Chapter 5

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Linear Equations in the Coordinate Plane

When you look at a map, you will sometimes use the latitude and longitude lines to help you identify where a town or geographical feature is located. These lines help you orient yourself. Similarly in math, the coordinate plane gives you information on where points, lines, and functions are graphed and how they relate to each other. This information can be calculated but is often easier to see when graphed on the coordinate plane.

Lesson 5.1
Interpret Slope
Understanding the coordinate plane is key to graphing equations of all types. The graph of a line on the coordinate plane can tell you information like the slope, or steepness, and what points it passes through. Learn how to calculate slope and interpret its real-world meaning.

Lesson 5.2
Write the Equation of a Line
People give directions in different ways. Some may use the names of the roads, others may use route numbers, others may describe the way using landmarks; however, they all describe the same path. Similarly, you can write the equation of a line in multiple ways. Learn how to write the equation of a line using different features like slope, intercepts, and points on the line.

Lesson 5.3
Graph Linear Equations
When solving real-life problems involving linear equations, you want to understand how the two variables relate to each other. While the equation can quickly tell you the slope, or even the intercept, the graph immediately shows you visually the relationship between the two. Learn how to graph linear equations on the coordinate plane.

Lesson 5.4
Solve Systems of Linear Equations
Sometimes you can solve a simple problem by modeling it with a linear equation. Often, however, you have multiple situations that need to be factored in, and one linear equation cannot describe the whole scenario. Learn how to solve a system of linear equations and model real-world situations.

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Goal Setting
Think about the last time you made plans with a friend. How did you find a date that worked for both of you? Were there times you were free that your friend was not? How many attempts did it take to find a time? Did you find more than one time that would work?

When you solve a system of linear equations you are looking for a solution that works for both equations. What information do you know about each equation? How can you find a solution for both equations? Can you have more than one solution?

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LESSON 5.1 Interpret Slope

LESSON OBJECTIVES

- Determine the slope of a line from a graph, equation, or table
- Interpret unit rate as the slope in a proportional relationship of real-world and mathematical problems

CORE SKILLS & PRACTICES

- Make Use of Structure
- Use Ratio Reasoning

Key Terms

proportional relationship
an equation of the form $y = kx$ (when $k \neq 0$)

slope
the ratio of vertical change to horizontal change

unit rate
a rate that compares to one unit, such as miles per gallon

Vocabulary

coordinate plane
a grid formed by the intersection of a horizontal number line and a vertical number line

ordered pair
a pair of numbers (x, y) that is used to describe the location of a point on the coordinate plane

quadrant
one of the four regions of the coordinate plane formed by the intersection of the x- and y-axes

Key Concept

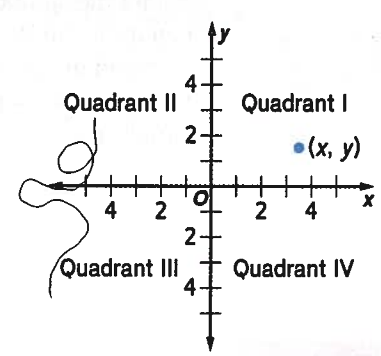
Slope, a measure of the steepness of a line, is the ratio of vertical change to horizontal change (or rise over run). For lines that represent proportional relationships, the slope of the line is equal to the unit rate.

Points and Lines in the Coordinate Plane

In some cities, streets that run east and west are named with numbers, and streets that run north and south are named with letters. Due to this convenient naming system, it is easy for people who are unfamiliar with the city to identify their current locations and navigate to a specific address.

Points in Four Quadrants

The **coordinate plane** is formed by a horizontal number line (the x-axis) and a vertical number line (the y-axis) that intersect at 0. The axes divide the coordinate plane into four regions called **quadrants**.



Points in the plane are described with two numbers, or an **ordered pair** (x, y). The first number in an ordered pair is the x-coordinate and the second number is the y-coordinate.

Plotting Points

Use x- and y-coordinates to plot a point in the plane. Start at (0, 0), move horizontally based on the x-coordinate, and then move vertically based on the y-coordinate.

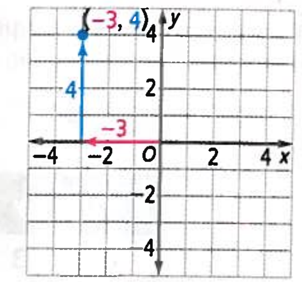
Example 1: Plotting a Point

Plot the point (−3, 4).

Step 1 Start at (0, 0).

Step 2 The x-coordinate is −3, so move 3 units left.

Step 3 The y-coordinate is 4, so move 4 units up.



Multiple Representations of Lines

There are several different ways to represent a line in the coordinate plane by describing the points that form the line.

Equations

The verbal description "y is 3 more than twice x" can be written as the equation $y = 3 + 2x$, or $y = 2x + 3$.

Verbal Description

y	is	3 more than	twice x
↓	↓	↓	↓
y	$=$	$3 \ +$	$2x$

Tables

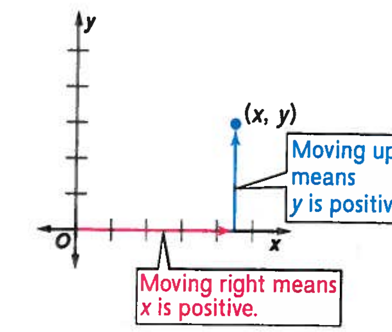
To make a table of values for the equation $y = 2x + 3$, choose several values to substitute for x and then find the corresponding values of y.

x	$y = 2x + 3$
0	3
1	5
2	7

CORE PRACTICE

Make Use of Structure

Points in Quadrant I are plotted by starting at (0, 0), moving to the right, and then moving up. These movements correspond to an ordered pair with a positive x-coordinate and a positive y-coordinate. Therefore, all points in Quadrant I have positive coordinates.



What is true about the signs of the coordinates of points in Quadrants II, III, and IV?

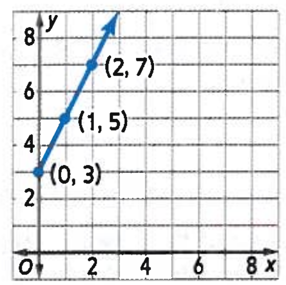
Graphs

To graph the line, plot the points (x, y) from the table and connect the points to form the line.

Table

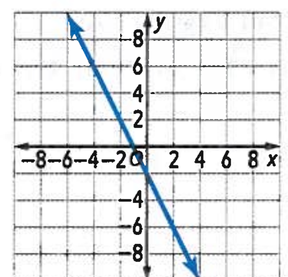
x	y
0	3
1	5
2	7

Graph



Think about Math

Directions: Answer the following questions.



1. Which ordered pair(s) represent solutions to the equation of the line?
   A. (−4, 6)
   B. (−2, 4)
   C. (2, −6)
   D. (4, −4)

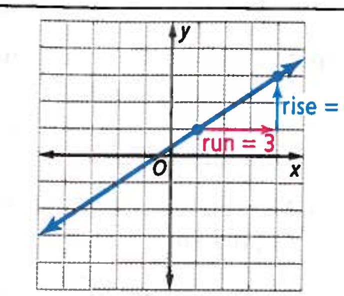
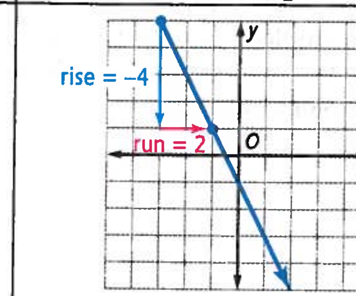
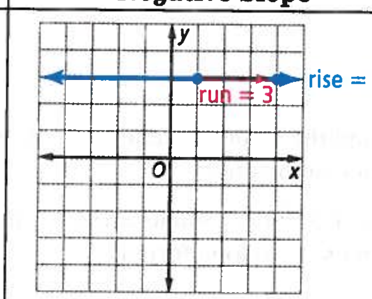
2. Which ordered pair or pairs could be in a table of values for the line?
   A. (−6, 6)
   B. (0, −2)
   C. (3, −8)
   D. (6, −6)

The Slope of a Line

The pitch of a roof is a ratio that describes how steep the roof is. A pitch of 4:12, for example, means that the roof rises 4 inches vertically for every 12 inches of horizontal run. You can also use the ratio of vertical change to horizontal change to describe the steepness of a line in the coordinate plane. This ratio is called slope.

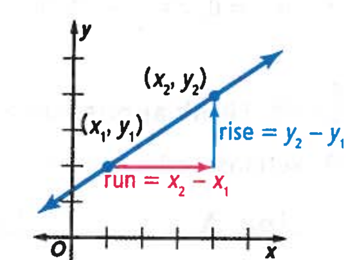
Defining Slope

Nonvertical lines in the plane have a measure of steepness, called the **slope** of the line, which is the ratio of the vertical change (rise) to the horizontal change (run).

Positive	Lines that rise from left to right have positive slopes.	 Slope $= \frac{\text{rise}}{\text{run}} = \frac{2}{3}$ **Positive Slope**
Negative	Lines that fall from left to right have negative slopes.	 Slope $= \frac{\text{rise}}{\text{run}} = \frac{-4}{2} = -2$ **Negative Slope**
Zero	Because horizontal lines have no vertical change, the rise is 0. This means that the slope of a horizontal line is 0.	 Slope $= \frac{\text{rise}}{\text{run}} = \frac{0}{3} = 0$ **Zero Slope**

The Slope Formula

The slope of a line is the same between any two points on the line. You can use the coordinates of two points on a line to calculate the slope. Subtract the y-coordinates to find the rise, and subtract the x-coordinates to find the run.



Slope $= \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$

CALCULATOR SKILL

When using a calculator to determine the slope of the line, parentheses are needed to make sure the order of operations are performed correctly.

On the TI-30XS MultiView™ calculator, the parentheses buttons, (and), help keep the numerator together and denominator together.

For example, calculating the slope between the points (3, 5) and (4, 1), you must press the calculator buttons in this order: (, 1, –, 5,), ÷, (, 4, –, 3,), and enter. This should give a slope of −4. Recheck the buttons you pushed if the answer is different.

21ST CENTURY SKILL

Health Literacy

Resting heart rate is a measure of your heart's efficiency. The lower your resting heart rate, the less exertion on your heart as it pumps blood through your body. The resting heart rate of an average adult is between 60 and 100 beats per minute.

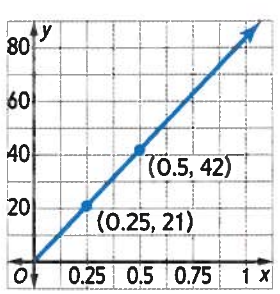
Four people calculated their resting heart rates.

- Person A's heart beat 6 times in 5 seconds and 24 times in 20 seconds.
- Person C wrote the equation $y = 48x$ to describe his resting heart rate, where y is the number of heartbeats in x minutes.
- The heart rates of Person B and Person D are described in the table and graph below, where x is minutes and y is heartbeats.

Person B

x	y
$\frac{1}{6}$	16
$\frac{1}{2}$	48

Person D



Who has the greatest resting heart rate?

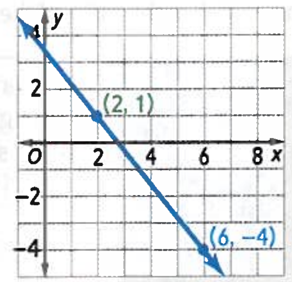
To find the slope of a line from its graph, follow these steps.

Example 2: Finding the Slope

Step 1 Identify two points on the line.

Step 2 Substitute the coordinates of the points into the slope formula. Be sure to subtract the coordinates in the same order.

Step 3 Evaluate to determine the slope of the line.



$$\text{Slope} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-4-1}{6-2} = \frac{-5}{4} = -\frac{5}{4}$$

Slopes from Equations and Tables

To find the slope of a line from a table, choose two points from the table and use the slope formula.

$$\text{Slope} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

x	y
−4	0
2	3
6	5

(−4, 0)

(6, 5)

$$\text{Slope} = \frac{5-0}{6-(-4)} = \frac{1}{2}$$

To find the slope of a line from an equation, use the equation to find two points on the line.

Choose a value for one variable and solve for the value of the other variable. Then use the slope formula.

$12x + 3y = 6$

When $x = 0$, $y = 2 \rightarrow (0, 2)$ Slope $= \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$

When $y = 0$, $x = \frac{1}{2} \rightarrow (\frac{1}{2}, 0)$ Slope $= \frac{0-2}{\frac{1}{2}-0} = \frac{-2}{\frac{1}{2}} = -2 \times 2 = -4$

Think about Math

Directions: Order the lines from least slope to greatest slope.

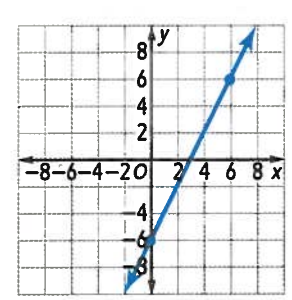
Line A

x	y
8	10
24	14

Line B

$y = -2x + 1$

Line C

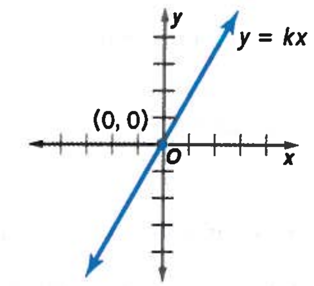


Slope as a Unit Rate

In real-world proportional relationships, the slope of a line does more than just describe its steepness. Knowing the slope can also provide context and help you better understand the relationship between variables, such as wages earned and miles traveled.

Proportional Relationships

Two variables x and y have a **proportional relationship** if there exists a nonzero number k such that $y = kx$. The constant k is called the constant of proportionality. It represents a unit rate, which is a ratio that compares a quantity to one unit, such as miles per gallon.



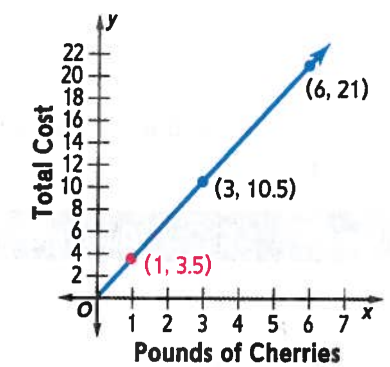
When $x = 0$, $y = k(0) = 0$. Therefore, a line that represents a proportional relationship passes through (0, 0).

The slope of a line that represents a proportional relationship is k, the constant of proportionality.

Connecting Slope and Unit Rate

The graph shows the prices for different quantities of cherries.

For a point (x, y) on this line, x pounds of cherries cost y dollars.



Using any two points, you can find that the slope of this line is 3.5. This is a proportional relationship with constant of proportionality 3.5. The unit rate can be found by dividing the cost by the number of pounds, which is $3.50 per pound. All three quantities (slope, unit rate, and constant of proportionality) are the same.

Notice that the point whose x-coordinate is 1 gives the unit cost per pound, $3.50.

The graph of a proportional relationship passes through the point $(1, k)$, where k is the constant of proportionality, unit rate, or slope of the line.

CORE SKILL

Use Ratio Reasoning

Use ratio reasoning to solve problems involving proportional relationships in which you must make a comparison. For example, when given two proportional relationships relating speed, time, and distance, find the unit rate for each relationship by finding the slope. You can then use this rate to compare times and distances.

Two cyclists traveling at constant speeds are tracking their distance traveled for periods of time. For Cyclist A, the equation $y = 0.3x$ describes miles traveled y in x minutes. For Cyclist B, this relationship is described in the table, where x is minutes and y is miles.

Cyclist B

x	y
0	0
1	0.2
2	0.4
3	0.6

After 30 minutes, how much farther will Cyclist A have traveled than Cyclist B?

Remember that when $x = 0$ and $y = 0$, there is a proportional relationship. Therefore, you can find the unit rate by finding the y value when $x = 1$. So the unit rate for Cyclist B is $0.2x$.

Vocabulary Review

Directions: Write the missing term in the blank.

coordinate plane	**ordered pair**	**proportional relationship**
quadrant	**slope**	**unit rate**

1. A(n) ________________ is a rate that compares a quantity to one unit, such as miles per gallon.
2. The ________________ is formed by the intersection of a horizontal number line and a vertical number line.
3. One of the four regions of the coordinate plane formed by the intersection of the x- and y-axes is called a(n) ________________.
4. An equation of the form $y = kx$ for some nonzero k describes a(n) ________________.
5. ________________ is the constant ratio of vertical change to horizontal change for a line.
6. A pair of numbers (x, y) that is used to describe the location of a point in the coordinate plane is a(n) ________________.

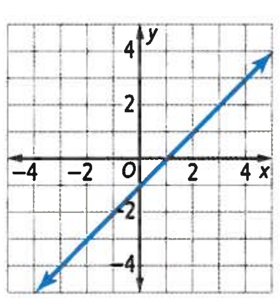
Skill Review

Directions: Read each problem and complete the task.

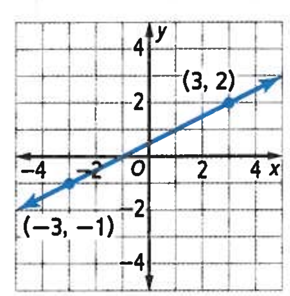
1. Write each ordered pair in the table to indicate the quadrant in which it is located.
(1, −15), (11, 2), (−10, 12), (−1, 8), (−20, −1), (7, −18)

Quadrant I	Quadrant II	Quadrant III	Quadrant IV

2. Explain the relationship between the graph of a line and the solutions to the equation of the line. Use the graph shown as an example in your explanation.



3. What is the slope of the line?
A. −2
B. −0.5
C. 0.5
D. 2



4. Which describes the unit rate associated with the table?

Time in Minutes, x	Words Read, y
2	160
4	320
6	480

A. The person's reading rate is 80 words per minute.
B. The person's reading rate is 82 words per minute.
C. The person's reading rate is 84 words per minute.
D. The person's reading rate is 86 words per minute.

5. The table shows a proportional relationship between time worked and money earned. Write the missing value in the table.

Time (hours), x	Money Earned ($), y
1	
2	21
4	42

Skill Practice

Directions: Read each problem and complete the task.

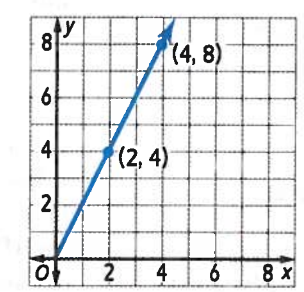
1. Give an example of a point in Quadrant III.

2. Which point or points lie on the line described by the equation $y = 3x + 4$?
A. (−1, 1)
B. (0, −4)
C. (1, 7)
D. (3, 13)

3. Lincoln says that the slope of the line described by the table is $\frac{1}{2}$. What error did Lincoln make? What is the correct slope?

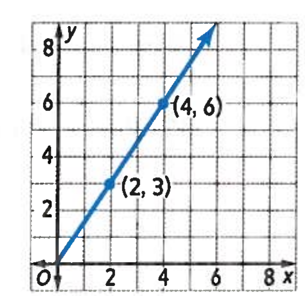
x	y
2	6
4	10
6	14

4. On the graph below, plot and label the point that represents the unit rate.



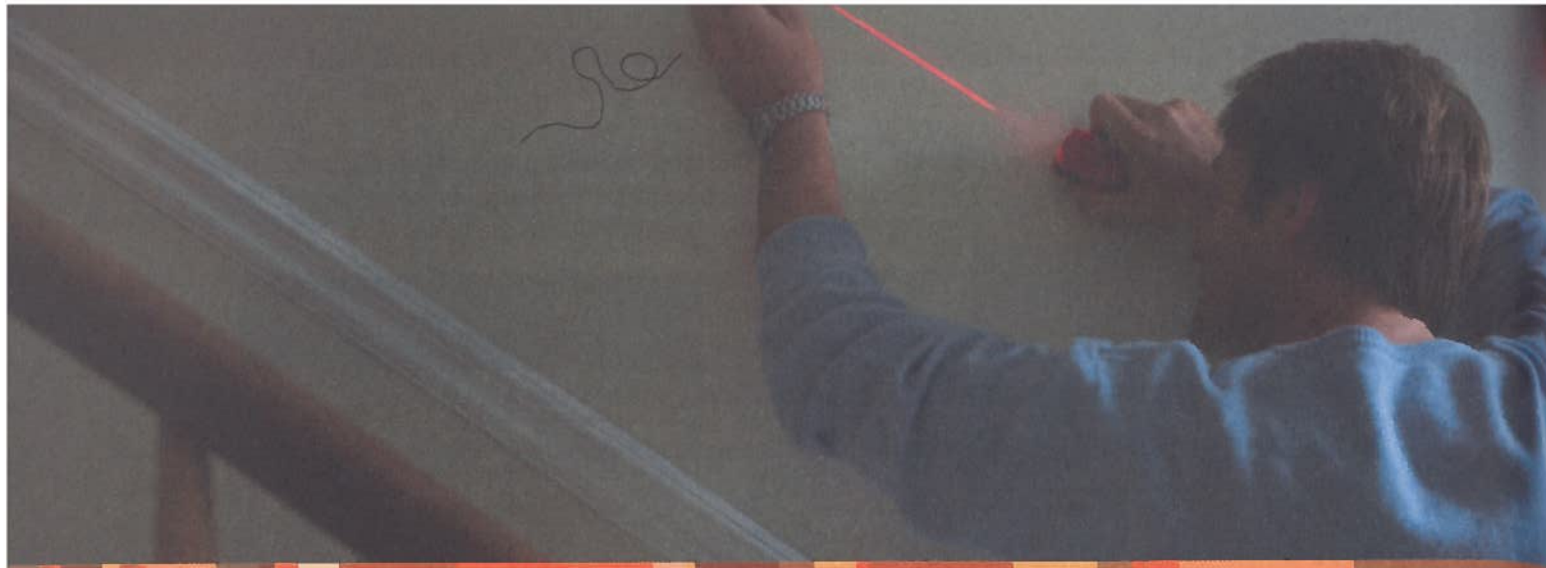
5. The table and graph show the costs in dollars y of x pounds of apples at two local grocery stores. At which store does it cost less to buy 5 pounds of apples? Describe a way you could answer this question without calculating the cost of 5 pounds of apples at either store.

Store A



Store B

Apples (lbs), x	Price ($), y
1	1.70
3	5.10



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LESSON 5.2 Write the Equation of a Line

LESSON OBJECTIVES

- Write the equation of a line given the slope and a point
- Write the equation of a line passing through two given distinct points
- Write the equation of a line from a graph or a table

CORE SKILLS & PRACTICES

- Build Solution Pathways
- Model with Mathematics

Key Terms

standard form of a linear equation
$Ax + By = C$, where A is a whole number and both A and B cannot be 0

y-intercept
the y-coordinate of the point where a line crosses the y-axis

slope-intercept form
$y = mx + b$, where m is the slope of the line and b is the y-intercept

point-slope form
an equation that allows points on a line to be calculated if one point and the slope is known

Vocabulary

coefficient
a number that is multiplied by a variable

slope
the ratio of rise to run

Key Concept

The equation of a line can be written in many different ways. You can use given information about the line to determine the best way to write the equation.

Using Slope and y-Intercept

A cab company charges an initial fee and then an additional charge for each mile traveled. To find the total cost of a cab ride, you can use the same formula used to write the equation of a line. If you were to graph this information, your graph would be a line that describes the relationship between the distance traveled and the total cost of the cab ride.

Standard Form

A linear equation can be written in several ways. The **standard form of a linear equation** is $Ax + By = C$. In standard form, A (the coefficient of x) must be a whole number, and A and B cannot both be equal to 0. A **coefficient** is a number placed before a variable that is multiplied by a variable.

To write an equation in standard form, perform operations on both sides until the equation is in the form $Ax + By = C$, where A is a whole number.

Example 1: Standard Form of a Linear Equation

Write the equation $4y = 2x - 5$ in standard form.

Step 1 Subtract $2x$ from both sides.

$$\begin{aligned} 4y &= 2x - 5 \\ \underline{-2x} &\quad \underline{-2x} \\ -2x + 4y &= -5 \end{aligned}$$

Step 2 Multiply both sides by -1.

$$\begin{aligned} -1(-2x + 4y) &= -1(-5) \\ 2x - 4y &= 5 \end{aligned}$$

For this equation, $A = 2$, $B = -4$, and $C = 5$.

Slope-Intercept Form

When the **slope**, which is the ratio of rise to run, and y-intercept are known, you can write the equation of the line in **slope-intercept form**, $y = mx + b$, where m is the slope of the line and b is the y-intercept. The **y-intercept** is the y-coordinate of the point where a line crosses the y-axis.

Example 2: Slope-Intercept Form

Write the equation of the line with slope -5 and y-intercept 4 in slope-intercept form.

Step 1 Identify m and b. $\quad m = -5, b = 4$

Step 2 Use the values of m and b to write the equation. $\quad y = -5x + 4$

Example 3: Write an Equation Given Slope and a Point

A line has slope 3 and contains the point (2, 7). Write the equation of the line in slope-intercept form.

Step 1 Write the slope-intercept form of a linear equation. Substitute the known values.

$$y = mx + b$$
$$m = 3, x = 2, y = 7$$

Step 2 Solve the equation to find the value of b.

$$\begin{aligned} 7 &= 3(2) + b \\ 7 &= 6 + b \\ 1 &= b \end{aligned}$$

Step 3 Use m and b to write the equation.

$$m = 3, b = 1$$
$$y = 3x + 1$$

Point-Slope Form

Point-slope form is another way to write the equation of a line. You can write a linear equation in point-slope form if you know the slope m and a point (4, −3) on the line.

Point-Slope Form: $y - y_1 = m(x - x_1)$

Example 4: Point-Slope Form

A line has slope 1 and contains the point (4, −3). Write the equation of the line in point-slope form.

Step 1 Substitute the known values into the point-slope form.

$$m = 1, x_1 = 4, y_1 = -3$$
$$y - (-3) = 1(x - 4)$$

Step 2 Simplify. $\quad y + 3 = x - 4$

To write this equation in slope-intercept form, solve for y.

Subtract 3 from both sides:

$$\begin{aligned} y + 3 - 3 &= x - 4 - 3 \\ y &= x - 7 \end{aligned}$$

Now you know that the y-intercept is -7. The graph of this equation crosses the y-axis at $(0, -7)$.

CORE SKILL

Build Solution Pathways

When solving a mathematics problem, you need to consider the given information as well as the desired answer. This will help you determine a method to find the solution.

Find the equation of a line with slope 2 that passes through the point (−3, 4). Write the equation in slope-intercept form. Because you are given the slope and a point, you can use either the slope-intercept form or the point-slope form to write the equation. However, the directions ask for the equation in slope-intercept form, so it likely will be simpler to start with slope-intercept form.

Think about Math

Directions: Use the following information to answer the questions.

A line has slope −3 and passes through the point (1, 2).

1. Write the equation of this line in point-slope form.
2. What are the values of A, B, and C when this equation is written in standard form?
3. Write the equation of the line in slope-intercept form.

Using Two Distinct Points

Joe is inspecting a wheelchair ramp built by a homeowner. He has measured the points where the wheelchair ramp begins and ends. In order to meet city building codes, the wheelchair ramp must have a slope of one inch in height for every one foot of horizontal distance. Joe must determine whether this ramp meets building codes.

Write the Equation Given Two Points

If you know two points on a line, you can write the equation of the line using either slope-intercept form or point-slope form. The first step is to use the slope formula to find the slope of the line.

Example 5: Write an Equation Given Two Points

A line contains the points (4, −4) and (3, 0). Write the equation of this line in slope-intercept form.

Step 1 Find the slope. Substitute the given values into the slope formula.

$$m = \frac{-4-0}{4-3} = \frac{-4}{1} = -4$$

Step 2 Now you know the slope and two points on the line. You can use either slope-intercept form or point-slope form to write the equation. Whichever form you use, choose only one of the given points to substitute.

$$y = mx + b$$

Choose slope-intercept form.

$$0 = -4(3) + b$$

Choose (3, 0): $m = -4, x = 3, y = 0$

$$0 = -12 + b$$

$$12 = b$$

Solve for b.

Step 3 Write the equation.

$m = -4, b = 12$

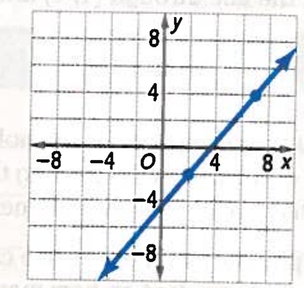
$$y = -4x + 12$$

Find Points from a Graph

You can write the equation of a line by using a graph.

Example 6: Write an Equation Given a Graph

Write the equation of the line shown in standard form.



Step 1 Identify the coordinates of two points on the line. Then find the slope by substituting the coordinates into the slope formula.

Two points on this line are (7, 4) and (2, −2).
Let (7, 4) = (x_1, y_1) and (2, −2) = (x_1, y_1)

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4-(-2)}{7-2} = \frac{6}{5}$$

Step 2 Use any method to write the equation. In this example, point slope form is used.

$$y - y_1 = m(x - x_1)$$
$$y - (-2) = \frac{6}{5}(x - 2)$$
$$y + 2 = \frac{6}{5}x - \frac{12}{5}$$
$$y = \frac{6}{5}x - \frac{22}{5}$$

Step 3 Write the equation in standard form.

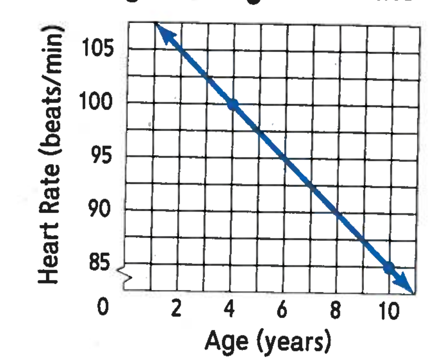
$$y = \frac{6}{5}x - \frac{22}{5}$$
$$5y = 6x - 22$$
$$-6x + 5y = -22$$
$$-1(-6x + 5y) = -1(-22)$$
$$6x - 5y = 22$$

CORE PRACTICE

Model with Mathematics

The graph shows the estimated resting heart rate in beats per minute based on a person's age. Using this information, write the equation of the given line and then use it to find the resting heart rate of a person who is 20 years old.

Average Resting Heart Rate



Think about Math

Directions: Answer the following questions.

1. The prices for boat rental are represented on a graph. The line starts at (0, 0) and passes through (3, 60). What is the slope?
2. What is the equation of the line through (1, 4) and (2, 1)?

Using Tables

Several high-school students have applied for a scholarship awarded by the local library. One measure of their effort in earning the scholarship includes the number of books they have read over the summer.

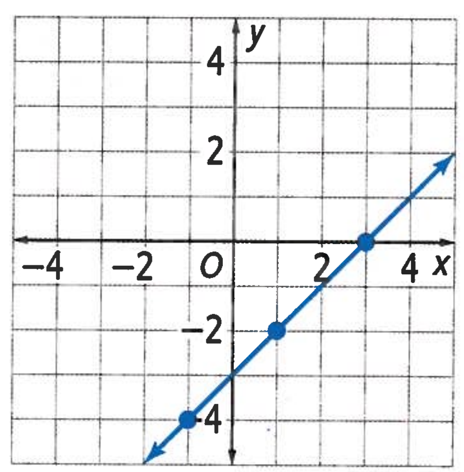
One student decides to graph how many books she can read over the summer, and finds that this is dependent on how many weeks she has free over the break. She then converts her graph to a table.

Summer Reading

Number of Weeks	Number of Books Read
1	3
2	6
3	9

Make a Table from a Graph

Make a table to represent the line graphed.



Example 7: Make a Table from a Graph

Step 1 Look at the line that is graphed and identify a few points. This line contains the points (3, 0), (1, −2), and (−1, −4).

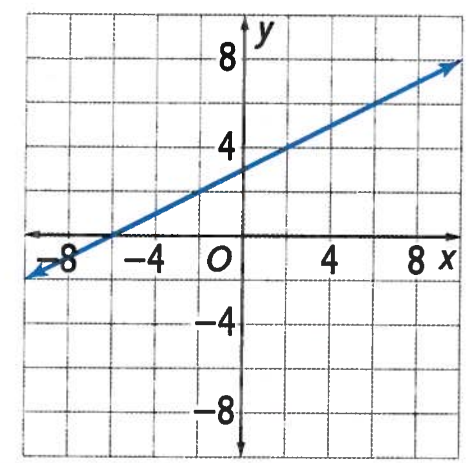
Step 2 For each point, write the x-coordinate and the y-coordinate in the appropriate column of the table.

x	y
3	0
1	−2
−1	−4

Think about Math

Directions: Determine which of these points are on the line. If the point is on the line, mark and label the point on the line.

(0, 2), (−2, 4), (−2, 2), (1, 5), (−4, 1), (4, 5)



WORKPLACE SKILL

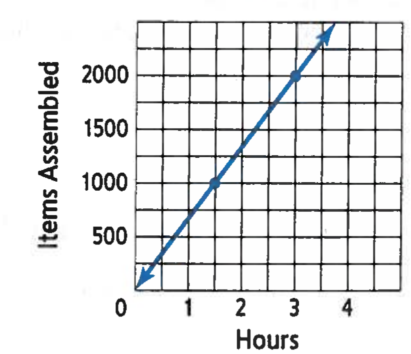
Understand Data in Different Formats

Sometimes you will need to compare similar data in different formats. A manufacturing company has collected the data shown in the graph and table that describes the relationship between time in hours and number of items each factory produces. How does the slope of a line showing this relationship for Factory 1 compare to the slope of the line showing this relationship for Factory 2? Which factory will produce the most items in an 8-hour workday? How do you know?

Factory 1

Hours	Items Assembled
1	1500
3	4500
4	6000

Factory 2



Vocabulary Review

Directions: Draw a line to match the term to its definition.

standard form of a linear equation	the y-coordinate of the point where a line crosses the y-axis
y-intercept	$y - y_1 = m(x - x_1)$
slope-intercept form	the ratio of rise to run
point-slope form	$Ax + By = C$
coefficient	a number that is multiplied by a variable
slope	$y = mx + b$, where m is the slope of the line and b is the y-intercept

Skill Review

Directions: Read each problem and complete the task.

1. A line has slope 4 and passes through the point $(-4, 6)$. What is the equation of this line in point-slope form?
   A. $y + 4 = x + 4$
   B. $y + 4 = 6x + 4$
   C. $y - 6 = x + 4$
   D. $y - 6 = 4x + 16$

2. What is the equation of the line written in standard form?
   $3y = 4x + 2$
   A. $4x - 3y = -2$
   B. $-3x + 4y = 2$
   C. $-2x + 3y = 4$
   D. $-4x + 2y = 3$

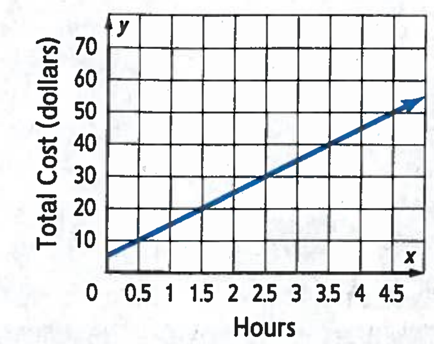
3. A line has slope -3 and passes through $(0, 0)$. What is the equation of the line in slope-intercept form?
   A. $y = -3x + 3$
   B. $y = 3x + 3$
   C. $y = 3x$
   D. $y = -3x$

4. Write the equation of the line through $(0, 2)$ and $(1, 4)$ in slope-intercept form.

5. Write the equation of the line through $(-4, 3)$ and $(-1, -1)$ in point-slope form.

6. Represent the information in the graph in a table. Identify at least three points.

Bicycle Rental



Skill Practice

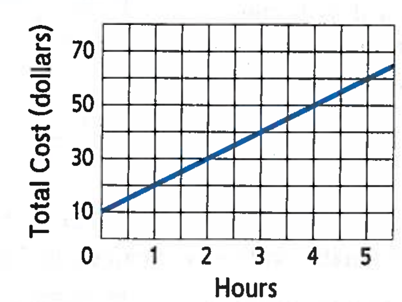
Directions: Read each problem and complete the task.

1. Emily's commission at a T-shirt shop depends on how many T-shirts she sells each day. She earns \$10 for the first T-shirt she sells and \$2 for each T-shirt after that. The line that represents her commission has a slope of 2 and passes through (5, 18). What is the equation of the line? Use the equation to find out how much Emily earns in commission for selling 20 T-shirts.

2. A slide is planned for a playground. When represented on a graph, the slide begins at (5, 4) and ends at (0, 0). What is the slope? Write the equation of the line in slope-intercept form.

3. The graph shows the cost to rent a boat at a marina. Find the equation of the line. Then find the cost of renting a boat for 8 hours.

Boat Rental



4. A line on a graph represents a ramp that extends from the back of a moving truck to the ground. The line has slope $-\frac{1}{2}$ and passes through (8, 0). The y-intercept represents the height of the back of the moving truck. How tall is the back of the moving truck?
   A. 2 feet
   B. 4 feet
   C. 6 feet
   D. 8 feet

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LESSON 5.3 Graph Linear Equations

LESSON OBJECTIVES

- Complete a table of x- and y-values for a linear equation
- Use x- and y-values to graph a linear equation
- Graph linear equations to solve real-world problems

CORE SKILLS & PRACTICES

- Solve Linear Equations
- Interpret Graphs

Key Terms

ordered pair
a pair of numbers (x, y) that is used to describe the location of a point in the coordinate plane

slope
the ratio of rise to run

y-intercept
The y-coordinate of a point where a graph crosses the y-axis

Vocabulary

slope-intercept form
$y = mx + b$, where m is the slope of the line and b is the y-intercept

x-value
the horizontal value in an ordered pair

y-value
the vertical value in an ordered pair

Key Concept

You can visualize how two variables in an equation are related by graphing the equation. Solutions of a linear equation can be plotted as ordered pairs on the coordinate plane. You can also use the special forms of linear equations to graph them.

Using Ordered Pairs

Graphing equations is one way to see the equation visually. Each graph is made up of many points, called ordered pairs, which record both the horizontal and vertical direction from the origin. The first value in an ordered pair is the x-value, which is the horizontal value along the x-axis. The second value is the y-value, which is the vertical value along the y-axis. You can use ordered pairs to graph points of relationships between two different objects, such as time vs. distance, products sold vs. profit, etc.

Making a Table

Consider this simple linear equation, $y = 5x$. This equation could represent the total cost in cents, y, for x minutes of cell phone data usage, at a cost of 5 cents per minute.

To find ordered pairs, make a table of the solutions. In the left column, you will write the x-values that you choose. In the right column, you will write the corresponding y-values that you find by evaluating the equation for each x-value.

x	y = 5x
0	
1	
2	

Finding x- and y-values

You can choose any values to substitute for x in a linear equation. However, it makes the most sense to choose smaller values that can easily be graphed.

The y-values are found by evaluating the equation at the x-values you've chosen, so you may want to choose x-values that make it easier to calculate y-values. You need at least two points to graph a line, so choose at least two to three x-values. Let's start with 0, 1, and 2. Calculate the y-values for the equation by substituting each x-value into the equation.

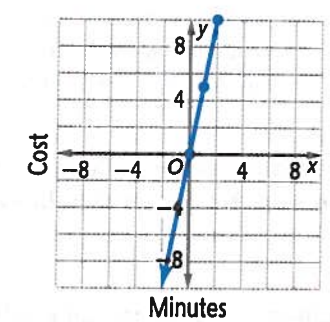
x	y = 5x
0	5(0) = 0
1	5(1) = 5
2	5(2) = 10

Graphing a Line

Now that you have ordered pairs for points on the line $y = 5x$, graph the points and connect them to form a line.

The three ordered pairs using the x- and y-values are (0, 0), (1, 5), and (2, 10).

Connect the points you plotted to form a line. The line represents the linear equation. The solutions of the linear equation are all of the points on the line. Be sure the coordinate axes are labeled and the scale makes sense.



Think about Math

Directions: Find the y-value for each x-value. Plot the points to graph the equation.

x	y = −4x + 5
1	
2	
3	

CORE SKILL

Solve Linear Equations

An integral part of algebra and problem solving involves solving linear equations. To graph a linear equation, you will often have to solve first for y. To solve a linear equation, isolate the variable on one side of the equation. To do this, perform the same operation on both sides of the equation.

Solve $-2x - 8 = 4$ for x.

CALCULATOR SKILL

When making a table of a function, your calculator can be a helpful way to solve for different values of x. You can set a number as a variable in your TI-30XS MultiView™ calculator and then enter the equation using the variable. This can be especially helpful when you want to substitute a negative value for x. To store a number as a variable, type the number you want and then press [recall sto▸] [clear var x^{yzt}_{abc}] [enter]. Now your number is stored as a variable and you can type it directly in your calculator. If you wanted to find $y = 9 - 2x$, when x is the number you stored, you can type [9] [−] [2] [clear var x^{yzt}_{abc}] [enter].

Find $y = 5x + 3$ for $x = -4$ by storing the variable and by entering it into your calculator. What are the advantages of storing it as a variable?

CORE SKILL

Interpret Graphs

You can learn a lot about an equation by looking at its graph. Learning how to interpret graphs can help you when graphing linear equations. You will be able to quickly recognize whether you have correctly graphed the equation. You can identify whether a line has a positive or negative slope and a positive or negative y-intercept by looking at its position on a graph.

The slope of a line can be either positive or negative. A line with a positive slope goes up from left to right. A line with a negative slope goes down from left to right. A line with a positive y-intercept will cross the y-axis above zero and a line with a negative y-intercept will cross the y-axis below zero.

On a blank graph, draw a line with a positive slope and a negative y-intercept. Write the equation of the line. Then draw a line with a negative slope and a positive y-intercept. Write the equation of the line.

Using Slope-Intercept Form

When a linear equation is in slope-intercept form, it is easy to graph. Many people use linear equations and graphs to build things, create budgets, and monitor fast-changing data. A fast, easy way to graph an equation is an important time-saving tool.

Writing an Equation in Slope-Intercept Form

The **slope-intercept form** of an equation gives you the slope of the line and the y-intercept. The **slope** is the "steepness" of a line. On a graph, it is measured as the ratio of rise to run. The **y-intercept** is the point at which the line crosses the y-axis. This makes it a very useful form for graphing an equation.

The slope-intercept equation is $y = mx + b$. In this equation, m represents the slope of the line and b represents the y-intercept. Linear equations are often written in slope-intercept form. If they are not, you can rewrite them.

Example 1: Convert a Linear Equation to Slope-Intercept Form

Step 1 Solve for y.

$5x + 6y = 12$

Step 2 Reorder the terms. In this equation, first subtract $5x$ from both sides, then divide both sides by 6.

$6y = 12 - 5x$

$y = 2 - \frac{5}{6}x$

Step 3 Arrange the terms to be in slope-intercept format.

$y = -\frac{5}{6}x + 2$

Graphing an Equation

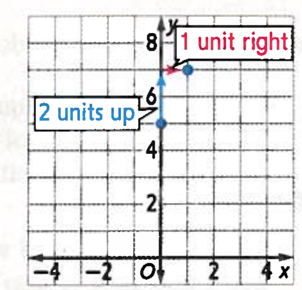
If you know the slope of a line and its y-intercept, you can graph it.

Example 2: Use Slope and y-intercept to Graph an Equation.

Step 1 Find the y-intercept. From the equation $y = 2x + 5$, we know that the y-intercept is 5. This means that one point on the line is (0, 5).

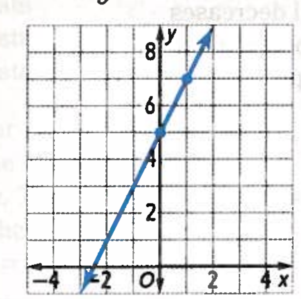
Step 2 Use the slope to find a second point on the line. From the equation $y = 2x + 5$, we know that the slope is 2. It is helpful to think of this slope as a fraction over 1, where the numerator is the distance you move on the y-axis and the denominator is the distance you move on the x-axis. A slope of 2 means move 2 units up and 1 unit to the right from a point on the line to identify another point on the line. If the slope were negative, you would move 2 units down and 1 unit to the left.

$y = 2x + 5$



Step 3 The point that is 2 units up and 1 unit right from (0, 5) is (1, 7). After plotting the second point, draw a line between these two points that extends beyond the points in both directions.

$y = 2x + 5$



Think about Math

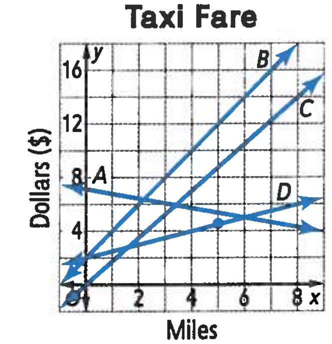
Directions: Answer the following questions.

1. Taxi fare with Green Taxis is \$2.00 plus \$0.50 per mile. The equation to represent total taxi fare is $y = 0.5x + 2$. Which line on the graph matches this equation?

   A. Line A B. Line B
   C. Line C D. Line D

2. What is the total fare for a 5-mile trip with Green Taxis?

Taxi Fare

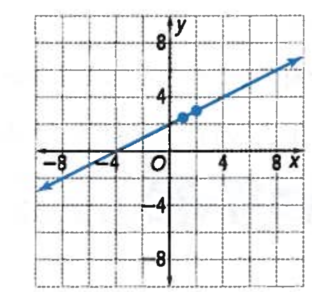


TEST-TAKING SKILL

Evaluate the Answer

When you answer test questions, it is a good idea to spend a few seconds evaluating your answer. By going back and checking your answer, you may catch a mistake you made while you have the opportunity to correct it. When you evaluate an answer, you are making sure the answer makes sense.

A student was asked to graph the equation $y = -\frac{1}{2}x + 2$. The student's graph is shown below. Does the answer make sense? Why or why not?



Vocabulary Review

Directions: Write the missing term in the blank.

***y*-intercept**	**slope**	**ordered pair**
***x*-value**	***y*-value**	**slope-intercept form**

1. The ________________ of a line is its ratio of rise to run.

2. The point at which a line crosses the y-axis is the ________________.

3. The ________________ is the horizontal value in an ordered pair.

4. A(n) ________________ is the horizontal and vertical values that denote the position of a point on a line on a graph

5. A linear equation written as $y = mx + b$ is written in ________________.

6. The vertical value in an ordered pair is the ________________.

Skill Review

Directions: Read each problem and complete the task.

1. Find the y-value for each x-value. Plot the points to graph the equation.

x	$y = 3x - 2$
0	
1	
2	

2. A store is running a special on cereal. The cost per box of cereal decreases the more boxes you buy. If price is the y-value, and number of boxes is the x-value, which best describes the slope of the line and y-intercept?

A. The slope is negative and the y-intercept is negative.
B. The slope is negative and the y-intercept is positive.
C. The slope is positive and the y-intercept is positive.
D. The slope is positive and the y-intercept is negative.

3. Marla is 20 miles from home at her uncle's house. She continues driving away from home toward her grandmother's house at a constant speed of 60 mph.

a. Graph an equation to represent her total miles from home.

b. If Marla drives for two hours, how far away from home will she be when she is at her grandmother's house?

A. 140 miles
B. 120 miles
C. 60 miles
D. 20 miles

4. Solve for x.

$-4x - 3 = 13$

5. Kellan brings x soccer balls to practice. His coach brings 12 soccer balls to practice. If $2x + 4$ equals the number of balls his coach brought to practice, how many balls did Kellan bring to practice?

Skill Practice

Directions: Read each problem and complete the task.

1. A kennel charges an upfront fee of $12. Each day of boarding is $8 for cats and $12 for dogs. Graph the equations $y = 8x + 12$ and $y = 12x + 12$.

a. What is the cost for boarding a cat for a week? What is the cost of boarding a dog for a week?

b. For how many dogs and how many cats is the total price per day the same?

A. 2 dogs and 3 cats
B. 3 dogs and 2 cats
C. 2 dogs and 2 cats
D. 3 dogs and 4 cats

2. Ellie wrote a paper for class that she is typing into the computer. She types at a rate of 120 words per minute. The equation to represent how long it will take her to type papers of different lengths is $y = 120x$.

a. Graph the equation.

b. How long will it take Ellie to type a 3,000-word paper?

3. The equation $y = -3x - 2$ represents Jaden's movement of his pieces across a game board.

a. Plot the point for the y-intercept and a second point with $x = 1$ to graph the line.

b. If Jaden began at the y-intercept and moved 1 unit to the right with each turn, how many units down from his starting point was he after 3 turns?

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LESSON 5.4 Solve Systems of Linear Equations

LESSON OBJECTIVES

- Solve a system of linear equations algebraically and graphically
- Solve problems leading to a system of linear equations

CORE SKILLS & PRACTICES

- Represent Real-World Problems
- Solve Pairs of Linear Equations

Key Terms

system of linear equations
a set of two or more linear equations with two or more variables

independent system
a system that has one solution

inconsistent system
a system that has no solutions

dependent system
a system that has an infinite number of solutions

Vocabulary

substitution method
a method of solving a system of equations by solving one equation for one variable and substituting the resulting expression into the other equation

elimination method
a method of solving a system of equations by adding or subtracting equations to eliminate one of the variables

Key Concept

Just like a solution of an equation is a value that makes the equation true, a solution of a system of equations is a set of values that makes all of the equations in the system true. You can solve systems of linear equations graphically by finding the point at which the graphs of the equations intersect. You can also solve systems algebraically, by using the substitution or the elimination method.

The Graphing Method

When planning a cookout for a large group of friends, you must determine what to buy and in what quantities. How many people will want hot dogs or hamburgers? How many buns come in a package? You can use linear equations to represent these questions and then graph the equations on a coordinate plane. The intersection of the lines is the solution and will help you make decisions about cookout supplies.

Systems of Linear Equations

A **system of linear equations** is a set of two or more linear equations with two or more variables. The system shown is a system of two linear equations with two variables.

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

A solution of a system of two linear equations with two variables is an ordered pair that makes *both* equations true. The ordered pair (4, 5) is *not* the solution of this system. It makes the first equation true, but not the second one. The ordered pair (5, −2) is *not* the solution of the system. It makes the second equation true, but not the first one. The ordered pair (1, 2) is the solution of the system. It makes both equations true.

Solving by Graphing

Remember that the graph of an equation contains all ordered pairs that make the equation true. One way, then, to solve a system of equations is to graph the equations and find the intersection point. Because the intersection point lies on both graphs, it will make both equations true.

Example 1: Solve a System by Graphing

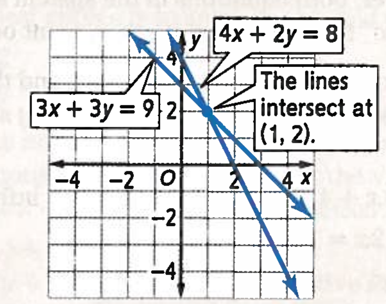
Solve the system by graphing.

$3x + 3y = 9$ $\quad$ $4x + 2y = 8$

Step 1 In order to make it easier to graph, write each equation in slope-intercept form by solving for y.

$3x + 3y = 9$	$4x + 2y = 8$
$3y = -3x + 9$	$2y = -4x + 8$
$y = -x + 3$	$y = -2x + 4$
slope: -1	slope: -2
y-intercept: 3	y-intercept: 4

Step 2 Use the slopes and y-intercepts to graph both equations. Identify the point where the lines intersect. This point is the solution.



Step 3 Check the solution by substituting into *both* original equations. The solution of the system is (1, 2).

Check
$3(1) + 3(2) = 9$ ✓
$4(1) + 2(2) = 8$ ✓

A system of equations that has exactly one solution, like the system in Example 1, is called an **independent system**.

CORE SKILL

Represent Real-World Problems

Systems of linear equations can be used to represent real-world problems. To write a system of linear equations to represent a real-world problem, read the problem carefully to identify the given information, determine the unknown values that will be represented with variables, and decide which operations are necessary. Write a system of linear equations to represent the problem.

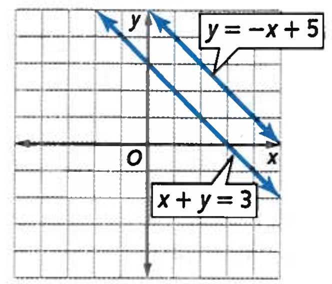
Tickets for a play cost either \$10 or \$15. A total of 200 tickets are sold. The total amount of money paid for tickets is \$2,600. Write a pair of equations that can be written to model the situation.

Inconsistent and Dependent Systems

Not all systems of equations have exactly one solution. For a system of two linear equations in two variables, there are two other possibilities.

The graphs of the two equations could be parallel lines. Because the lines do not intersect, such a system has no solutions. A system with no solutions is called an **inconsistent system.**

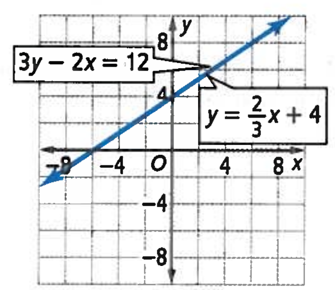
$y = -x + 5$ This system has no solutions
$x + y = 3$



The graphs of the two equations could be the same line. The graph will look like just one line. However, both equations in the system are represented by the same line, so the "two" lines intersect at every point on the line.

This means that every point on the line is a solution and the system has infinitely many solutions. A system with infinitely many solutions is called a **dependent system.**

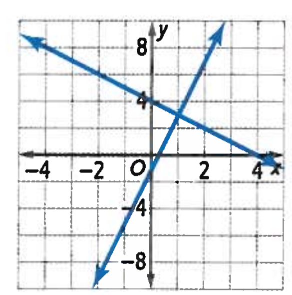
$y = \frac{2}{3}x + 4$ This system has infinitely
$3y - 2x = 12$ many solutions.



Think about Math

Directions: Answer the following question.

What is the solution of the system shown in the graph?



A. (0, 4)
B. (1, 4)
C. (0, 0)
D. (1, 3)

The Substitution Method

When cooking, you might substitute one ingredient for another ingredient. You make substitutions in math as well. Sometimes you are given a value to substitute for a variable in an equation. By substituting the value, you can solve the equation. You can also use substitution to solve a system of equations.

Solving by Substitution

Sometimes it may be difficult to solve a system by graphing because you cannot read the exact coordinates of the intersection point. There are also algebraic methods to solve a system. One algebraic method is the **substitution method.**

In the substitution method, the first step is to solve one of the equations for one of the variables. You then substitute into the other equation.

Example 2: Solve a System by Substitution

Solve the system by substitution. $-3x + 2y = -12$
$x - y = 2$

Step 1 Choose an equation to solve for one of the variables. You may choose either equation and solve for either variable. In this case, the simplest choice is to solve the second equation for x.

$x - y = 2$
$x = 2 + y$ Add y to both sides.

Step 2 Substitute into the *other* equation. Now you have one equation that contains one variable. Solve for the variable. In this case, substitute $2 + y$ for x in the first equation. Then solve for y.

$-3(2 + y) + 2y = -12$
$-6 - 3y + 2y = -12$ Distributive Property
$-6 - y = -12$ Combine like terms.
$-y = -6$ Add 6 to both sides.
$y = 6$ Multiply both sides by -1.

Step 3 Substitute the value you found in Step 2 into either original equation to find the value of the other variable. Here, substitute $y = 6$ into the second equation and solve for x.

$x - y = 2$ Choose the second equation.
$x - 6 = 2$ Substitute $y = 6$.
$x = 8$ Add 6 to both sides.

Step 4 Write the solution as an ordered pair. Check by substituting into both original equations. The solution is $x = 8$ and $y = 6$, or (8, 6).

Check $-3(8) + 2(6) = -12$ ✓
$8 - 6 = 2$ ✓

Think about Math

Directions: Answer the following question.

1. Caden spent $600 on supplies to start a document-shredding business from his home. He estimates it will cost $2.00 per box of documents to shred. He plans to charge $10 per box of documents. How many boxes of documents will he need to shred to break even?

WORKPLACE SKILL

Use Data Effectively

Many companies do not perform all of their business tasks themselves. Instead, they may hire other companies to supply raw materials, transport goods, or provide billing or payroll services.

David has an office supply store. He wants to hire a company to provide delivery service for his customers. He has researched two different delivery companies. Company A charges $40 per day plus $0.20 per mile. Company B charges $15 per day plus $0.40 per mile. David must determine which company will be more cost effective. For what number of miles are the companies the same price? Which company should he choose if he expects that his deliveries will be fewer than 100 miles per day?

The Elimination Method

Many of us have "To Do" lists—lists of tasks that need to be done. When you complete a task and cross it off your list, you eliminate it. As you eliminate tasks, your list becomes more and more manageable. The same is true when you eliminate a variable from a system of linear equations. The system becomes easier to solve!

Multiplying One Equation

Another algebraic method to solve systems of equations is the **elimination method**. In this method, you eliminate one variable by adding or subtracting equations.

Example 3: Eliminate by Multiplying One Equation

Solve the system by elimination.

$3x + y = 11$
$4x + y = 14$

Step 1 Multiply one or both of the equations by a constant so that the two x-terms or the two y-terms will have opposite coefficients. If either of these equations is multiplied by -1, the y-terms will have opposite coefficients.

$4x + y = 14$	Choose the second equation.
$-1(4x + y) = (-1)\,14$	Multiply both sides by -1.
$-4x - y = -14$	Simplify.

Step 2 Add the equations so that terms are eliminated. Add the new equation from Step 1 to the first equation.

$$\begin{array}{r} 3x + y = 11 \\ \underline{+\ -4x - y = -14} \\ -x \qquad = -3 \end{array}$$

The y-terms are eliminated

Now you have one equation that contains one variable. Solve for the variable.

$-x = -3$
$x = 3$ To solve for x and eliminate the negative, multiply both sides by -1.

Step 3 Substitute the value you found in Step 2 into either original equation to find the value of the other variable.

$3x + y = 11$	Choose the first equation.
$3(3) + y = 11$	Substitute $x = 3$.
$9 + y = 11$	Simplify.
$y = 2$	Subtract 9 from both sides.

Step 4 Write the solution as an ordered pair. Check by substituting into both original equations. The solution is $x = 3$ and $y = 2$, or (3, 2).

Check
$3(3) + 2 = 11$ ✓
$4(3) + 2 = 14$ ✓

Multiplying Both Equations

You may have to multiply both equations by a constant before you can add to eliminate terms.

Example 4: Eliminate by Multiplying Both Equations

Solve the system by elimination.

$5x + 2y = -4$
$-2x + 6y = 5$

Step 1 Multiply one or both of the equations by a constant so that the two x-terms or the two y-terms will have opposite coefficients. If the first equation is multiplied by 2 and the second is multiplied by 5, the x-terms will have opposite coefficients.

Multiply the first equation by 2 and simplify:
$2(5x + 2y) = 2(-4)$
$10x + 4y = -8$

Multiply the second equation by 5 and simplify:
$5(-2x + 6y) = 5(5)$
$-10x + 30y = 25$

Step 2 Add the equations from Step 1 so that terms are eliminated.

$$\begin{array}{r} 10x + 4y = -8 \\ \underline{+\ -10x + 30y = 25} \\ 34y = 17 \end{array}$$

The x-terms are eliminated

Now you have one equation that contains one variable.

Solve for y.
$34y = 17$
$y = 0.5$ Divide both sides by 34.

Step 3 Substitute the value you found in Step 2 into either equation to find the value of the other variable. Substitute $y = 0.5$ into either equation and solve for y.

$5x + 2y = -4$	Choose the first equation.
$5x + 2(0.5) = -4$	Substitute $y = 0.5$.
$5x + 1 = -4$	Simplify.
$5x = -5$	Subtract 1 from both sides.
$x = -1$	Divide both sides by 5.

Step 4 Write the solution as an ordered pair. The solution is $x = -1$ and $y = 0.5$, or $(-1, 0.5)$. Check by substituting into both original equations.

Check $5(-1) + 2(0.5) = -4$ ✓
$-2(-1) + 6(0.5) = 5$ ✓

Think about Math

Directions: Answer the following question.

1. Elias purchased rectangular and square patio blocks to build a patio. He paid \$2 for each square block and \$3 for each rectangular block. The total cost was \$350, and he bought 150 blocks in all. How many square blocks and how many rectangular blocks did Elias purchase?

CORE SKILL

Solve Pairs of Linear Equations

You have learned three methods to solve a system of equations: graphing, substitution, and elimination. When solving a system, you should try to choose the method that is most efficient for that particular system.

- If both equations are solved for y and the numbers are relatively small, graphing may be a good choice.
- If one of the equations is solved for a variable or can easily be solved for a variable, substitution may be the best method.
- In all other cases, elimination may be best.

For each system of equations, describe the solution method that would work best.

$-5x + 4y = 12$
$2x - y = 5$

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

$y = 2x + 8$
$4x + y = 5$

Vocabulary Review

Directions: Write the missing term in the blank.

system of linear equations	**independent system**	**inconsistent system**
dependent system	**substitution method**	**elimination method**

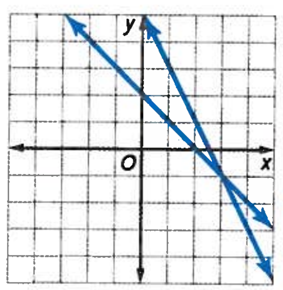
1. A system that has exactly one solution is called a(n) ________________.
2. The ________________ is a method of solving a system of equations by solving one equation for one variable and substituting the resulting expression into the other equation.
3. A(n) ________________ has an infinite number of solutions.
4. A set of two of more linear equations with two or more variables is a(n) ________________.
5. A(n) ________________ has no solutions.
6. The ________________ is a method of solving a system of equations by adding or subtracting equations to eliminate one of the variables.

Skill Review

Directions: Read each problem and complete the task.

1. Identify the type of system shown in the graph.

$x + y = 2$
$2x + y = 5$



2. Which statement or statements are true of the system of linear equations?

$-3x + 2y = -12$
$x - y = 2$

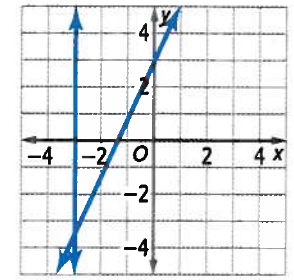
A. The system is independent.
B. The system is dependent.
C. The solution of the system is (8, 6).
D. The solution of the system is (4, −8).

3. Find the values of two numbers if their sum is 5 and their difference is 1.
   a. Write a system of equations to solve the problem.
   b. What are the values of x and y?

4. A quiz has 20 questions worth a total of 40 points. Each multiple-choice question is worth 1 point, and each short-answer question is worth 5 points. Which system of equations can be used to represent this situation?

A. $x + y = 20$
$x + 5y = 40$
B. $5x + y = 20$
$x + y = 40$
C. $x + y = 20$
$5x + 5y = 40$
D. $x - y = 20$
$x + y = 40$

5. What is the solution of the system shown in the graph?



6. Amy and Dan are looking for a photographer for their wedding. Photographer A charges $400 for the photo shoot and $6 for each print, no matter the size. Photographer B charges $500 for the photo shoot and $4 for each print.
   a. For how many prints are the total prices of the two photographers the same?
   b. Which photographer will be the best value if they expect to order 100 prints?

Skill Practice

Directions: Read each problem and complete the task.

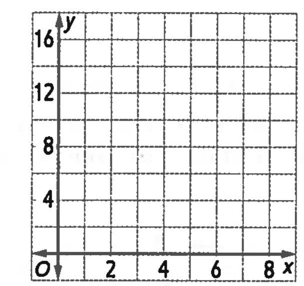
1. A theater is selling tickets to a musical. On the first day of ticket sales, they sold 25 senior tickets and 14 child tickets for a total of $362. On the second day, they sold 5 senior tickets and 7 child tickets for a total of $106. What is the price each for one senior ticket and one child ticket?

A. $8 for a child and $12 for a senior
B. $10 for a child and $10 for a senior
C. $8 for a child and $10 for a senior
D. $10 for a child and $8 for a senior

2. Taya is a certified lifeguard. She spent $90 to get her certification. She gets paid a base salary at the pool of $40 per week plus $10 for each swimming class she assists. How many classes does she need to teach in the first week to earn back what she spent on her certification?

3. Iris flew two separate airlines to reach her destination. With the first airline, she had to pay $26 to check her bag, plus $3 for every pound that her bag was over the weight limit. On the second flight, she had to pay $5 per pound that her bag was over the weight limit, in addition to the checked bag fee of $22. The two airlines have the same weight limit for checked luggage. Iris's luggage fees were the same for both flights.

   a. Graph the two equations to find out how many pounds over the weight limit Iris's bag was.



   b. What was Iris's checked luggage fee for each flight?

4. Eric is comparing phone plans. Information about each plan is shown in the table.

	Monthly Fee	Price per Minute of Talk or Text
Plan A	$22	$0.05
Plan B	$18	$0.07

   a. For what number of minutes is the total monthly cost of the two plans the same?

A. 400
B. 200
C. 100
D. 20

   b. If Eric spends an average of 150 minutes talking and texting each month, which phone plan is a better option for him?

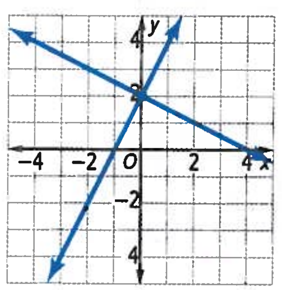
Directions: Choose the best answer to each question.

1. Bailey's Barbeque sells adult meals at one price and children's meals at another price. At lunch they sold 15 adult meals and 5 children's meals for a total of $90. At dinner they sold 12 adult meals and 6 children's meals for a total of $78. What is the price for each adult meal and the price for each children's meal?
   A. Adult meal: $4, Child meal: $6
   B. Adult meal: $5, Child meal: $3
   C. Adult meal: $6, Child meal: $1
   D. Adult meal: $3, Child meal: $5

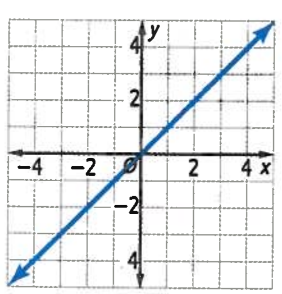
2. A line contains the points (4, 7) and (8, 19). What is the equation of this line in slope-intercept form?
   A. $4x + 7y = 19$
   B. $y = 4x + 7$
   C. $7x + 8y = 19$
   D. $y = 3x - 5$

3. Apples cost $3 per pound. When you graph this rate as a line on a coordinate plane, (1, 3) is a point on the graph. Another point on the line is ________________.

4. Abby graphs these two equations: $y = 2x + 2$ and $x + 2y = 4$. The solution to the system of equations is represented by the point ________________.



5. Greg graphed a line shown below. Which is a point on the line?



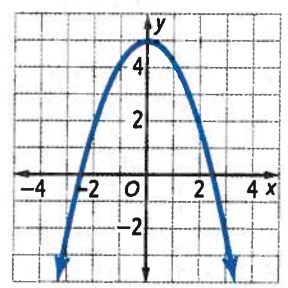
   A. (−2, 2)
   B. (6, 7)
   C. (7, 7)
   D. (0, 5)

6. Sophia is solving this system of equations with the elimination method: $2x + 5y = 10$ and $x - 5y = 11$. What are the values of x and y?
   A. $x = 7, y = -\frac{4}{5}$
   B. $x = 7, y = \frac{4}{5}$
   C. $x = \frac{4}{5}, y = -7$
   D. $x = -\frac{4}{5}, y = 7$

7. Jen graphs a line that has the points (4, 28) and (7, 43). What is the slope of the line she graphed?
   A. 71
   B. 15
   C. 5
   D. $\frac{1}{5}$

8. The equation $10x + 2y = 6$ can be rewritten in point-slope form as ________________.

Directions: Use Graph A for Problems 9–11.



Graph A

9. The y-intercept is 5 and the x-intercepts are ________________.

10. The increasing interval is $x < 0$ and the decreasing interval is ________________.

11. The ________________ is 5 and there is no relative minimum.

12. Eva plotted a point on a coordinate plane. To plot the point, she started at the point (0, 0), then moved two units right and 3 units down. What is the coordinate pair for the point?
    A. (2, −3)
    B. (3, −2)
    C. (−2, 3)
    D. (2, 3)

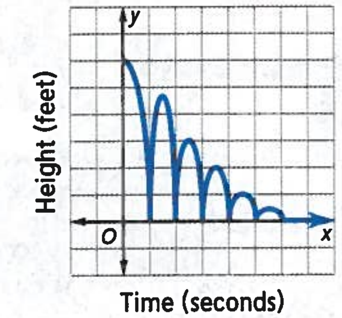
13. Heather graphed a line with the points (6, 4) and (9, 5). Then she made a table with the x- and y-coordinates. What are the x- and y-coordinates for another entry in the table?

x-coordinate	y-coordinate
6	4
9	5

   A. (12, 6)
   B. (15, 8)
   C. (6, 12)
   D. (10, 7)

14. Crystal is using the substitution method to solve this system of linear equations: $5x + 2y = 18$ and $x + 6y = 5$. Which of the equations below could she use to solve the problem?
    A. $5x + 2\left(\frac{5}{6} - x\right) = 18$
    B. $5\left(\frac{5}{6} - x\right) + 2y = 18$
    C. $5(x + 6y) + 2y = 18$
    D. $5(5 - 6y) + 2y = 18$

15. Which situation is represented by the graph?



    A. The height of a child as he grows into an adult.
    B. A rubber ball dropped from 4 feet and bounces several times before rolling to a stop.
    C. The speed of a car when driving, stopping at a stop sign, then continuing for 10 minutes, and stopping at its destination.
    D. The depth of the ocean floor as the distance from the shore increases.

16. Ella records the inputs and outputs of a function in a table. The table represents the equation ________________.

x	y
0	2
1	7
2	12

Check Your Understanding

On the following chart, circle the items you missed. The last column shows pages you can review to study the content covered in the question. Review those lessons in which you missed half or more of the questions.

Lesson	Item Number(s)			Review Page(s)
	Procedural	Conceptual	Problem Solving	
5.1 Interpret Slope	16	3	7, 12	150–157
5.2 Write the Equation of a Line	2	8		158–165
5.3 Graph Linear Equations	5	9, 10, 11, 15	13	166–171
5.4 Solve Systems of Linear Equations	4	6, 14	1	172–179