _____
This is the solution of the equation.

The puppy gained _____ ounces.

Math Talk
Mathematical Practices

Why did you remove tiles from each side of your model?

Reflect

1. **Communicate Mathematical Ideas** How do you know when the model shows the final solution? How do you read the solution?

_____

_____

Using Subtraction to Solve Equations

Removing the same number of tiles from each side of an equation mat models subtracting the same number from both sides of an equation.

Subtraction Property of Equality

You can subtract the same number from both sides of an equation, and the two sides will remain equal.

When an equation contains addition, solve by subtracting the same number from both sides.

EXAMPLE 1

6.EE.5

Solve the equation $a + 15 = 26$. Graph the solution on a number line.

$a + 15 = 26$ *Notice that the number 15 is added to a.*

$$\begin{array}{l} a + 15 = 26 \\ \underline{-15 \quad -15} \\ a \quad\;\; = 11 \end{array}$$ *Subtract 15 from both sides of the equation.*

Check: $a + 15 = 26$

$11 + 15 \stackrel{?}{=} 26$ *Substitute 11 for a.*

$26 \stackrel{?}{=} 26$ *Add on the left side.*

Graph the solution on a number line.

Reflect

2. **Communicate Mathematical Ideas** How do you decide which number to subtract from both sides?

_____

_____

YOUR TURN

3. Solve the equation $5 = w + 1.5$.
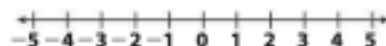
Graph the solution on a number line.

$w =$ _____

Using Addition to Solve Equations

When an equation contains subtraction, solve by adding the same number to both sides.

Addition Property of Equality

You can add the same number to both sides of an equation, and the two sides will remain equal.

EXAMPLE 2

6.EE.5

Solve the equation $y - 21 = 18$. Graph the solution on a number line.

$y - 21 = 18$ *Notice that the number 21 is subtracted from y.*

$$\begin{array}{l} y - 21 = 18 \\ \underline{+21 \quad +21} \\ y \quad\;\; = 39 \end{array}$$ *Add 21 to both sides of the equation.*

Check: $y - 21 = 18$

$39 - 21 \stackrel{?}{=} 18$ *Substitute 39 for y.*

$18 \stackrel{?}{=} 18$ *Subtract.*

Graph the solution on a number line.

Reflect

4. **Communicate Mathematical Ideas** How do you know whether to add on both sides or subtract on both sides when solving an equation?
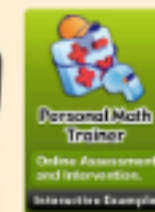
_____

_____

_____

YOUR TURN

5. Solve the equation $h - \frac{1}{2} = \frac{3}{4}$.

Graph the solution on a number line.

$h =$ _____

Solving Equations that Represent Geometric Concepts

You can write equations to represent geometric relationships.

Recall that a straight line has an angle measure of 180°. Two angles whose measures have a sum of 180° are called supplementary angles. Two angles whose measures have a sum of 90° are called complementary angles.

EXAMPLE 3 — COMMON CORE 6.EE.7, 6.EE.6

Find the measure of the unknown angle.

STEP 1 Write the information in the boxes.

$$x \quad 60°$$

Unknown angle	$+$	60°	$=$	180°

STEP 2 Write a description to represent the model. Include a question for the unknown angle.

The sum of an unknown angle and a 60° angle is 180°. What is the measure of the unknown angle?

STEP 3 Write an equation.

$$x + 60° = 180°$$

STEP 4 Solve the equation.

$$x + 60° = 180°$$
$$\underline{-60° \quad -60°}$$
$$x \quad = 120°$$

Subtract 60 from each side.

The final answer includes units of degrees.

The unknown angle measures 120°.

YOUR TURN

6. Write and solve an equation to find the measure of the unknown angle.

$$x$$
$$65°$$

_____

7. Write and solve an equation to find the complement of an angle that measures 42°.

_____

Writing Real-World Problems for a Given Equation

You can write a real-world problem for a given equation. Examine each number and mathematical operation in the equation.

EXAMPLE 4 — Real World — COMMON CORE 6.EE.7

Write a real-world problem for the equation $21.79 + x = 25$. Then solve the equation.

$$21.79 + x = 25$$

STEP 1 Examine each part of the equation.

x is the unknown or quantity we are looking for.

21.79 is added to x.

$= 25$ means that after adding 21.79 and x, the result is 25.

STEP 2 Write a real-world situation that involves *adding* two quantities.

Joshua wants to buy his mother flowers and a card for Mother's Day. Joshua has $25 to spend and selects roses for $21.79. How much can he spend on a card?

STEP 3 Solve the equation.

$$21.79 + x = 25$$
$$\underline{-21.79 \quad -21.79}$$
$$x = 3.21$$

The final answer includes units of money in dollars.

Joshua can spend $3.21 on a Mother's Day card.

Math Talk
Mathematical Practices

How is the question in a real-world problem related to its equation?

Reflect

8. **What If?** How might the real-world problem change if the equation was $x - 21.79 = 25$ and you still used roses for 21.79?

_____

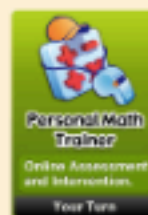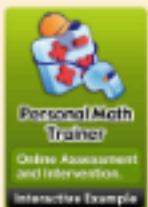_____

_____

YOUR TURN

9. Write a real-world problem for the equation $x - 100 = 40$. Then solve the equation.

_____

Guided Practice

1. A total of 14 guests attended a birthday party. Three friends stayed after the party to help clean up. How many left when the party ended? (Explore Activity)

   a. Let x represent the _____

   b.
Number that		Number that		

   $+$ _____ $=$ _____

   _____ $+$ _____ $=$ _____

   c. Draw algebra tiles to model the equation.

   _____ friends left when the party ended.

Solve each equation. Graph the solution on a number line. (Examples 1 and 2)

2. $2 = x - 3$ $x =$ _____

$$-5\ -4\ -3\ -2\ -1\ \ 0\ \ 1\ \ 2\ \ 3\ \ 4\ \ 5$$

3. $s + 12.5 = 14$ $s =$ _____

$$-5\ -4\ -3\ -2\ -1\ \ 0\ \ 1\ \ 2\ \ 3\ \ 4\ \ 5$$

Solve each equation. (Examples 1 and 2)

4. $h + 6.9 = 11.4$

   $h =$ _____

5. $82 + p = 122$

   $p =$ _____

6. $n + \frac{1}{2} = \frac{7}{4}$

   $n =$ _____

7. Write and solve an equation to find the measure of the unknown angle. (Example 3)

   _____

   $45°$ x

8. Write a real-world problem for the equation $x - 75 = 200$. Then solve the equation. (Example 4)

   _____

? ESSENTIAL QUESTION CHECK-IN

9. How do you solve equations that contain addition or subtraction?

   _____
   _____
   _____

11.2 Independent Practice

COMMON CORE 6.EE.5, 6.EE.6, 6.EE.7

Write and solve an equation to answer each question.

10. A wildlife reserve had 8 elephant calves born during the summer and now has 31 total elephants. How many elephants were in the reserve before summer began?

    _____
    _____

11. My sister is 14 years old. My brother says that his age minus twelve is equal to my sister's age. How old is my brother?

    _____

12. Kim bought a poster that cost $8.95 and some colored pencils. The total cost was $21.35. How much did the colored pencils cost?

    _____
    _____

13. The Acme Car Company sold 37 vehicles in June. How many compact cars were sold in June?

Acme Car Company — June Sales	
Type of car	Number sold
SUV	8
Compact	?

    _____
    _____

14. Sandra wants to buy a new MP3 player that is on sale for $95. She has saved $73. How much more money does she need?

    _____
    _____

15. Ronald spent $123.45 on school clothes. He counted his money and discovered that he had $36.55 left. How much money did he originally have?

    _____

16. Brita withdrew $225 from her bank account. After her withdrawal, there was $548 left in Brita's account. How much money did Brita have in her account before the withdrawal?

    _____

17. **Represent Real-World Problems** Write a real-world situation that can be represented by $15 + c = 17.50$. Then solve the equation and describe what your answer represents for the problem situation.

    _____
    _____
    _____

18. **Critique Reasoning** Paula solved the equation $7 + x = 10$ and got 17, but she is not certain if she got the correct answer. How could you explain Paula's mistake to her?

    _____
    _____
    _____
    _____

Multiplication Equations

6.EE.7

Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.

? ESSENTIAL QUESTION

How can you model solving a multiplication equation?

EXPLORE ACTIVITY 1   6.EE.7

Modeling Equations

When solving a multiplication equation, you can model the equation on a balance scale.

Solve $3x = 9$.

A Model the equation on a balance scale. For this lesson the variable will be represented by a triangle and 1 will be represented by a square. The left side of the equation is already represented on the scale. Represent the right side by drawing nine squares on the right side of the scale.

B Place the triangles in a single column. Place one square across from each triangle. Continue placing squares across from the triangles until all nine squares have been used.

C Circle each of the groups created above. Each group should have one triangle on the left side of the scale and three squares on the right side.

How many squares are equal to one triangle? _____

$x =$ _____

Reflect

1. **What if?** Suppose the equation were $3x = 15$. How many squares would be grouped with each triangle? Why?

_____

_____

EXPLORE ACTIVITY 2   6.EE.7

Balancing Equations

When balancing equations, the first step is to place all triangles and squares on the scale.

Solve $8 = 2g$.

A Model the equation on a balance scale. Represent the left side by drawing eight squares on the left side of the scale. Represent the right side by drawing two triangles on the right side of the scale.

B Place the triangles in a single column. Place one square across from each triangle. Continue placing squares across from the triangles until all eight squares have been used.

C Circle each of the groups created above. Each group should have one triangle on the right side of the scale and four squares on the left side.

How many squares are equal to one triangle? _____

$g =$ _____

Reflect

2. **What If?** Which steps from Explore Activity 1 and Explore Activity 2 could you combine?

_____

_____

_____

Solving Equations

When solving equations on a balance scale, make sure each row has one triangle and an equal number of squares.

EXAMPLE

6.EE.7

Solve the equation by modeling on the scale provided. Place triangles on one side of the scale and squares on the other. Write the solution in the space provided.

$4w = 4$

STEP 1 Draw four triangles on the left side of the scale to represent $4w$. Draw 4 squares on the right side of the scale to represent 4.

STEP 2 Place the triangles in a single column. Place one square across from each triangle until all squares have been used.

STEP 3 Circle each of the groups created above.

$w = 1$

Practice

Solve each equation by circling each triangle and the corresponding group of squares. Write the solution in the space provided.

1. $4x = 16$

$x =$ _____

2. $8 = 4b$

$b =$ _____

Solve each equation by modeling on the scale provided. Group the squares on the empty side of the scale based on the number of triangles provided. Circle each triangle and the corresponding groups of squares. Write the solution in the space provided.

3. $3f = 3$

$f =$ _____

4. $5x = 10$

$x =$ _____

Solve each equation by modeling on the scale provided. Place triangles on one side of the scale and squares on the other. Write the solution in the space provided.

5. $2y = 6$

$y =$ _____

6. $12 = 3c$

$c =$ _____

7. $6 = 3r$

$r =$ _____

8. $2p = 4$

$p =$ _____

LESSON 11.3 Multiplication and Division Equations

6.EE.5

Understand solving an equation...as a process of answering a question: which values...make the equation...true! Also 6.EE.6, 6.EE.7

? **ESSENTIAL QUESTION**

How do you solve equations that contain multiplication or division?
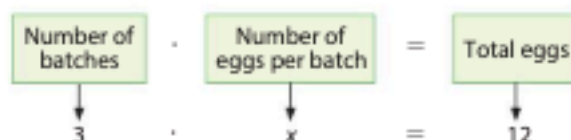
EXPLORE ACTIVITY *Real World*   **6.EE.6**

Modeling Equations

Q Deanna has a cookie recipe that requires 12 eggs to make 3 batches of cookies. How many eggs are needed per batch of cookies?

Let x represent the number of eggs needed per batch.

Number of batches	·	Number of eggs per batch	=	Total eggs
3	·	x	=	12

To answer this question, you can use algebra tiles to solve $3x = 12$.

A Model $3x = 12$.

$3x$ 12

B There are **3** x tiles, so draw circles to separate the tiles into **3** equal groups. One group has been circled for you.

Math Talk
Mathematical Practices

Why is the solution to the equation the number of tiles in each group?
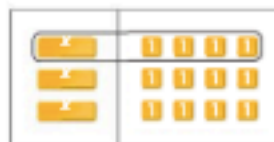
C How many 1 tiles are in each group? _____
This is the solution of the equation.

_____ eggs are needed per batch of cookies.

Reflect

1. **Look for a Pattern** Why does it make sense to arrange the twelve 1 tiles in 3 rows of 4 instead of any other arrangement of twelve 1 tiles, such as 2 rows of 6?

_____

Using Division to Solve Equations

Separating the tiles on both sides of an equation mat into an equal number of groups models dividing both sides of an equation by the same number.

Division Property of Equality

You can divide both sides of an equation by the same nonzero number, and the two sides will remain equal.

When an equation contains multiplication, solve by dividing both sides of the equation by the same nonzero number.

EXAMPLE 1   **6.EE.5**

Solve each equation. Graph the solution on a number line.

A $9a = 54$

$9a = 54$ Notice that 9 is multiplied by a.

$\frac{9a}{9} = \frac{54}{9}$ Divide both sides of the equation by 9.

$a = 6$

Check: $9a = 54$
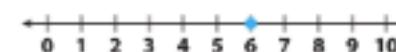
$9(6) \stackrel{?}{=} 54$ Substitute 6 for a.

$54 \stackrel{?}{=} 54$ Multiply on the left side.

B $18 = 6d$

$18 = 6d$ Notice that 6 is multiplied by d.

$\frac{18}{6} = \frac{6d}{6}$ Divide both sides of the equation by 6.

$3 = d$

Check: $18 = 6d$

$18 \stackrel{?}{=} 6(3)$ Substitute 3 for d.

$18 \stackrel{?}{=} 18$ Multiply on the right side.

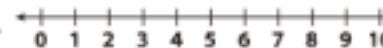**My Notes**

YOUR TURN

Solve the equation $3x = 21$. Graph the solution on a number line.

2. $x =$ _____

Using Multiplication to Solve Equations

When an equation contains division, solve by multiplying both sides of the equation by the same number.

Multiplication Property of Equality

You can multiply both sides of an equation by the same number, and the two sides will remain equal.

EXAMPLE 2

6.EE.5

Solve each equation. Graph the solution on a number line.

A $\frac{x}{5} = 10$

$\frac{x}{5} = 10$ Notice that x is divided by the number 5.

$5 \cdot \frac{x}{5} = 5 \cdot 10$

$x = 50$

Check: $\frac{x}{5} = 10$

$\frac{50}{5} \stackrel{?}{=} 10$ Substitute 50 for x.

$10 \stackrel{?}{=} 10$ Divide on the left side.

B $15 = \frac{r}{2}$

$15 = \frac{r}{2}$ Notice that r is divided by the number 2.

$2 \cdot 15 = 2 \cdot \frac{r}{2}$ Multiply both sides of the equation by 2.

$30 = r$

Check: $15 = \frac{r}{2}$

$15 \stackrel{?}{=} \frac{30}{2}$ Substitute 30 for r.

$15 \stackrel{?}{=} 15$ Divide on the right side.
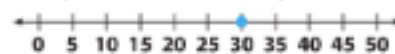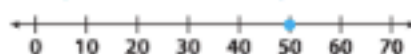
Math Talk
Mathematical Practices

How is solving a multiplication equation similar to solving a division equation? How is it different?

YOUR TURN

Solve the equation $\frac{y}{9} = 1$. Graph the solution on a number line.

3. $\frac{y}{9} = 1$

$y = $ _____

My Notes
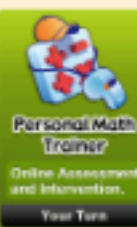
Using Equations to Solve Problems

You can use equations to solve real-world problems.

EXAMPLE 3 — Problem Solving

6.EE.7

Juanita is scrapbooking. She usually completes about 9 pages per hour. One night last week she completed pages 23 through 47 in 2.5 hours. Did she work at her average rate?

Analyze Information

Identify the important information.

- Worked for 2.5 hours
- Starting page: 23   Ending page: 47
- Scrapbooking rate: 9 pages per hour

Formulate a Plan

- Solve an equation to find the number of pages Juanita can expect to complete.
- Compare the number of pages Juanita can expect to complete with the number of pages she actually completed.

Solve

Let n represent the number of pages Juanita can expect to complete in 2.5 hours if she works at her average rate of 9 pages per hour.

Write an equation.

$\frac{n}{2.5} = 9$ Write the equation.

$2.5 \cdot \frac{n}{2.5} = 2.5 \cdot 9$ Multiply both sides by 2.5.

$n = 22.5$

Juanita can expect to complete 22.5 pages in 2.5 hours.

Juanita completed pages 23 through 47, a total of 25 pages. Because $25 > 22.5$, she worked faster than her expected rate.

Justify and Evaluate

You used an equation to find the number of pages Juanita could expect to complete in 2.5 hours if she worked at her average rate. You found that she could complete 22.5 pages.

Since 22.5 pages is less than the 25 pages Juanita completed, she worked faster than her average rate.

The answer makes sense, because Juanita completed 25 pages in 2.5 hours, which is equivalent to a rate of 10 pages in 1 hour. Since $10 > 9$, you know that she worked faster than her average rate.

YOUR TURN

4. Roberto is dividing his baseball cards equally among himself, his brother, and his 3 friends. Roberto was left with 9 cards. How many cards did Roberto give away? Write and solve an equation to solve the problem.

_____

_____

Writing Real-World Problems

You can write a real-world problem for a given equation.

EXAMPLE 4 Real World

6.EE.7

Write a real-world problem for the equation $8x = 72$. Then solve the problem.

STEP 1 Examine each part of the equation.

x is the unknown value you want to find.

8 is multiplied by x.

$= 72$ means that after multiplying 8 and x, the result is 72.

STEP 2 Write a real-world situation that involves multiplying two quantities.

A hot air balloon flew at 8 miles per hour. Write and solve a multiplication equation to find out how many hours the balloon traveled if it covered a distance of 72 miles.

STEP 3 Use the equation to solve the problem.

$8x = 72$

$\frac{8x}{8} = \frac{72}{8}$ Divide both sides by 8.

$x = 9$

The balloon traveled for 9 hours.

YOUR TURN

5. Write a real-world problem for the equation $11x = 385$. Then solve the problem.

_____

_____
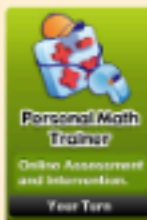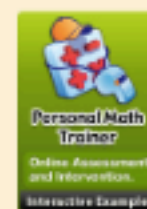
Guided Practice

1. Caroline ran 15 miles in 5 days. She ran the same distance each day. Write and solve an equation to determine the number of miles she ran each day. (Explore Activity)

a. Let x represent the _____.

b.

Number of	·	Number of	=	

| _____ | · | _____ | = | _____ |

c. Draw algebra tiles to model the equation.

Caroline ran _____ miles each day.

Solve each equation. Graph the solution on a number line.
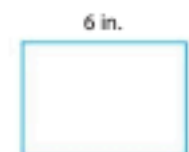(Examples 1 and 2)

2. $x \div 3 = 3; x =$ _____

0 1 2 3 4 5 6 7 8 9 10

3. $4x = 32; x =$ _____

0 1 2 3 4 5 6 7 8 9 10

4. The area of the rectangle shown is 24 square inches. How much longer is its length than its width? (Example 3)

6 in.

w

_____

_____

5. Write a real-world problem for the equation $15w = 45$. Then solve the problem. (Example 4)

_____

_____

? ESSENTIAL QUESTION CHECK-IN

6. How do you solve equations that contain multiplication or division?

_____

_____

_____

Name _____ Class _____ Date _____

11.3 Independent Practice

COMMON CORE 6.EE.5, 6.EE.6, 6.EE.7

In 7–13, write and solve an equation to answer each question.

7. Jorge baked cookies for his math class's end-of-year party. There are 28 people in Jorge's math class including Jorge and his teacher. Jorge baked enough cookies for everyone to get 3 cookies each. How many cookies did Jorge bake?

_____

8. Sam divided a rectangle into 8 congruent rectangles that each have the area shown. What is the area of the rectangle before Sam divided it?

Area = 5 cm²

_____

9. Carmen participated in a read-a-thon. Mr. Cole pledged $4.00 per book and gave Carmen $44. How many books did Carmen read?

_____

10. Lee drove 420 miles and used 15 gallons of gasoline. How many miles did Lee's car travel per gallon of gasoline?

_____

11. On some days, Melvin commutes 3.5 hours per day to the city for business meetings. Last week he commuted for a total of 14 hours. How many days did he commute to the city?

_____

12. Dharmesh has a square garden with a perimeter of 132 feet. Is the area of the garden greater than 1,000 square feet?

s

s

_____
_____
_____
_____
_____
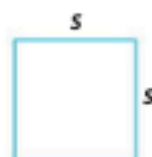
13. Ingrid walked her dog and washed her car. The time she spent walking her dog was one-fourth the time it took her to wash her car. It took Ingrid 14 minutes to walk the dog. How long did it take Ingrid to wash her car?

_____

14. Representing Real-World Problems
Write and solve a problem involving money that can be solved with a multiplication equation.

_____
_____
_____
_____
_____
_____
_____

LESSON 11.4 Writing Inequalities

COMMON CORE 6.EE.8
Write an inequality…to represent a constraint or condition in a real-world or mathematical problem….
Also 6.EE.5, 6.EE.6

? ESSENTIAL QUESTION
How can you use inequalities to represent real-world constraints or conditions?

EXPLORE ACTIVITY Real World
COMMON CORE 6.EE.8, 6.EE.5

Using Inequalities to Describe Quantities

You can use inequality symbols with variables to describe quantities that can have many values.

Symbol	Meaning	Word Phrases
$<$	Is less than	Fewer than, below
$>$	Is greater than	More than, above
$\leq$	Is less than or equal to	At most, no more than
$\geq$	Is greater than or equal to	At least, no less than

A The lowest temperature ever recorded in Florida was -2 °F. Graph this temperature on the number line.

```
◄─┼─┼─┼─┼─┼─┼─┼─┼─┼─┼─┼─┼─┼─┼─┼─┼─►
 -8 -7 -6 -5 -4 -3 -2 -1  0  1  2  3  4  5  6  7  8
```

B The temperatures 0 °F, 3 °F, 6 °F, 5 °F, and -1 °F have also been recorded in Florida. Graph these temperatures on the number line.

C How do the temperatures in **B** compare to -2? How can you see this relationship on the number line?

_____
_____

D How many other numbers have the same relationship to -2 as the temperatures in **B** ? Give some examples.

_____
_____

E Suppose you could graph all of the possible answers to **D** a number line. What would the graph look like?

_____

F Let x represent all the possible answers to **D** .

Complete this inequality: x ☐ -2

Graphing the Solutions of an Inequality

A **solution of an inequality** that contains a variable is any value of the variable that makes the inequality true. For example, 7 is a solution of $x > -2$, since $7 > -2$ is a true statement.
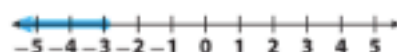
EXAMPLE 1

COMMON CORE **6.EE.5**

Graph the solutions of each inequality. Check the solutions.

A $y \leq -3$

Math Talk
Mathematical Practices
Is $-4\frac{1}{4}$ a solution of $y \leq -3$? Is -5.6?

| STEP 1 | Draw a solid circle at -3 to show that -3 is a solution. |
| STEP 2 | Shade the number line to the left of -3 to show that numbers less than -3 are solutions. |

> Use a solid circle for an inequality that uses ≥ or ≤.

$$-5\ -4\ -3\ -2\ -1\ \ 0\ \ 1\ \ 2\ \ 3\ \ 4\ \ 5$$

| STEP 3 | Check your solution. |

Choose a number that is on the shaded section of the number line, such as -4. Substitute -4 for y.

$-4 \leq -3$ -4 is less than -3, so -4 is a solution.

B $1 < m$

| STEP 1 | Draw an empty circle at 1 to show that 1 is not a solution. |
| STEP 2 | Shade the number line to the right of 1 to show that numbers greater than 1 are solutions. |

> Use an open circle for an inequality that uses > or <.

$$-5\ -4\ -3\ -2\ -1\ \ 0\ \ 1\ \ 2\ \ 3\ \ 4\ \ 5$$

| STEP 3 | Check your answer. |

Substitute 2 for m.

$1 < 2$ 1 is less than 2, so 2 is a solution.

Reflect

1. **Critique Reasoning** Inez says you can rewrite $1 < m$ as $m > 1$. Do you agree?

2. **Analyze Relationships** How is $x < 5$ different from $x \leq 5$?

YOUR TURN

3. Graph the solution of the inequality $t \leq -4$.

$$-10\ -9\ -8\ -7\ -6\ -5\ -4\ -3\ -2\ -1\ \ 0\ \ 1\ \ 2\ \ 3\ \ 4\ \ 5\ \ 6\ \ 7\ \ 8\ \ 9\ \ 10$$
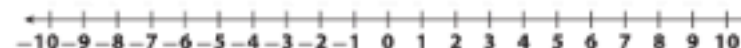
Writing Inequalities

You can write an inequality to model the relationship between an algebraic expression and a number. You can also write inequalities to represent certain real-world situations.

EXAMPLE 2   Real World

COMMON CORE **6.EE.8, 6.EE.6**

A Write an inequality that represents the phrase *the sum of y and 2 is greater than 5*. Draw a graph to represent the inequality.

| STEP 1 | Write the inequality. |

The sum of y and 2 is greater than 5.

$$y + 2 \qquad > \qquad 5$$

| STEP 2 | Graph the solution. |

For $y + 2$ to have a value greater than 5, y must be a number greater than 3.

> Use an open circle at 3 and shade to the right of 3.

$$-5\ -4\ -3\ -2\ -1\ \ 0\ \ 1\ \ 2\ \ 3\ \ 4\ \ 5$$

| STEP 3 | Check your solution by substituting a number greater than 3, such as 4, into the original inequality. |

$4 + 2 > 5$ Substitute 4 for y.

$6 > 5$ 6 is greater than 5, so 4 is a solution.

B To test the temperature rating of a coat, a scientist keeps the temperature below 5 °C. Write and graph an inequality to represent this situation.

| STEP 1 | Write the inequality. Let t represent the temperature in the lab. |

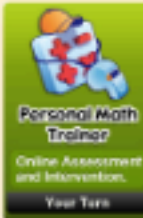$t < 5$ The temperature must be less than 5 °C.

| STEP 2 | Graph the inequality. |

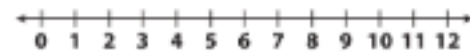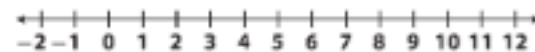$$0\ \ 1\ \ 2\ \ 3\ \ 4\ \ 5\ \ 6\ \ 7\ \ 8\ \ 9\ \ 10$$

YOUR TURN

4. Write an inequality that represents the phrase *the sum of 1 and y is greater than or equal to 3*. Check to see if $y = 1$ is a solution.

_____

_____

Write and graph an inequality to represent each situation.

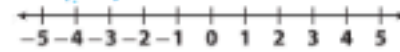5. The temperature in February was at most 6 °F. _____

0 1 2 3 4 5 6 7 8 9 10 11 12

6. Each package must weigh more than 2 ounces. _____

−2 −1 0 1 2 3 4 5 6 7 8 9 10 11 12

Guided Practice

1. Graph $1 \leq x$. Use the graph to determine which of these numbers are solutions of the inequality: −1, 3, 0, 1 (Explore Activity and Example 1)

_____

−5 −4 −3 −2 −1 0 1 2 3 4 5

2. Graph $−3 > z$. Check the graph using substitution. (Example 1)

−5 −4 −3 −2 −1 0 1 2 3 4 5
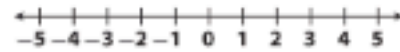
3. Write an inequality that represents the phrase "the sum of 4 and *x* is greater than 6." Draw a graph that represents the inequality, and check your solution. (Example 2)

−5 −4 −3 −2 −1 0 1 2 3 4 5

_____
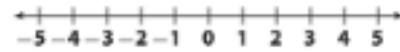
4. During hibernation, a garter snake's body temperature never goes below 3 °C. Write and graph an inequality that represents this situation. (Example 2)

−5 −4 −3 −2 −1 0 1 2 3 4 5

_____
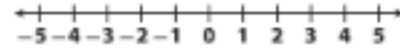
? ESSENTIAL QUESTION CHECK-IN

5. Write an inequality to represent this situation: Nina wants to take at least $15 to the movies. How did you decide which inequality symbol to use?

_____

_____

Name _____ Class _____ Date _____

11.4 Independent Practice
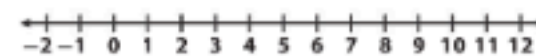
COMMON CORE 6.EE.5, 6.EE.6, 6.EE.8

6. Which of the following numbers are solutions to $x \geq 0$?

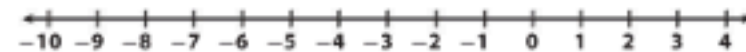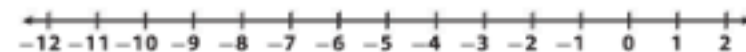$-5, 0.03, -1, 0, 1.5, -6, \frac{1}{2}$ _____
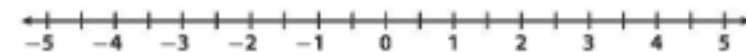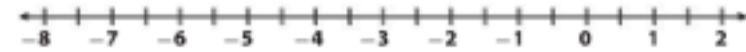
Graph each inequality.

7. $t \leq 8$
−2 −1 0 1 2 3 4 5 6 7 8 9 10 11 12

8. $−7 < h$
−10 −9 −8 −7 −6 −5 −4 −3 −2 −1 0 1 2 3 4

9. $x \geq −9$
−12 −11 −10 −9 −8 −7 −6 −5 −4 −3 −2 −1 0 1 2

10. $n > 2.5$
−5 −4 −3 −2 −1 0 1 2 3 4 5

11. $−4\frac{1}{2} > x$
−8 −7 −6 −5 −4 −3 −2 −1 0 1 2

Write an inequality that matches the number line model.

12. _____
−10 −9 −8 −7 −6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6 7 8 9 10

13. _____
−10 −9 −8 −7 −6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6 7 8 9 10
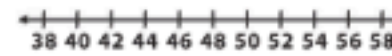
14. _____
−5 −4 −3 −2 −1 0 1 2 3 4 5

15. _____
−5 −4 −3 −2 −1 0
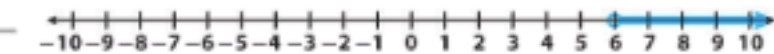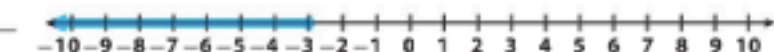
16. A child must be at least 48 inches tall to ride a roller coaster.

   a. Write and graph an inequality to represent this situation.
   38 40 42 44 46 48 50 52 54 56 58

   _____

   b. Can a child who is 46 inches tall ride the roller coaster? Explain.

   _____

MODULE QUIZ

Ready to Go On?

11.1 Writing Equations to Represent Situations

Determine whether the given value is a solution of the equation.

1. $\frac{b}{12} = 5; b = 60$ _____

2. $7w = 87; w = 12$ _____

Write an equation to represent the situation.

3. The number of eggs in the refrigerator e decreased by 5 equals 18.

_____

11.2 Addition and Subtraction Equations

Solve each equation.

4. $r - 38 = 9$ _____

5. $h + 17 = 40$ _____

6. $n + 75 = 155$ _____

7. $q - 17 = 18$ _____

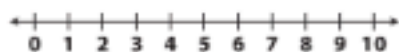### 11.3 Multiplication and Division Equations

Solve each equation.

8. $8z = 112$ _____

9. $\frac{d}{14} = 7$ _____

10. $\frac{f}{28} = 24$ _____

11. $3a = 57$ _____

11.4 Writing Inequalities

Write an inequality to represent each situation, then graph the solutions.

12. There are fewer than 8 gallons of gas in the tank. _____

13. There are at least 3 slices of bread left in the bag. _____

? ESSENTIAL QUESTION

14. How can you solve problems involving equations that contain addition, subtraction, multiplication, or division?

_____

_____

COMMON CORE

MODULE 11 MIXED REVIEW

Assessment Readiness

Selected Response

1. Kate has gone up to the chalkboard to do math problems 5 more times than Andre. Kate has gone up 11 times. Which equation represents this situation?

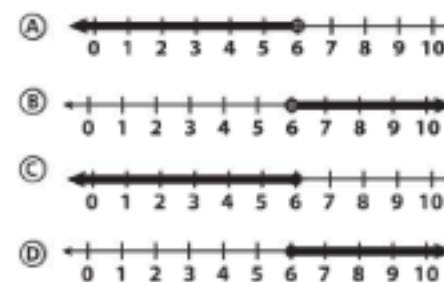(A) $a - 11 = 5$

(B) $5a = 11$

(C) $a - 5 = 11$

(D) $a + 5 = 11$

2. For which equation is $y = 7$ a solution?

(A) $7y = 1$

(B) $18 = 11 + y$

(C) $y + 7 = 0$

(D) $\frac{y}{2} = 14$

3. Which is an equation?

(A) $17 + x$

(C) $20x = 200$

(B) $45 \div x$

(D) $90 - x$

4. The temperature never rose above 6 °F on Friday. Which number line could represent this situation?

(A)

(B)

(C)

(D)

5. Becca hit 7 more home runs than Beverly. Becca hit 21 home runs. How many home runs did Beverly hit?

(A) 3

(C) 21

(B) 14

(D) 28

6. Jeordie spreads out a rectangular picnic blanket with an area of 42 square feet. Its width is 6 feet. Which equation could you use to find its length?

(A) $6x = 42$

(C) $\frac{6}{x} = 42$

(B) $42 - x = 6$

(D) $6 + x = 42$

7. What is a solution to the equation $6t = 114$?

(A) $t = 19$

(C) $t = 120$

(B) $t = 108$

(D) $t = 684$

8. The area of a rectangular deck is 680 square feet. The deck's width is 17 feet. What is its perimeter?

(A) 40 feet

(C) 114 feet

(B) 57 feet

(D) 228 feet

Mini-Task

9. Sylvia earns $7 per hour at her afterschool job. After working one week, she received a paycheck for $91.

a. Write and solve an equation to find the number of hours Sylvia worked to earn $91.

_____

b. The greatest number of hours Sylvia can work in any week is 15. Write an inequality to represent this statement.

_____

c. What is the greatest amount of money Sylvia can earn in one week?

_____

Are YOU Ready?

Complete these exercises to review skills you will need for this module.

Personal Math Trainer

Online Assessment and Intervention.

Are You Ready?

Multiplication Facts

EXAMPLE $8 \times 7 = \blacksquare$

Use a related fact you know.
$7 \times 7 = 49$
Think: $8 \times 7 = (7 \times 7) + 7$
$= 49 + 7$
$= 56$

Multiply.

1. 7×6 _____ **2.** 10×9 _____ **3.** 13×12 _____ **4.** 8×9 _____

Write the rule for each table.

5.

x	1	2	3	4
y	7	14	21	28

6.

x	1	2	3	4
y	7	8	9	10

_____

7.

x	1	2	3	4
y	5	10	15	20

8.

x	0	4	8	12
y	0	2	4	6

_____

Graph Ordered Pairs (First Quadrant)

EXAMPLE
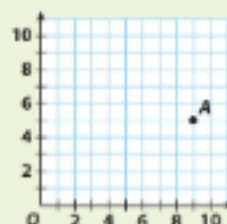
Start at the origin.
Move 9 units right.
Then move 5 units up.
Graph point $A(9, 5)$.

Graph each point on the coordinate grid above.

9. $B(0, 8)$ **10.** $C(2, 3)$ **11.** $D(6, 7)$ **12.** $E(5, 0)$

LESSON 12.1

Graphing on the Coordinate Plane

COMMON CORE 6.NS.6c
...find and position pairs of integers and other rational numbers on a coordinate plane. Also 6.NS.6, 6.NS.6b, 6.NS.8
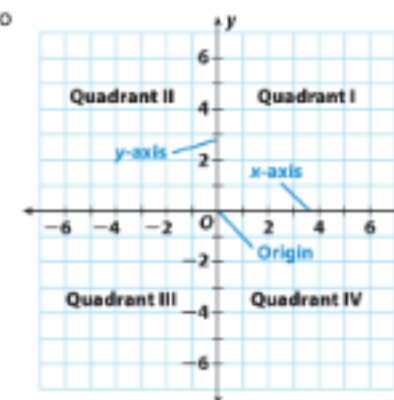
? ESSENTIAL QUESTION

How do you locate and name points in the coordinate plane?

EXPLORE ACTIVITY **COMMON CORE** 6.NS.6c, 6.NS.6b

Naming Points in the Coordinate Plane

A **coordinate plane** is formed by two number lines that intersect at right angles. The point of intersection is 0 on each number line.

- The two number lines are called the **axes**.
- The horizontal axis is called the **x-axis**.
- The vertical axis is called the **y-axis**.
- The point where the axes intersect is called the **origin**.
- The two axes divide the coordinate plane into four **quadrants**.

An **ordered pair** is a pair of numbers that gives the location of a point on a coordinate plane. The first number tells how far to the right (positive) or left (negative) the point is located from the origin. The second number tells how far up (positive) or down (negative) the point is located from the origin.

The numbers in an ordered pair are called **coordinates**. The first number is the **x-coordinate** and the second number is the **y-coordinate**.

EXAMPLE 1 Identify the coordinates of each point. Name the quadrant where each point is located.

Point A is 1 unit _____ of the origin and 5 units _____.
It has x-coordinate _____ and y-coordinate _____, written
(_____, _____). It is located in Quadrant _____.

Point B is 2 unit _____ of the origin and 3 units _____.
It has x-coordinate _____ and y-coordinate _____, written
(_____, _____). It is located in Quadrant _____.
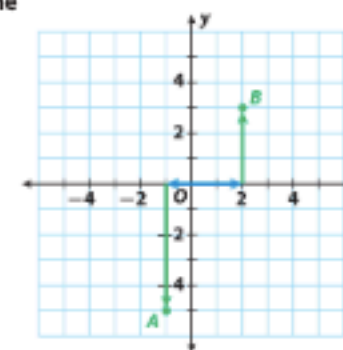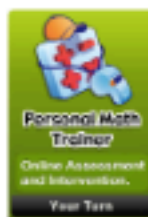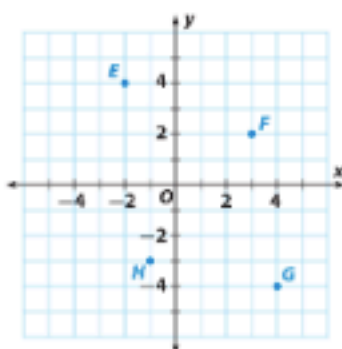
Reflect

1. If both coordinates of a point are negative, in which quadrant is the point located? _____

2. Describe the coordinates of all points in Quadrant I.

   _____

3. **Communicate Mathematical Ideas** Explain why $(-3, 5)$ represents a different location than $(3, 5)$.

   _____
   _____
   _____

YOUR TURN

Identify the coordinates of each point. Name the quadrant where each point is located.

4. G _____

   E _____

5. F _____

   H _____

Graphing Points in the Coordinate Plane

Points that are located on the axes are not located in any quadrant. Points on the x-axis have a y-coordinate of 0, and points on the y-axis have an x-coordinate of 0.
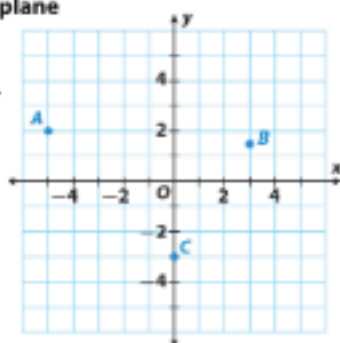
EXAMPLE 2   6.NS.6c, 6.NS.6

Graph and label each point on the coordinate plane
$A(-5, 2)$, $B(3, 1.5)$, $C(0, -3)$

Point A is 5 units *left* and 2 units *up* from the origin.

Point B is 3 units *right* and 1.5 units *up* from the origin. Graph the point halfway between (3, 1) and (3, 2).

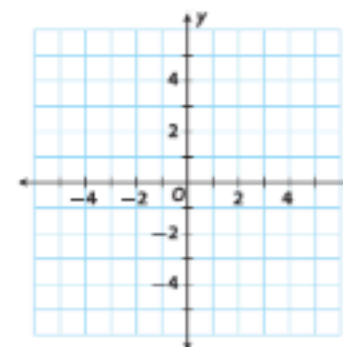Point C is 3 units *down* from the origin. Graph the point on the y-axis.

YOUR TURN

Graph and label each point on the coordinate plane.

6. $P(-4, 2)$

7. $Q(3, 2.5)$

8. $R(-4.5, -5)$

9. $S(4, -5)$

10. $T(-2.5, 0)$

Reading Scales on Axes

The *scale* of an axis is the number of units that each grid line represents. So far, the graphs in this lesson have a scale of 1 unit, but graphs frequently use other units.

EXAMPLE 3 Real World   6.NS.8

The graph shows the location of a city. It also shows the location of Gary's and Jen's houses. The scale on each axis represents miles.
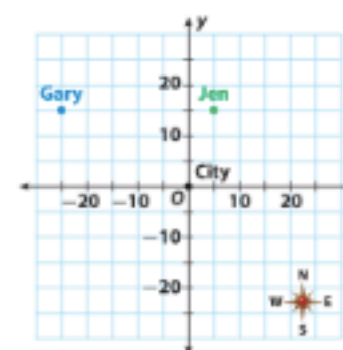
A Use the scale to describe Gary's location relative to the city.

Each grid square is 5 miles on a side.

Gary's house is at $(-25, 15)$, which is 25 miles west and 15 miles north of the city.

B Describe the location of Jen's house relative to Gary's house.

Jen's house is located 6 grid squares to the right of Gary's house. Since each grid square is 5 miles on a side, her house is $6 \cdot 5 = 30$ miles from Gary's.
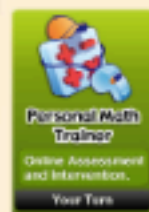
YOUR TURN

Use the graph in the Example.

11. Ted lives 20 miles south and 20 miles west of the city represented on the graph in Example 3. His brother Ned lives 50 miles north of Ted's house. Give the coordinates of each brother's house.

    _____

Math Talk
Mathematical Practices

How are north, south, east, and west represented on the graph in Example 3?

Guided Practice

Identify the coordinates of each point in the coordinate plane. Name the quadrant where each point is located.
(Explore Activity Example 1)

1. Point A is 5 units _____ of the origin and
   1 unit _____ from the origin.
   Its coordinates are _____. It is in quadrant _____.

2. Point B is _____ units right of the origin
   and _____ units down from the origin.
   Its coordinates are _____. It is in quadrant _____.
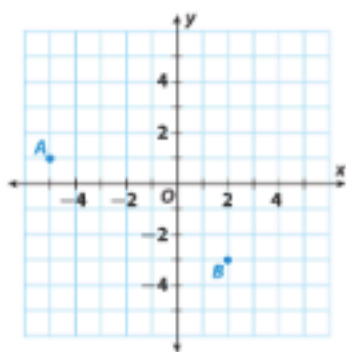
Graph and label each point on the coordinate plane above. (Example 2)

3. Point C at $(-3.5, 3)$

4. Point D at $(5, 0)$

For 5–7, use the coordinate plane shown. (Example 3)

5. Describe the scale of the graph.

6. Plot point A at $\left(-\frac{1}{2}, 2\right)$.

7. Plot point B at $\left(2\frac{1}{2}, -2\right)$.

8. **Vocabulary** Describe how an ordered pair represents a point on a coordinate plane. Include the terms x-coordinate, y-coordinate, and origin in your answer.
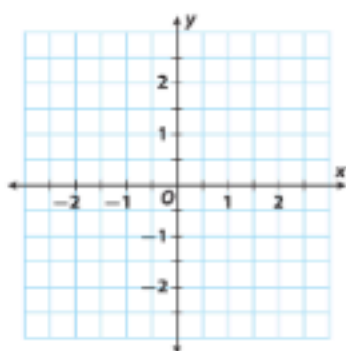
? ESSENTIAL QUESTION CHECK-IN

9. Give the coordinates of one point in each of the four quadrants, one point on the x-axis, and one point on the y-axis.

Name _____ Class _____ Date _____

12.1 Independent Practice

COMMON CORE 6.NS.6, 6.NS.6b, 6.NS.6c, 6.NS.8

For 10–13, use the coordinate plane shown. Each unit represents 1 kilometer.

10. Write the ordered pairs that represent the location of Sam and the theater.

11. Describe Sam's location relative to the theater.

12. Sam wants to meet his friend Beth at a restaurant before they go to the theater. The restaurant is 9 km south of the theater. Plot and label a point representing the restaurant. What are the coordinates of the point?

13. Beth describes her current location: "I'm directly south of the theater, halfway to the restaurant." Plot and label a point representing Beth's location. What are the coordinates of the point?
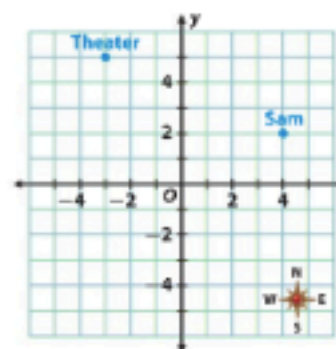
For 14–15, use the coordinate plane shown.

14. Find the coordinates of points T, U, and V.

15. Points T, U, and V are the vertices of a rectangle. Point W is the fourth vertex. Plot point W and give its coordinates.

16. **Explain the Error** Janine tells her friend that ordered pairs that have an x-coordinate of 0 lie on the x-axis. She uses the origin as an example. Describe Janine's error. Use a counterexample to explain why Janine's statement is false.
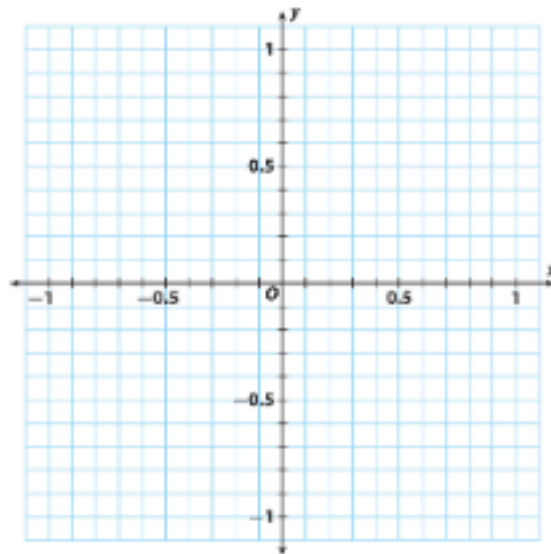
Practice

Q
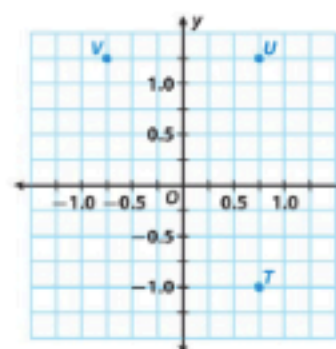
Identify the coordinates of each point.

1. C _____

2. D _____

3. E _____

4. F _____

Q
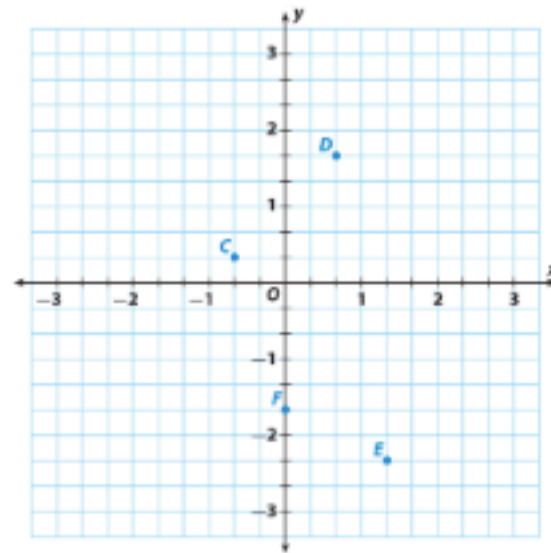
Graph and label each point on the coordinate plane.

5. $P(-0.8, 0.5)$

6. $Q(0.4, 0.7)$

7. $R(0.3, -0.3)$

8. $S(0.8, -1)$

9. $T(-0.7, -0.6)$

LESSON 12.2

Independent and Dependent Variables in Tables and Graphs

? **ESSENTIAL QUESTION**

How can you identify independent and dependent quantities from tables and graphs?

EXPLORE ACTIVITY 1 Real World — COMMON CORE 6.EE.9

Identifying Independent and Dependent Quantities from a Table

Many real-world situations involve two variable quantities in which one quantity depends on the other. The quantity that depends on the other quantity is called the **dependent variable**, and the quantity it depends on is called the **independent variable**.

Q

A freight train moves at a constant speed. The distance y in miles that the train has traveled after x hours is shown in the table.

Time x (h)	0	1	2	3
Distance y (mi)	0	50	100	150

A What are the two quantities in this situation?

_____

Which of these quantities depends on the other?

_____

What is the independent variable?

What is the dependent variable? _____

B How far does the train travel each hour? _____

The relationship between the distance traveled by the train and the time in hours can be represented by an equation in two variables.

Distance traveled (miles)	=	Distance traveled per hour	·	Time (hours)
↓		↓		↓
y	=	50	·	x

EXPLORE ACTIVITY *(cont'd)*

Reflect

1. Analyze Relationships Describe how the value of the independent variable is related to the value of the dependent variable. Is the relationship additive or multiplicative?

_____

2. What are the units of the independent variable and of the dependent variable?

_____

_____

3. A rate is used in the equation. What is the rate?

_____

EXPLORE ACTIVITY 2 *Real World* **COMMON CORE 6.EE.9**

Identifying Independent and Dependent Variables from a Graph

In Explore Activity 1, you used a table to represent a relationship between an independent variable (time) and a dependent variable (distance). You can also use a graph to show this relationship.

An art teacher has 20 pounds of clay but wants to buy more clay for her class. The amount of clay *x* purchased by the teacher and the amount of clay *y* available for the class are shown on the graph.
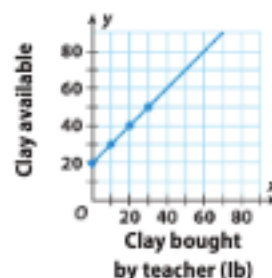
A If the teacher buys 10 more pounds of clay, how many

pounds will be available for the art class? _____ lb

If the art class has a total of 50 pounds of clay available, how many pounds of clay did the teacher buy?

How can you use the graph to find this information?

_____

_____

_____

Clay Used in Art Class

Clay available (y-axis: 20, 40, 60, 80)
Clay bought by teacher (lb) (x-axis: 20, 40, 60, 80)

B What are the two quantities in this situation?

_____

_____

Which of these quantities depends on the other?

_____

_____

What is the independent variable? _____

What is the dependent variable? _____

C The relationship between the amount of clay purchased by the teacher and the amount of clay available to the class can be represented by an equation in two variables.

Amount of clay available (pounds)	=	Current amount of clay (pounds)	+	Amount of clay purchased (pounds)
↓		↓		↓
y	=	20	+	x

D Describe in words how the value of the independent variable is related to the value of the dependent variable.

_____

_____

Reflect

4. In this situation, the same units are used for the independent and dependent variables. How is this different from the situation involving the train in the first Explore?

_____

_____

5. Analyze Relationships Tell whether the relationship between the independent variable and the dependent variable is a multiplicative or an additive relationship.

_____

6. What are the units of the independent variable, and what are the units of the dependent variable?

independent variable: _____ ; dependent variable: _____

Describing Relationships Between Independent and Dependent Variables

Thinking about how one quantity depends on another helps you identify which quantity is the independent variable and which quantity is the dependent variable. In a graph, the independent variable is usually shown on the horizontal axis and the dependent variable on the vertical axis.

EXAMPLE 1 Real World

6.EE.9

A The table shows a relationship between two variables, *x* and *y*. Describe a possible situation the table could represent. Describe the independent and dependent variables in the situation.

Independent variable, *x*	0	1	2	3
Dependent variable, *y*	10	11	12	13

As *x* increases by 1, *y* increases by 1. The relationship is additive. The value of *y* is always 10 units greater than the value of *x*.

The table could represent Jina's savings if she starts with $10 and adds $1 to her savings every day.

The independent variable, *x*, is the number of days she has been adding money to her savings.

The dependent variable, *y*, is her savings after *x* days.

B The graph shows a relationship between two variables. Describe a possible situation that the graph could represent. Describe the independent and dependent variables.

As *x* increases by 1, *y* increases by 12. The relationship is multiplicative. The value of *y* is always 12 times the value of *x*.

The graph could represent the number of eggs in cartons that each hold 12 eggs.

The independent variable, *x*, is the number of cartons. The dependent variable, *y*, is the total number of eggs.
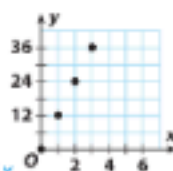
Reflect

7. What are other possible situations that the table and graph in the Examples could represent?

_____

_____

_____

_____

YOUR TURN

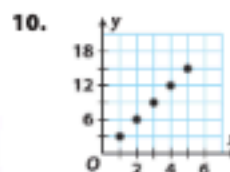Describe real-world values that the variables could represent. Describe the relationship between the independent and dependent variables.

8.

x	0	1	2	3
y	15	16	17	18

_____

_____

_____

_____

_____

9.

x	0	1	2	3	4
y	0	16	32	48	64

_____

_____

_____

_____

_____

10.

_____

_____

_____

_____

_____

Personal Math Trainer
Online Assessment and Intervention

Selected Answers
See all the selected answers.

1. A boat rental shop rents paddleboats for a fee plus an additional cost per hour. The cost of renting for different numbers of hours is shown in the table.

Time (hours)	0	1	2	3
Cost ($)	10	11	12	13

What is the independent variable, and what is the dependent variable? How do you know? (Explore Activity 1)

_____

_____

_____

2. A car travels at a constant rate of 60 miles per hour. (Explore Activity 1)

| Time x (h)	0	1	2	3
Distance y (mi)				

a. Complete the table.

b. What is the independent variable, and what is the dependent?

_____

_____

c. Describe how the value of the independent variable is related to the value of the dependent variable.

_____

_____

Use the graph to answer the questions.

3. Describe in words how the value of the independent variable is related to the value of the dependent variable. (Explore Activity 2)

_____

_____

4. Describe a real-world situation that the graph could represent. (Example 1)

_____

_____
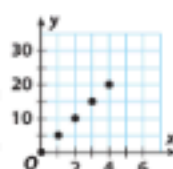
? ESSENTIAL QUESTION CHECK-IN

5. How can you identify the dependent and independent variables in a real-world situation modeled by a graph?

_____

_____

_____

12.2 Independent Practice

Personal Math Trainer
Online Assessment and Intervention

Selected Answers
See all the selected answers.

COMMON CORE 6.EE.9

6. The graph shows the relationship between the hours a soccer team practiced after the season started and their total practice time for the year.

a. How many hours did the soccer team practice before the season began?

_____

b. What are the two quantities in this situation?

_____

_____

c. What are the dependent and independent variables?

_____

_____

d. Is the relationship between the variables additive or multiplicative? Explain.

_____

_____

e. **Analyze Relationships** Describe the relationship between the quantities in words.

_____

_____
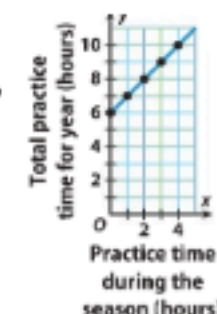
7. **Multistep** Teresa is buying glitter markers to put in gift bags. The table shows the relationship between the number of gift bags and the number of glitter markers she needs to buy.

Number of gift bags, x	0	1	2	3
Number of markers, y	0	5	10	15

a. What is the dependent variable? _____

b. What is the independent variable? _____

c. Is the relationship additive or multiplicative? Explain.

_____

_____

d. Describe the relationship between the quantities in words.

_____

LESSON 12.3 Writing Equations from Tables

COMMON CORE 6.EE.9
...write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable....

? ESSENTIAL QUESTION

How can you use an equation to show a relationship between two variables?

EXPLORE ACTIVITY
COMMON CORE 6.EE.9

Writing an Equation to Represent a Real-World Relationship

Many real-world situations involve two variable quantities in which one quantity depends on the other. This type of relationship can be represented by a table. You can also use an equation to model the relationship.

The table shows how much Amanda earns for walking 1, 2, or 3 dogs. Use the table to determine how much Amanda earns per dog. Then write an equation that models the relationship between number of dogs walked and earnings. Use your equation to complete the table.

Dogs walked	1	2	3	5	10	20
Earnings	$8	$16	$24			

For 1 dog, Amanda earns 1 · 8 = $8.
For 2 dogs, she earns 2 · 8 = $16.

A For each column, compare the number of dogs walked and earnings. What is the pattern?

_____

_____

B Based on the pattern, Amanda earns $ _____ for each dog she walks.

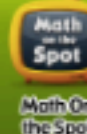**C** Write an equation that relates the number of dogs Amanda walks to the amount she earns. Let e represent earnings and d represent dogs.

_____

D Use your equation to complete the table for 5, 10, and 20 walked dogs.

E Amanda's earnings depend on _____ .

Reflect

1. **What If?** If Amanda changed the amount earned per dog to $11, what equation could you write to model the relationship between number of

dogs walked and earnings? _____

Math On the Spot

Animated Math

Personal Math Trainer
Online Assessment and Intervention.
Interactive Example

Writing an Equation Based on a Table

The relationship between two variables where one variable depends on the other can be represented in a table or by an equation. An equation expresses the dependent variable in terms of the independent variable.

When there is no real-world situation to consider, we usually say x is the independent variable and y is the dependent variable. The value of y depends on the value of x.

EXAMPLE 1
COMMON CORE 6.EE.9

Write an equation that expresses y in terms of x.

A

x	1	2	3	4	5
y	0.5	1	1.5	2	2.5

STEP 1 Compare the x- and y-values to find a pattern.

Each y-value is $\frac{1}{2}$, or 0.5 times, the corresponding x-value.

STEP 2 Use the pattern to write an equation expressing y in terms of x.

$y = 0.5x$

B

x	2	4	6	8	10
y	5	7	9	11	13

STEP 1 Compare the x- and y-values to find a pattern.

Each y-value is 3 more than the corresponding x-value.

STEP 2 Use the pattern to write an equation expressing y in terms of x.

$y = x + 3$

Math Talk
Mathematical Practices
How can you check that your equations are correct?

YOUR TURN

For each table, write an equation that expresses y in terms of x.

2.

x	12	11	10
y	10	9	8

3.

x	10	12	14
y	25	30	35

_____   _____

4.

x	5	4	3
y	10	9	8

5.

x	0	1	2
y	0	2	4

_____   _____

Personal Math Trainer
Online Assessment and Intervention.
Your Turn

Using Tables and Equations to Solve Problems

You can use tables and equations to solve real-world problems.

EXAMPLE 2 Problem Solving

COMMON CORE 6.EE.9

A certain percent of the sale price of paintings at a gallery will be donated to charity. The donation will be $50 if a painting sells for $200. The donation will be $75 if a painting sells for $300. Find the amount of the donation if a painting sells for $1,200.

Analyze Information

You know the donation amount when the sale price of a painting is $200 and $300. You need to find the donation amount if a painting sells for $1,200.

Formulate a Plan

You can make a table to help you determine the relationship between sale price and donation amount. Then you can write an equation that models the relationship. Use the equation to find the unknown donation amount.

Solve

Make a table.

Sale price ($)	200	300
Donation amount ($)	50	75

$\frac{50}{200} = \frac{50 \div 2}{200 \div 2} = \frac{25}{100} = 25\%$ $\frac{75}{300} = \frac{75 \div 3}{300 \div 3} = \frac{25}{100} = 25\%$

> One way to determine the relationship between sale price and donation amount is to find the percent.

Write an equation. Let p represent the sale price of the painting. Let d represent the donation amount to charity.

The donation amount is equal to 25% of the sale price.

$d = 0.25 \cdot p$

> p is the independent variable; its value does not depend on any other value. d is the dependent variable; its value depends on the price of the painting.

Find the donation amount when the sale price is $1,200.

$d = 0.25 \cdot p$

$d = 0.25 \cdot 1,200$ Substitute $1,200 for the sale price of the painting.

$d = 300$ Simplify to find the donation amount.

When the sale price is $1,200, the donation to charity is $300.

Justify and Evaluate

Substitute values from the table for p and d to check that they are solutions of the equation $d = 0.25 \cdot p$. Then check your answer of $300 by substituting for d and solving for p.

$d = 0.25 \cdot p$ $d = 0.25 \cdot p$ $d = 0.25 \cdot p$
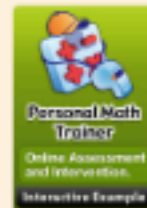$d = 0.25 \cdot 200$ $d = 0.25 \cdot 300$ $300 = 0.25 \cdot p$
$d = 50$ ✓ $d = 75$ ✓ $p = 1,200$ ✓

YOUR TURN

6. When Ryan is 10, his brother Kyle is 15. When Ryan is 16, Kyle will be 21. When Ryan is 21, Kyle will be 26. Write and solve an equation to find Kyle's age when Ryan is 52.

Guided Practice

Write an equation to express y in terms of x. (Explore Activity, Example 1)

1.

x	10	20	30	40
y	6	16	26	36

2.

x	0	1	2	3
y	0	4	8	12

3.

x	4	6	8	10
y	7	9	11	13

4.

x	12	24	36	48
y	2	4	6	8

5. Jameson downloaded one digital song for $1.35, two digital songs for $2.70, and 5 digital songs for $6.75. Write and solve an equation to find the cost to download 25 digital songs. (Example 2)

Songs downloaded	1	2	5	10
Total cost ($)	1.35			

Number of songs = n; Cost = _____

The total cost of 25 songs is _____

? ESSENTIAL QUESTION CHECK-IN

6. Explain how to use a table to write an equation that represents the relationship in the table.

_____

_____

12.3 Independent Practice

6.EE.9

7. Vocabulary What does it mean for an equation to express y in terms of x?

_____

_____

8. The length of a rectangle is 2 inches more than twice its width.

Write an equation relating the length l of the rectangle to its width w.

_____

9. Look for a Pattern Compare the y-values in the table to the corresponding x-values. What pattern do you see? How is this pattern used to write an equation that represents the relationship between the x- and y-values?

x	20	24	28	32
y	5	6	7	8

_____

_____

10. Explain the Error A student modeled the relationship in the table with the equation $x = 4y$. Explain the student's error. Write an equation that correctly models the relationship.

x	2	4	6	8
y	8	16	24	32

_____

_____

11. Multistep Marvin earns $8.25 per hour at his summer job. He wants to buy a video game system that costs $206.25.

a. Write an equation to model the relationship between number of hours worked h and amount earned e.

_____

b. Solve your equation to find the number of hours Marvin needs to work in order to afford the video game system.

_____

LESSON

12.4 Representing Algebraic Relationships in Tables and Graphs

6.EE.9
...Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.

? ESSENTIAL QUESTION How can you use verbal descriptions, tables, and graphs to represent algebraic relationships?

EXPLORE ACTIVITY 1 Real World **6.EE.9**

Representing Algebraic Relationships

Angie's walking speed is 5 kilometers per hour, and May's is 4 kilometers per hour. Show how the distance each girl walks is related to time.

**A** For each girl, make a table comparing time and distance.

For every hour Angie walks, she travels 5 km.

Time (h)	0	1	2	3	4
Angie's distance (km)	0	5	10		

For every hour May walks, she travels 4 km.

Time (h)	0	1	2	3	4
May's distance (km)	0	4	8		

B For each girl, make a graph showing her distance y as it depends on time x. Plot points from the table and connect them with a line. Write an equation for each girl that relates distance y to time x.
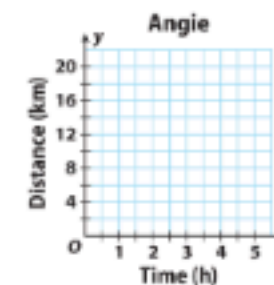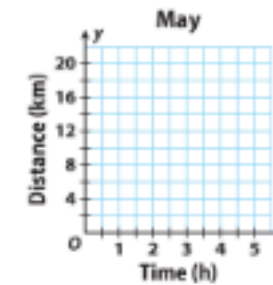
Angie's equation: _____   May's equation: _____

Math Talk
Mathematical Practices
Why does it make sense to connect the points in each graph?

Reflect

1. Analyze Relationships How can you use the tables to determine which girl is walking faster? How can you use the graphs?

_____

_____

EXPLORE ACTIVITY 2 · Real World · COMMON CORE 6.EE.9

# Writing an Equation from a Graph

Cherise pays the entrance fee to visit a museum, then buys souvenirs at the gift shop. The graph shows the relationship between the total amount she spends at the museum and the amount she spends at the gift shop. Write an equation to represent the relationship.

A Read the ordered pairs from the graph. Use them to complete a table comparing total spent y to amount spent at the gift shop x.

Gift shop amount ($)	0	5	10	15	
Total amount ($)	5	10			

B What is the pattern in the table?

_____

_____

_____

C Write an equation that expresses the total amount spent, y, in terms of the amount spent at the gift shop, x.

_____

Total amount ($) vs **Gift shop amount ($)**
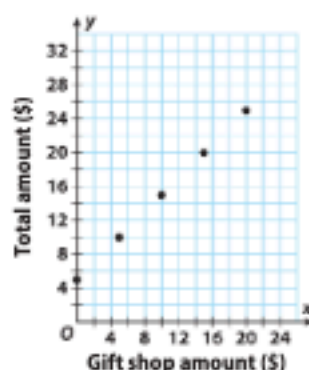
Reflect

2. Communicate Mathematical Ideas Identify the dependent and independent quantities in this situation.

_____

_____

_____

3. Multiple Representations Draw a line through the points on the graph. Find the point that represents Cherise spending $18 at the gift shop. Use this point to find the total she would spend if she spent $18 at the gift shop. Then use your equation from **C** to verify your answer.

_____

_____

Graphing an Equation

An ordered pair (x, y) that makes an equation like $y = x + 1$ true is called a **solution** of the equation. The graph of an equation represents all the ordered pairs that are solutions.
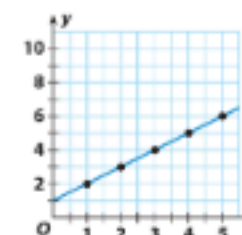
EXAMPLE 1 · COMMON CORE 6.EE.9

Graph each equation.

A $y = x + 1$

STEP 1 Make a table of values. Choose some values for x and use the equation to find the corresponding values for y.

STEP 2 Plot the ordered pairs from the table.

STEP 3 Draw a line through the plotted points to represent all of the ordered pair solutions of the equation.
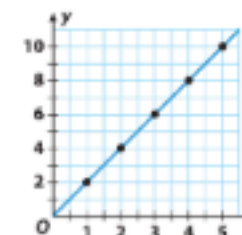
x	$x + 1 = y$	(x, y)
1	$1 + 1 = 2$	$(1, 2)$
2	$2 + 1 = 3$	$(2, 3)$
3	$3 + 1 = 4$	$(3, 4)$
4	$4 + 1 = 5$	$(4, 5)$
5	$5 + 1 = 6$	$(5, 6)$

B $y = 2x$

STEP 1 Make a table of values. Choose some values for x and use the equation to find the corresponding values for y.

STEP 2 Plot the ordered pairs from the table.

STEP 3 Draw a line through the plotted points to represent all of the ordered pair solutions of the equation.

x	$2x = y$	(x, y)
1	$2 \times 1 = 2$	$(1, 2)$
2	$2 \times 2 = 4$	$(2, 4)$
3	$2 \times 3 = 6$	$(3, 6)$
4	$2 \times 4 = 8$	$(4, 8)$
5	$2 \times 5 = 10$	$(5, 10)$

Math Talk
Mathematical Practices

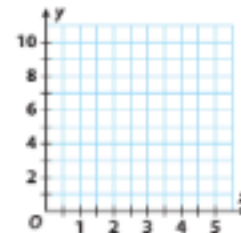Is the ordered pair $(3.5, 4.5)$ a solution of the equation $y = x + 1$? Explain.

YOUR TURN

Q 4. Graph $y = x + 2.5$.

x	$x + 2.5 = y$	(x, y)

Personal Math Trainer
Online Assessment and Intervention.
Guided Practice

Selected Answers
See all the selected answers.

Guided Practice

Frank mows lawns in the summer to earn extra money. He can mow 3 lawns every hour he works. (Explore Activity 1 and Explore Activity 2)

1. Make a table to show the relationship between the number of hours Frank works, x, and the number of lawns he mows, y. Graph the relationship and write an equation. Label the axes of your graph.
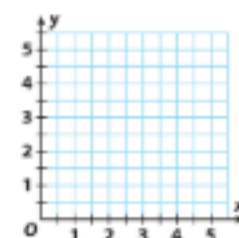
Hours worked	Lawns mowed
0	
1	
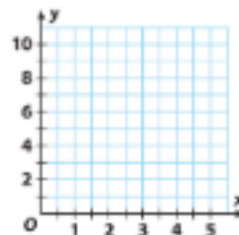
Graph $y = 1.5x$. (Example 1)

2. Make a table to show the relationship.

x			
y			

3. Plot the points and draw a line through them.

? ESSENTIAL QUESTION CHECK-IN

4. How can a table represent an algebraic relationship between two variables?

Name _____ Class _____ Date _____

12.4 Independent Practice

COMMON CORE 6.EE.9

Personal Math Trainer
Online Assessment and Intervention.
Independent Practice

Selected Answers
See all the selected answers.

Q Students at Mills Middle School are required to work a certain number of community service hours. The table shows the numbers of additional hours several students worked beyond their required hours, as well as the total numbers of hours worked.

5. Read the ordered pairs from the graph to make a table.

Additional hours				
Total hours				

6. Write an equation that expresses the total hours in terms of the additional hours.

_____

7. **Analyze Relationships** How many community service hours are students required to work? Explain.

_____

_____
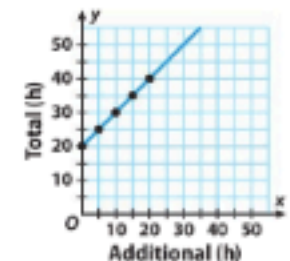
Q Beth is using a map. Let x represent a distance in centimeters on the map. To find an actual distance y in kilometers, Beth uses the equation $y = 8x$.

8. Make a table comparing a distance on the map to the actual distance.

Map distance (cm)				
Actual distance (km)				

9. Make a graph that compares the map distance to the actual distance. Label the axes of the graph.

10. **Critical Thinking** The actual distance between Town A and Town B is 64 kilometers. What is the distance on Beth's map? Did you use the graph or the equation to find the answer? Why?

_____

_____
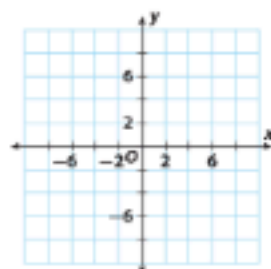
_____

_____
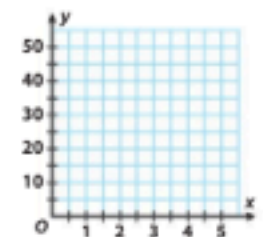
Ready to Go On?

12.1 Graphing on the Coordinate Plane

Graph each point on the coordinate plane.

1. $A(-2, 4)$

2. $B(3, 5)$

3. $C(6, -4)$

4. $D(-3, -5)$

5. $E(7, 2)$

6. $F(-4, 6)$

12.2 Independent and Dependent Variables in Tables and Graphs

7. Jon buys packages of pens for $5 each. Identify the independent and dependent variables in the situation.

12.3 Writing Equations from Tables

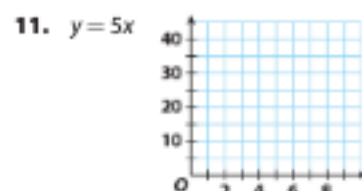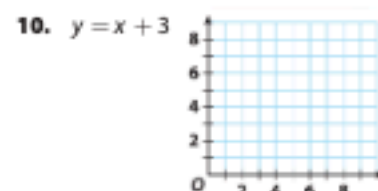**Write an equation that represents the data in the table.**

8.

x	3	5	8	10
y	21	35	56	70

9.

x	5	10	15	20
y	17	22	27	32

12.4 Representing Algebraic Relationships in Tables and Graphs

Graph each equation.

10. $y = x + 3$

11. $y = 5x$

? ESSENTIAL QUESTION

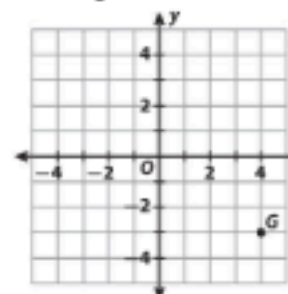**12.** How can you write an equation in two variables to solve a problem?

COMMON CORE

Assessment Readiness

Selected Response

1. What are the coordinates of point G on the coordinate gr

- (A) $(4, 3)$
- (B) $(4, -3)$
- (C) $(-4, 3)$
- (D) $(-4, -3)$

2. A point is located in quadrant II of a coordinate plane. Which of the following could be the coordinates of that point?

- (A) $(-5, -7)$
- (B) $(5, 7)$
- (C) $(-5, 7)$
- (D) $(5, -7)$

3. Matt had 5 library books. He checked 1 additional book out every week without returning any books. Which equation describes the number of books he has, y, after x weeks?

- (A) $y = 5x$
- (B) $y = 5 - x$
- (C) $y = 1 + 5x$
- (D) $y = 5 + x$

4. Stewart is playing a video game. He earns the same number of points for each prize he captures. He earned 1,200 points for 6 prizes, 2,000 points for 10 prizes, and 2,600 points for 13 prizes. Which is the dependent variable in the situation?

- (A) the number of prizes captured
- (B) the number of points earned
- (C) the number of hours
- (D) the number of prizes available

5. Which point is *not* on the graph of the equation $y = 10 + x$?

- (A) $(0, 10)$
- (B) $(3, 13)$
- (C) $(8, 2)$
- (D) $(5, 15)$

6. Amy gets paid by the hour. Her sister helps. As shown, Amy gives her sister part of her earnings. Which equation represents Amy's pay when her sister's pay is $13?

Amy's pay in dollars	10	20	30	40
Sister's pay in dollars	2	4	6	8

- (A) $y = \frac{13}{5}$
- (B) $13 = \frac{x}{5}$
- (C) $5 = 13y$
- (D) $13 = 5x$

Mini-Task

7. The table compares the ages, in years, of two cousins.

Ann's age, x	4	8	12
Tom's age, y	8	12	16

a. Write an equation that compares Tom's and Ann's ages.

b. Draw a graph to represent the equation.
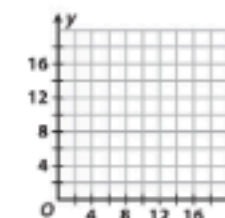
UNIT 5
Study Guide Review

MODULE 11 Equations and Relationships

? ESSENTIAL QUESTION

How can you use equations and relationships to solve real-world problems?

EXAMPLE 1

Determine if the given value is a solution of the equation.

A. $r - 5 = 17; r = 12$

$12 - 5 \stackrel{?}{=} 17$ Substitute.

$7 \neq 17$

12 is not a solution of $r - 5 = 17$.

B. $\frac{x}{6} = 7; x = 42$

$\frac{42}{6} \stackrel{?}{=} 7$ Substitute.

$7 = 7$

42 is a solution of $\frac{x}{6} = 7$.

EXAMPLE 2

Solve each equation. Check your answer.

A. $y - 12 = 10$

$\underline{+12 \quad +12}$ Add 12 to both sides.

$y = 22$

Check: $22 - 12 \stackrel{?}{=} 10$ Substitute.

$10 = 10$

B. $5p = 30$

$\frac{5p}{5} = \frac{30}{5}$ Divide both sides by 5.

$p = 6$

Check: $5(6) \stackrel{?}{=} 30$ Substitute.

$30 = 30$

EXAMPLE 3

Write and graph an inequality to represent each situation.

A. There are at least 5 gallons of water in an aquarium.

$g \geq 5$ [number line 0 to 10, shaded from 5]

B. The temperature today will be less than 35 °F.

$t < 35$ [number line 30 to 40, shaded below 35]

EXERCISES

Determine whether the given value is a solution of the equation. (Lesson 11.1)

1. $7x = 14; x = 3$ _____

2. $y + 13 = 17; y = 4$ _____

Write an equation to represent the situation. (Lesson 11.1)

3. Don has three times as much money as his brother, who has $25. _____

4. There are s students enrolled in Mr. Rodriguez's class. There are 6 students absent and 18 students present today. _____

Solve each equation. Check your answer. (Lessons 11.2, 11.3)

5. $p - 5 = 18$ _____

6. $9q = 18.9$ _____

7. $3.5 + x = 7$ _____

8. $\frac{2}{7} = 2x$ _____

9. Sonia used $12.50 to buy a new journal. She has $34.25 left in her savings account. How much money did Sonia have before she bought the journal? Write and solve an equation to solve the problem. (Lesson 11.2) _____

Write and graph an inequality to represent each situation. (Lesson 11.4)

10. The company's stock is worth less than $2.50 per share. _____

[number line 0 to 5, shaded below 2.5]

11. Tina got a haircut, and her hair is still at least 15 inches long. _____

[number line 10 to 20, shaded from 15]

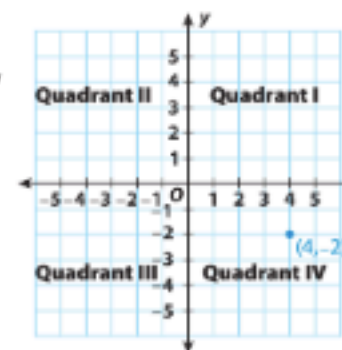### MODULE 12 Relationships in Two Variables

? ESSENTIAL QUESTION

How can you use relationships in two variables to solve real-world problems?

EXAMPLE 1

Graph the point (4, −2) and identify the quadrant where it is located.

$(4, -2)$ is located 4 units to the right of the origin and 2 units down from the origin.

$(4, -2)$ is in quadrant IV.

[coordinate plane showing Quadrant II, Quadrant I, Quadrant III, Quadrant IV with point (4, −2) plotted]

EXAMPLE 2

Tim is paid $8 more than the number of bags of peanuts he sells at the baseball stadium. The table shows the relationship between the money Tim earns and the number of bags of peanuts Tim sells. Identify the independent and dependent variables, and write an equation that represents the relationship.

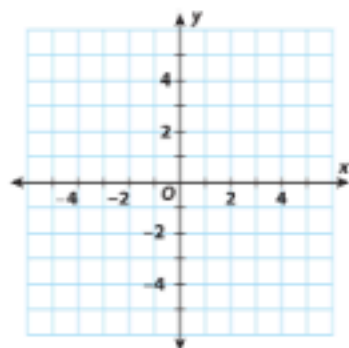| Bags of peanuts, x	0	1	2	3
Money earned, y	8	9	10	11

The number of bags is the independent variable, and the money Tim earns is the dependent variable.

The equation $y = x + 8$ expresses the relationship between the number of bags Tim sells and the amount he earns.
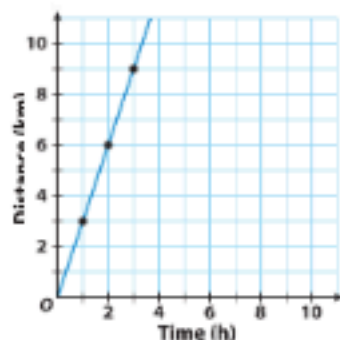
EXERCISES

Graph and label each point on the coordinate plane. (Lesson 12.1)
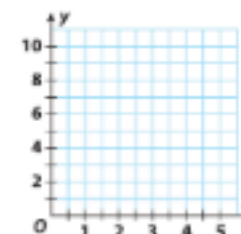
1. $(4, 4)$

2. $(-3, -1)$

3. $(-1, 4)$

Use the graph to answer the questions. (Lesson 12.2)

4. What is the independent variable? _____

5. What is the dependent variable? _____

6. Describe the relationship between the independent variable and the dependent variable.

_____

7. Use the data in the table to write an equation to express y in terms of x. Then graph the equation. (Lessons 12.3, 12.4)

x	0	1	2	3
y	4	5	6	7

_____

Unit 5 Performance Tasks

1. **CAREERS IN MATH** Botanist Dr. Adama is a botanist. She measures the daily height of a particular variety of sunflower, Sunny Yellow, beginning when the sunflower is 60 days old. At 60 days, the height of the sunflower is 205 centimeters. Dr. Adama finds that the growth rate of this sunflower is 2 centimeters per day after the first 60 days.

   a. Write an expression to represent the sunflower's height after d days. _____

   b. How many days does it take for the sunflower to reach 235 centimeters? Show your work.

   _____

   c. The Suntracker grows at a rate of 2.5 centimeters per day after the first 60 days. If this sunflower is 195 centimeters tall when it is 60 days old, write an expression to represent Suntracker's height after d days. Which sunflower will be taller after 22 days, or when it is 82 days old? Explain how you found your answer.

   _____

   _____

2. Vernon practiced soccer $5\frac{3}{4}$ hours this week. He practiced $4\frac{1}{3}$ hours on weekdays and the rest over the weekend.

   a. Write an equation that represents the situation. Define your variable.

   _____

   _____

   b. What is the least common multiple of the denominators of $5\frac{3}{4}$ and $4\frac{1}{3}$? Show your work.

   _____

   c. Solve the equation and interpret the solution. Show your work.

   _____

   _____

Assessment Readiness

COMMON CORE

Personal Math Trainer
Online Assessment and Intervention
my.hrw.com

1. Using the expression $7x = 3y$, if y is 35, what is x?

Ⓐ 15

Ⓑ 21

Ⓒ 35

Ⓓ 105

2. Bruce has 97 sports cards. 34 of them are football cards. Which equation can be used to find the number of sports cards y that are not football cards?

Ⓐ $97 + 34 = y$

Ⓑ $y + 97 = 34$

Ⓒ $34 + y = 97$

Ⓓ $y - 97 = 34$

3. The overnight temperature in Tampa never reached below 40 °F during November. Which inequality shows that?

Ⓐ $x < 40$

Ⓑ $x > 40$

Ⓒ $x = 40$

Ⓓ $x \geq 40$

4. Truman puts money into his savings account every time he gets paid. The table below shows how much he saves.

Amount Truman is paid	$15	$30	$45
Amount Truman saves	$1.50	$3	$4.50

Which of the following equations can be used to find the amount m Truman saves when he is paid $20?

Ⓐ $m = 20(0.10)$

Ⓑ $20m = 0.10$

Ⓒ $0.10m = 20$

Ⓓ $m = \frac{10}{20}$

5. No more than 7 copies of a newspaper are left in the newspaper rack. Which inequality represents this situation?

Ⓐ $n < 7$

Ⓑ $n \leq 7$

Ⓒ $n > 7$

Ⓓ $n \geq 7$

6. For which of the inequalities below is $v = 4$ a solution?

Ⓐ $v + 5 \geq 9$

Ⓑ $v + 5 > 9$

Ⓒ $v + 5 \leq 8$

Ⓓ $v + 5 < 8$

7. Sarah has read aloud in class 3 more times than Joel. Sarah has read 9 times. Which equation represents this situation?

Ⓐ $j - 9 = 3$

Ⓑ $3j = 9$

Ⓒ $j - 3 = 9$

Ⓓ $j + 3 = 9$

8. The number line below represents the solution to which inequality?

Ⓐ $m > 4.4$

Ⓑ $m > 5$

Ⓒ $m < 4.4$

Ⓓ $m < 4$

Hot Tip! When possible, use logic to eliminate at least two answer choices.

9. Brian is playing a video game. He earns the same number of points for each star he picks up. He earned 2,400 points for 6 stars, 4,000 points for 10 stars, and 5,200 points for 13 stars. Which is the independent variable in the situation?

Ⓐ the number of stars picked up

Ⓑ the number of points earned

Ⓒ the number of hours played

Ⓓ the number of stars available

10. Which ratio is **not** equivalent to the other three?

Ⓐ $\frac{2}{5}$

Ⓑ $\frac{12}{25}$

Ⓒ $\frac{6}{15}$

Ⓓ $\frac{18}{45}$

11. One inch is about 2.54 centimeters. About how many centimeters is 4.5 inches?

Ⓐ 1.8 centimeters

Ⓑ 11.4 centimeters

Ⓒ 13.7 centimeters

Ⓓ 114 centimeters

Mini-Tasks

12. Dana, Neil, and Frank are siblings. Dana is the oldest.

a. Frank's age is one-fourth of Dana's age. Write an equation to represent Frank's age f if Dana's age is d years.

b. Neil's age is one-half of the difference between Dana's and Frank's ages. Write an equation to represent Neil's age n in terms of Dana's age d.

c. Use the equations to find Neil's and Frank's ages if Dana is 16 years old.

13. Jillian is participating in a book reading contest to raise funds for her local library. For every book Jillian reads, her mother pledged to make a donation.

a. The table shows how much Jillian's mother will donate. Find the pattern, and finish the table.

Books Jillian reads	3	5	7	
Money Jillian's mother donates	$15	$25		

b. Write an equation showing the pattern from the table. Identify the variables.

c. Graph the equation.