LESSON 11-1

Writing Equations to Represent Situations

Practice and Problem Solving: A/B

Determine whether the given value is a solution of the equation. Write *yes* or *no*.

1. $x + 11 = 15$; $x = 4$ _____

2. $36 - w = 10$; $w = 20$ _____

3. $0.2v = 1.2$; $v = 10$ _____

4. $15 = 6 + d$; $d = 8$ _____

5. $28 - w = 25$; $w = 3$ _____

6. $4t = 32$; $t = 8$ _____

7. $\dfrac{12}{s} = 4$; $s = 3$ _____

8. $\dfrac{33}{p} = 3$; $p = 11$ _____

Circle the letter of the equation that each given solution makes true.

9. $m = 19$

   A $10 + m = 20$ C $7m = 26$

   B $m - 4 = 15$ D $\dfrac{18}{m} = 2$

10. $a = 16$

   A $2a = 18$ C $24 - a = 6$

   B $a + 12 = 24$ D $\dfrac{a}{4} = 4$

Write an equation to represent each situation.

11. Seventy-two people signed up for the soccer league. After the players were evenly divided into teams, there were 6 teams in the league and *x* people on each team.

   _____

12. Mary covered her kitchen floor with 10 tiles. The floor measures 6 feet long by 5 feet wide. The tiles are each 3 feet long and *w* feet wide.

   _____

Solve.

13. The low temperature was 35°F. This was 13°F lower than the daytime high temperature. Write an equation to determine whether the high temperature was 48°F or 42°F.

   _____

14. Kayla bought 16 bagels. She paid a total of $20. Write an equation to determine whether each bagel cost $1.50 or $1.25.

   _____

15. Write a real-world situation that could be modeled by the equation $\dfrac{24}{y} = 3$. Then solve the problem.

   _____

   _____

   _____

LESSON 11-1

Writing Equations to Represent Situations

Practice and Problem Solving: C

Circle the letter of the value that makes each equation true.

1. $\dfrac{18}{m} = 15 - 12$

    A $m = 6$ C $m = 9$

    B $m = 3$ D $m = 2$

2. $6d = 8(12 - 6)$

    A $d = 18$ C $d = 8$

    B $d = 48$ D $d = 4$

3. $x = \dfrac{14 - 6}{2}$

    A $x = 6$ C $x = 16$

    B $x = 8$ D $x = 4$

4. $\dfrac{a}{4} = 3(10 \div 2)$

    A $a = 15$ C $a = 40$

    B $a = 60$ D $a = 20$

For Exercises 5–7, use the table at the right that shows how many minutes certain mammals can stay under water.

5. A sperm whale can stay under water 7 times as long as x minutes more than a platypus can. Write an equation that states the relationship of the minutes these two mammals can stay under water.

   _____

Animal	Min
Hippopotamus	15
Platypus	10
Sea Cow	
Seal	22
Sperm Whale	112

6. A sea cow can stay under water y minutes. This is 11 minutes longer than one-third the time a hippopotamus can. Write an equation that states the relationship of the minutes these two mammals can stay under water. Complete the table with 16 or 56.

   _____

7. Write an equation that includes division that relates the number of minutes a seal can stay under water to the number of minutes a sperm whale can stay under water.

   _____

Solve.

8. Mr. Sosha teaches 4 math classes, with the same number of students in each class. Of those students, 80 are sixth graders and 40 are fifth graders. Write an equation to determine whether there are 22, 25, or 30 students in each class. How many are in each class?
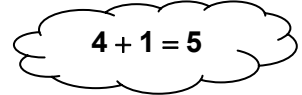
   _____

9. Write an equation that involves multiplication, addition, contains a variable, and has a solution of 8.

   _____

Name _____ Date _____ Class _____

Writing Equations to Represent Situations

Practice and Problem Solving: D

Is the given value of the variable a solution of the equation? Write *yes* or *no*. The first one is done for you.

(cloud: $4 + 1 = 5$)

1. $x + 1 = 5$; $x = 4$ ___**yes**___

2. $13 - w = 10$; $w = 2$ _____

3. $2v = 12$; $v = 10$ _____

4. $\dfrac{14}{p} = 2$; $p = 7$ _____

5. $8 + w = 11$; $w = 3$ _____

6. $4t = 20$; $t = 5$ _____

Circle the letter of the equation that each given solution makes true. The first one is done for you.

7. $x = 5$

  Ⓐ $2 + x = 7$ *(cloud: $2 + 5 = 7$)*

  B $9 - x = 3$

  C $3x = 18$

8. $g = 7$

  A $9g = 16$

  B $8 - g = 1$

  C $11 + g = 17$

9. $y = 2$

  A $7 - y = 1$

  B $3y = 6$

  C $\dfrac{10}{y} = 20$

10. $m = 9$

  A $m - 4 = 13$

  B $7m = 36$

  C $\dfrac{18}{m} = 2$

11. $z = 4$

  A $5z = 20$

  B $\dfrac{12}{z} = 4$

  C $z - 3 = 7$

12. $a = 8$

  A $2a = 10$

  B $a + 12 = 20$

  C $\dfrac{a}{4} = 4$

13. Rhonda has $13. She has one $5 bill, three $1 bills, and one other bill. Is the other bill a $1 bill or a $5 bill? Explain.

  ___**(1)$5**___   +   (3)_____   +   Other bill   = $_____

  _____

  _____

LESSON 11-1 — Writing Equations to Represent Situations
Reteach

An **equation** is a mathematical sentence that says that two quantities are equal.

Some equations contain variables. A **solution** for an equation is a value for a variable that makes the statement true.

You can write related facts using addition and subtraction.

$7 + 6 = 13$ $13 - 6 = 7$

You can write related facts using multiplication and division.

$3 \cdot 4 = 12$ $\dfrac{12}{4} = 3$

You can use related facts to find solutions for equations. If the related fact matches the value for the variable, then that value is a solution.

A. $x + 5 = 9;\ x = 3$

   Think: $9 - 5 = x$
   $4 = x$
   $4 \neq 3$

   3 is **not** a solution of $x + 5 = 9$.

B. $x - 7 = 5;\ x = 12$

   Think: $5 + 7 = x$
   $12 = x$
   $12 = 12$

   12 is a solution of $x - 7 = 5$.

C. $2x = 14;\ x = 9$

   Think: $14 \div 2 = x$
   $7 = x$
   $7 \neq 9$

   9 is **not** a solution of $2x = 14$.

D. $\dfrac{x}{5} = 3\ ;\ x = 15$

   Think: $3 \cdot 5 = x$
   $15 = x$
   $15 = 15$

   15 is a solution of $x \div 5 = 3$.

Use related facts to determine whether the given value is a solution for each equation.

1. $x + 6 = 14;\ x = 8$

2. $\dfrac{s}{4} = 5;\ s = 24$

3. $g - 3 = 7;\ g = 11$

4. $3a = 18;\ a = 6$

5. $26 = y - 9;\ y = 35$

6. $b \cdot 5 = 20;\ b = 3$

7. $15 = \dfrac{v}{3};\ v = 45$

8. $11 = p + 6;\ p = 5$

9. $6k = 78;\ k = 12$

LESSON 11-1	**Writing Equations to Represent Situations**

Reading Strategies: Build Vocabulary

You can see part of the word **equal** in **equation.** In math, an equation indicates that two expressions have the same value, or are equal. The = **sign** in an equation separates one expression from the other. The value on each side of the = sign is the same.

Look at the equations below. Notice how the value on each side of the = sign is the same for each equation:

$5 + 7 = 8 + 4$ $19 - 7 = 12$ $42 = 3 \bullet 14$

If an equation contains a variable, and the variable is replaced by a value that keeps the equation equal, that value is called a **solution** of the equation.

Determine whether 80 or 60 is a solution to $\frac{y}{4} = 15$

$$\frac{y}{4} = 15$$

$$\frac{80}{4} \overset{?}{=} 15$$

$$20 \overset{?}{=} 15$$

"20 is **not** equal to 15."

$$\frac{y}{4} = 15$$

$$\frac{60}{4} \overset{?}{=} 15$$

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

"15 is equal to 15."

Which are equations? Write *yes* or *no*.

1. $7 + 23 \overset{?}{=} 9 + 21$ _____

2. $35 + 15 \overset{?}{=} 45$ _____

3. $28 - 7 \overset{?}{=} 15 + 6$ _____

Replace the given value for the variable. Is it a solution? Write *yes* or *no*.

4. $d + 28 = 45; d = 17$

5. $\frac{84}{s} = 28; s = 3$

_____

_____

6. $17 = 56 - t; t = 40$

7. $86 = 4w; w = 24$

_____

_____

Solve.

8. Use the numbers 2, 11, 13, and 15 to write an equation.

_____

9. Replace one of the numbers in your equation in Exercise 8 with the variable *y*. Determine whether 2, 11, 13, or 15 is a solution of your equation.

_____

_____

LESSON 11-1

Writing Equations to Represent Situations

Success for English Learners

Problem

Determine whether 61 or 59 is a solution of the equation $a + 23 = 82$.

Is 61 a solution?

$a + 23 = 82$

$61 + 23 \overset{?}{=} 82$ Replace a with 61.

$84 \neq 82$

These are NOT equal.
61 is NOT a solution.

Is 59 a solution?

$a + 23 = 82$

$59 + 23 \overset{?}{=} 82$ Replace a with 59.

$82 = 82$

These are equal.
59 is a solution.

1. How do you know that 61 is not a solution of $a + 23 = 82$?

   _____

   _____

2. How can you find out whether 65 is a solution of $a + 23 = 82$?

   _____

3. Write a real-world situation that could be modeled by $a + 23 = 82$.

   _____

   _____

LESSON 11-2

Addition and Subtraction Equations

Practice and Problem Solving: A/B

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

1. $6 = r + 2$ $r =$ ____

2. $26 = w - 12$ $w =$ ____
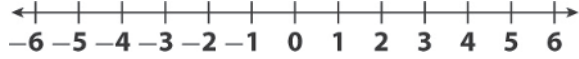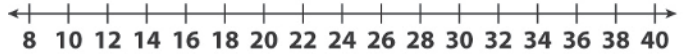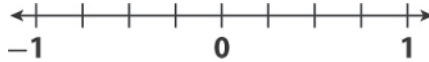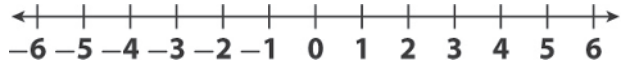
3. $\dfrac{1}{2} = m - \dfrac{1}{8}$ $m =$ ____

4. $t + 1 = -3$ $t =$ ____

Use the drawing at the right for Exercises 5–6.

5. Write an equation to represent the measures of the angles.

   _____
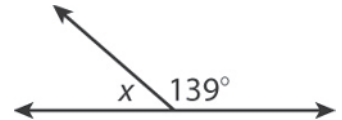
6. Solve the equation to find the measure of the unknown angle.

   _____

Use the drawing at the right for Exercises 7–8.

7. Write an equation to represent the measures of the angles.

   _____
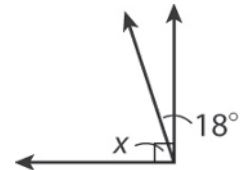
8. Solve the equation to find the measure of the unknown angle.

   _____

Write a problem for the equation $3 + x = 8$. Then solve the equation and write the answer to your problem.

9. _____

   _____

   _____

LESSON
11-2

Addition and Subtraction Equations

Practice and Problem Solving: C

Solve each equation.

1. $b + 2.3 = 5.7$ $b =$ ____

2. $s - \dfrac{1}{3} = \dfrac{4}{9}$ $s =$ ____

3. $6\dfrac{1}{2} + n = 12$ $n =$ ____

4. $15.35 = z - 1.84$ $z =$ ____

5. $d + (-3) = -7$ $d =$ ____

6. $12 = g + 52$ $g =$ ____

Use the drawing at the right for Exercises 7–8.

7. Write an equation to represent the measures of the angles.

   _____

8. Solve the equation to find the measure of the unknown angle.

   _____
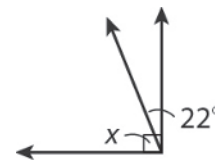
Write and solve an equation to answer each question.

9. Kayla is 13 years old. Her uncle says that his age minus 22 is equal to Kayla's age. How old is Kayla's uncle?

   _____

10. Gavin wants to buy a jacket that sells for $38.95. An advertisement says that next week that jacket will be on sale for $22.50. How much will Gavin save if he waits until next week to buy the jacket?

   _____

11. Sierra sawed $10\dfrac{1}{2}$ inches off the end of a board. The remaining board was $37\dfrac{1}{2}$ inches long. How long was the board that Sierra started with?

   _____

Write a problem for the equation $4.65 = x - 2.35$. Then solve the equation and write the answer to your problem.

12. _____

   _____

   _____

   _____

LESSON 11-2

Addition and Subtraction Equations

Practice and Problem Solving: D

Solve each equation. Graph the solution on the number line. The first one is done for you.

1. $5 = r - 1$ $r = \underline{\ 6\ }$

   $5 = r - 1$
   $\underline{+1 \quad +1}$
   $6 = r$
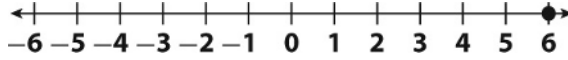
2. $2 = w + 3$ $w = \underline{\ \ \ }$
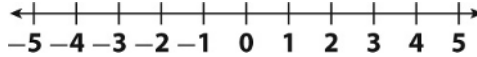
3. $5 = m + 2$ $m = \underline{\ \ \ }$
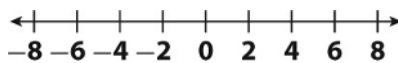
4. $t - 5 = 0$ $t = \underline{\ \ \ }$
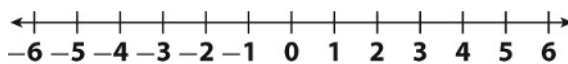
Use the drawings at the right for Exercises 5–6. The first one has been done for you.

5. Write an equation to represent the measures of the angles.

   $x + 100 = 180$
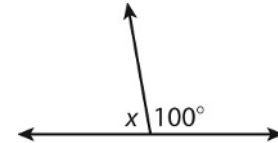
6. Solve the equation to find the measure of the unknown angle.

   _____

7. Mayumi has the boxes shown at the right. The total number of objects in two of the boxes is the same as the number of objects in the third box. Write an equation to show the relationship of the number of objects in the boxes.

   _____
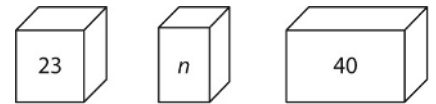
8. How many objects are in the box marked *n*? ____ objects

Write a problem for the equation $x - 5 = 2$. Then solve the equation and write the answer to your problem.

9. _____

   _____

   _____

**LESSON
11-2**

Addition and Subtraction Equations
Reteach

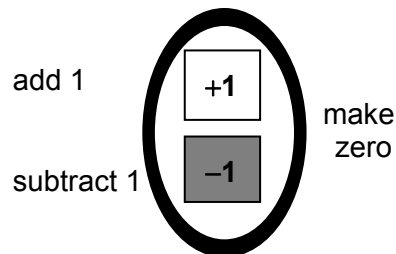To solve an equation, you need to get the variable alone on one side of the equal sign.

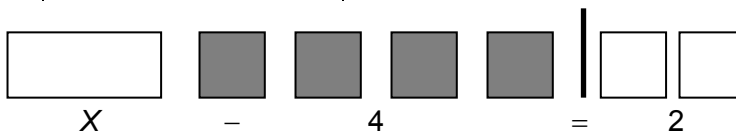| You can use tiles to help you solve subtraction equations.	Addition undoes subtraction, so you can use addition to solve subtraction equations.	Zero pair: $+1 + (-1) = 0$
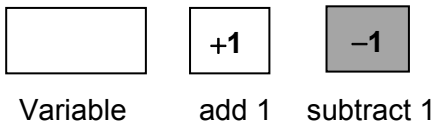
Variable   add 1   subtract 1

+1   –1

One positive tile and one negative tile make a **zero pair**.

add 1

subtract 1

+1

–1

make zero

To solve $x - 4 = 2$, first use tiles to model the equation.

X   –   4   =   2

To get the variable alone, you have to add positive tiles. Remember to add the same number of positive tiles to each side of the equation.

x –   4   +   4   =   2   +   4
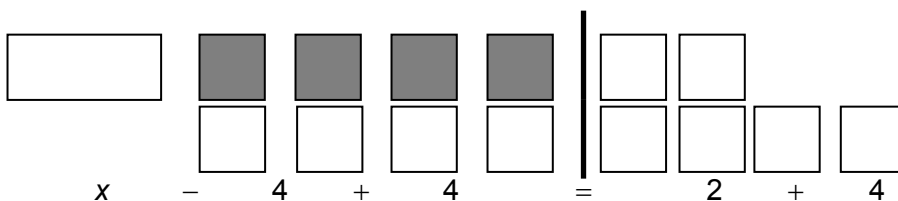
Then remove the greatest possible number of zero pairs from each side of the equal sign.

x =   6

The remaining tiles represent the solution.
$x = 6$
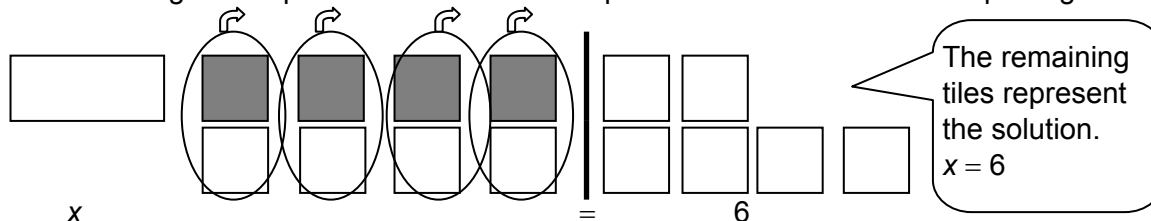
Use tiles to solve each equation.

1. $x - 5 = 3$

   $x = $ ____

2. $x - 2 = 7$

   $x = $ ____

3. $x - 1 = 4$

   $x = $ ____

4. $x - 8 = 1$

   $x = $ ____

5. $x - 3 = 3$

   $x = $ ____

6. $x - 6 = 2$

   $x = $ ____

LESSON 11-2 Addition and Subtraction Equations

Reading Strategies: Use a Visual Clue

You can picture balanced scales to solve subtraction equations.
Picture balanced scales for this equation.

Step 1: To find the value of b, get b by itself on the left side of the equation. So, add 17 to the left side of the equation.
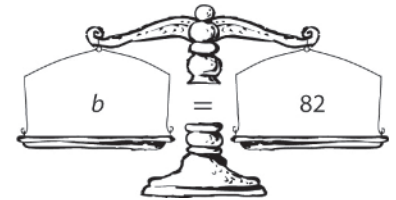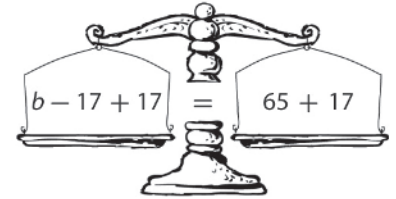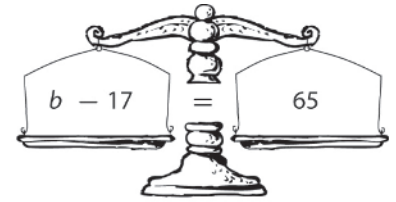
Step 2: To keep the equation balanced, add 17 to the right side of the equation as well.

Step 3: Check to verify that $b = 82$ is the solution.

$$b - 17 = 65$$

$$82 - 17 \overset{?}{=} 65$$

$$65 \overset{?}{=} 65 \checkmark$$

To get the variable by itself in a subtraction equation, add the same value to both sides of the equation.

| $b - 17$ | $=$ | 65 |

| $b - 17 + 17$ | $=$ | $65 + 17$ |

| b | $=$ | 82 |

Use $n - 21 = 32$ to answer Exercises 1–4.

1. On which side of the equation is the variable? _____

2. What will you do to get the variable by itself? _____

3. What must you do the other side of the equation to keep it balanced? _____

4. What is the value of n? _____

Use $12 = p - 25$ to answer Exercises 5–8.

5. On which side of the equation is the variable? _____

6. What will you do to get the variable by itself? _____

7. What must you do the other side of the equation to keep it balanced? _____

8. What is the value of p? _____

LESSON 11-2

Addition and Subtraction Equations

Success for English Learners

Problem 1

The surfboard is 14 inches taller than the person. How tall is the person?

14 in.

82 in.

h
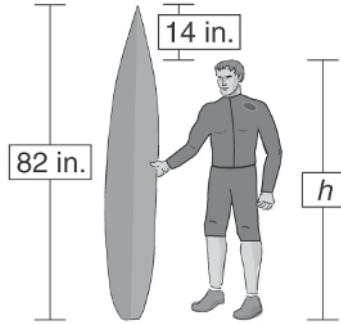
Height of person

Surfboard height

Think: This is an addition equation. I subtract to undo the addition.

$h + 14 = 82$

$\underline{-14 \quad -14}$ Subtract 14 from both sides.

$h = 68$

The person is 68 inches tall.

$68 + 14 = 82$ ✓ Check your answer.

Problem 2

Think: This is a subtraction equation. I add to undo the subtraction.

$x - 21 = 36$

$\underline{+21 \quad +21}$ Add 21 to both sides.

$x = 57$

1. Why do you use an addition equation to find the surfer's height?

_____

_____

2. How can you check the answer to Problem 2?

_____

_____

3. Write an addition or a subtraction equation. Explain how to solve your equation. Give the solution to your equation.

_____

_____

Name _____ Date _____ Class_____
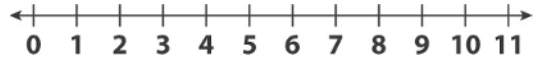
Multiplication and Division Equations

Practice and Problem Solving: A/B

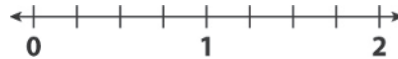**Solve each equation. Graph the solution on the number line. Check your work.**
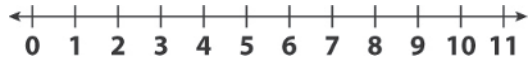
1. $\dfrac{e}{2} = 3$ $e =$ ____
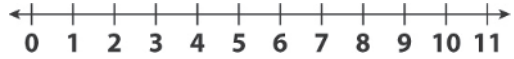
   0 1 2 3 4 5 6 7 8 9 10 11

   _____

   _____

2. $20 = 2w$ $w =$ ____

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

   _____

   _____

3. $\dfrac{1}{2} = 2m$ $m =$ ____

   0   1   2

   _____

   _____

4. $\dfrac{k}{5} = 2$ $k =$ ____

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

   _____

   _____

Use the drawing at the right for Exercises 5–6.

5. Write an equation you can use to find the length of the rectangle.

   _____

6. Solve the equation. Give the length of the rectangle.

   _____

   8 m Area $= 72\ m^2$

   x m
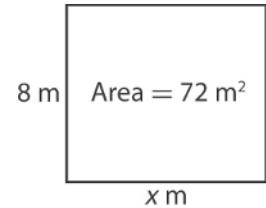
Solve.

7. Alise separated her pictures into 3 piles. Each pile contained 9 pictures. How many pictures did she have in all? Write and solve an equation to represent the problem. State the answer to the problem.

   _____

<div>

LESSON 11-3

Multiplication and Division Equations
Practice and Problem Solving: C

Solve each equation.

1. $8b = 5.6$ $b = $ ____

2. $9 = \dfrac{s}{3}$ $s = $ ____

3. $2\dfrac{1}{2} = 5n$ $n = $ ____

4. $15 = 0.2z$ $z = $ ____

5. $3.5d = 70$ $d = $ ____

6. $\dfrac{t}{3} = \dfrac{4}{9}$ $t = $ ____

7. The perimeter of the square at the right is 48 inches. What is the area of the square at the right? Explain how you found your answer.

_____

_____

_____

s | perimeter $= 48$ in.

s
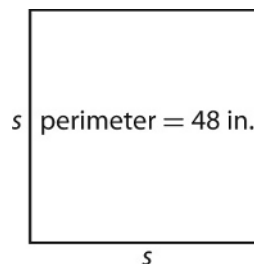
Write and solve an equation to answer each question.

8. Jose is making model SUVs. Each SUV takes 5 tires. He used 85 tires for the models. How many model SUVs did Jose make?

_____

9. Renee talked for 6 minutes on the phone. Nathan talked for *n* minutes. Nathan talked three times as long as Renee. How long did Nathan talk?

_____

10. Sylvia rented a boat for $16.50 per hour. Her total rental fee was $49.50. For how many hours did Sylvia rent the boat?

_____

Write a problem for the equation 0.5n = 12.5. Then solve the equation and write the answer to your problem.

11. _____

_____

_____

_____

</div>

Name _____ Date _____ Class _____

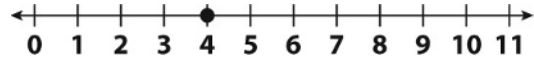# Multiplication and Division Equations

Practice and Problem Solving: D

Solve each equation. Graph the solution on the number line.
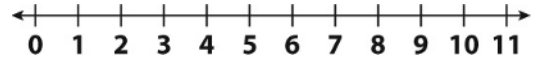**Check your work. The first is done for you.**

1. $8 = 2m$ $m = \underline{\;4\;}$
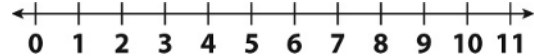
   $\dfrac{8}{2} = \dfrac{2m}{2}$
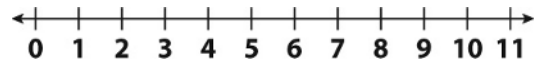
   $4 = m$ $8 = 2 \bullet 4 \checkmark$

   ```
   ←+—+—+—+—●—+—+—+—+—+—+—+→
    0  1  2  3  4  5  6  7  8  9 10 11
   ```

2. $\dfrac{a}{4} = 2$ $a = \underline{\quad}$

   ```
   ←+—+—+—+—+—+—+—+—+—+—+—+→
    0  1  2  3  4  5  6  7  8  9 10 11
   ```

   _____

   _____

3. $12 = 3s$ $s = \underline{\quad}$

   ```
   ←+—+—+—+—+—+—+—+—+—+—+—+→
    0  1  2  3  4  5  6  7  8  9 10 11
   ```

   _____

   _____

4. $\dfrac{u}{2} = 5$ $u = \underline{\quad}$

   ```
   ←+—+—+—+—+—+—+—+—+—+—+—+→
    0  1  2  3  4  5  6  7  8  9 10 11
   ```

   _____

   _____

Use the situation below to complete Exercises 5–8.
The first one is done for you.

Jim knows the length of his garden is 12 feet. He knows the area of the
garden is 60 ft². What is the width of Jim's garden?

5. Fill in the known values in the picture at the right.

6. Write an equation you can use to solve the problem.

   _____
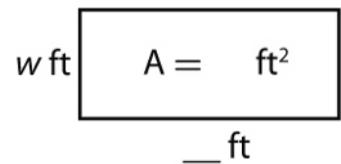
7. Solve the equation. $w = \underline{\quad}$

8. Write the solution to the problem.

   _____

```
        ┌─────────────────────┐
  w ft  │   A =      ft²       │
        └─────────────────────┘
              __ ft
```

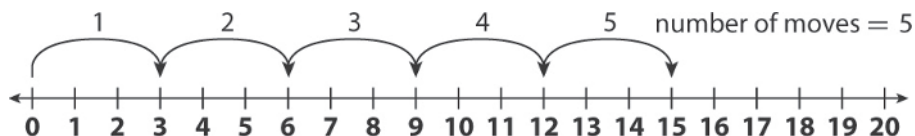Name _____ Date _____ Class _____

Multiplication and Division Equations
Reteach

Number lines can be used to solve multiplication and division equations.

Solve: $3n = 15$
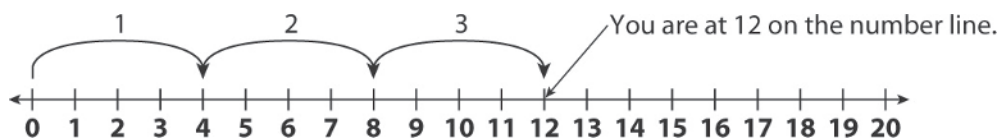
How many moves of 3 does it take to get to 15?

$n = 5$ Check: $3 \bullet 5 = 15$✓

Solve: $\dfrac{n}{3} = 4$

If you make 3 moves of 4, where are you on the number line?

You are at 12 on the number line.

$n = 12$ Check: $12 \div 3 = 4$✓

Show the moves you can use to solve each equation. Then give the solution to the equation and check your work.

1. $3n = 9$

Solution: $n =$ ____

Show your check:

2. $\dfrac{n}{2} = 4$

Solution: $n =$ ____

Show your check:

Name _____ Date _____ Class_____
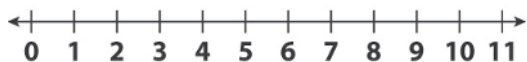
LESSON 11-3

Multiplication and Division Equations

Reading Strategies: Use a Flowchart

A flowchart gives you a plan. You can use a flowchart to solve equations.

| **1** Decide how to get the variable by itself. | ⟹ | **2** Do the same on both sides of the equation. | ⟹ | **3** Solve the equation. | ⟹ | **4** Check the solution. |
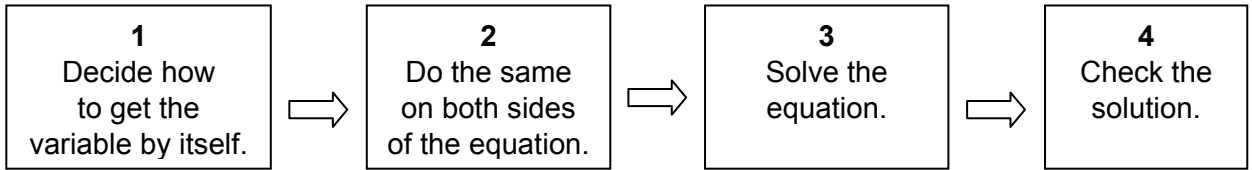
Solve: $\dfrac{x}{6} = 4$

Think: Multiplying by 6 undoes dividing by 6.

$\dfrac{x}{6} \cdot 6 = 4 \cdot 6$

$x = 24$

$\dfrac{24}{6} = 4\checkmark$

Plan

1 Decide on what operation to use.

2 Do the same on both sides.

3 Solve the equation.

4 Check the solution.

Solve: $4n = 12$

Think: Dividing by 4 undoes multiplying by 4.

$\dfrac{4n}{4} = \dfrac{12}{4}$

$n = 3$

$4 \cdot 3 = 12\checkmark$

Use the flowchart to solve each equation.

1.

Plan	**Solve:** $3r = 24$
1 Decide on what operation to use.	
2 Do the same on both sides.	
3 Solve the equation.	
4 Check the solution.	

2.

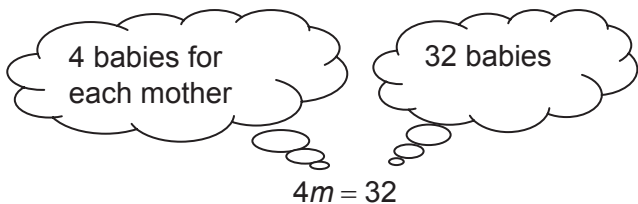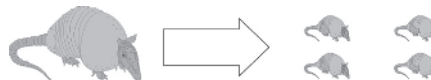| **Plan**	**Solve:** $\dfrac{b}{8} = 16$
1 Decide on what operation to use.	
2 Do the same on both sides.	
3 Solve the equation.	
4 Check the solution.	

LESSON
11-3

Multiplication and Division Equations

Success for English Learners

Problem 1

Some armadillo mothers had
these babies.

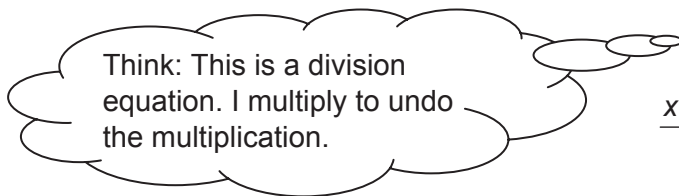Each mother had 4 babies.
How many mothers were there?

4 babies for
each mother

32 babies

$4m = 32$

To undo
multiplication,
use division.

$4m = 32$

$$\frac{4m}{4} = \frac{32}{4}$$

$m = 8$

There are 8 mothers.

Problem 2

Think: This is a division
equation. I multiply to undo
the multiplication.

$$\frac{x}{6} = 12$$

$$\frac{x \cdot 6}{6} = 12 \cdot 6 \quad \text{Multiply each side by 6.}$$

$x = 72$

$72 \div 6 = 12 \checkmark \quad$ The answer checks.

1. Explain how to check the solution to Problem 1.

_____

_____

2. Solve $\dfrac{n}{3} = 2$. Show your work.
   Check your work.

3. Solve $5t = 20$. Show your work.
   Check your work.

LESSON 11-4

Writing Inequalities

Practice and Problem Solving: A/B

Complete the graph for each inequality.

1. $a > 3$
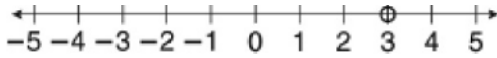
2. $r \leq -2$
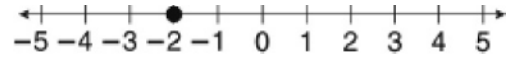
Graph the solutions of each inequality. Check the solutions.

3. $w \geq 0$

   Check: _____

4. $b \leq -4$

   Check: _____

5. $a < 1.5$

   Check: _____

Write an inequality that represents each phrase. Draw a graph to represent the inequality.

6. The sum of 1 and x is less than 5.

   _____

7. 3 is less than y minus 2.

   _____

Write and graph an inequality to represent each situation.

8. The temperature today will be at least 10°F. _____

9. Ben wants to spend no more than $3. _____

Write an inequality that matches the number line model.

10. _____
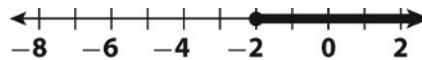
11. _____
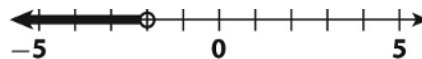
LESSON 11-4

Writing Inequalities

Practice and Problem Solving: C

Circle the values that are solutions for each inequality.

1. $a > -2$

   -3.5 -1 0 $4\dfrac{1}{4}$

2. $r \leq 2$

   -3.5 -1 0 $4\dfrac{1}{4}$

Graph the solutions of each inequality. Check the solutions.

3. $4 \geq y$

   Check: _____

4. $b \leq 0.5$

   Check: _____

5. $a < 1 - 3$

   Check: _____

Write and graph an inequality to represent each situation. Then determine if 36 is a possible solution. Write *yes* or *no*.

6. The temperature today will be at least 35°F. _____

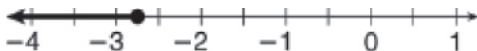7. Monica wants to spend no more than $35. _____

Write an inequality that matches the number line model. Then write a situation that the inequality could represent.
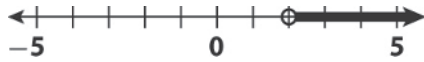
8. _____

   0 5 10 15 20 25 30 35 40 45 50

   _____

   _____

9. _____

   −4   −3   −2   −1   0   1

   _____

   _____

Name _____ Date _____ Class _____
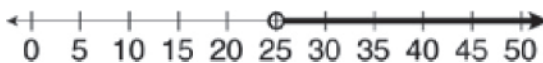
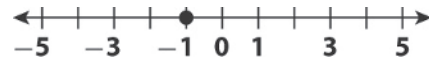# Writing Inequalities

Practice and Problem Solving: D

Complete the graph for each inequality. The first one is done for you.

1. $a > 2$

2. $r \le -1$

Graph the solutions of each inequality. Check the solutions. The first one is done for you.

3. $m \ge -2$

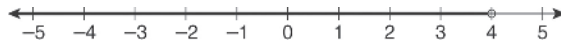   Check: _____**$0 \ge -2$; this is true**_____

4. $d \le 3$

   Check: _____

5. $s < -3$

   Check: _____

Write an inequality that represents each phrase. Draw a graph to represent the inequality. The first one is done for you.

6. x is less than 4

   _____**$x < 4$**_____

7. -1 is greater than y

   _____

Write and graph an inequality to represent each situation. The first one is done for you.

8. Today's temperature is greater than 0°F. _____**$t > 0$**_____
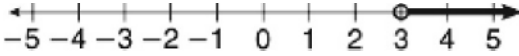

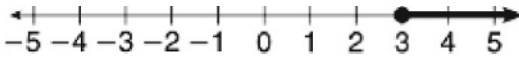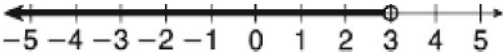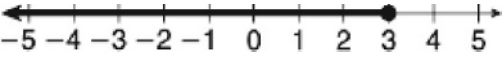
9. Lyle paid more than $2 for lunch. _____

LESSON 11-4

Writing Inequalities

Reteach

An equation is a statement that says two quantities are equal. An **inequality** is a statement that says two quantities are **not** equal.

A **solution of an inequality** that contains a variable is any value or values of the variable that makes the inequality true. All values that make the inequality true can be shown on a graph.

| Inequality	Meaning	Solution of Inequality
$x > 3$	All numbers *greater than* 3	 The *open circle* at 3 shows that the value 3 is **not** included in the solution.
$x \geq 3$	All numbers *greater than or equal to* 3	 The *closed circle* at 3 shows that the value 3 **is** included in the solution.
$x < 3$	All numbers *less than* 3	
$x \leq 3$	All numbers *less than or equal to* 3	

Graph the solutions of each inequality.

1. $x > -4$

 • Draw an open circle at –4.

 • Read $x > -4$ as "x is greater than –4."

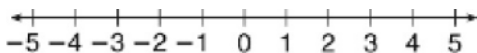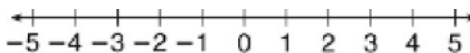 • Draw an arrow to the right of –4.
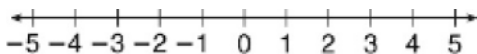
2. $x \leq 1$

 • Draw a closed circle at 1.

 • Read $x \leq 1$ as "x is less than or equal to 1."

 • Draw an arrow to the left of 1.
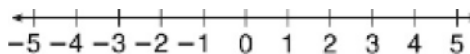
3. $a > -1$

4. $y \leq 3$

Write an inequality that represents each phrase.

5. the sum of 2 and 3 is less than y

6. the sum of y and 2 is greater than or equal to 6

_____

_____

LESSON	**Writing Inequalities**
11-4	*Reading Strategies: Understand Symbols*

An **inequality** is a comparison of two unequal values. This chart will help you understand both words and symbols for inequalities.

The team has scored fewer than 5 runs in each game. "Fewer than 5" means **"less than 5."** Symbol for "less than 5": < 5	No more than 8 people can ride in the elevator. "No more than 8" Means **"8 or less than 8."** Symbol for "less than or equal to 8": ≤ 8
Inequalities	
More than 25 students try out for the team each year. "More than 25" means **"a number greater than 25."** Symbol for "greater than 25": > 25	There are at least 75 fans at each home game. "At least 75" means "75 or more" or **"a number greater than or equal to 75."** Symbol for "greater than or equal to 75": ≥ 75

Use the chart to answer each question.

1. What is an inequality?

   _____

2. Explain the difference between the symbols $<$ and $\leq$.

   _____

   _____

3. Explain the difference between the symbols $>$ and $\geq$.

   _____

   _____

4. Write an inequality to describe the number of students in each homeroom: There is a limit of 30 students for each homeroom.

   _____

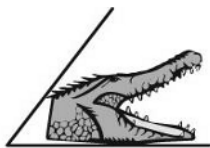5. Is 28 a solution to the inequality you wrote in Exercise 4? How do you know?

   _____

**LESSON
11-4**

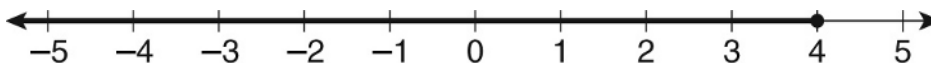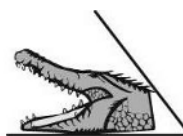# Writing Inequalities

Success for English Learners

Problem 1

$w \leq 4$

Word Phrase	Symbol
is less than or equal to	$\leq$
is greater than or equal to	$\geq$
is greater than	$>$
is less than	$<$

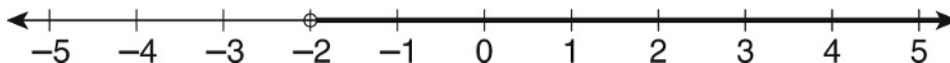Solid Circle   Arrow to the left

●   ⟵

Problem 2

$w > -2$

Empty Circle   Arrow to the right
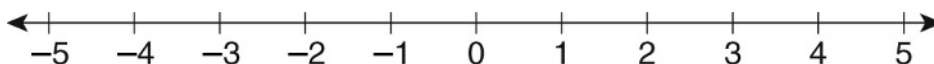
○   ⟶

1. In Problem 1, is 4 part of the solution set? How do you know?

   _____

2. In Problem 2, is −2 part of the solution set? How do you know?

   _____

3. When graphing an inequality with a $\geq$ sign, should you use an empty or a solid circle? Why?

   _____

4. Graph the solutions of $x \leq -2$.

MODULE
11
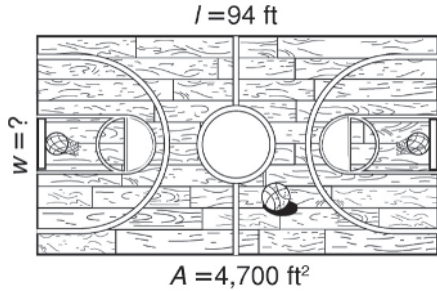
# Equations and Relationships
Challenge

Write and solve an equation to find the unknown measurement. Then use your answer to find the perimeter of each field or court.
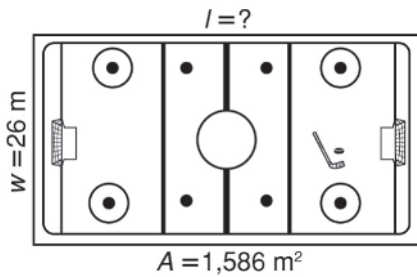
> Remember
> Area = length • width or $A = l \cdot w$
> Perimeter is the distance around
> or $P = 2l + 2w$

$l = 94$ ft

$w = ?$

$A = 4,700$ ft²

$l = ?$

$w = 75$ m

$A = 8,250$ m²

1. Equation to find area: _____

    Unknown measurement: _____

    Equation to find perimeter:

    $P =$ _____

    Perimeter of court: _____

2. Equation to find area: _____

    Unknown measurement: _____

    Equation to find perimeter:

    $P =$ _____

    Perimeter of field: _____

$l = ?$

$w = 26$ m

$A = 1,586$ m²

$l = 90$ ft

$w = ?$

$A = 8,100$ ft²
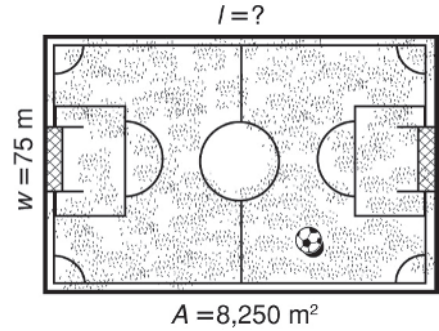
3. Equation to find area: _____

    Unknown measurement: _____

    $P =$ _____
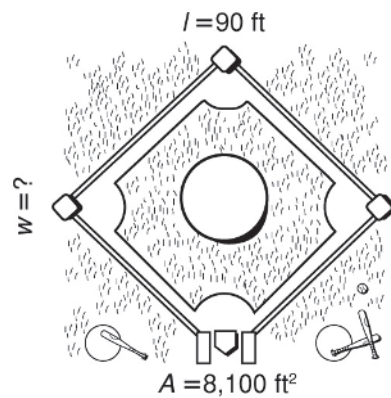
    Perimeter of rink: _____

4. Equation to find area: _____

    Unknown measurement: _____

    $P =$ _____
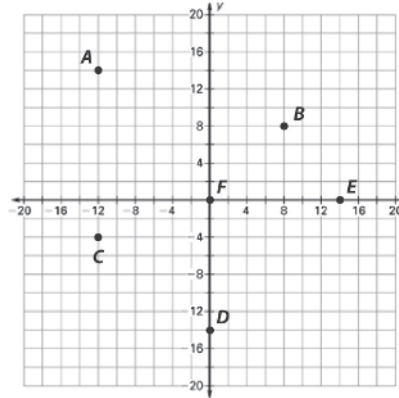
    Perimeter of diamond: _____

Name _____ Date _____ Class_____

Graphing on the Coordinate Plane
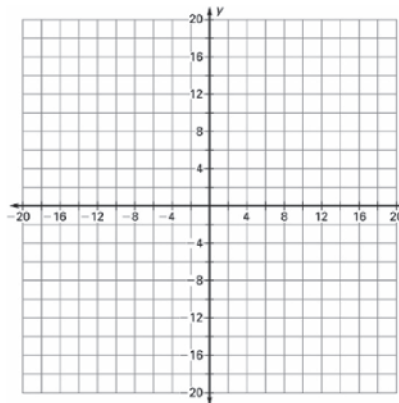*Practice and Problem Solving: A/B*

Give the coordinates of the points on the coordinate plane.

1. *A* (____ , ____)

2. *B* (____ , ____)

3. *C* (____ , ____)

4. *D* (____ , ____)

5. *E* (____ , ____)

6. *F* (____ , ____)

Plot the points on the coordinate plane.

7. *G* (2, 4)

8. *H* (−6, 8)

9. *J* (10, −12)

10. *K* (−14, −16)

11. *M* (0, 18)

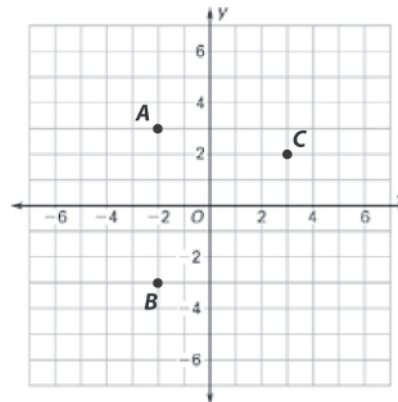12. *P* (−20, 0)

Describe how to go from one store to the next on the map. Use words like *left*, *right*, *up*, *down*, *north*, *south*, *east*, and *west*. Each square on the coordinate plane is a city block.

13. The computer store, *A*, to the food store, *B*.

_____

14. The computer store, *A*, to the hardware store, *C*.

_____

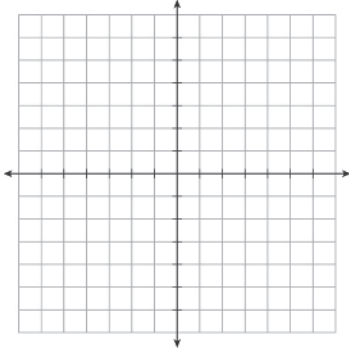15. The hardware store, *C*, to the food store, *B*.

_____

LESSON 12-1

Graphing on the Coordinate Plane

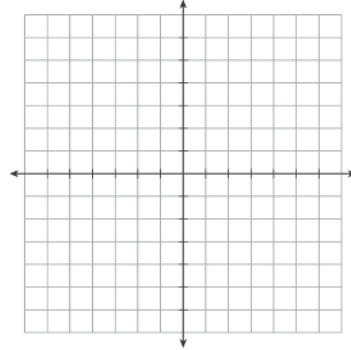*Practice and Problem Solving: C*

Label the axes to locate the points on the coordinate planes.

1. A(−6, 15), B(3, −9), C(−9, −9)

2. D(0, 6), E(−12, 6), F(18, 0)

Start with the given point. Give the quadrant in which you end up after following the directions. Then, give the coordinates of the point where you end up.

3. X(5, −8) Go down 5, left 7, and down 6 more.

   Quadrant: _____ ; Point: X(_____, _____)

4. Y(−2, 6) Go up 3, right 5, and up 4 more.

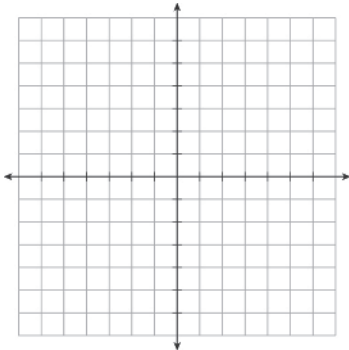   Quadrant: _____; Point: Y(_____, _____)

5. Z(0, −5) Go left 5, up 4, right 7, and down 3.

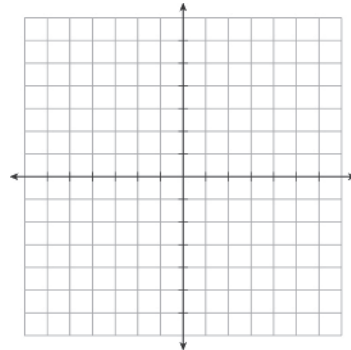   Quadrant: _____; Point: Z(_____, _____)

Give the coordinates of a point that would form a right triangle with the points given. Use the grids for reference. Tell what you know about one of the coordinates of your new point.

6. P(2, 4), Q(2, 8), R(_____, _____)

7. S(−3, −5), T(4, −5), U(_____, _____)

LESSON 12-1

Graphing on the Coordinate Plane

Practice and Problem Solving: D

Use the coordinate plane for Exercises 1–3. Give the letter of the correct answer. The first one is done for you.

1. Which point is located in Quadrant I?

   A point Q

   B point P

   C point X

   <u> C </u>

2. Which point is located in Quadrant IV?

   A point X

   B point Y

   C point P

   ____

3. Which point is located in Quadrant II?

   A point Q

   B point Y

   C point X

   ____
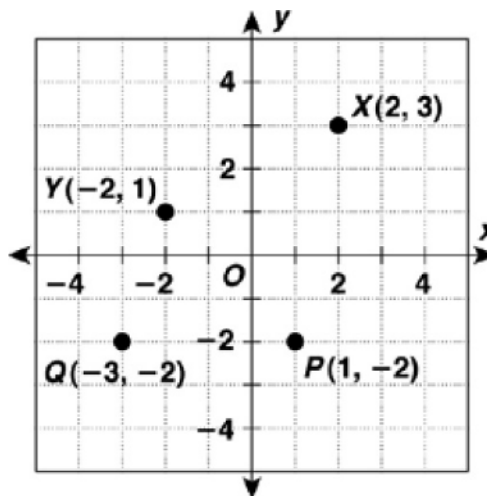
Use the coordinate plane for Exercises 4–7. The first one is done for you.

4. What are the coordinates of point A?
   Go over 3 to the right and down 1, so the *x*-coordinate is 3 and the *y*-coordinate is –1, or *A*(3, –1).

5. What are the coordinates of point B?

   B (_____ , _____)

6. What are the coordinates of point C?

   C (_____ , _____)

7. What are the coordinates of point D?

   D (_____ , _____)

LESSON
12-1

Graphing on the Coordinate Plane
Reteach

Each quadrant of the coordinate plane has a unique combination of positive and negative signs for the *x*-coordinates and *y*-coordinates as shown here.

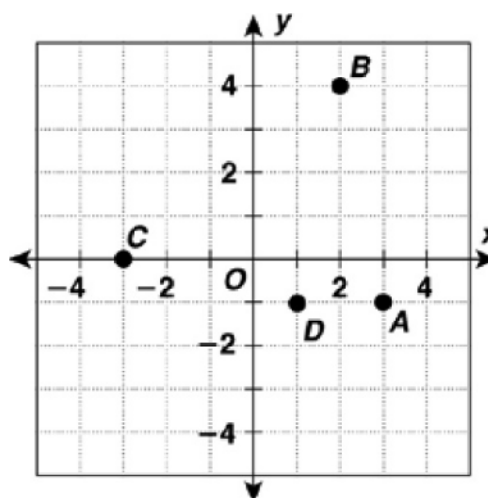| Quadrant	*x*-coordinate	*y*-coordinate
I	+	+
II	–	+
III	–	–
IV	+	–

Use these rules when naming points on the coordinate plane.

Example 1

Draw the point *A*(1, –3) on the coordinate grid.

Solution

According to the table, this point will be in Quadrant IV.

So, go to the *right* (+) one unit, and go *down* (–) three units.
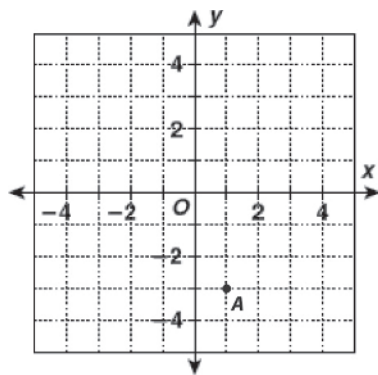
Example 2

What are the coordinates of point *B*?

Solution

According to the table, this point will have a negative *x*-coordinate and a positive *y*-coordinate.

Point *B* is 3 three units to the *left* (–) and four units *up* (+). So the coordinates of point *B* are (–3, 4).
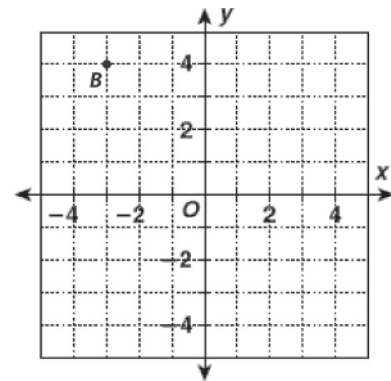
Add the correct sign for each point's coordinates.

1. (____ 3, ____ 4) in

   Quadrant II

2. (____ 2, ____ 5) in

   Quadrant IV

3. (____ 9, ____ 1) in

   Quadrant I

4. In which quadrant is the point (0, 7) located? Explain your answer.

   _____

Name _____ Date _____ Class_____

Graphing on the Coordinate Plane
Reading Strategies: Build Vocabulary

This lesson introduces words used to graph numbers. Mathematics uses these words to build new concepts. It is important to remember and to use them. Look at this example. Read each definition, and find it on the picture.

A. The **coordinate plane** includes all of the parts marked on the picture.

B. The **axes** are the darker number lines.

C. The *x*-axis goes left to right, whereas the *y*-axis goes up and down.

D. The axes intersect at the **origin**, which is marked with an "*O*".

E. The **scale** on the number line is always important in using a coordinate plane. Here, every square on the grid is 2 units.

F. The axes divide the coordinate plane into four **quadrants**. **Quadrant I** is upper right, **Quadrant II** is upper left, **Quadrant III** is lower left, and **Quadrant IV**, which is read "quadrant four," is lower right.

G. Pairs of numbers, called **ordered pairs**, are represented on the coordinate plane as points and in the format **P(a, b)**, where *P* is the point's label, *a* is a value on the *x*-axis, and *b* is a value on the *y*-axis.

H. The numbers *a* and *b* in the format (*a*, *b*) are called **coordinates**. The *a* is called the *x*-coordinate and the *b* is called the *y*-coordinate.
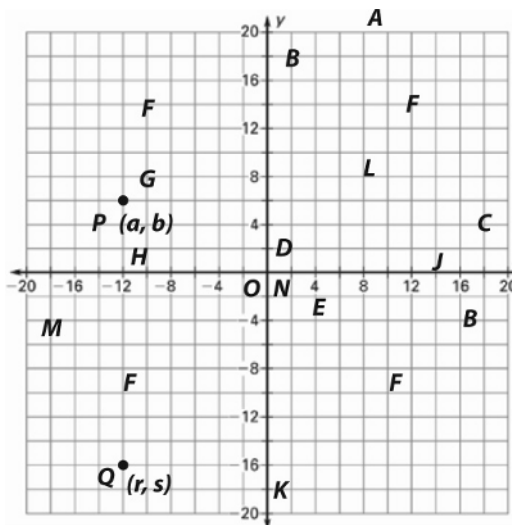
Write a letter that indicates each of the following in the diagram above.

1. point on *x*-axis   2. *x*-coordinate of *Q*   3. *y*-coordinate of *Q*   4. point on *y*-axis

   _____   _____   _____   _____

5. point in Quadrant I   6. ordered pair for *Q*   7. point in Quadrant III   8. origin

   _____   _____   _____   _____

LESSON
12-1

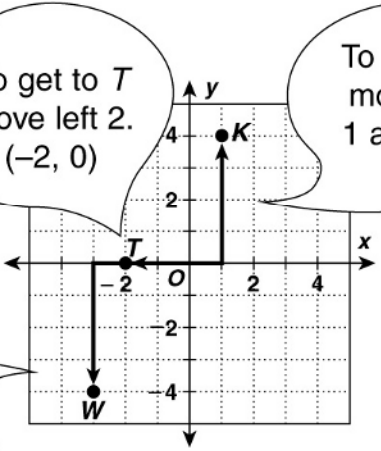# Graphing on the Coordinate Plane

Success for English Learners

Problem

This number shows how many units to move right or left.		This number shows how many units to move up or down.

(x, y)

To get to *T* move left 2. (–2, 0)

To get to *K*, move right 1 and up 4. (1, 4)

To get to *W*, move left 3 and down 4. (– 3, – 4)

Moves up or to the right are positive values.

Moves down or to the left are negative values.

1. If an ordered pair has an *x*-value of 0, which direction do you move from the origin?

   _____

2. A negative *y*-coordinate means that a point may lie in which two quadrants?

   _____

3. Does it matter which number comes first in an ordered pair? Explain.

   _____

   _____

LESSON
12-2

Independent and Dependent Variables in Tables and Graphs

Practice and Problem Solving: A/B

Name the *dependent variable* and the *independent variable* in each problem.

1. A food service worker earns $12 per hour. How much money, *m*, does the worker earn on a shift of *h* hours?

   Dependent variable: _____; independent variable: _____

2. A large 2-topping pizza, *L*, costs $2 more than a medium 3-topping pizza, *M*.

   Dependent variable: _____; independent variable: _____

The table shows the electric current produced by a solar cell in different amounts of sunlight (light intensity). Answer the questions using the data.

Light intensity	150	300	450	600	750	900
Current	10	30	45	60	75	90

3. What is the dependent variable?   4. What is the independent variable?

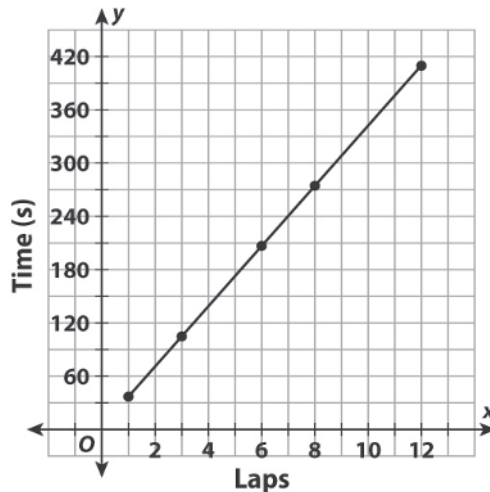   _____   _____

5. What do you predict the current will be in the absence of sunlight? Explain.

   _____

6. What do you predict the current will be if the light intensity is 1,000? Explain.

   _____

A race car driver's time in seconds to complete 12 laps is plotted on the graph.

7. Which axis shows the dependent variable?

   _____

8. Why does the graph begin at *x* = 1?

   _____

LESSON 12-2

Independent and Dependent Variables in Tables and Graphs

Practice and Problem Solving: C

Use the situation below to complete Exercises 1–4.

The commuter bus system collected the data in the table below. All of the data were collected under the same conditions: dry roads, no accidents or traffic jams, same distance each trip, and no mechanical problems with the bus on each trip.

Number of passengers per trip, *n*	30	35	40	45	50
Average speed, km per hour, *s*	60	58	55	55	52
Liters of biodiesel fuel used, *f*	45	48	50	52	54

1. Assume that more passengers cause the bus to travel slower. Of these two factors, which would be the dependent and independent variables?

   Dependent variable: _____; independent variable: _____

2. Assume that an average slower speed causes the bus to consume more fuel. Describe the relationship between bus speed and fuel consumption.

   _____

3. What can you say about the relationship between the number of passengers and the fuel consumption?

   _____

4. What effect does the number of passengers have on bus speed *and* fuel consumption?

   _____

In the graph, the independent variable is the *x*-axis and the dependent variable is the *y*-axis. Use the graph to answer Exercises 5–6.

5. Describe and compare how the dependent variables shown by lines *A* and *B* change as the independent variables change.

   _____

6. Describe and compare how the dependent variables shown by lines *B* and *C* change as the independent variables change.
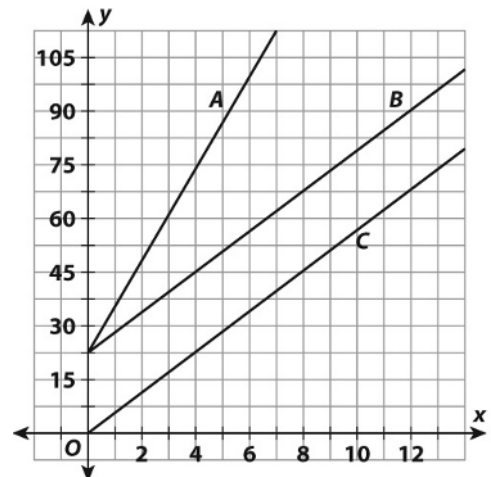
   _____

LESSON 12-2

Independent and Dependent Variables in Tables and Graphs

Practice and Problem Solving: D

Answer the questions for each real-world situation. The first one is done for you.

1. The table gives the amount of water in a water tank as it is being filled.

Gallons	50	100	150	200	250
Time (min)	10	20	30	40	50

a. Why is gallons the *dependent* variable?

   It depends on how long the water has been filling the tank.

b. Divide gallons by time in each pair of cells. What do you get?

   50 ÷ 10 = 100 ÷ 20 = 150 ÷ 30 = 200 ÷ 40 = 250 ÷ 50 = 5; 5

c. If the time is 60 minutes, how would you get the gallons? What would you get?

   Multiply 60 times 5, which gives 300 gallons.

2. The table shows how to change miles to kilometers. Divide kilometers by miles for each of the four mileage numbers. How many kilometers per mile do you get?

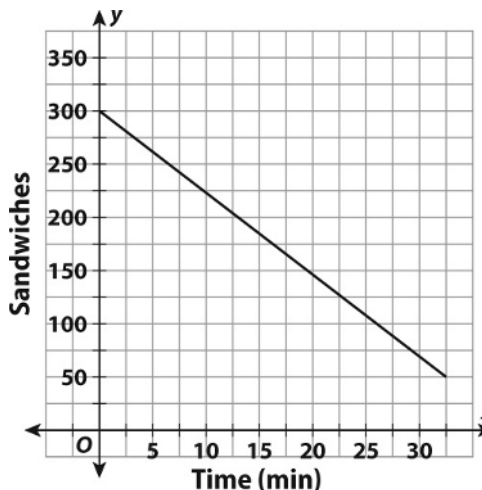| (km)	3.22	4.83	6.44	8.05
(mi)	2	3	4	5

_____

Answer each question using the graph. The first one is done for you.

3. How many sandwiches are available at the start of the business day?

   300

4. Which axis shows the *dependent* variable, sandwiches?

_____

5. How many sandwiches are left after 20 minutes?

_____

Name _____ Date _____ Class_____

Independent and Dependent Variables in Tables and Graphs
Reteach

In a table, the *independent variable* is often represented by *x*. The *dependent variable* is often represented by *y*. Look at this example.

x	0	1	2	3	4	5	6	7
y	4	5	6	7	8	9	10	?

What *y* value goes for the question mark?

Step 1 Notice that 4 is added to each value of *x* to give the *y* value.

Step 2 So, add 4 to 7. What does this give? $4 + 7 = 11$
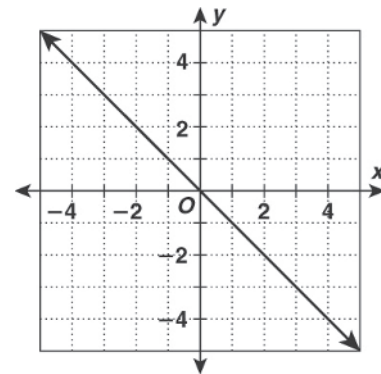
On a chart or graph,

- the *x*-axis is usually used for the *independent variable*, and

- the *y*-axis is usually used for the *dependent variable*.

Look at the example. ———➤

How does *y* depend on *x*?

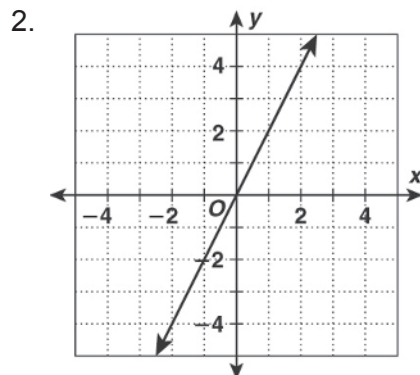**Step 1** Each value of *y* is the opposite of the value of *x*.

Step 2 What equation shows this fact?
$y = -x$

Give the relationship between *x* and *y*.

1.

x	1	2	3	4	5
y	3	4	5	6	7

_____

2.

a. What is *y* when $x = 2$?

_____

b. What value of *x* gives $y = -2$?

_____

c. Write the equation for the graph.

_____

LESSON 12-2

Independent and Dependent Variables in Tables and Graphs

Reading Strategies: Cause and Effect

It can sometimes be useful to think of the **independent variable** as the *cause* of an event. This cause has an *effect* on the **dependent variable**. This type of thinking can be helpful in doing some real-world problems.

Example 1

A middle-school science student did an experiment in which different amounts of water were added on a one-time basis to a solution to see what effect it would have on the solution's concentration. Here are the results.

Water (milliliters)	5	10	15	20
Change in dilution	2	5	10	15

As more water is added (the "cause"), the concentration dilutes. The amount of water is the independent variable. The amount of dilution is the dependent variable.

Example 2

The chart shows how the yield of a crop per acre changes as the number of insect pests counted per acre increases.

- If the vertical axis (left) is the crop yield, what is happening as the number of insects (horizontal axis) increases?

- The crop yield continues to increase but not as fast as at the beginning.

- The number of insects is the independent variable (the cause), and the crop yield is the dependent variable (the effect).
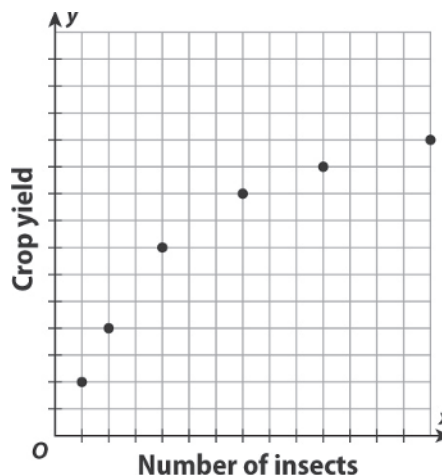
Identify the cause and the effect in each problem.

1. After a storm, the number of bottles of drinking water available per family decreases as the number of families requesting assistance increases.

   _____

2. The number of hours it takes to vote increases as the number of voters per hour increases.

   _____

3. The car's mileage, or miles per gallon, increases as its speed goes from 20 miles per hour to 40 miles per hour.
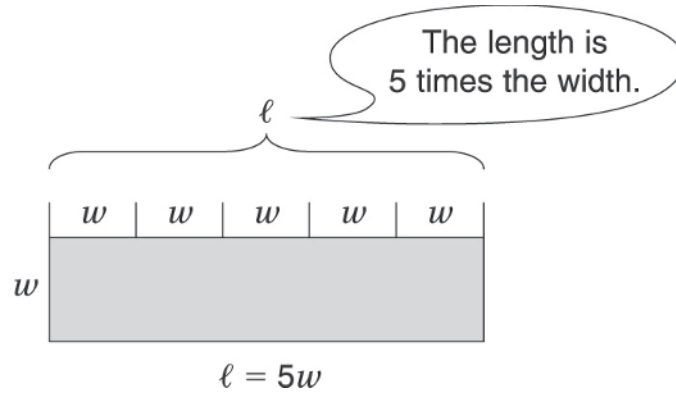
   _____

LESSON 12-2 Independent and Dependent Variables in Tables and Graphs
Success for English Learners

Problem 1

Let ℓ = length.

Let w = width.

The length is 5 times the width.

ℓ

| w | w | w | w | w |

w

$\ell = 5w$

Problem 2

In Problem 1, the length, *l*, "depends" on the width, *w*.

Independent variable ⟶ width, *w*

Dependent variable ⟶ length, *l*

The variables are related by the formula, *l* = *5 w.*

1. Suppose the width of the rectangle in Problem 1 is 10 inches. What is the length of the rectangle?

   _____

2. The table shows the money the school band members collected for washing cars on four different days.

Cars washed	12	15	20	30
Money collected	$120	$150	$200	?

   What is the **dependent variable**? _____

   What is the **independent variable**? _____

   How much money is collected for washing 30 cars?

   _____

LESSON 12-3

Writing Equations from Tables

Practice and Problem Solving: A/B

Write an equation to express *y* in terms of *x*. Use your equation to complete the table.

1.

x	1	2	3	4	5
y	7	14	21	28	

_____

2.

x	2	3	4	5	6
y	−3	−2	−1	0	

_____

3.

x	20	16	12	8	4
y	10	8	6	4	

_____

4.

x	7	8	9	10	11
y	11	12	13	14	

_____

Solve.

5. Henry records how many days he rides his bike and how far he rides each week. He rides the same distance each time. He rode 18 miles in 3 days, 24 miles in 4 days, and 42 miles in 7 days. Write and solve an equation to find how far he rides his bike in 10 days.

Number of days, *d*	3	4	7	10
Number of miles, *m*	18			

Equation relating *d* and *m* is _____.

The number of miles Henry rides his bike in 10 days is _____.

6. When Cabrini is 6, Nikos is 2. When Cabrini is 10, Nikos will be 6. When Cabrini is 16, Nikos will be 12. When Cabrini is 21, Nikos will be 17. Write and solve an equation to find Nikos' age when Cabrini is 40.

Cabrini's age, *x*	6	10	16	21	40
Nikos' age, *y*	2				

Equation relating *x* and *y* is _____.

When Cabrini is 40 years old, Nikos will be _____.

Name _____ Date _____ Class _____

Writing Equations from Tables

Practice and Problem Solving: C

Write an equation to express *y* in terms of *x*. Use your equation to complete the table.

1.

x	1	2	3	4	5
y	1	4	9	16	

_____

2.

x	32	28	24		16
y	−8		−6	−5	−4

_____

3.

x		8	6	4	2
y	4	3.2		1.6	0.8

_____

4.

x	1		3	4	5
y	7	12	17	22	

_____

Solve.

5. $F = \dfrac{9}{5}C + 32$ is an equation that models the relationship in the table.

Equivalent Temperatures					
Celsius, (°C)	−15	−10	−5	0	5
Fahrenheit, (°F)	5	14	23	32	41

What does each variable represent?_____.

What is the temperature in °F when it is 20°C? _____.

Is the ordered pair (30, 86) a solution for the equation? Justify your answer.

_____

6. Use the table of values and the equation in Exercise 5 to write an equation for which *F* is the independent variable and *C* is the dependent variable.

An equation relating *F* and *C* is _____.

What is the temperature in °C when it is 59°F? Justify your answer.

_____

LESSON 12-3

Writing Equations from Tables

Practice and Problem Solving: D

Write an equation to express *y* in terms of *x*. The first one is done for you.

1.

x	0	1	2	3
y	2	3	4	5

$y = x + 2$

2.

x	5	10	15	20
y	1	2	3	4

_____

3.

x	3	4	5	6
y	9	12	15	18

_____

4.

x	7	8	9	10
y	5	6	7	8

_____

Solve. The first one is done for you.

5. When George works 8 hours he earns $80. When George works 10 hours he earns $100. When George works 12 hours he earns $120. Complete the table. Circle the letter of the equation that relates the dollars George earns, *y*, to the number of hours he works, *x*.

Number of hours, *x*	8	10	12
Dollars earned, *y*	80	**100**	**120**

A $y = x \div 10$ (C) $y = 10x$

B $y = x + 72$

6. When Javier is 2, Arianna is 5. When Javier is 3, Arianna is 6. When Javier is 8, Arianna will be 11. When Javier is 20, Arianna is 23. Complete the table. Circle the letter of the equation that relates the age of Arianna, *y*, to the age of Javier, *x*.

Javier's age, *x*	2	3	8	20
Arianna's age, *y*	5			

A $y = x \div 2$ C $y = 2x$

B $y = x + 3$

When Javier is 30 years old, Arianna will be _____.

Name _____ Date _____ Class_____

Writing Equations from Tables
Reteach

The relationship between two variables in which one quantity depends on the other can be modeled by an equation. The equation expresses the dependent variable *y* in terms of the independent variable *x*.

To write an equation from a table of values, first compare the *x*- and *y*-values to find a pattern.

x	0	1	2	3	4	5	6	7
y	4	5	6	7	8	9	10	?

In each, the *y*-value <u>is 4 more than</u> the *x*-value.

Then use the pattern to write an equation expressing *y* in terms of *x*.
$y = x + 4$

You can use the equation to find the missing value in the table.
To find *y* when *x* = 7, substitute 7 in for *x* in the equation.

$y = x + 4$
$y = 7 + 4$
$y = 11$
So, *y* is **11** when *x* is 7.

Write an equation to express *y* in terms of *x*. Use your equation to find the missing value of *y*.

1.

x	1	2	3	4	5	6
y	3	6	9	12	15	?

_____

2.

x	18	17	16	15	14	13
y	15	14	13	?	11	10

_____

To solve a real-world problem, use a table of values and an equation.

When Todd is 8, Jane is 1. When Todd is 10, Jane will be 3. When Todd is 16, Jane will be 9. What is Jane's age when Todd is 45?

Todd, *x*	8	10	16	45
Jane, *y*	1	3	9	?

Jane is 7 years younger than Todd.
So $y = x - 7$. When $x = 45$, $y = 45 - 7$. So, $y = 38$.

Solve.

3. When a rectangle is 3 inches wide its length is 6 inches. When it is 4 inches wide its length will be 8 inches. When it is is 9 inches wide its length will be 18 inches. Write and solve an equation to complete the table.

Width, *x*	3	4	9	20
Length, *y*	6			

_____

When the rectangle is 20 inches wide, its length is _____.

Name _____ Date _____ Class_____

Writing Equations from Tables

Reading Strategies: Analyze Information

A table is useful for changing cups to ounces.

Cups	Ounces
1	8
2	16
3	24
4	32
5	40

Use the table above to complete Exercises 1–3.

1. How many ounces are in 1 cup?

   _____

2. How many ounces are in 3 cups?

   _____

3. If "6 cups" were added to the table, how many ounces would be listed?

   _____

An equation shows the relationship between cups and ounces.

ounces = 8 • cups

$y = 8x$

Independent Variable $\longrightarrow$	x	1	2	3	4	5
Dependent Variable $\longrightarrow$	y	8	16	24	32	40
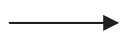
The number of ounces depends on the number of cups. The value of y depends on the value of x.

Use the table above to complete Exercises 4–6.

4. Which variable stands for ounces? for cups?

   _____

5. What is the value of y when $x = 2$?

   _____

6. Use the equation to find the number of ounces when the number of cups is 15.

   _____

LESSON
12-3

Writing Equations from Tables
Success for English Learners

Problem 1

The number of inches is 12 times the number of feet.

Independent variable ⟶ *x*-value

The number of inches depends on how many feet there are.
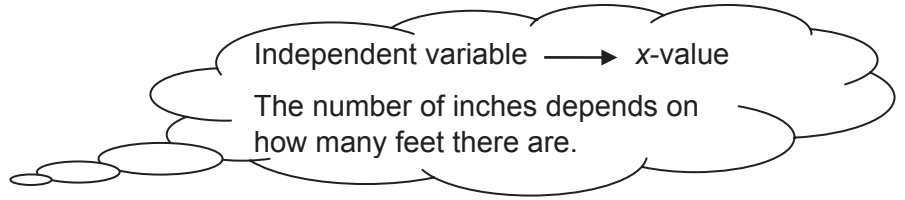
The <u>independent</u> variable is the *x-value* of the equation.

number of feet ⟶ *x*

The <u>dependent</u> variable is the *y-value* of the equation.

number of inches ⟶ *y*

<u>Write an equation</u> to show the relationship between *x* and *y*.

$y = 12x$

Problem 2

Mike has 8 feet of rope. How many inches of rope does he have?

<u>Solve an equation</u> to find a value.

<u>Substitute</u> the value for *x* into the equation, then <u>solve</u> for *y*.

$y = 12x$		
$x = 8$	Substitute 8 for *x*.	$y = 12(8) = 96$

Mike has 96 inches of rope.

1. What does an equation with *x* and *y* show?

   _____

   _____

2. What does it mean to substitute a value into the equation?

   _____

3. Suppose Mike has 5 feet of rope. How many inches of rope does he have?

   _____

Representing Algebraic Relationships in Tables and Graphs
Practice and Problem Solving: A/B

An antiques dealer has 24 clock radios to sell at a 12-hour-long antique-radio sale. Use the graph to complete the table.
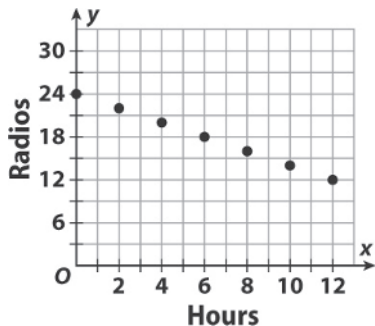
1. Complete the table with the data from the graph.

Radios remaining	24	?	?	?	?	?	?
Hours completed	0	2	4	6	8	10	12

2. What are the dependent (*y*) and independent (*x*) variables?

   dependent: _____; independent: _____

3. Write ordered pairs for the points on the graph and in the table.

   _____

4. How many radios are sold every two hours? _____

5. What happens to the *total* number of radios every two hours?

   _____

6. If *h* is hours and *n* is the number of radios remaining, complete the equation:

   n = _____ × *h* + _____

7. Why is the sign of the number that is multiplied by hours, *h*, negative?

   _____

LESSON
12-4

Representing Algebraic Relationships in Tables and Graphs
Practice and Problem Solving: C

Use the graph to answer the questions.
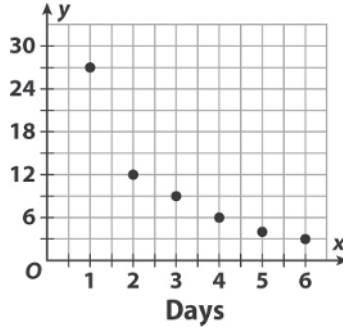
1. A paleontologist is counting fossilized remains of extinct plants at a geological site. Complete the table with data from the graph.

Plant fossils counted, *f*	____	____	____	____	____	____
Elapsed days of dig, *d*	1	2	3	4	5	6

2. There are three rates at which the fossils are being counted: Rate *A* for Days 1 and 2, Rate *B* for Days 2 – 4, and Rate *C*: for Days 5 – 6. What is happening to the number of fossils counted as each day passes?

   _____

3. Which rate describes the period of time over which the number of fossils counted decreases at the *greatest* rate? Explain your answer.

   _____

4. Give the numerical value of each of the rates, *A*, *B*, and *C*. Your answer should be negative and expressed in units of "fossils counted per day" or "fossils/day."

   Rate *A*: _____; Rate *B*: _____; Rate *C*: _____

LESSON 12-4

Representing Algebraic Relationships in Tables and Graphs
Practice and Problem Solving: D

Complete the tables. Then, write the ordered pairs. Finally, fill in the blanks to give the algebraic relationship of *x* and *y*. The first problem has been done for you.

1.

x	0	1	2	3
y	4	7	**10**	**13**

 (0, 4), (1, 7), (2, 10), (3, 13)

 $y = \underline{3}\, x + \underline{4}$

2.

x	0	1	2	4
y	0	−4	___	−16

 _____

 $y = \underline{\hspace{1.5cm}} x + \underline{\hspace{1.5cm}}$

3.

x	0	2	___	6
y	5	11	17	___

 _____

 $y = \underline{\hspace{1.5cm}} x + \underline{\hspace{1.5cm}}$

Write the ordered pairs of three points on the graph. Then, write the algebraic relationship of *x* and *y*. The first one is done for you.
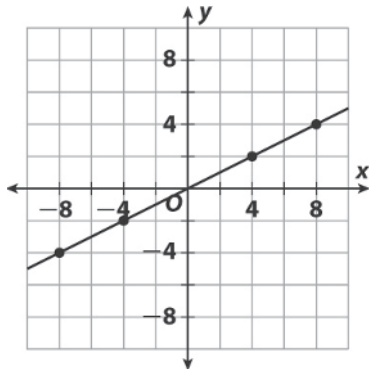
4.

 (−8, −4), (4, 2), (8, 4)

 $y = \underline{0.5}\, x + \underline{0}$

5.
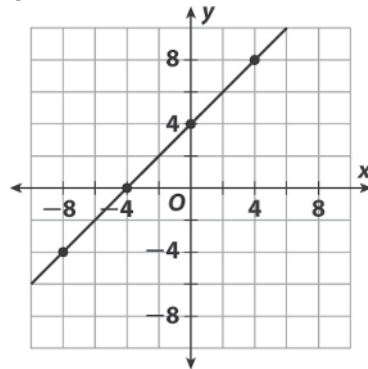
 _____

 $y = \underline{\hspace{1.5cm}} x + \underline{\hspace{1.5cm}}$

6.

 _____

 $y = \underline{\hspace{1.5cm}} x + \underline{\hspace{1.5cm}}$

Name _____ Date _____ Class_____
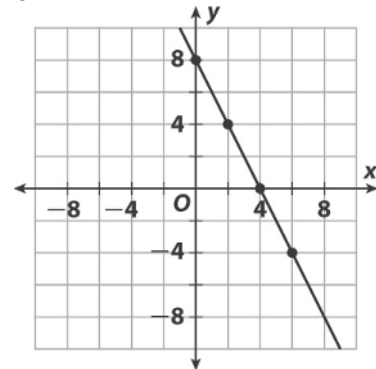
Representing Algebraic Relationships in Tables and Graphs
Reteach

The *x*- and *y*-values in an algebraic relationship should be related in the same way when new values of *x* or *y* are used. This pattern should be seen in a table of values and from a graph of the *x* and *y* values.

Example 1

What is the relationship of the *x* and *y* values in the table?

x	2	4	6	8	10
y	6	12	18	24	30

Solution

First, check to see if there is a simple addition, multiplication, division, or subtraction relationship between the *x* and *y* values.

Here, the *y* values are 3 times the *x* values.

This means that the algebraic relationship is $y = 3x$.

Example 2

What is the relationship between *x* and *y* represented by the graph.
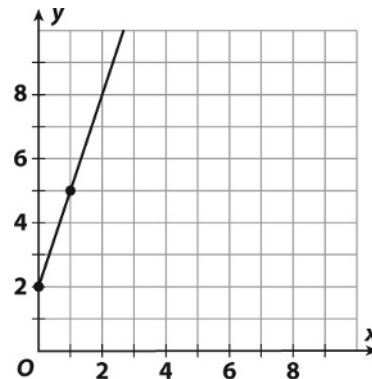
Solution

First, notice that the line through the points crosses the *y*-axis at $y = 2$. This means that part of the relationship between *x* and *y* is given by $y = \_\_\_ + 2$.

Next, notice that the line through the points goes over to the right by one unit as it "rises" by 3 units. This means that any *x* value is multiplied by 3 over 1 or 3 units as the line goes from one point to another. This is written as $y = 3x$.

Combine these two observations:
$y = 3x$ and $y = 2$ give $y = 3x + 2$.
Both parts are needed to completely describe the relationship shown.

1. Find the relationship of *x* and *y* in the table.

x	0	1	3	6	7
y	1.5	2	3	4.5	5

$y = _____ x + _____$

2. Find the relationship of *x* and *y* from a graph of a line that crosses the *y*-axis at $y = 6$ and that goes to the left 2 units and rises 3 units.

$y = _____ x + _____$

LESSON 12-4

Representing Algebraic Relationships in Tables and Graphs

Reading Strategies: Reading a Table

In order to write a rule that gives an algebraic relationship, you sometimes need to use a table.

Car washers tracked the number of cars they washed and the total amount of money they earned. They charged the same price for each car they washed. They earned $60 for 20 cars, $66 for 22 cars, and $81 for 27 cars. Use the information to make a table and write an equation.

Make a table.

Cars washed (c)	20	22	27
Money earned (m)	60	66	81

The money earned is three times the number of cars washed.
$20 \times 3 = 60$
$22 \times 3 = 66$
$27 \times 3 = 81$

Write an equation.
$m = 3c$

1. What is the value of m when there are no cars washed?

   _____

2. What is the value of m when 100 cars are washed?

   _____

3. Complete the table. Then write an equation to represent the table.

Tickets (t)	8	10	12	14	16
Total cost (c)	40	50	60		

   _____

4. Complete the table. Then write an equation to represent the table.

x	4	8	12	16	20	24
y	1	2	3	4		

   _____

LESSON 12-4

Representing Algebraic Relationships in Tables and Graphs
Success for English Learners

Problem 1

Find the algebraic rule from a table.

> If $x = 0$, that value of y goes in the rule:
> $y = \_\_\_ + 4$

> What happens to x before it is added to 4 to give 6? Multiplied by 2: 2×1
> $y = 2x$
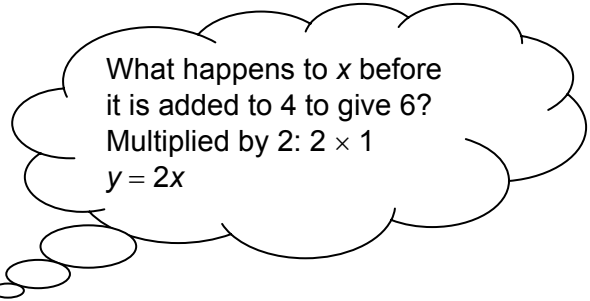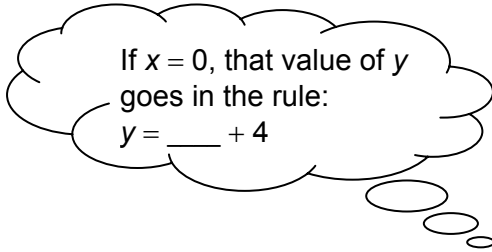
x	0	1	2	3
y	4	6	8	10

Combine the two steps: ⟶ $y = 2x + 4$

Problem 2

> Where does the line cross the y-axis?

> How far over and how far up?
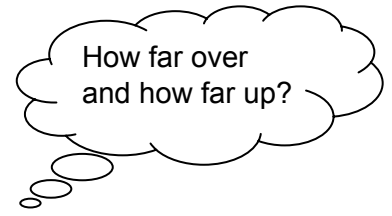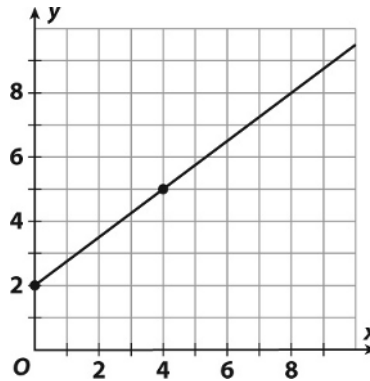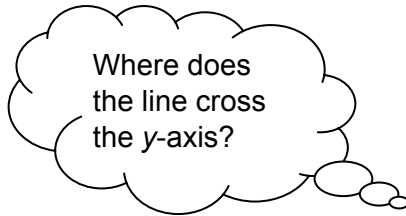
The line crosses the y-axis at 2.

The line goes over 4 and up 3.

$y = _____ + \mathbf{2}$

$y = \dfrac{\mathbf{3}}{\mathbf{4}}x + 2$

Give the algebraic rule.

1. (0, 2), (1, 3), (2, 4)

2. (0, 1), (2, 5), (4, 9)

_____   _____

Name _____ Date _____ Class _____

Relationships in Two Variables
Challenge

Exploring Temperature Data

This activity illustrates the difference between experimental and theoretical data.

1. Complete the tables. Graph the Table 1 data as individual points.
   Show the data in Table 2 as a straight line.

Table 1

data read from
the thermometer

°C	°F
10	
11	
12	
13	
14	
15	
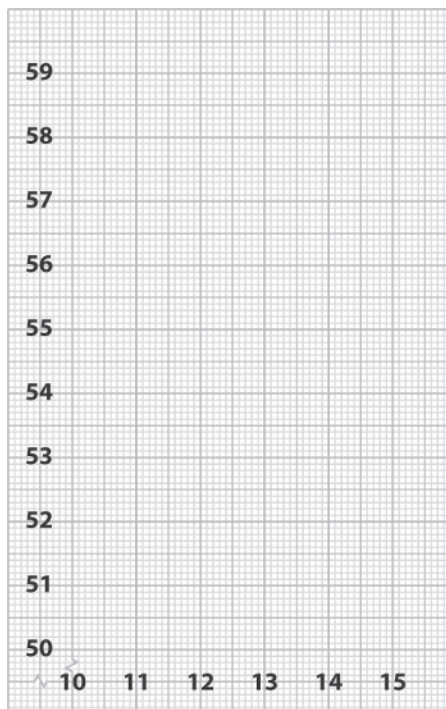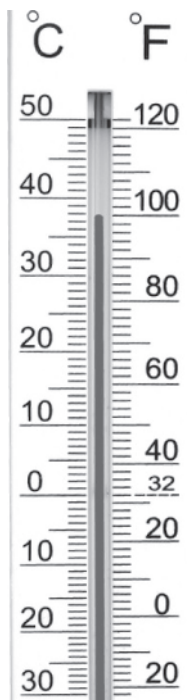
Table 2

data computed
from the equation

$F = C \times \dfrac{9}{5} + 32$

°C	°F
10	
11	
12	
13	
14	
15	

2. Describe the difference between the two data sets and explain why they differ.

_____

_____

_____

UNIT 5: Equations and Inequalities

MODULE 11 Equations and Relationships

LESSON 11-1

Practice and Problem Solving: A/B

1. yes
2. no
3. no
4. no
5. yes
6. yes
7. yes
8. yes
9. B
10. D
11. Sample equation: $6x = 72$
12. Sample equation: $(6)(5) = (10)(3)(w)$
13. Sample equation: $x - 13°F = 35°F$; $x = 48°F$
14. Sample equation: $16x = \$20$; $x = \$1.25$
15. Sample problem: Twenty-four people were divided evenly into y teams. There were 3 people on each team. Determine whether there were 8 teams or 6 teams.

    Answer: There were 8 teams.

Practice and Problem Solving: C

1. A
2. C
3. D
4. B
5. Sample equation: $7(10 + x) = 112$
6. Sample equation: $y = 11 + \frac{1}{3}(15)$; $y = 16$;

   sea cow $= 16$
7. Sample equation: $22 = \frac{112}{4} - 6$
8. Sample equation: $4x = 80 + 40$; $x = 30$
9. Sample equation: $3x + 5 = 29$

Practice and Problem Solving: D

1. yes
2. no
3. no
4. yes
5. yes
6. yes
7. A
8. B
9. B
10. C
11. A
12. B
13. (1) $\underline{\$5} + (3)\underline{\$1} + $ Other bill $= \$13$; $\$5 + \$3 + x = \$13$; $x = \$5$; The other bill must be a \$5 bill.

Reteach

1. yes
2. no
3. no
4. yes
5. yes
6. no
7. yes
8. yes
9. no

Reading Strategies

1. yes
2. no
3. yes
4. yes
5. yes
6. no
7. no
8. Sample equation: $2 \bullet 13 = 15 + 11$
9. Sample answer: $2 \bullet 13 = 15 + y$; $y = 11$

Success for English Learners

1. Because when the variable in the equation is replaced with 61, it does not make a true statement.

2. Substitute 65 for a and check to see if the equation is true.

3. Sample answer: Andrea is given $82 to buy fruit for the class picnic. She spends some of the money on apples and $23 on bananas. Determine whether she spent $61 or $59 on apples.

LESSON 11-2

Practice and Problem Solving: A/B

1. $r = 4$
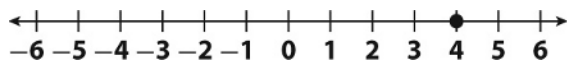
2. $w = 38$
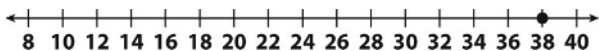
3. $m = \dfrac{5}{8}$
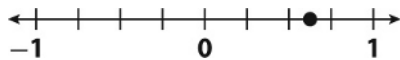
4. $t = -4$
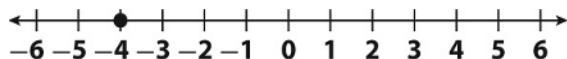
5. $x + 139 = 180$

6. $x = 41°$

7. $x + 18 = 90$

8. $x = 72°$

9. $x = 5$; Sample answer. John has some CDs. If he buys 3 more CDs, he will have 8 CDs. How many CDs did he start with? John started with 5 CDs.

Practice and Problem Solving: C

1. 3.4

2. $\dfrac{7}{9}$

3. $5\dfrac{1}{2}$

4. 17.19

5. −4

6. −40

7. $x + 22 = 90$

8. $x = 68°$

9. Sample answer: $u - 22 = 13$; $u = 35$; Kayla's uncle is 35 years old.

10. Sample answer: $38.95 - 22.50 = g$; $g = 16.45$; Gavin will save $16.45.

11. Sample answer: $s - 10\dfrac{1}{2} = 37\dfrac{1}{2}$; $s = 48$; The board Sierra started with was 48 inches long.

12. $x = 7$; Sample answer: Andy ran 4.65 kilometers. Pam said that if she had run 2.35 fewer kilometers, she would have run as far as Andy. How far did Pam run? Answer: Pam ran 7 kilometers.

Practice and Problem Solving: D

1. $r = 6$
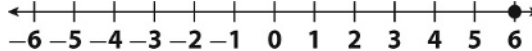
2. $w = -1$
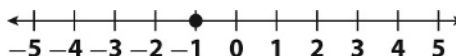
3. $m = 3$
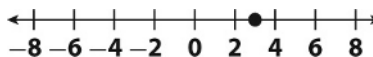
4. $t = 5$
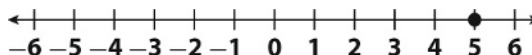
5. $x + 100 = 180$

6. $x = 80°$

7. $23 + n = 40$

8. 17

9. $x = 7$; Sample answer: Joan has some pencils. If she gives away 5 pencils, she will have 2 pencils left. How many pencils did Joan start with? She started with 7 pencils.

Reteach

1. 8

2. 9

3. 5

4. 9

5. 6

6. 8

Reading Strategies

1. Left

2. Add 21.
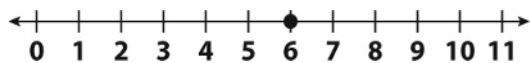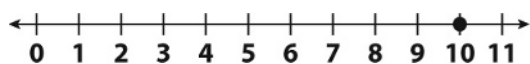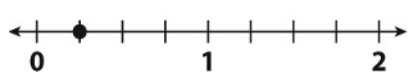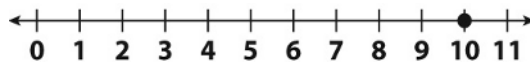
3. Add 21.

4. 53

5. Right.

6. Add 25.

7. Add 25.

8. 37

Success for English Learners

1. Because the surfer's height, h, plus 14 inches is equal to the height of the surfboard.

2. Substitute 57 for x in the original equation and see if that makes the equation true.

3. Sample answer: $x - 12 = 10$; Add 12 to both sides; $x = 22$.

LESSON 11-3

Practice and Problem Solving: A/B

1. $e = 6$

2. $w = 10$

3. $m = \dfrac{1}{4}$

4. $k = 10$

5. Sample answer: $8x = 72$

6. $x = 9$; 9 m

7. $\dfrac{a}{3} = 9$; $a = 27$; 27 pictures

Practice and Problem Solving: C

1. 0.7

2. 27

3. $\dfrac{1}{2}$

4. 75

5. 20

6. $\dfrac{4}{3}$ or $1\dfrac{1}{3}$
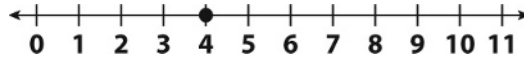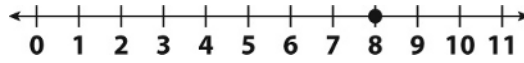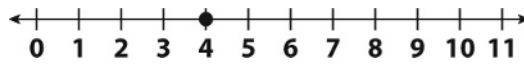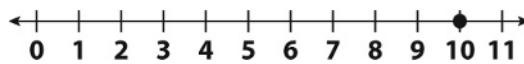
7. $A = 144$ in.^{2}; $P = 4s$; $48 = 4s$, so $s = 12$. $A = s^2$, $A = 12^2 = 144$

8. 17 model SUVs; Sample equation: $5m = 85$, $m = 17$

9. 18 min; Sample equation: $\dfrac{n}{3} = 6$, $n = 18$

10. 3 h; Sample equation: $16.50b = 49.50$, $b = 3$

11. $n = 25$; Sample answer: Maria used 12.5 meters of material to make doll clothes for a charity project. Each piece of clothing used 0.5 meter of material. How many pieces of clothing did Maria make? She made 25 pieces of clothing.

Practice and Problem Solving: D

1. $m = 4$

2. $a = 8$

3. $s = 4$

4. $u = 10$

5. Area—60 ft^2; length—12 ft

6. Sample answer: $60 = 12w$

7. 5

8. Jim's garden is 5 feet wide.

Reteach

1. $n = 3$; $3 \bullet 3 = 9\checkmark$
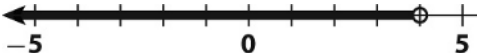
2. $n = 8$; $8 \div 2 = 4\checkmark$

Reading Strategies
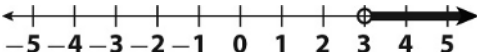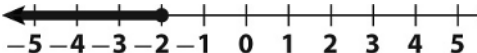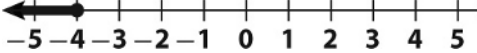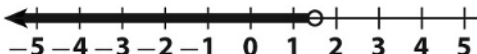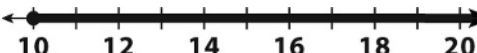
1. Divide by 3; $\dfrac{3r}{3} = \dfrac{24}{3}$; $r = 8$; $3 \bullet 8 = 24\checkmark$

2. Multiply by 8; $\dfrac{b \bullet 8}{8} = 16 \bullet 8$; $b = 128$; $\dfrac{128}{8} = 16 \checkmark$

Success for English Learners

1. Substitute 8 for *m*. Check whether that equation is true. $4 \cdot 8 = 32$ ✓

2. $\dfrac{n}{3} = 2$; $\dfrac{n \cdot 3}{3} = 2 \cdot 3$; $n = 6$; $6 \div 3 = 2$ ✓

3. $5t = 20$; $\dfrac{5t}{5} = \dfrac{20}{5}$; $t = 4$; $5 \cdot 4 = 20$ ✓

LESSON 11-4

Practice and Problem Solving: A/B

1.

2.

3.

Possible check: $1 \geq 0$ is true.

4.

Possible check: $-5 \leq -4$ is true.

5.

Possible check: $1 < 1.5$ is true.

6. Sample inequality: $1 + x < 5$

7. Sample inequality: $3 < y - 2$

8. Sample inequality: $t \geq 10$

9. Sample inequality: $b \leq 3$

10. Sample inequality: $x \geq -2$
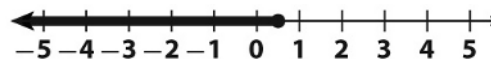
11. Sample inequality: $x < -2$

Practice and Problem Solving: C

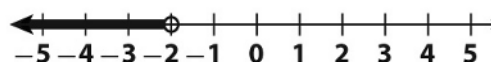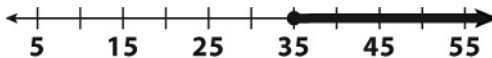1. $-1,\ 0,\ 4\dfrac{1}{4}$

2. $-3.5,\ -1,\ 0$

3. Sample check: $4 \geq 1$

4. Sample check: $-4 \leq 0.5$

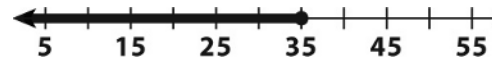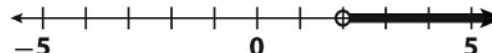5. Sample check: $-3 < 1 - 3$

6. Sample inequality: $35 \leq t$; yes
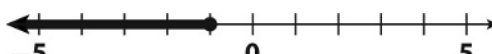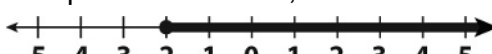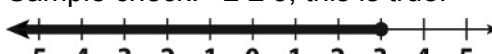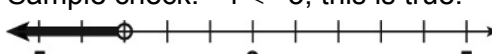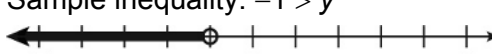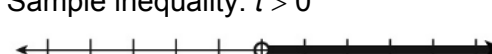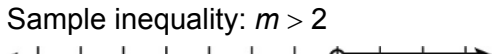
7. Sample inequality: $m \leq 35$; yes

8. Sample answer: $x > 25$; there are more than 25 students in the school band.

9. Sample answer: $x \leq -2.75$; the highest temperature today was $-2.75°C$.

Practice and Problem Solving: D

1.

2.

3. Sample check: $0 \geq -2$; this is true.

4. Sample check: $-2 \leq 3$; this is true.

5. Sample check: $-4 < -3$; this is true.
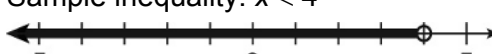
6. Sample inequality: $x < 4$

7. Sample inequality: $-1 > y$

8. Sample inequality: $t > 0$

9. Sample inequality: $m > 2$

Reteach

1.

2.

3.

4.

5. Sample inequality: $2 + 3 < y$

6. Sample inequality: $y + 2 \geq 6$

Reading Strategies

1. An inequality is a comparison of two unequal values.

2. The symbol $<$ means less than and the symbol $\leq$ means less than or equal to.

3. The symbol $>$ means greater than and the symbol $\geq$ means greater than or equal to.

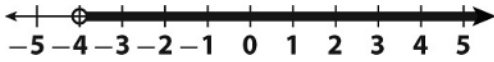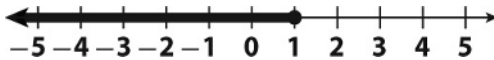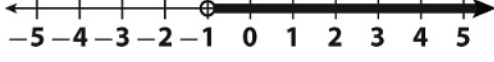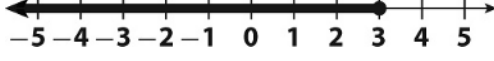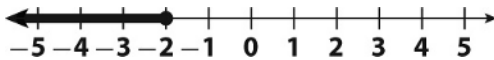4. Sample inequality: $x \leq 30$

5. 28 is a solution to the inequality because $28 \leq 30$ is true.

Success for English Learners

1. Yes, $4 \leq 4$ is true.

2. No, $-2 > -2$ is not true.

3. Solid circle; the inequality $\geq$ means it can be equal to or greater than.

4.

MODULE 11 Challenge

1. $4{,}700 = 94w$; $w = 50$ ft; $P = 2 \bullet 94 + 2 \bullet 50$; $P = 288$ ft

2. $8{,}250 = 75l$; $l = 110$ m; $P = 2 \bullet 75 + 2 \bullet 110$; $P = 370$ m

3. $1{,}586 = 26l$; $l = 61$ m; $P = 2 \bullet 26 + 2 \bullet 61$; $P = 174$ m

4. $8{,}100 = 90w$; $w = 90$ ft; $P = 2 \bullet 90 + 2 \bullet 90$ (or $4 \bullet 90$); $P = 360$ ft

MODULE 12 Relationships In Two Variables

LESSON 12-1

Practice and Problem Solving: A/B

1. $A(-12, 14)$

2. $B(8, 8)$

3. $C(-12, -4)$

4. $D(0, -14)$

5. $E(14, 0)$

6. $F(0, 0)$

7–12.
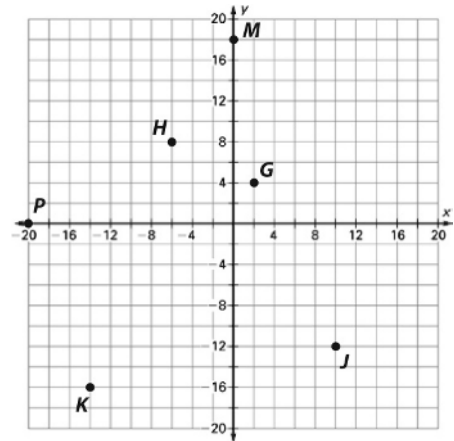
13. Answers will vary. Sample answer: "Go 6 blocks south."

14. Answers will vary. Sample answer: "Go 5 blocks east and 1 block south."

15. Answers will vary. Sample answer: "Go 5 blocks south and 5 blocks west."

Practice and Problem Solving: C

1. Axes labeling may vary. Sample answer:

2. Axes labeling may vary. Sample answer:

3. Quadrant III; $X(-2, -19)$

4. Quadrant I; $Y(3, 13)$

5. Quadrant IV; $Z(2, -4)$

6. Answers will vary. Sample answer: One of the coordinates of the new point must be 4 or 8. $P(2, 4)$, $Q(2, 8)$, $R(5, 8)$.

7. Answers will vary. Sample answer: One of the coordinates of the new point must be -3 or 4. $S(-3, -5)$, $T(4, -5)$, $U(4, 5)$.

Practice and Problem Solving: D

1. C

2. C

3. B

4. $A(3, -1)$

5. $B(2, 4)$

6. $C(-3, 0)$

7. $D(1, -1)$

Reteach

1. $(-3, +4)$

2. $(+2, -5)$
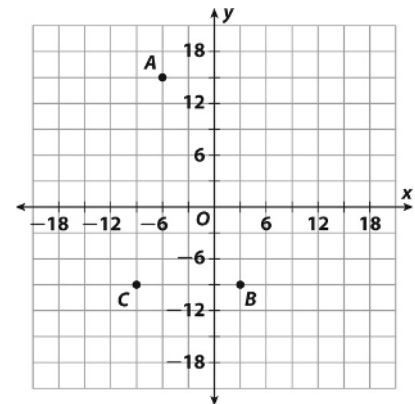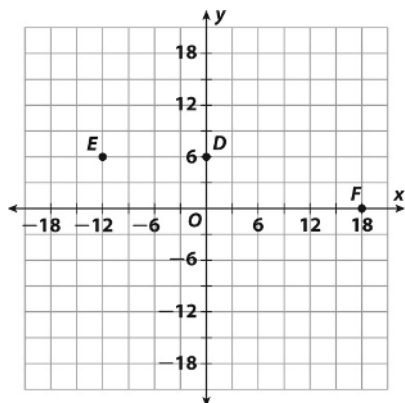
3. $(+9, +1)$

4. The point $(0, 7)$ is not in a quadrant; it is on the positive y-axis between quadrants I and II.

Reading Strategies

Some answers will vary. Sample answers are given.

1. J

2. r

3. s

4. K

5. Sample answer: L

6. (r, s)

7. Sample answer: M

8. O

Success for English Learners

1. Up or down, if the y-value is non-zero.

2. Quadrants III or IV

3. Yes, unless the x- and y-values are equal.

LESSON 12-2

Practice and Problem Solving: A/B

1. m, money; h, hours worked

2. L, cost of large pizza; M, cost of medium pizza

3. Current

4. Light intensity

5. Answers will vary. Sample answer: close to zero.

6. Answers will vary. Sample answer: 100; $c = \dfrac{L}{10}$.

7. y-axis

8. There is no lap time until the driver drives the first lap, $x = 1$.

Practice and Problem Solving: C

1. Speed; number of passengers

2. Answers will vary. Sample answer: the slower the bus goes, the more fuel it uses.

3. Answers will vary. Sample answer: the more passengers the bus carries, the more fuel that is consumed.

4. Answers will vary. Sample answer: Students should recognize that the fuel consumption is related to *both* the number of passengers and the bus speed. The three variables interact in a complex way that is not completely clear from or explained by this data.

5. For each increase in the independent variable, the dependent variables changes more for line A than it does for line B, except when the value of the independent variables is zero, in which case the value

of line *A*'s dependent variable and line *B*'s dependent variable are the same (22.5 units).

6. For each change in the independent variable, the dependent variable increases by the same amount. However, the value of line *B*'s dependent variable will always be 22.5 units more than the corresponding value of line *C*'s dependent variable.

Practice and Problem Solving: D

1. a. It depends on how long the water has been filling the tank.

   b. $50 \div 10 = 100 \div 20 = 150 \div 30 = 200 \div 40 = 250 \div 50 = 5$; 5

   c. Multiply 60 times 5, which gives 300 gal.

2. 1.61 km per mi

3. 300 sandwiches

4. vertical axis or *y*-axis

5. 150

Reteach

1. Add 2 to *x* to get *y* or $x + 2 = y$.

2. a. $y = 4$

   b. $x = -1$

   c. $y = 2x$

Reading Strategies

1. Cause: increasing number of families requesting assistance; effect: fewer bottles of drinking water per family.

2. Cause: increasing number of voters per hour; effect: the number of hours it takes to vote increases.

3. Cause: car speed; effect: increasing mileage or miles per gallon.

Success for English Learners

1. 50 in.

2. Money collected; cars washed; $300

LESSON 12-3

Practice and Problem Solving: A/B

1. $y = 7x$; 35

2. $y = x - 5$; 1

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

4. $y = x + 4$; 15

5. 24, 42, 60; $m = 6d$; 60 mi

6. 6, 12, 17, 36; $y = x - 4$; 36 years old

Practice and Problem Solving: C

1. $y = x^2$; 25

2. $y = x \div -4$; 20, −7

3. $y = 0.4x$; 10, 2.4

4. $y = 5x + 2$; 2, 27

5. *F* represents °F, *C* represents °C; 68°F; Yes it is a solution because
$F = \dfrac{9}{5}(30) + 32 = 86$.

6. $C = \dfrac{5}{9}(F - 32)$; $C = \dfrac{5}{9}(59 - 32) = 15$, so the temperature is 15°C.

Practice and Problem Solving: D

1. $y = x + 2$

2. $y = x \div 5$

3. $y = 3x$

4. $y = x - 2$

5. 100, 120; C

6. 6, 11, 23; B; 33 years old

Reteach

1. $y = 3x$; $y = 18$

2. $y = x - 3$; $y = 12$

3. 8, 18, 40; $y = 2x$; 40 in.

Reading Strategies

1. 8

2. 24

3. 48

4. *y* stands for ounces; *x* stands for cups

5. $y = 16$

6. $y = 8(15)$, So 120 ounces is the same as 15 cups.

Success for English Learners

1. The equation shows the relationship between *x* and *y*.

2. To substitute a value means to replace the variable in the equation with the value given for it.

3. $y = 12(5)$, $y = 60$; So Mike has 60 inches of rope.

LESSON 12-4

Practice and Problem Solving: A/B

1. 22, 20, 18, 16, 14, 12
2. radios; hours
3. (0, 24), (2, 22), (4, 20), (6, 18), (8, 16), (10, 14), (12, 12)
4. 2
5. The total number decreases.
6. −1; 24
7. Because the total number of radios decreases by h, the number of hours.

Practice and Problem Solving: C

1. 27, 12, 9, 6, 4, 3
2. The number of plant fossils counted daily is decreasing.
3. Rate A for Days 1 and 2 is the greatest decrease in fossils counted.
4. −15 fossils counted per day; −3 fossils counted per day; −1 fossil counted per day.

Practice and Problem Solving: D

1. 10, 13; (0, 4), (1, 7), (2, 10), (3, 13); $y = 3x + 4$
2. 8; (0, 0), (1, 4), (2, 8), (4, 16); $y = 4x$
3. 4, 23; (0, 5), (2, 11), (4, 17), (6, 23); $y = 3x + 5$
4. (4, 2), (8, 4); $y = 0.5x + 0$ or $y = 0.5x$
5. (0, 4), (4, 8); $y = x + 4$
6. (0, 8), (2, 4); $y = -2x + 8$

Reteach

1. $y = 0.5x + 1.5$
2. $y = -\dfrac{3}{2}x + 6$

Reading Strategies

1. 0
2. 300
3.

Tickets (*t*)	8	10	12	14	16
Total cost (*c*)	40	50	60	70	80

$t = 5c$

4.

x	4	8	12	16	20	24
y	1	2	3	4	5	6

$y = \dfrac{1}{4}x$

Success for English Learners

1. $y = x + 2$
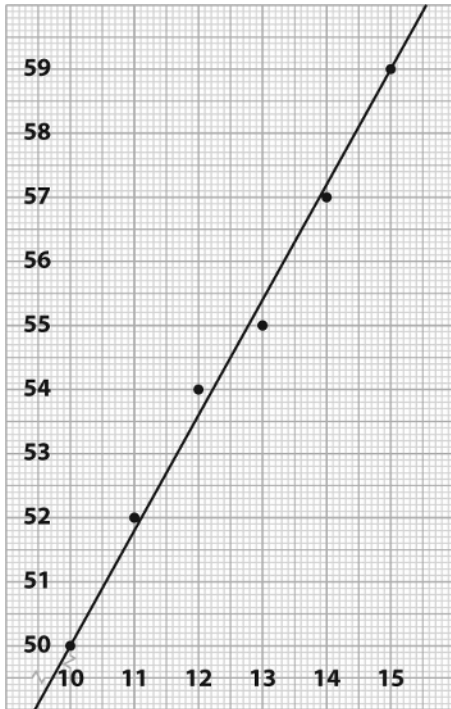2. $y = 2x + 1$

MODULE 12 Challenge

1. tables and graph

Table 1

°C	°F
10	50
11	52
12	54
13	55
14	57
15	59

Table 2

°C	°F
10	50
11	51.8
12	53.6
13	55.4
14	57.2
15	59

2. Sample answer: The data for Table 2 lie along the straight line because they are computed from the equation. For Table 1, four of the data points are either above or below the line, although they are close to it. The data for Table 1 are approximations because the thermometer can only be read to about the nearest half degree.