4-1 Graphing Equations in Slope-Intercept Form

Write an equation of a line in slope-intercept form with the given slope and y-intercept. Then graph the equation.

1. slope: 2, y-intercept: 4

**SOLUTION:**

The slope-intercept form of a line is \( y = mx + b \), where \( m \) is the slope, and \( b \) is the y-intercept.

\[
y = mx + b \quad \text{Slope-intercept form}
\]

\[
y = 2x + 4 \quad \text{Replace } m \text{ with 2 and } b \text{ with 4}
\]

Plot the y-intercept (0, 4). The slope is \( \frac{\text{rise}}{\text{run}} = \frac{2}{1} \).

From (0, 4), move down 2 units and left 1 unit. (Note that we can move up and to the right, or down and to the left. Normally we would move up and to the right, but moving down and to the left keeps the point near the origin.) Plot the point. Draw a line through the two points.

2. slope: -5, y-intercept: 3

**SOLUTION:**

The slope-intercept form of a line is \( y = mx + b \), where \( m \) is the slope, and \( b \) is the y-intercept.

\[
y = mx + b \quad \text{Slope-intercept form}
\]

\[
y = -5x + 3 \quad \text{Replace } m \text{ with -5 and } b \text{ with 3}
\]

Plot the y-intercept (0, 3). The slope is \( \frac{\text{rise}}{\text{run}} = \frac{-5}{1} \).

From (0, 3), move down -5 units and right 1 unit. Plot the point. Draw a line through the two points.
3. slope: $\frac{3}{4}$, y-intercept: $-1$

**SOLUTION:**
The slope-intercept form of a line is $y = mx + b$, where $m$ is the slope, and $b$ is the y-intercept.

$y = mx + b$  slope-intercept form

$y = \frac{3}{4}x - 1$  replace $m$ with $\frac{3}{4}$ and $b$ with $-1$.

Plot the y-intercept $(0, -1)$. The slope is $\frac{\text{rise}}{\text{run}} = \frac{3}{4}$.
From $(0, -1)$, move up 3 units and right 4 units. Plot the point. Draw a line through the two points.

4. slope: $-\frac{5}{7}$, y-intercept: $-\frac{2}{3}$

**SOLUTION:**
The slope-intercept form of a line is $y = mx + b$, where $m$ is the slope, and $b$ is the y-intercept.

$y = mx + b$  slope-intercept form

$y = -\frac{5}{7}x - \frac{2}{3}$  replace $m$ with $-\frac{5}{7}$ and $b$ with $-\frac{2}{3}$

Plot the y-intercept $(0, -\frac{2}{3})$. The slope is $\frac{\text{rise}}{\text{run}} = -\frac{5}{7}$.
From $(0, -\frac{2}{3})$, move down 5 units and right 7 units. Plot the point. Draw a line through the two points.
Graph each equation.

5. \(-4x + y = 2\)

\textbf{SOLUTION:}
Rewrite the equation in slope-intercept form.

\[
-4x + y = 2 \quad \text{Original equation} \\
-4x + 4x + y = 2 + 4x \quad \text{Add } 4x \text{ to each side} \\
y = 4x + 2 \quad \text{Simplify.}
\]

The slope is 4, and the y-intercept is 2. Plot the y-intercept (0, 2). The slope is \(\frac{\text{rise}}{\text{run}} = \frac{4}{1}\). From (0, 2), move up 4 units and right 1 unit. Plot the point. Draw a line through the two points.

6. \(2x + y = -6\)

\textbf{SOLUTION:}
Rewrite the equation in slope-intercept form.

\[
2x + y = -6 \quad \text{Original equation} \\
2x - 2x + y = -6 - 2x \quad \text{Subtract } 2x \text{ from each side} \\
y = -2x - 6 \quad \text{Simplify.}
\]

The slope is \(-2\), and the y-intercept is \(-6\). Plot the y-intercept (0, \(-6\)). The slope is \(\frac{\text{rise}}{\text{run}} = \frac{-2}{1}\). From (0, \(-6\)), move down 2 units and right 1 unit. Plot the point. Draw a line through the two points.
7. $-3x + 7y = 21$

**SOLUTION:**
Rewrite the equation in slope-intercept form.

\[
-3x + 7y = 21 \quad \text{Original equation} \\
-3x + 3x + 7y = 21 + 3x \quad \text{Add } 3x \text{ to each side} \\
7y = 3x + 21 \quad \text{Simplify} \\
\frac{7y}{7} = \frac{3x + 21}{7} \quad \text{Divide each side by 7} \\
y = \frac{3}{7}x + \frac{21}{7} \quad \text{Simplify}
\]

The slope is $\frac{3}{7}$, and the $y$-intercept is 3. Plot the $y$-intercept $(0, 3)$. The slope is $\frac{\text{rise}}{\text{run}} = \frac{3}{7}$. From $(0, 3)$, move up 3 units and right 7 units. Plot the point. Draw a line through the two points.

8. $6x - 4y = 16$

**SOLUTION:**
Rewrite the equation in slope-intercept form.

\[
6x - 4y = 16 \quad \text{Original equation} \\
6x - 6x - 4y = 16 - 6x \quad \text{Subtract } 6x \text{ from each side} \\
-4y = -6x + 16 \quad \text{Simplify} \\
\frac{-4y}{-4} = \frac{-6x + 16}{-4} \quad \text{Divide each side by } -4 \\
\quad y = \frac{3}{2}x - 4 \quad \text{Simplify}
\]

The slope is $\frac{3}{2}$, and the $y$-intercept is $-4$. Plot the $y$-intercept $(0, -4)$. The slope is $\frac{\text{rise}}{\text{run}} = \frac{3}{2}$. From $(0, -4)$, move up 3 units and right 2 units. Plot the point. Draw a line through the two points.

9. $y = -1$

**SOLUTION:**
Plot the $y$-intercept $(0, -1)$. The slope is 0. Draw a line through the points with $y$-coordinate $-1$. 

---

4-1 **Graphing Equations in Slope-Intercept Form**
Write an equation in slope-intercept form with the given slope and y-intercept. Then graph the equation.

10. $15y = 3$

**SOLUTION:**

$15y = 3$ \hspace{1cm} \text{Original equation}

$\frac{15y}{15} = \frac{3}{15} \hspace{1cm} \text{Divide each side by 15}$

$y = \frac{1}{5} \hspace{1cm} \text{Simplify.}$

Plot the y-intercept $\left(0, \frac{1}{5}\right)$. The slope is 0. Draw a line through the points with y-coordinate $\frac{1}{5}$.

11. **SOLUTION:**

Use the two points $(-3, 0)$ and $(0, 2)$. Find the slope of the line containing the given points.

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 2}{-3 - 0} = \frac{-2}{-3} = \frac{2}{3}$

The line crosses the y-axis at $(0, 2)$, so the y-intercept is 2.

Write the equation in slope-intercept form.

$y = mx + b$

$y = \frac{2}{3}x + 2$
4-1 Graphing Equations in Slope-Intercept Form

**SOLUTION:**

Use the two points (5, 0) and (0, 1).

Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
= \frac{0 - 1}{5 - 0}
= \frac{-1}{5}
\]

The line crosses the y-axis at (0, 1), so the y-intercept is 1.

Write the equation in slope-intercept form.

\[
y = mx + b
\]

\[
y = -\frac{1}{5}x + 1
\]
14. Write an equation of a line in slope-intercept form with the given slope and y-intercept. Then graph the equation.

**SOLUTION:**
Use the two points $(2, -1)$ and $(0, 3)$. Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - (-1)}{0 - 2} = \frac{4}{-2} = -2
\]

The line crosses the y-axis at $(0, 3)$, so the y-intercept is $3$.

Write the equation in slope-intercept form.

\[
y = mx + b
\]

\[
y = -2x + 3
\]

15. **FINANCIAL LITERACY** Rondell is buying a new stereo system for his car using a layaway plan.

a. Write an equation for the total amount $S$ that he has paid after $w$ weeks.

b. Graph the equation.

c. Find out how much Rondell will have paid after 8 weeks.

**SOLUTION:**
a. The rate of $10$ per week represents the rate or slope. The amount he has already saved is a constant $75$, no matter how much more he saves. So, the total amount saved for $w$ weeks can be written as $S = 10w + 75$.

b. To graph the equation, plot the y-intercept $(0, 75)$. Then move up $10$ units and right $1$ unit. Plot the point. Draw a line through the two points.

c. To find out how much Rondell has saved after 8 weeks, evaluate the equation from part a for $w = 8$.

\[
S = 10w + 75
\]

\[
S = 10(8) + 75
\]

\[
S = 80 + 75
\]

\[
S = 155
\]

So, Rondell has saved $155$ after 8 weeks.
16. **CCSS REASONING** Ana is driving from her home in Miami, Florida, to her grandmother’s house in New York City. On the first day, she will travel 240 miles to Orlando, Florida, to pick up her cousin. Then they will travel 350 miles each day.

**a.** Write an equation for the total number of miles $m$ that Ana has traveled after $d$ days.

**b.** Graph the equation.

**c.** How long will the drive take if the total length of the trip is 1343 miles?

**SOLUTION:**

**a.** The rate of 350 miles per day represents the rate or slope. The amount she has already driven is a constant 240 miles, no matter how much more she drives. So, the total amount driven for $d$ days can be written as $m = 350d + 240$.

**b.** To graph the equation, plot the $y$-intercept (0, 240). Then move up 350 units and right 1 unit. Plot the point. Draw a line through the two points.

**c.**

\[
\begin{align*}
  m &= 350d + 240 \\
  1343 &= 350d + 240 \\
  1343 - 240 &= 350d + 240 - 240 \\
  1103 &= 350d \\
  \frac{1103}{350} &= \frac{350d}{350} \\
  3.15 &= d
\end{align*}
\]

So, it will take about 4 days.

17. **Write an equation of a line in slope-intercept form with the given slope and $y$-intercept. Then graph the equation.**

**SOLUTION:**

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

\[y = 5x + 8\] Replace with 5 and $b$ with 8

Plot the $y$-intercept (0, 8). The slope is $\frac{\text{rise}}{\text{run}} = \frac{5}{1}$. From (0, 8), move down 5 units and left 1 unit. (Note that we can move up and to the right, or down and to the left. Normally we would move up and to the right, but moving down and to the left keeps the point near the origin.) Plot the point. Draw a line through the two points.
### 4-1 Graphing Equations in Slope-Intercept Form

18. slope: 3, $y$-intercept: 10

**SOLUTION:**

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

\[ y = mx + b \hspace{1cm} \text{Slope-intercept form} \]
\[ y = 3x + 10 \hspace{1cm} \text{Replace } m \text{ with } 3 \text{ and } b \text{ with } 10 \]

Plot the $y$-intercept $(0, 10)$. The slope is $\frac{\text{rise}}{\text{run}} = \frac{3}{1}$.

From $(0, 10)$, move up 3 units and right 1 unit. Plot the point. Draw a line through the two points.

![Graph showing y-intercept and slope](image)

19. slope: $-4$, $y$-intercept: 6

**SOLUTION:**

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

\[ y = mx + b \hspace{1cm} \text{Slope-intercept form} \]
\[ y = -4x + 6 \hspace{1cm} \text{Replace } m \text{ with } -4 \text{ and } b \text{ with } 6 \]

Plot the $y$-intercept $(0, 6)$. The slope is $\frac{\text{rise}}{\text{run}} = \frac{-4}{1}$.

From $(0, 6)$, move down 4 units and right 1 unit. Plot the point. Draw a line through the two points.

![Graph showing y-intercept and slope](image)
20. slope: $-2$, y-intercept: 8

**SOLUTION:**
The slope-intercept form of a line is $y = mx + b$, where $m$ is the slope, and $b$ is the y-intercept.

\[ y = mx + b \quad \text{Slope-intercept form} \]
\[ y = -2x + 8 \quad \text{Replace } m \text{ with } -2 \text{ and } b \text{ with } 8 \]

Plot the y-intercept (0, 8). The slope is \( \frac{\text{rise}}{\text{run}} = \frac{-2}{1} \).

From (0, 8), move down 2 units and right 1 unit. Plot the point. Draw a line through the two points.

21. slope: 3, y-intercept: $-4$

**SOLUTION:**
The slope-intercept form of a line is $y = mx + b$, where $m$ is the slope, and $b$ is the y-intercept.

\[ y = mx + b \quad \text{Slope-intercept form} \]
\[ y = 3x - 4 \quad \text{Replace } m \text{ with } 3 \text{ and } b \text{ with } -4 \]

Plot the y-intercept (0, $-4$). The slope is \( \frac{\text{rise}}{\text{run}} = \frac{3}{1} \).

From (0, $-4$), move up 3 units and right 1 unit. Plot the point. Draw a line through the two points.
4-1 Graphing Equations in Slope-Intercept Form

22. slope: 4, y-intercept: −6

**SOLUTION:**
The slope-intercept form of a line is \( y = mx + b \), where \( m \) is the slope, and \( b \) is the y-intercept.

\[
y = mx + b \quad \text{Slope-intercept form}
\]
\[
y = 4x - 6 \quad \text{Replace } m \text{ with } 4 \text{ and } b \text{ with } -6
\]

Plot the y-intercept (0, −6). The slope is \( \frac{\text{rise}}{\text{run}} = \frac{4}{1} \).

From (0, −6), move up 4 units and right 1 unit. Plot the point. Draw a line through the two points.

Graph each equation.

23. \(-3x + y = 6\)

**SOLUTION:**
Rewrite the equation in slope-intercept form.

\[
-3x + y = 6 \quad \text{Original equation}
\]
\[
-3x + 3x + y = 6 + 3x \quad \text{Add } 3x \text{ to each side}
\]
\[
y = 3x + 6 \quad \text{Simplify.}
\]

The slope is 3, and the y-intercept is 6. Plot the y-intercept (0, 6). The slope is \( \frac{\text{rise}}{\text{run}} = \frac{3}{1} \). From (0, 6), move up 3 units and right 1 unit. Plot the point. Draw a line through the two points.
4-1 Graphing Equations in Slope-Intercept Form

24. $-5x + y = 1$

**SOLUTION:**
Rewrite the equation in slope-intercept form.

$-5x + y = 1 \quad \text{Original equation}$

$-5x + 5x + y = 1 + 5x \quad \text{Add 5x to each side}$

$y = 5x + 1 \quad \text{Simplify}$

The slope is 5, and the y-intercept is 1. Plot the y-intercept (0, 1). The slope is \( \frac{\text{rise}}{\text{run}} = \frac{5}{1} \). From (0, 1), move up 5 units and right 1 unit. Plot the point. Draw a line through the two points.

25. $-2x + y = -4$

**SOLUTION:**
Rewrite the equation in slope-intercept form.

$-2x + y = -4 \quad \text{Original equation}$

$-2x + 2x + y = -4 + 2x \quad \text{Add 2x to each side}$

$y = 2x - 4 \quad \text{Simplify}$

The slope is 2, and the y-intercept is $-4$. Plot the y-intercept (0, $-4$). The slope is \( \frac{\text{rise}}{\text{run}} = \frac{2}{1} \). From (0, $-4$), move up 2 units and right 1 unit. Plot the point. Draw a line through the two points.

26. $y = 7x - 7$

**SOLUTION:**
The slope is 7, and the y-intercept is $-7$. Plot the y-intercept (0, $-7$). The slope is \( \frac{\text{rise}}{\text{run}} = \frac{7}{1} \). From (0, $-7$), move up 7 units and right 1 unit. Plot the point. Draw a line through the two points.
4-1 Graphing Equations in Slope-Intercept Form

27. $5x + 2y = 8$

**SOLUTION:**
Rewrite the equation in slope-intercept form.

\[
\begin{align*}
5x + 2y &= 8 \\
5x - 5x + 2y &= 8 - 5x \\
2y &= -5x + 8 \\
\frac{2y}{2} &= \frac{-5x + 8}{2} \\
y &= \frac{-5}{2}x + 4
\end{align*}
\]

The slope is $\frac{-5}{2}$, and the $y$-intercept is 4. Plot the $y$-intercept $(0, 4)$. The slope is $\frac{\text{rise}}{\text{run}} = \frac{-5}{2}$. From $(0, 4)$, move down 5 units and right 2 units. Plot the point. Draw a line through the two points.

28. $4x + 9y = 27$

**SOLUTION:**
Rewrite the equation in slope-intercept form.

\[
\begin{align*}
4x + 9y &= 27 \\
4x - 4x + 9y &= 27 - 4x \\
9y &= -4x + 27 \\
\frac{9y}{9} &= \frac{-4x + 27}{9} \\
y &= \frac{-4}{9}x + 3
\end{align*}
\]

The slope is $\frac{-4}{9}$, and the $y$-intercept is 3. Plot the $y$-intercept $(0, 3)$. The slope is $\frac{\text{rise}}{\text{run}} = \frac{-4}{9}$. From $(0, 3)$, move down 4 units and right 9 units. Plot the point. Draw a line through the two points.

29. $y = 7$

**SOLUTION:**
Plot the $y$-intercept $(0, 7)$. The slope is 0. Draw a line through the points with $y$-coordinate 7.
30. \( y = \frac{-2}{3} \)

**SOLUTION:**
Plot the \( y \)-intercept \((0, -\frac{2}{3})\). The slope is 0. Draw a line through the points with \( y \)-coordinate \(-\frac{2}{3}\).

31. \( 21 = 7y \)

**SOLUTION:**
\[
\begin{align*}
21 &= 7y \\
\frac{21}{7} &= \frac{7y}{7} \\
3 &= y
\end{align*}
\]
Plot the \( y \)-intercept \((0, 3)\). The slope is 0. Draw a line through the points with \( y \)-coordinate 3.

32. \( 3y - 6 = 2x \)

**SOLUTION:**
Rewrite the equation in slope-intercept form.
\[
\begin{align*}
3y - 6 &= 2x & \text{Original equation} \\
3y - 6 + 6 &= 2x + 6 & \text{Add 6 to each side.} \\
3y &= 2x + 6 & \text{Simplify.} \\
\frac{3y}{3} &= \frac{2x + 6}{3} & \text{Divide each side by 3} \\
y &= \frac{2}{3}x + 2 & \text{Simplify.}
\end{align*}
\]
The slope is \( \frac{2}{3} \), and the \( y \)-intercept is 2. Plot the \( y \)-intercept \((0, 2)\). The slope is \( \frac{\text{rise}}{\text{run}} = \frac{2}{3} \). From \((0, 2)\), move up 2 units and right 3 units. Plot the point. Draw a line through the two points.
Write an equation in slope-intercept form for each graph shown.

33.

**SOLUTION:**

Use the two points (0, 4) and (5, 1).

Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 1}{0 - 5} = \frac{3}{-5} = -\frac{3}{5}
\]

The line crosses the y-axis at (0, 4), so the y-intercept is 4.

Write the equation in slope-intercept form.

\[
y = mx + b
\]

\[
y = -\frac{3}{5}x + 4
\]

34. **SOLUTION:**

Use the two points (0, -2) and (7, -6).

Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-6 - (-2)}{0 - 7} = \frac{-4}{-7} = \frac{4}{7}
\]

The line crosses the y-axis at (0, -2), so the y-intercept is -2.

Write the equation in slope-intercept form.

\[
y = mx + b
\]

\[
y = \frac{4}{7}x - 2
\]
4-1 Graphing Equations in Slope-Intercept Form

**SOLUTION:**

Use the two points (0, −3) and (6, 0) and find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-3 - 0}{6 - 0} = \frac{-3}{6} = -\frac{1}{2}
\]

The line crosses the y-axis at (0, −3), so the y-intercept is −3.

Write the equation in slope-intercept form.

\[
y = mx + b \\
y = -\frac{1}{2}x - 3
\]

**SOLUTION:**

Use the two points (0, −4) and (8, −2) and find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - (-4)}{8 - 0} = \frac{2}{8} = \frac{1}{4}
\]

The line crosses the y-axis at (0, −4), so the y-intercept is −4.

Write the equation in slope-intercept form.

\[
y = mx + b \\
y = \frac{1}{4}x - 4
\]
4-1 Graphing Equations in Slope-Intercept Form

37. MANATEES In 1991, 1267 manatees inhabited Florida’s waters. The manatee population has increased at a rate of 123 manatees per year.

a. Write an equation for the manatee population, \( P \), \( t \) years since 1991.

b. Graph this equation.

c. In 2006, the manatee was removed from Florida’s endangered species list. What was the manatee population in 2006?

**SOLUTION:**

a. The rate of 123 manatees per year represents the rate or slope. The original population of manatees is a constant 1267, no matter how many more manatees are born. So, the total population of manatees for \( t \) years since 1991 can be written as \( P = 1267 + 123t \).

b. To graph the equation, plot the y-intercept (0, 1267). Then move up 123 units and right 1 unit. Plot the point. Draw a line through the two points.

---

<table>
<thead>
<tr>
<th>Years since 1991</th>
<th>Manatees</th>
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</thead>
<tbody>
<tr>
<td>0</td>
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</tr>
<tr>
<td>1</td>
<td>1380</td>
</tr>
<tr>
<td>2</td>
<td>1493</td>
</tr>
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<td>5</td>
<td>1832</td>
</tr>
<tr>
<td>6</td>
<td>1945</td>
</tr>
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<td>7</td>
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</tr>
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<tr>
<td>15</td>
<td>2962</td>
</tr>
</tbody>
</table>

---

![Graph of Manatee Population](image)

---

c. Fifteen years passed between 1991 and 2006, so substitute 15 for \( t \) and solve for \( P \).

\[
P = 1267 + 123t \]
\[
P = 1267 + 123(15) \]
\[
P = 1267 + 1845 \]
\[
P = 3112 \]

So, the manatee population in 2006 was 3112.

---

38. Write an equation of a line in slope-intercept form with the given slope and y-intercept.

a. Slope: \( \frac{1}{2} \), y-intercept: \(-3\)

**SOLUTION:**

The slope-intercept form of a line is \( y = mx + b \), where \( m \) is the slope, and \( b \) is the y-intercept.

\[
y = mx + b \]
\[
y = \frac{1}{2}x + (-3) \]
\[
y = \frac{1}{2}x - 3 \]

---

39. Slope: \( \frac{2}{3} \), y-intercept: \(-5\)

**SOLUTION:**

The slope-intercept form of a line is \( y = mx + b \), where \( m \) is the slope, and \( b \) is the y-intercept.

\[
y = mx + b \]
\[
y = \frac{2}{3}x + (-5) \]
\[
y = \frac{2}{3}x - 5 \]

---

40. Slope: \( \frac{-5}{6} \), y-intercept: \(5\)

**SOLUTION:**

The slope-intercept form of a line is \( y = mx + b \), where \( m \) is the slope, and \( b \) is the y-intercept.

\[
y = mx + b \]
\[
y = -\frac{5}{6}x + 5 \]
41. slope: $\frac{-3}{7}$, y-intercept: 2

**SOLUTION:**
The slope-intercept form of a line is $y = mx + b$, where $m$ is the slope, and $b$ is the y-intercept.

\[ y = mx + b \]
\[ y = \frac{-3}{7}x + 2 \]

42. slope: 1, y-intercept: 4

**SOLUTION:**
The slope-intercept form of a line is $y = mx + b$, where $m$ is the slope, and $b$ is the y-intercept.

\[ y = mx + b \]
\[ y = 1x + 4 \]

43. slope: 0, y-intercept: 5

**SOLUTION:**
The slope-intercept form of a line is $y = mx + b$, where $m$ is the slope, and $b$ is the y-intercept.

\[ y = mx + b \]
\[ y = 0x + 5 \]
\[ y = 5 \]

---

44. $y = \frac{3}{4}x - 2$

**SOLUTION:**
The slope is $\frac{3}{4}$, and the y-intercept is $-2$. Plot the y-intercept (0, -2). The slope is $\frac{\text{rise}}{\text{run}} = \frac{3}{4}$. From (0, -2), move up 3 units and right 4 units. Plot the point. Draw a line through the two points.
4-1 Graphing Equations in Slope-Intercept Form

45. \( y = \frac{5}{3}x + 4 \)

**SOLUTION:**

The slope is \( \frac{5}{3} \), and the y-intercept is 4. Plot the y-intercept (0, 4). The slope is \( \frac{\text{rise}}{\text{run}} = \frac{5}{3} \). From (0, 4), move down 5 units and left 3 units. (Note that we can move up and to the right, or down and to the left. Normally we would move up and to the right, but moving down and to the left keeps the point near the origin.). Plot the point. Draw a line through the two points.

![Graph](image)

46. \( 3x + 8y = 32 \)

**SOLUTION:**

Rewrite the equation in slope-intercept form.

\[
3x + 8y = 32 \\
3x - 3x + 8y = 32 - 3x \\
8y = -3x + 32 \\
\frac{8y}{8} = \frac{-3x + 32}{8} \\
y = -\frac{3}{8}x + 4
\]

The slope is \( -\frac{3}{8} \), and the y-intercept is 4. Plot the y-intercept (0, 4). The slope is \( \frac{\text{rise}}{\text{run}} = \frac{-3}{8} \). From (0, 4), move down 3 units and right 8 units. Plot the point. Draw a line through the two points.

![Graph](image)
4-1 Graphing Equations in Slope-Intercept Form

47. \(5x - 6y = 36\)

**SOLUTION:**
Rewrite the equation in slope-intercept form.

\[
\begin{align*}
5x - 6y &= 36 \\
5x - 5x - 6y &= 36 - 5x \\
-6y &= -5x + 36 \\
\frac{-6y}{-6} &= \frac{-5x + 36}{-6} \\
y &= \frac{5}{6}x - 6
\end{align*}
\]

The slope is \(\frac{5}{6}\), and the \(y\)-intercept is \(-6\). Plot the \(y\)-intercept \((0, -6)\). The slope is \(\frac{\text{rise}}{\text{run}} = \frac{5}{6}\). From \((0, -6)\), move up 5 units and right 6 units. Plot the point. Draw a line through the two points.

48. \(-4x + \frac{1}{2}y = -1\)

**SOLUTION:**
Rewrite the equation in slope-intercept form.

\[
\begin{align*}
-4x + \frac{1}{2}y &= -1 \\
-4x + 4x + \frac{1}{2}y &= -1 + 4x \\
\frac{1}{2}y &= 4x - 1 \\
2\left(\frac{1}{2}y\right) &= 2(4x - 1) \\
y &= 8x - 2
\end{align*}
\]

The slope is 8, and the \(y\)-intercept is \(-2\). Plot the \(y\)-intercept \((0, -2)\). The slope is \(\frac{\text{rise}}{\text{run}} = \frac{8}{1}\). From \((0, -2)\), move up 8 units and right 1 unit. Plot the point. Draw a line through the two points.
4-1 Graphing Equations in Slope-Intercept Form

49. \(3x - \frac{1}{4}y = 2\)

**SOLUTION:**
Rewrite the equation in slope-intercept form.

\[
3x - \frac{1}{4}y = 2 \\
3x - 3x - \frac{1}{4}y = 2 - 3x \\
- \frac{1}{4}y = -3x + 2 \\
-4\left(\frac{-1}{4}y\right) = -4(-3x + 2) \\
y = 12x - 8
\]

The slope is 12, and the y-intercept is -8. Plot the y-intercept (0, -8). The slope is \(\frac{\text{rise}}{\text{run}} = \frac{12}{1}\). From (0, -8), move up 12 units and right 1 unit. Plot the point. Draw a line through the two points.

---

50. **TRAVEL** A rental company charges $8 per hour for a mountain bike plus a $5 fee for a helmet.

a. Write an equation in slope-intercept form for the total rental cost \(C\) for a helmet and a bicycle for \(t\) hours.

\[C = 8t + 5\]

b. Graph the equation.

**SOLUTION:**

a. The rate of $8 per hour represents the rate or slope. The amount of $5 for a helmet is constant, no matter how many hours you use the bike. So, the total rental fee for \(t\) hours can be written as \(C = 8t + 5\).

b. To graph the equation, plot the y-intercept (0, 5). Then move up 8 units and right 1 unit. Plot the point. Draw a line through the two points.

\[C = 8t + 5\]
\[C = 8(8) + 5\]
\[C = 64 + 5\]
\[C = 69\]

The cost for one bike and one helmet for 8 hours is $69. So, the cost for two bikes and two helmets for 8 hours is $138.
51. CCSS REASONING For Illinois residents, the average tuition at Chicago State University is $157 per credit hour. Fees cost $218 per year.

a. Write an equation in slope-intercept form for the tuition \( T \) for \( c \) credit hours.

\[ T = 157c + 218 \]

b. Find the cost for a student who is taking 32 credit hours.

\[ T = 157(32) + 218 = \$5242 \]

Write an equation of a line in slope-intercept form with the given slope and y-intercept.

52. slope: \(-1\), y-intercept: 0

\[ y = mx + b \]

\[ y = -1x + 0 \]

\[ y = -x \]

53. slope: 0.5, y-intercept: 7.5

\[ y = mx + b \]

\[ y = 0.5x + 7.5 \]

54. slope: 0, y-intercept: 7

**SOLUTION:**

The slope-intercept form of a line is \( y = mx + b \), where \( m \) is the slope, and \( b \) is the y-intercept.

\[ y = mx + b \]

\[ y = 0x + 7 \]

\[ y = 7 \]

55. slope: \(-1.5\), y-intercept: \(-0.25\)

**SOLUTION:**

The slope-intercept form of a line is \( y = mx + b \), where \( m \) is the slope, and \( b \) is the y-intercept.

\[ y = mx + b \]

\[ y = -1.5x + (-0.25) \]

\[ y = -1.5x - 0.25 \]

56. Write an equation of a horizontal line that crosses the y-axis at \((0, -5)\).

**SOLUTION:**

A horizontal line has the same y-values. So, the slope is 0. The y-intercept is at \(-5\), so the equation would be \( y = 0x - 5 \) or \( y = -5 \).

57. Write an equation of a line that passes through the origin and has a slope of 3.

**SOLUTION:**

\[ y = mx + b \]

\[ 0 = 3(0) + b \]

\[ 0 = 0 + b \]

\[ 0 = b \]

So, the equation of the line would be \( y = 3x \).
4-1 Graphing Equations in Slope-Intercept Form

58. **TEMPERATURE** The temperature dropped rapidly overnight. Starting at 80°F, the temperature dropped 3° per minute.

   a. Draw a graph that represents this drop from 0 to 8 minutes.
   
   b. Write an equation that describes this situation. Describe the meaning of each variable as well as the slope and y-intercept.

   **SOLUTION:**
   
   a. To graph the equation, plot the y-intercept (0, 80). Then move down 3 units and right 1 unit. Plot the point. Draw a line through the two points.
   
   ![Graph of temperature drop](image)

   b. The rate of 3° per minute represents the rate or slope. The amount of 80° starting temperature is constant, no matter how many minutes the temperature drops. So, the total temperature drop for x minutes can be written as \( y = -3x + 80 \). \( y \) represents the temperature and \( x \) represents the elapsed time in minutes. The slope represents the change in temperature per minute and the y-intercept represents the temperature when it started to drop.

59. **FITNESS** Refer to the information given.

   ![Fitness Image](image)

   a. Write an equation that represents the cost \( C \) of a membership for \( m \) months.
   
   b. What does the slope represent?
   
   c. What does the \( C \)-intercept represent?
   
   d. What is the cost of a two-year membership?

   **SOLUTION:**
   
   a. The rate of $45 per month represents the rate or slope. The amount of $145 startup fee is constant, no matter how many months you have a membership. So, the total cost for \( m \) months can be written as \( C = 45m + 145 \).
   
   b. The slope represents the cost per month to maintain the membership.
   
   c. The \( C \)-intercept represents the start-up fee.
   
   d. There are 24 months in 2 years, solve substitute 24 for \( m \) and solve for \( C \).

   \[ C = 45m + 145 \]
   
   \[ C = 45(24) + 145 \]
   
   \[ C = 1080 + 145 \]
   
   \[ C = 1225 \]

   The cost for a two-year membership is $1225.
4-1 Graphing Equations in Slope-Intercept Form

60. MAGAZINES A teen magazine began with a circulation of 500,000 in its first year. Since then, the circulation has increased an average of 33,388 per year.

a. Write an equation that represents the circulation \( c \) after \( t \) years.

b. What does the slope represent?

c. What does the \( c \)-intercept represent?

d. If the magazine began in 1944, and this trend continues, in what year will the circulation reach 3,000,000?

SOLUTION:
a. The rate of 33,388 magazines per year represents the rate or slope. The amount of 500,000 magazines in the first year of circulation is constant, no matter how many magazines are sold. So, the total circulation for \( t \) years can be written as \( c = 33,388t + 500,000 \).

b. The slope represents the increase in circulation each year.

c. The \( c \)-intercept represents the circulation in the first year.

d. \[
c = 33,388t + 500,000
\]

That means it will take 75 years to reach 3,000,000 magazines circulated. So, this will happen in 1944 + 75 = 2019.

61. SMART PHONES A telecommunications company sold 3305 smart phones in the first year of production. Suppose, on average, they expect to sell 25 phones per day.

a. Write an equation for the number of smart phones \( P \) sold \( t \) years after the first year of production, assuming 365 days per year.

b. If sales continue at this rate, how many years will it take for the company to sell 100,000 phones?

SOLUTION:
a. The end of the first year, \( t = 0 \), and \( P = 3305 \). This is the \( y \)-intercept. The slope is the number on phone sales per year or \( 25 \). \( m = 25 \cdot 365 = 9125 \). Thus, the equation to represent this scenario is \( P = 9125t + 3305 \).

b. To find the number of years to reach 100,000, substitute 100,000 for \( P \) and solve for \( t \).

\[
\begin{align*}
P &= 9125t + 3305 \\
100,000 &= 9125t + 3305 \\
100,000 - 3305 &= 9125t \\
96,705 &= 9125t \\
10.59 &= t
\end{align*}
\]

So, it will take 11 years to sell 100,000 phones.
62. OPEN ENDED Draw a graph representing a real-world linear function and write an equation for the graph. Describe what the graph represents.

**SOLUTION:**
Students’ answers will vary.
Sample answer: y = x + 15; The initial cost of joining a movie club is $15. Then each movie costs $1 for a 1-night rental.

63. REASONING Determine whether the equation of a vertical line can be written in slope-intercept form. Explain your reasoning.

**SOLUTION:**
A vertical line cannot be written in slope-intercept form. Consider the following example.

Choose points (−2, −3) and (−2, 4). Find the slope.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - (-3)}{-2 - (-2)} = \frac{7}{0}
\]

The slope is not defined for a vertical. Since the line has no slope, it cannot be written in slope-intercept form.

64. CHALLENGE Summarize the characteristics that the graphs y = 2x + 3, y = 4x + 3, y = −x + 3, and y = −10x + 3 have in common.

**SOLUTION:**
All for graph have the same y-intercept. Therefore they all cross the y-axis at 3.

65. CCSS REGULARITY If given an equation in standard form, explain how to determine the rate of change.

**SOLUTION:**
Assume that the coefficient of y is not 0. We would first have to rewrite the equation in slope-intercept form. The rate of change is also the slope, so the coefficient for the x-variable is the rate of change.

For example, consider the equation 2x + 4y = 12. Solve for y.

\[
2x + 4y = 12 \quad \text{Original equation}
\]

\[
2x + 2x + 4y = -2x + 12 \quad \text{Subtract 2x from each side}
\]

\[
4y = 2x + 12 \quad \text{Simplify}
\]

\[
\frac{3y}{4} = \frac{2x + 12}{4} \quad \text{Divide each side by 4}
\]

\[
y = \frac{1}{2}x + 3 \quad \text{Simplify}
\]

The slope is \(\frac{1}{2}\).

66. WRITING IN MATH Explain how you would use a given y-intercept and the slope to predict a y-value for a given x-value without graphing.

**SOLUTION:**
If the slope is \(m\) and the y-intercept is \(b\), substitute the given x-values for \(x\) in \(y = mx + b\). Then simplify.

For example, if \(m = 12\) and \(b = 4\), write the equation in slope-intercept form.
\(y = 12x + 4\).
If you are given \(x = 14\) and asked to find \(y\).
Substitute the x-value into \(y = 12x + 4\).
\(y = 12(13) + 4 = 160\)
4-1 Graphing Equations in Slope-Intercept Form

67. A music store has $x$ CDs in stock. If 350 are sold and 3$y$ are added to stock, which expression represents the number of CDs in stock?

A  $350 + 3y - x$

B  $x - 350 + 3y$

C  $x + 350 + 3y$

D  $3y - 350 - x$

**SOLUTION:**
If $x$ is the number of CDs the store has, the number sold will be represented by $-350$, so choices A and C can be eliminated because they do not have a negative 350. The number of CDs stocked can be represented by $+3y$. So the expression is $x - 350 + 3y$.

The correct choice is B.

68. **PROBABILITY** The table shows the result of a survey of favorite activities. What is the probability that a student’s favorite activity is sports or drama club?

<table>
<thead>
<tr>
<th>Extracurricular Activity</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>art club</td>
<td>24</td>
</tr>
<tr>
<td>band</td>
<td>134</td>
</tr>
<tr>
<td>choir</td>
<td>37</td>
</tr>
<tr>
<td>drama club</td>
<td>46</td>
</tr>
<tr>
<td>mock trial</td>
<td>19</td>
</tr>
<tr>
<td>school paper</td>
<td>26</td>
</tr>
<tr>
<td>sports</td>
<td>314</td>
</tr>
</tbody>
</table>

F  $\frac{3}{8}$

G  $\frac{4}{9}$

H  $\frac{3}{5}$

J  $\frac{2}{3}$

**SOLUTION:**
To find the probability, you need to first find the number of favorable results, which is sports or drama club. This total is $314 + 46 = 360$. Next, find the total number of outcomes $24 + 134 + 37 + 46 + 19 + 26 + 314 = 600$. So, the probability is favorable outcomes over the total outcomes. $\frac{360}{600} = \frac{3}{5}$. So, the correct choice is H.
69. A recipe for fruit punch calls for 2 ounces of orange juice for every 8 ounces of lemonade. If Jennifer uses 64 ounces of lemonade, which proportion can she use to find \( x \), the number of ounces of orange juice needed?

\[
\begin{align*}
\text{A} & \quad \frac{2}{x} = \frac{64}{6} \\
\text{B} & \quad \frac{8}{x} = \frac{64}{2} \\
\text{C} & \quad \frac{2}{8} = \frac{x}{64} \\
\text{D} & \quad \frac{6}{2} = \frac{x}{64}
\end{align*}
\]

**SOLUTION:**
The fraction of orange juice to lemonade for one recipe can be represented by \( \frac{2}{8} \). The number of ounces of orange juice needed if 64 ounces of lemonade are used can be found by the equation \( \frac{2}{8} = \frac{x}{64} \).

So, the correct choice is C.

70. **EXTENDED RESPONSE** The table shows the results of a canned food drive. 1225 cans were collected, and the 12th grade class collected 55 more cans than the 10th grade class. How many cans each did the 10th and 12th grade classes collect? Show your work.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Cans</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>340</td>
</tr>
<tr>
<td>10</td>
<td>( x )</td>
</tr>
<tr>
<td>11</td>
<td>280</td>
</tr>
<tr>
<td>12</td>
<td>( y )</td>
</tr>
</tbody>
</table>

**SOLUTION:**
The 10th grade class collected 275, and the 12th grade class collected 330. First I found that the total number of cans collected by the 10th and 12th grade classes is \( 1225 - (340 + 280) \) or 605. Then, if \( x \) is the number of cans the 10th grade class collected, then the 12th grade class collected \( x + 55 \) cans. The sum of these is 605.

\[
\begin{align*}
10th &= x, \quad 12th = x + 55 \\
x + x + 55 &= 605 \\
2x + 55 &= 605 \\
2x &= 550 \\
x &= 275
\end{align*}
\]

10th = 275; 12th = 275 + 55 = 330
4-1 Graphing Equations in Slope-Intercept Form

For each arithmetic sequence, determine the related function. Then determine if the function is proportional or nonproportional.

71. 3, 7, 11, …

SOLUTION:
7 – 3 = 4  
11 – 7 = 4  
The common difference is 4. Substitute the first term and the difference into the formula for the nth term is \( a_n = a_1 + (n - 1)d \).

\[ a_n = 3 + (n - 1)(4) \]
\[ a_n = 3 + 4n - 4 \]
\[ a_n = 4n - 1 \]

Graph the equation.

Since (0, 0) is not on the graph, it is nonproportional.

72. 8, 6, 4, …

SOLUTION:
6 – 8 = -2  
4 – 6 = -2  
The common difference is -2. Substitute the first term and the difference into the formula for the nth term is \( a_n = a_1 + (n - 1)d \).

\[ a_n = 8 + (n - 1)(-2) \]
\[ a_n = 8 - 2n + 2 \]
\[ a_n = -2n + 10 \]

Graph the equation.

Since (0, 0) is not on the graph, it is nonproportional.
4-1 Graphing Equations in Slope-Intercept Form

73. 0, 3, 6, …

**SOLUTION:**

\[ 3 - 0 = 3 \]
\[ 6 - 3 = 3 \]

The common difference is 3. Substitute the first term and the difference into the formula for the \( n \)th term is \( a_n = a_1 + (n - 1)d \).

\[ a_n = 0 + (n - 1)(3) \]
\[ a_n = 3n - 3 \]

Graph the equation.

Since (0, 0) is not on the graph, it is nonproportional.

74. 1, 2, 3, …

**SOLUTION:**

The common difference is 1. Substitute the first term and the difference into the formula for the \( n \)th term is \( a_n = a_1 + (n - 1)d \).

\[ a_n = 1 + (n - 1)(1) \]
\[ a_n = 1 + n - 1 \]
\[ a_n = n \]

Graph the equation.

Since (0, 0) is not on the graph, it is nonproportional.
4-1 Graphing Equations in Slope-Intercept Form

75. **GAME SHOWS** Contestants on a game show win money by answering 10 questions.

![10 Questions!](image)

<table>
<thead>
<tr>
<th>Question</th>
<th>Prize</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>$3000</td>
</tr>
<tr>
<td>2.</td>
<td>$2500</td>
</tr>
<tr>
<td>3.</td>
<td>$2500</td>
</tr>
<tr>
<td>4.</td>
<td>$2500</td>
</tr>
<tr>
<td>5.</td>
<td>$2500</td>
</tr>
</tbody>
</table>

- **a.** If the value of the first question is $3000, find the value of the 10th question.

- **b.** If all questions are answered correctly, how much are the winnings?

**SOLUTION:**

**a.** Let \( q \) represent the number of questions.

The contestant wins $3000 for first questions and $2500 for the remaining ones. Since \( q \) represent the number of questions, the the remaining number of questions is \( q - 1 \). Then the total winning can be represented at \( 3000 + 2500(q - 1) \).

\[
3000 + 2500(q - 1) = 3000 + 2500(10 - 1) \\
= 3000 + 2500(9) \\
= 3000 + 22,500 \\
= 25,500
\]

So, the 10th question is worth $25,500.

**b.** If the contestant answers all 10 questions correctly, he or she will win:

\[
3000 + 5500 + 8000 + 10,500 + 13,000 + 15,500 + 18,000 + 20,500 + 23,000 + 25,500 \\
= 142,500
\]

So, the contestant will win $142,500.

76. Suppose \( y \) varies directly as \( x \). Write a direct variation equation that relates \( x \) and \( y \). Then solve.

- If \( y = 10 \) when \( x = 5 \), find \( y \) when \( x = 6 \).

**SOLUTION:**

\[
y = kx \\
10 = k(5) \\
\frac{10}{5} = \frac{k(5)}{5} \\
2 = k
\]

So, the direct variation equation is \( y = 2x \). Substitute 6 for \( x \) and find \( y \).

\[
y = 2x \\
y = 2(6) \\
y = 12
\]

So, \( y = 12 \) when \( x = 6 \).

77. If \( y = -16 \) when \( x = 4 \), find \( x \) when \( y = 20 \).

**SOLUTION:**

\[
y = kx \\
-16 = k(4) \\
\frac{-16}{4} = \frac{k(4)}{4} \\
-4 = k
\]

So, the direct variation equation is \( y = -4x \). Substitute 20 for \( y \) and find \( x \).

\[
y = -4x \\
20 = -4x \\
\frac{20}{-4} = \frac{-4x}{-4} \\
-5 = x
\]

So, \( x = -5 \) when \( y = 20 \).
4-1 Graphing Equations in Slope-Intercept Form

78. If \( y = 6 \) when \( x = 18 \), find \( y \) when \( x = -12 \).

**SOLUTION:**

\[
y = kx \\
6 = k(18) \\
6 = k(18) \\
\frac{6}{18} = \frac{k}{18} \\
\frac{1}{3} = k
\]

So, the direct variation equation is \( y = \frac{1}{3}x \).

Substitute \(-12\) for \( x \) and find \( y \).

\[
y = \frac{1}{3}(-12) \\
y = -4
\]

So, \( y = -4 \) when \( x = -12 \).

79. If \( y = 12 \) when \( x = 15 \), find \( x \) when \( y = -6 \).

**SOLUTION:**

\[
y = kx \\
12 = k(15) \\
12 = k(15) \\
\frac{12}{15} = \frac{k}{15} \\
\frac{4}{5} = k
\]

So, the direct variation equation is \( y = \frac{4}{5}x \).

Substitute \(-6\) for \( y \) and find \( x \).

\[
y = \frac{4}{5}x \\
-6 = \frac{4}{5}x \\
\frac{5}{4}(-6) = \frac{5}{4}\left(\frac{4}{5}x\right) \\
\frac{-15}{2} = x \\
-7.5 = x
\]

So, \( x = -7.5 \) when \( y = -6 \).

Find the slope of the line that passes through each pair of points.

80. \((2, 3), (9, 7)\)

**SOLUTION:**

\[
m = \frac{y_2 - y_1}{x_2 - x_1} \\
= \frac{7 - 3}{9 - 2} \\
= \frac{4}{7}
\]

So, the slope is \( \frac{4}{7} \).

81. \((-3, 6), (2, 4)\)

**SOLUTION:**

\[
m = \frac{y_2 - y_1}{x_2 - x_1} \\
= \frac{6 - 4}{-3 - 2} \\
= \frac{2}{-5} \\
= -\frac{2}{5}
\]

So, the slope is \( -\frac{2}{5} \).

82. \((2, 6), (-1, 3)\)

**SOLUTION:**

\[
m = \frac{y_2 - y_1}{x_2 - x_1} \\
= \frac{6 - 3}{2 - (-1)} \\
= \frac{3}{3} \\
= 1
\]

So, the slope is 1.
83. \((-3, 3), (1, 3)\)

**SOLUTION:**

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
= \frac{3 - 3}{1 - (-3)}
\]

\[
= \frac{0}{4}
\]

\[
= 0
\]

So, the slope is 0.
**4-2 Writing Equations in Slope-Intercept Form**

Write an equation of the line that passes through the given point and has the given slope.

1. (3, −3), slope 3

*SOLUTION:*
Find the *y*-intercept.

\[ y = mx + b \]
\[-3 = 3(3) + b \]
\[-3 = 9 + b \]
\[-12 = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = 3x - 12 \]

2. (2, 4), slope 2

*SOLUTION:*
Find the *y*-intercept.

\[ y = mx + b \]
\[ 4 = 2(2) + b \]
\[ 4 = 4 + b \]
\[ 0 = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = 2x + 0 \]
\[ y = 2x \]

3. (1, 5), slope −1

*SOLUTION:*
Find the *y*-intercept.

\[ y = mx + b \]
\[ 5 = -1(1) + b \]
\[ 5 = -1 + b \]
\[ 6 = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = -x + 6 \]

4. (−4, 6), slope −2

*SOLUTION:*
Find the *y*-intercept.

\[ y = mx + b \]
\[ 6 = -2(-4) + b \]
\[ 6 = 8 + b \]
\[ -2 = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = -2x + 2 \]
4-2 Writing Equations in Slope-Intercept Form

**Write an equation of the line that passes through each pair of points.**

5. $(4, -3), (2, 3)$

**SOLUTION:**

Find the slope of the line containing the given points.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - (-3)}{2 - 4} = \frac{6}{-2} = -3$$

Use the slope and either of the two points to find the $y$-intercept.

$$y = mx + b$$

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

$$9 = b$$

Write the equation in slope-intercept form.

$$y = mx + b$$

$$y = -3x + 9$$

---

6. $(-7, -3), (-3, 5)$

**SOLUTION:**

Find the slope of the line containing the given points.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - (-3)}{-3 - (-7)} = \frac{8}{4} = 2$$

Use the slope and either of the two points to find the $y$-intercept.

$$y = mx + b$$

$$-3 = 2(-7) + b$$

$$-3 = -14 + b$$

$$11 = b$$

Write the equation in slope-intercept form.

$$y = mx + b$$

$$y = 2x + 11$$
7. \((-1, 3), (0, 8)\)

**SOLUTION:**
Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8 - 3}{0 - (-1)} = \frac{5}{1} = 5
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]
\[
3 = 5(-1) + b
\]
\[
3 = -5 + b
\]
\[
8 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]
\[
y = 5x + 8
\]

8. \((-2, 6), (0, 0)\)

**SOLUTION:**
Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 6}{0 - (-2)} = \frac{-6}{2} = -3
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]
\[
6 = -3(-2) + b
\]
\[
6 = 6 + b
\]
\[
0 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]
\[
y = -3x + 0
\]
\[
y = -3x
\]
9. **WHITEWATER RAFTING** Ten people from a local youth group went to Black Hills Whitewater Rafting Tour Company for a one-day rafting trip. The group paid $425.

a. Write an equation in slope-intercept form to find the total cost $C$ for $p$ people.

$$C = mp + b$$

$425 = 35(10) + b$

$425 = 350 + b$

$75 = b$

Write the equation in slope-intercept form.

$$C = mp + b$$

$$C = 35p + 75$$

The total cost $C$ for $p$ people can be represented by the linear equation $C = 35p + 75$.

b. Solve for $C$ when $p = 15$.

$$C = 35p + 75$$

$$C = 35(15) + 75$$

$$C = 525 + 75$$

$$C = 600$$

So, the cost for 15 people is $600.

Write an equation of the line that passes through the given point and has the given slope.

10. $(3, 1)$, slope 2

**SOLUTION:**

Find the $y$-intercept.

$$y = mx + b$$

$1 = 2(3) + b$

$1 = 6 + b$

$-5 = b$

Write the equation in slope-intercept form.

$$y = mx + b$$

$$y = 2x - 5$$

11. $(-1, 4)$, slope $-1$

**SOLUTION:**

Find the $y$-intercept.

$$y = mx + b$$

$4 = -1(-1) + b$

$4 = 1 + b$

$3 = b$

Write the equation in slope-intercept form.

$$y = mx + b$$

$$y = -x + 3$$

12. $(1, 0)$, slope 1

**SOLUTION:**

Find the $y$-intercept.

$$y = mx + b$$

$0 = 1(1) + b$

$0 = 1 + b$

$-1 = b$

Write the equation in slope-intercept form.

$$y = mx + b$$

$$y = x - 1$$
13. (7, 1), slope 8

**SOLUTION:**
Find the y-intercept.

\[ y = mx + b \]
\[ 1 = 8(7) + b \]
\[ 1 = 56 + b \]
\[ -55 = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = 8x - 55 \]

14. (2, 5), slope -2

**SOLUTION:**
Find the y-intercept.

\[ y = mx + b \]
\[ 5 = -2(2) + b \]
\[ 5 = -4 + b \]
\[ 9 = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = -2x + 9 \]

15. (2, 6), slope 2

**SOLUTION:**
Find the y-intercept.

\[ y = mx + b \]
\[ 6 = 2(2) + b \]
\[ 6 = 4 + b \]
\[ 2 = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = 2x + 2 \]
4-2 Writing Equations in Slope-Intercept Form

17. \((-2, 5), (5, -2)\)

**SOLUTION:**
Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - 5}{5 - (-2)} = \frac{-7}{7} = -1
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]
\[
5 = -1(-2) + b
\]
\[
5 = 2 + b
\]
\[
3 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]
\[
y = -x + 3
\]

18. \((-5, 3), (0, -7)\)

**SOLUTION:**
Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-7 - 3}{0 - (-5)} = \frac{-10}{5} = -2
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]
\[
3 = -2(-5) + b
\]
\[
3 = 10 + b
\]
\[
-7 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]
\[
y = -2x - 7
\]
4-2 Writing Equations in Slope-Intercept Form

19. (3, 5), (2, −2)

**SOLUTION:**
Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - 5}{2 - 3} = \frac{-7}{-1} = 7
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]
\[
5 = 7(3) + b
\]
\[
5 = 21 + b
\]
\[
-16 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]
\[
y = 7x - 16
\]

20. (−1, −3), (−2, 3)

**SOLUTION:**
Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - (-3)}{-2 - (-1)} = \frac{6}{-1} = -6
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]
\[
-3 = -6(-1) + b
\]
\[
-3 = 6 + b
\]
\[
-9 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]
\[
y = -6x - 9
\]
21. \((−2, −4), (2, 4)\)

**SOLUTION:**
Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - (−4)}{2 - (−2)} = \frac{8}{4} = 2
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]
\[-4 = 2(−2) + b
\]
\[-4 = -4 + b
\]
\[0 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]
\[y = 2x + 0
\]
\[y = 2x
\]

22. **CCSS MODELING** Greg is driving a remote control car at a constant speed. He starts the timer when the car is 5 feet away. After 2 seconds the car is 35 feet away.

**a.** Write a linear equation to find the distance \(d\) of the car from Greg.

**b.** Estimate the distance the car has traveled after 10 seconds.

**SOLUTION:**

**a.** Let \(t\) be the number of seconds after the timer starts. Let \(d\) be the distance traveled by the car. The \(d\)-intercept is 5, because the car has traveled that far when the time starts at 0. Use the slope-intercept form to find the slope, which is distance divided by time, or the speed of the car.

\[
d = mt + b
\]
\[35 = m(2) + 5
\]
\[30 = 2m
\]
\[\frac{30}{2} = \frac{2m}{2}
\]
\[15 = m
\]

Write the equation in slope-intercept form with \(t\) as \(x\) and \(d\) as \(y\).

\[
y = mx + b
\]
\[d = 15t + 5
\]

The distance of the car from Greg can be represented by the linear equation \(d = 15t + 5\).

**b.** Solve for \(d\) when \(t = 10\).

\[
d = 15t + 5
\]
\[d = 15(10) + 5
\]
\[d = 150 + 5
\]
\[d = 155
\]

So, the distance the car has traveled after 10 seconds is 155 ft.
23. **ZOOS** In 2006, the attendance at the Columbus Zoo and Aquarium was about 1.6 million. In 2009, the zoo’s attendance was about 2.2 million.

**a.** Write a linear equation to find the attendance (in millions) \(y\) after \(x\) years. Let \(x\) be the number of years since 2000.

**b.** Estimate the zoo’s attendance in 2020.

**SOLUTION:**

**a.** The attendance increased from 1.6 million to 2.2 million, so it increased by \(2.2 - 1.6 = 0.6\) million. This increase took 3 years, so the increase per year is \(0.6 \div 3 = 0.2\) million. This represents the slope. We want \(x\) to represent the year 2000, so we need to find the corresponding \(y\)-intercept. Use the coordinate \((6, 1.6)\) for 2006 since \(x = 6\) represents 2006.

\[y = mx + b\]

\[1.6 = 0.2(6) + b\]

\[1.6 = 1.2 + b\]

\[b = 0.4\]

The linear equation for attendance is \(y = 0.2x + 0.4\).

**b.** Substitute 20 for \(x\).

\[y = 0.2x + 0.4\]

\[y = 0.2(20) + 0.4\]

\[y = 4 + 0.4\]

\[y = 4.4\]

The estimated attendance for 2020 is 4.4 million.

24. **BOOKS** In 1904, a dictionary cost 30¢. Since then the cost of a dictionary has risen an average of 6¢ per year.

**a.** Write a linear equation to find the cost \(C\) of a dictionary \(y\) years after 2004.

**b.** If this trend continues, what will the cost of a dictionary be in 2020?

**SOLUTION:**

**a.** Let \(y\) be the number of years since 1904. The \(C\)-intercept is 30, because that was the cost of a dictionary in the \(y = 0\) year, 1904. The slope is 6 as it represents the rate of increase in price. Write the equation in slope-intercept form with \(y\) as \(x\) and \(C\) as \(y\).

\[y = mx + b\]

\[C = 6y + 30\]

The cost of a dictionary after \(y\) years can be represented by the linear equation \(C = 30 + 6y\).

**b.** The year 2020 occurs 116 years after 1904, so solve for \(C\) when \(y = 116\).

\[C = 30 + 6y\]

\[C = 30 + 6(116)\]

\[C = 30 + 696\]

\[C = 726\]

So, if the trend continues, the cost of a dictionary in 2020 will be 726¢, or $7.26.
Write an equation of the line that passes through the given point and has the given slope.

25. $(4, 2)$, slope $\frac{1}{2}$

**SOLUTION:**
Find the $y$-intercept.

$$y = mx + b$$

$$2 = \frac{1}{2}(4) + b$$

$$2 = 2 + b$$

$$0 = b$$

Write the equation in slope-intercept form.

$$y = mx + b$$

$$y = \frac{1}{2}x$$

26. $(3, -2)$, slope $\frac{1}{3}$

**SOLUTION:**
Find the $y$-intercept.

$$y = mx + b$$

$$-2 = \frac{1}{3}(3) + b$$

$$-2 = 1 + b$$

$$-3 = b$$

Write the equation in slope-intercept form.

$$y = mx + b$$

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

27. $(6, 4)$, slope $-\frac{3}{4}$

**SOLUTION:**
Find the $y$-intercept.

$$y = mx + b$$

$$4 = -\frac{3}{4}(6) + b$$

$$4 = -\frac{9}{2} + b$$

$$\frac{17}{2} = b$$

$$8\frac{1}{2} = b$$

Write the equation in slope-intercept form.

$$y = mx + b$$

$$y = -\frac{3}{4}x + 8\frac{1}{2}$$

28. $(2, -3)$, slope $\frac{2}{3}$

**SOLUTION:**
Find the $y$-intercept.

$$y = mx + b$$

$$-3 = \frac{2}{3}(2) + b$$

$$-3 = \frac{4}{3} + b$$

$$\frac{13}{3} = b$$

$$-4\frac{1}{3} = b$$

Write the equation in slope-intercept form.

$$y = mx + b$$

$$y = \frac{2}{3}x - 4\frac{1}{3}$$
29. \((2, -2), \text{slope } \frac{2}{7}\)

**SOLUTION:**

Find the \(y\)-intercept.

\[
y = mx + b
\]

\[
-2 = \frac{2}{7}(2) + b
\]

\[
-2 = \frac{4}{7} + b
\]

\[
-2\frac{4}{7} = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]

\[
y = \frac{2}{7}x - 2\frac{4}{7}
\]

30. \((-4, -2), \text{slope } -\frac{3}{5}\)

**SOLUTION:**

Find the \(y\)-intercept.

\[
y = mx + b
\]

\[
-2 = -\frac{3}{5}(-4) + b
\]

\[
-2 = \frac{12}{5} + b
\]

\[
-2\frac{2}{5} = b
\]

\[-4\frac{2}{5} = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]

\[
y = -\frac{3}{5}x - 4\frac{2}{5}
\]

31. **DOGS** In 2001, there were about 56.1 thousand golden retrievers registered in the United States. In 2002, the number was 62.5 thousand.

**a.** Write a linear equation to find the number of golden retrievers \(G\) that will be registered in year \(t\), where \(t = 0\) is the year 2000.

**b.** Graph the equation.

**c.** Estimate the number of golden retrievers that will be registered in 2017.

**SOLUTION:**

**a.** Two points on the line are \((1, 56.1)\) and \((2, 62.5)\). Find the slope of the line.

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
= \frac{62.5 - 56.1}{2 - 1}
\]

\[
= \frac{6.4}{1}
\]

\[
= 6.4
\]

Let \(t\) be the number of years after 2000. Use the slope-intercept form and one of the points to find the \(y\)-intercept for \(t = 0\) year, 2000.

\[
62.5 = 6.4(2) + b
\]

\[
62.5 = 12.8 + b
\]

\[
49.7 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]

\[
G = 6.4t + 49.7
\]

The number of golden retrievers that will be registered in the year \(t\) can be represented by the linear equation \(G = 6.4t + 49.7\).

**b.** Plot points and draw a line through them.
32. **GYM MEMBERSHIPS** A local recreation center offers a yearly membership for $265. The center offers aerobics classes for an additional $5 per class.

   a. Write an equation that represents the total cost of the membership.

   b. Carly spent $500 one year. How many aerobics classes did she take?

   **SOLUTION:**

   a. Let \( y \) be the total cost of membership and \( x \) the number of additional classes taken. The \( y \)-intercept is the yearly fee of 265. The slope is 5 as it represents the fixed rate per additional class. Write the equation in slope-intercept form.

   \[
   y = mx + b
   \]

   \[
   y = 5x + 265
   \]

   So, the total cost of the membership can be represented by the linear equation \( y = 5x + 265 \).

   b. To find the number of additional classes Carly took, we can substitute the total cost into the equation and solve for \( x \):

   \[
   500 = 5x + 265
   \]

   \[
   500 - 265 = 5x + 265 - 265
   \]

   \[
   235 = 5x
   \]

   \[
   \frac{235}{5} = \frac{5x}{5}
   \]

   \[
   47 = x
   \]

   Therefore, she paid for 47 classes.
Write an equation of the line that passes through the given point and has the given slope.

1. (3, −3), slope 3 ...

SOLUTION:
Solve.
Check.

69. SOLUTION:
Solve.
Check.

70. SOLUTION:
Solve.

33. SUBSCRIPTION A magazine offers an online subscription that allows you to view up to 25 archived articles free. To view 30 archived articles, you pay $49.15. To view 33 archived articles, you pay $57.40.

a. What is the cost of each archived article for which you pay a fee?

b. What is the cost of the magazine subscription?

SOLUTION:
a. The cost of each archived article can be found by finding the slope using the two points (30, 49.15) and (33, 57.40).

\[ m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{57.40 - 49.15}{33 - 30} = \frac{8.25}{3} = 2.75 \]

So, the cost of each archived article is $2.75.

b. The cost of the magazine subscription is the y-intercept. Use the slope-intercept form and one of the points to find the y-intercept for x = 5 (five additional articles).

\[ y = mx + b \]

\[ 49.15 = 2.75(5) + b \]

\[ 49.15 = 13.75 + b \]

\[ 35.40 = b \]

So, the cost of the magazine subscription is $35.40.
35. (5, -3), (2, 5)

**SOLUTION:**

Find the slope of the line containing the given points.

\[ m = \frac{y_2-y_1}{x_2-x_1} \]

\[ = \frac{-3-(-3)}{5-2} \]

\[ = \frac{0}{3} \]

\[ = -2 \frac{2}{3} \]

Use the slope and either of the two points to find the y-intercept.

\[ y = mx + b \]

\[-3 = -2\frac{2}{3}(5) + b \]

\[-3 = -13\frac{1}{3} + b \]

\[ 10\frac{1}{3} = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]

\[ y = -2\frac{2}{3}x + 10\frac{1}{3} \]

36. \( \left( \frac{5}{4}, 1 \right), \left( -\frac{1}{4}, \frac{3}{4} \right) \)

**SOLUTION:**

Find the slope of the line containing the given points.

\[ m = \frac{y_2-y_1}{x_2-x_1} \]

\[ = \frac{-1-1}{-\frac{1}{4}-\frac{5}{4}} \]

\[ = -\frac{1}{6} \]

\[ = \left( -\frac{1}{4} \right) \cdot \left( -\frac{4}{6} \right) \]

\[ = \frac{1}{6} \]

Use the slope and either of the two points to find the y-intercept.

\[ y = mx + b \]

\[ 1 = \frac{1}{6} \left( \frac{5}{4} \right) + b \]

\[ 1 = \frac{5}{24} + b \]

\[ \frac{24}{24} - \frac{5}{24} = b \]

\[ \frac{19}{24} = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]

\[ y = \frac{1}{6}x + \frac{19}{24} \]
4-2 Writing Equations in Slope-Intercept Form

37. \( \left( \frac{5}{12}, -1 \right), \left( -\frac{3}{4}, \frac{1}{6} \right) \)

**SOLUTION:**
Find the slope of the line containing the given points.

\[
m = \frac{y_2-y_1}{x_2-x_1} = \frac{-1 - (-1)}{\frac{5}{12} - \frac{3}{4}} = \frac{\frac{5}{12}}{\frac{1}{6}} = \frac{5}{2} \cdot \frac{6}{12} = \frac{5}{4}
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]

\[-1 = \frac{5}{12} \left( \frac{5}{12} \right) + b
\]

\[-1 = \frac{5}{12} + b
\]

\[-\frac{7}{12} = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]

\[
y = -\frac{7}{12}
\]

38. \((3, -1); \ y = \frac{1}{3}x + 5\)

**SOLUTION:**
If the point is on the line, then inputing the \(x\)-value into the equation will yield the \(y\)-value. Try substituting 3 and -1 for \(x\) and \(y\).

\[-1 = \frac{1}{3}(3) + 5
\]

\[-1 = 1 + 5
\]

\[-1 = 6
\]

The equation is not true, so the point is not on the line.

39. \((6, -2); \ y = \frac{1}{2}x - 5\)

**SOLUTION:**
If the point is on the line, then inputing the \(x\)-value into the equation will yield the \(y\)-value. Try substituting 6 and -2 for \(x\) and \(y\).

\[-2 = \frac{1}{2}(6) - 5
\]

\[-2 = 3 - 5
\]

\[-2 = -2
\]

The equation is true, so the point is on the line.

**Determine which equation best represents each situation. Explain the meaning of each variable.**

\[
\begin{align*}
A \quad & y = -\frac{1}{3}x + 72 \\
B \quad & y = 2x + 225 \\
C \quad & y = 8x + 4
\end{align*}
\]

40. **CONCERTS** Tickets to a concert cost $8 each plus a processing fee of $4 per order.

**SOLUTION:**
The equation in choice C is best because the cost of each ticket, 8, is the slope, and the processing fee, 4 is the \(y\)-intercept. \(x\) represents the number of tickets per order and \(y\) represents the total cost of an order.
4.2 Writing Equations in Slope-Intercept Form

41. **FUNDRAISING**  The freshman class has $225. They sell raffle tickets at $2 each to raise money for a field trip.

**SOLUTION:**
The equation in choice B is best because the cost of each ticket, 2, is the slope, and the amount in the class treasury before the fund-raiser, 225, is the y-intercept. $x$ represents the number of raffle tickets sold, $y$ represents the total amount of money in the treasury.

42. **POOLS**  The current water level of a swimming pool in Tucson, Arizona, is 6 feet. The rate of evaporation is $\frac{1}{3}$ inch per day.

**SOLUTION:**
The equation in choice A is best because the rate of evaporation, $\frac{1}{3}$, is the slope. Six feet is the same as 72 inches, so the beginning water level of the pool, 72, is the y-intercept. $x$ represents the number of days since summer began, $y$ represents the total depth of water in the pool in inches.

43. **CCSS SENSE-MAKING**  A manufacturer implemented a program to reduce waste. In 1998 they sent 946 tons of waste to landfills. Each year after that, they reduced their waste by an average 28.4 tons.

**a.** How many tons were sent to the landfill in 2010?

**b.** In what year will it become impossible for this trend to continue? Explain.

**SOLUTION:**

**a.** Write an equation in slope-intercept form: $y = -28.4x + 946$. Solve for $y$ where $x$ represents the number of years since 1998 when the program was implemented.

$$y = -28.4x + 946$$

**b.** When the waste sent ($y$) is 0, a continued trend of reducing waste would be impossible, because a negative amount of waste is impossible. Solve for $x$ when $y = 0$.

$$y = -28.4x + 946$$

Original equation

$$0 = -28.4x + 946$$

Replace $y$ with 0

$$-28.4x = -946$$

Add $-28.4x$ to each side

$$x = \frac{946}{28.4}$$

Divide each side by $-28.4$

Simplify

So, 605.2 tons were sent to the landfill in 2010.

44. **COMBINING FUNCTIONS**  The parents of a college student open an account for her with a deposit of $5000, and they set up automatic deposits of $100 to the account every week.

**a.** Write a function $d(t)$ to express the amount of money in the account $t$ weeks after the initial deposit. $d(t) = 5000 + 100t$

**b.** The student plans on spending $600 the first week and $250 in each of the following weeks for room and board and other expenses. Write a function $w(t)$
4-2 Writing Equations in Slope-Intercept Form

to express the amount of money taken out of the account each week.

c. Find \( B(t) = d(t) - w(t) \). What does this new function represent?

d. Will the student run out of money? If so, when?

**SOLUTION:**

a. Let \( d = \) the amount of money in the account and \( t = \) the number of weeks after the initial deposit. The y-intercept is the initial deposit of $5000. The slope is 100 as it represents the fixed rate of increase in the account. Write the equation in slope-intercept form.

\[
y = mx + b \\
d(t) = 100t + 5000
\]

b. Let \( w = \) the amount of money taken out of the account and \( t = \) the number of weeks after the first amount is removed. The y-intercept is the initial amount taken out of $600. The slope is the 250 as it represents the fixed rate of increase in the amount removed from the account. Write in slope-intercept form.

\[
y = mx + b \\
w(t) = 250t + 600
\]

c. \( B(t) = d(t) - w(t) \)

\[
B(t) = (100t + 5000) - (250t + 600) \\
B(t) = 4400 - 150t
\]

The new function represents the amount remaining in the account at time \( t \).

d. The student will run out of money when the amount remaining in the account equals 0.

\[
B(t) = 4400 - 150t \\
0 = 4400 - 150t \\
B(t) = 0 \\
150t = 4400 \\
t \approx 29.33
\]

So, the student will run out of money in about 29 weeks.

45. **CONCERT TICKETS**  Jackson is ordering tickets for a concert online. There is a processing fee for each order, and the tickets are $52 each. Jackson ordered 5 tickets and the cost was $275.

a. Determine the processing fee. Write a linear equation to represent the total cost \( C \) for \( t \) tickets.

b. Make a table of values for at least three other numbers of tickets.

c. Graph this equation. Predict the cost of 8 tickets.

**SOLUTION:**

a. To determine the amount of the processing fee, find the y-intercept.

\[
y = mx + b \\
275 = 52(5) + b \\
275 = 260 + b \\
275 - 260 = 260 - 260 + b \\
15 = b
\]

So, the fee is $15.

b. The total cost for the tickets can be represented by the linear equation \( C = 52t + 15 \).

<table>
<thead>
<tr>
<th>( t )</th>
<th>( C = 52t + 15 )</th>
<th>( C )</th>
<th>( (t, C) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>( C(3) = 52(3) + 15 )</td>
<td>174</td>
<td>(3, 174)</td>
</tr>
<tr>
<td>4</td>
<td>( C(4) = 52(4) + 15 )</td>
<td>223</td>
<td>(4, 223)</td>
</tr>
<tr>
<td>6</td>
<td>( C(6) = 52(6) + 15 )</td>
<td>327</td>
<td>(6, 327)</td>
</tr>
<tr>
<td>7</td>
<td>( C(7) = 52(7) + 15 )</td>
<td>379</td>
<td>(7, 379)</td>
</tr>
</tbody>
</table>

c. To graph the equation, plot the values from the table in part b. Draw a line through the points.
The cost to order 8 tickets should be another $52 more than the cost of 7 tickets. So, the cost is $379 + 52 or $431.

46. **MUSIC** A music store is offering a Frequent Buyers Club membership. The membership costs $22 per year, and then a member can buy CDs at a reduced price. If a member buys 17 CDs in one year, the cost is $111.25.

a. Determine the cost of each CD for a member.

b. Write a linear equation to represent the total cost \( y \) of a one year membership, if \( x \) CDs are purchased.

c. Graph this equation.

**SOLUTION:**

a. Write an equation in slope-intercept form to find the cost of each CD for a member where \( y = 111.25 \), \( x = 17 \), and \( b = 22 \). Then, solve for \( m \).

\[
y = mx + b \\
111.25 = m(17) + 22 \\
89.25 = 17m \\
\frac{89.25}{17} = \frac{17m}{17} \\
5.25 = m
\]

So, the cost of each CD for a member is $5.25.

b. The total cost of a one-year membership if \( x \) CDs are purchased, can be represented by the linear equation \( y = 5.25x + 22 \).

c. To graph the equation, plot the \( y \)-intercept (0, 22) and the point (17, 111.25). Draw a line through the points.
4-2 Writing Equations in Slope-Intercept Form

47. ERROR ANALYSIS  Tess and Jacinta are writing an equation of the line through (3, −2) and (6, 4). Is either of them correct? Explain your reasoning.

**Tess**

\[
\begin{align*}
m &= \frac{4 - (-2)}{6 - 3} = \frac{6}{3} = 2 \\
y &= mx + b \\
-2 &= 2(3) + b \\
b &= -8 \\
y &= 2x - 8
\end{align*}
\]

**Jacinta**

\[
\begin{align*}
m &= \frac{4 - (-2)}{6 - 3} = \frac{6}{3} = 2 \\
y &= mx + b \\
2 &= 2(3) + b \\
b &= -4 \\
y &= 2x - 4
\end{align*}
\]

**SOLUTION:**

Jacinta is correct. Both found the slope correctly. However, Tess switched the \(x\)- and \(y\)-coordinates on the point that she entered in step 3.

48. CHALLENGE  Consider three points, (3, 7), (−6, 1) and (9, \(p\)), on the same line. Find the value of \(p\) and explain your steps.

**SOLUTION:**

Find the slope of the line containing the first two points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 7}{-6 - 3} = \frac{-6}{-9} = \frac{2}{3}
\]

Use the slope and either of the first two points to solve for \(p\). Let \((x_1, y_1) = (9, p)\) and \((x_2, y_2) = (-6, 1)\).

\[
m = \frac{x_2 - x_1}{y_2 - y_1} \quad \text{Slope formula}
\]

\[
\frac{2}{3} = \frac{-6 - 1}{y_2 - y_1} \quad \text{Substitute}
\]

\[
\frac{2}{3} = \frac{-7}{y_2 - y_1} \quad \text{Simplify}
\]

\[
\frac{2}{3} \cdot (-15) = \frac{-7}{15} \cdot (-15) \quad \text{Multiply each side by } -15
\]

\[
-10 = 1 - p \quad \text{Simplify}
\]

\[
-10 - 1 = 1 - 1 - p \quad \text{Subtract 1 to each side}
\]

\[
-11 = - p \quad \text{Simplify}
\]

\[
11 - p \quad \text{Divide each side by } -1.
\]
4-2 Writing Equations in Slope-Intercept Form

49. **REASONING** Consider the standard form of a linear equation, \( Ax + By = C \).

   a. Rewrite equation in slope-intercept form.
   
   \[
   Ax + By = C \\
   Ax - Ax + By = C - Ax \\
   By = -Ax + C \\
   \frac{By}{B} = \frac{-Ax + C}{B} \\
   y = -\frac{A}{B} x + \frac{C}{B}
   \]
   
   b. The slope is \(-\frac{A}{B}\).
   
   c. The \(y\)-intercept is \(\frac{C}{B}\).
   
   d. No, \(B\) cannot equal zero.

50. **OPEN ENDED** Create a real-world situation that fits the graph shown. Define the two quantities and describe the functional relationship between them. Write an equation to represent this relationship and describe what the slope and \(y\)-intercept mean.

   ![Graph](image.png)

   **SOLUTION:**

   Sample answer: Let \(y\) represent the number of quarts of water in a pitcher, and let \(x\) represent the time in seconds that water is pouring from the pitcher. As time increases by 1 second, the amount of water in the pitcher decreases by \(\frac{1}{2}\) qt. An equation is \(y = -\frac{1}{2} x + 4\). The slope is the rate at which the water is leaving the pitcher, \(\frac{1}{2}\) quart per second. The \(y\)-intercept represents the amount of water in the pitcher when it is full, 4 qt.

51. **WRITING IN MATH** Linear equations are useful in predicting future events. Describe some factors in real-world situations that might affect the reliability of the graph in making any predictions.

   **SOLUTION:**

   Linear equations can be used to predict something that has a constant rate of change. If the problem is about something that could suddenly change, such as weather or prices, the graph could suddenly spike up.

52. **CCSS ARGUMENTS** What information is needed to write the equation of a line? Explain.

   **SOLUTION:**

   To write the equation of a line, you need to know the slope and \(y\)-intercept of the line. You can also write the equation of a line if you have the slope and the coordinates of another point on the line, or the coordinates of two points on the graph.
53. Which equation best represents the graph?

\[ y = 2x \]

\[ y = -2x \]

\[ y = \frac{1}{2}x \]

\[ y = -\frac{1}{2}x \]

**SOLUTION:**
The equation that best represents the graph is \( y = -\frac{1}{2}x \), because the slope of the graph moves down one unit and right two units, or \(-\frac{1}{2}\). So, the correct choice is D.

54. Roberto receives an employee discount of 12%. If he buys a $355 item at the store, what is his discount to the nearest dollar?

F $3

G $4

H $30

J $43

**SOLUTION:**
\[
d = 0.12 \cdot 355
\]
\[
d = 42.6
\]
Rounded to the nearest dollar, the discount is $43.

So, the correct choice is J.

55. **GEOMETRY** The midpoints of the sides of the large square are joined to form a smaller square. What is the area of the smaller square?

\[ A \]

\[ B \]

\[ C \]

\[ D \]

**SOLUTION:**
Let the length of a side of the smaller square be represented by \( c \). So, the formula for area of the square would be \( A = c^2 \). Use the Pythagorean theorem to find the length of a side of the smaller square.

\[
a^2 + b^2 = c^2
\]
\[
(8)^2 + (8)^2 = c^2
\]
\[
64 + 64 = c^2
\]
\[
128 = c^2
\]
So, since \( A = c^2 \), \( A = 128 \). The correct choice is B.
4-2 Writing Equations in Slope-Intercept Form

56. SHORT RESPONSE If \( \frac{5(x+4)}{2} + 7 = 37 \), what is the value of \( 3x - 9 \)?

**SOLUTION:**
Solve for \( x \).

\[
\frac{5(x+4)}{2} + 7 = 37
\]
\[
\frac{5(x+4)}{2} + 7 - 7 = 37 - 7 \quad \text{Subtract 7 from each side}
\]
\[
\frac{5(x+4)}{2} = 30 \quad \text{Simplify}
\]
\[
2 \left( \frac{5(x+4)}{2} \right) = 2(30) \quad \text{Multiply each side by 2}
\]
\[
5(x+4) = 60 \quad \text{Simplify}
\]
\[
\frac{5(x+4)}{5} = \frac{60}{5} \quad \text{Divide each side by 5}
\]
\[
x + 4 = 12 \quad \text{Simplify}
\]
\[
x + 4 - 4 = 12 - 4 \quad \text{Subtract 4 from each side}
\]
\[
x = 8 \quad \text{Simplify}
\]

Substitute 8 for \( x \) in the expression.

\[
3x - 9 = 3(8) - 9 \quad \text{Replace \( x \) with 8}
\]
\[
= 24 - 9 \quad \text{Simplify}
\]
\[
= 15 \quad \text{Simplify}
\]

**Graph each equation.**

57. \( y = 3x + 2 \)

**SOLUTION:**
To graph the equation, plot the \( y \)-intercept (0, 2).
Then move up 3 units and right 1 unit. Plot the point.
Draw a line through the two points.

58. \( y = -4x + 2 \)

**SOLUTION:**
To graph the equation, plot the \( y \)-intercept (0, 2).
Then move down 4 units and right 1 unit. Plot the point.
Draw a line through the two points.

59. \( 3y = 2x + 6 \)

**SOLUTION:**
Write the equation in slope-intercept form.

\[
3y = 2x + 6
\]
\[
\frac{3y}{3} = \frac{2x + 6}{3}
\]
\[
y = \frac{2}{3}x + 2
\]

To graph the equation, plot the \( y \)-intercept (0, 2).
Then move up 2 units and right 3 units. Plot the point.
Draw a line through the two points.
4-2 Writing Equations in Slope-Intercept Form

60. \( y = \frac{1}{2}x + 6 \)

SOLUTION:
To graph the equation, plot the y-intercept (0, 6). Then move up 1 unit and right 2 units. Plot the point. Draw a line through the two points.

61. \( 3x + y = -1 \)

SOLUTION:
Write the equation in slope-intercept form.

\[
3x + y = -1 \\
3x - 3x + y = -3x - 1 \\
y = -3x - 1
\]

To graph the equation, plot the y-intercept (0, -1). Then move down 3 units and right 1 unit. Plot the point. Draw a line through the two points.

62. \( 2x + 3y = 6 \)

SOLUTION:
Write the equation in slope-intercept form.

\[
2x + 3y = 6 \\
2x - 2x + 3y = -2x + 6 \\
\frac{3y}{3} = \frac{-2x + 6}{3} \\
y = \frac{-2}{3}x + 2
\]

To graph the equation, plot the y-intercept (0, 2). Then move down 2 units and right 3 units. Plot the point. Draw a line through the two points.

Write an equation in function notation for each relation.

63.

SOLUTION:
Looking at the graph, the y-intercept is 0, and the slope is -2 (down 2 units, right 1 unit). Write the linear equation in slope-intercept form. Then, write as a function of \( x \).

\[
y = mx + b \\
y = -2x \\
f(x) = -2x
\]
Write an equation of the line that passes through the given point and has the given slope.

1. (3, −3), slope 3

SOLUTION:

Solve. Check.

69.

SOLUTION:

Solve. Check.

70.

SOLUTION:

Solve.

65. METEOROLOGY The distance \( d \) in miles that the sound of thunder travels in \( t \) seconds is given by the equation \( d = 0.21t \).

a. Graph the equation.

b. Use the graph to estimate how long it will take you to hear thunder from a storm 3 miles away.

SOLUTION:

a. In the equation, the \( y \)-intercept is 0 and the slope is 0.21. To graph the equation, plot the \( y \)-intercept (0, 0). Make a table of values to add a few more points.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1.05</td>
</tr>
<tr>
<td>10</td>
<td>2.10</td>
</tr>
<tr>
<td>15</td>
<td>3.15</td>
</tr>
<tr>
<td>20</td>
<td>4.20</td>
</tr>
</tbody>
</table>

b. Follow the line of the graph until \( y = 3 \). The \( x \)-coordinate is about 14. So, according to the graph, it will take you about 14 seconds to hear thunder from a storm 3 miles away.
Solve each equation. Check your solution.

66. \(-5t - 2.2 = -2.9\)

\textbf{SOLUTION:}

Solve.

\[-5t - 2.2 = -2.9\]
\[-5t - 2.2 + 2.2 = -2.9 + 2.2\]
\[-5t = 0.7\]
\[-5t = 0.7\]
\[-\frac{5t}{-5} = -\frac{0.7}{-5}\]

\[t = 0.14\]

Check.

\[-5(0.14) - 2.2 = -2.9\]
\[-0.7 - 2.2 = -2.9\]
\[-2.9 = -2.9\,\checkmark\]

67. \(-5.5a - 43.9 = 77.1\)

\textbf{SOLUTION:}

Solve.

\[-5.5a - 43.9 = 77.1\]
\[-5.5a - 43.9 + 43.9 = 77.1 + 43.9\]
\[-5.5a = 121\]
\[-\frac{5.5a}{-5.5} = \frac{121}{-5.5}\]

\[a = -22\]

Check.

\[-5.5(-22) - 43.9 = 77.1\]
\[-5.5(-22) - 43.9 = ? 77.1\]
\[121 - 43.9 = ? 77.1\]
\[77.1 = 77.1\,\checkmark\]

68. \(4.2r + 7.14 = 12.6\)

\textbf{SOLUTION:}

Solve.

\[4.2r + 7.14 = 12.6\]
\[4.2r + 7.14 - 7.14 = 12.6 - 7.14\]
\[4.2r = 5.46\]
\[\frac{4.2r}{4.2} = \frac{5.46}{4.2}\]

\[r = 1.3\]

Check.

\[4.2r + 7.14 = 12.6\]
\[4.2(1.3) + 7.14 = ? 12.6\]
\[5.46 + 7.14 = ? 12.6\]
\[12.6 = 12.6\,\checkmark\]

69. \(-14 - \frac{n}{9} = 9\)

\textbf{SOLUTION:}

Solve.

\[-14 - \frac{n}{9} = 9\]
\[-14 + 14 - \frac{n}{9} = 9 + 14\]
\[-\frac{n}{9} = 23\]
\[-9\left(-\frac{n}{9}\right) = -9(23)\]

\[n = -207\]

Check.

\[-14 - \frac{-207}{9} = 9\]
\[-14 + 23 = ? 9\]
\[9 = 9\,\checkmark\]
4-2 Writing Equations in Slope-Intercept Form

70. \(-\frac{8 \cdot b - (-9)}{-10} = 17\)

\[
SOLUTION:
\]
Solve.
\[
-\frac{8 \cdot b - (-9)}{-10} = 17
\]
\[
-10 \left( -\frac{8 \cdot b - (-9)}{-10} \right) = -10(17)
\]
\[
-8b + 9 = -170
\]
\[
-8b + 9 - 9 = -170 - 9
\]
\[
-8b = -179
\]
\[
\frac{-8b}{-8} = \frac{-179}{-8}
\]
\[
\begin{align*}
b &= 22.375
\end{align*}
\]
Check.
\[
\frac{-8b - (-9)}{-10} = 17
\]
\[
-8(22.375) - (-9) \div -10 \\
-179 - (-9) \div -10 \\
170 - (-9) \div -10 \\
170 \div -10 \\
17 = 17\]

71. \(9.5x + 11 - 7.5x = 14\)

\[
SOLUTION:
\]
Solve.
\[
9.5x + 11 - 7.5x = 14
\]
\[
2x + 11 = 14
\]
\[
2x + 11 - 11 = 14 - 11
\]
\[
2x = 3
\]
\[
\frac{2x}{2} = \frac{3}{2}
\]
\[
x = 1.5
\]
Check.
\[
9.5x + 11 - 7.5x = 14
\]
\[
9.5(1.5) + 11 - 7.5(1.5) = 14
\]
\[
14.25 + 11 - 11.25 = 14
\]
\[
14 = 14
\]

Find the value of \(r\) so the line through each pair of points has the given slope.

72. \((6, -2), (r, -6), m = 4\)

\[
SOLUTION:
\]
Solve for \(r\) using the formula for slope. Replace \(m\) with 4, \((x_1, y_1)\) with \((6, -2)\), and \((x_2, y_2)\) with \((4, -6)\).
\[
m = \frac{y_2 - y_1}{x_2 - x_1} \quad \text{Slope Formula}
\]
\[
4 = \frac{-6 - (-2)}{r - 6} \quad \text{Substitute}
\]
\[
4 = \frac{-4}{r - 6} \quad \text{Simplify}
\]
\[
4(r - 6) = -4 \left( \frac{r - 6}{r - 6} \right) \quad \text{Multiply}
\]
\[
4(r - 6) = -4 \quad \text{Distributive Property}
\]
\[
4r - 24 = -4 \quad \text{Simplify}
\]
\[
4r - 24 + 24 = -4 + 24 \quad \text{Add 24 to each side}
\]
\[
4r = 20 \quad \text{Simplify}
\]
\[
\frac{4r}{4} = \frac{20}{4} \quad \text{Divide each side by 4}
\]
\[
r = 5 \quad \text{Simplify}
\]

73. \((8, 10), (r, 4), m = 6\)

\[
SOLUTION:
\]
Solve for \(r\) using the formula for slope.
\[
m = \frac{y_2 - y_1}{x_2 - x_1} \quad \text{Slope Formula}
\]
\[
6 = \frac{4 - 10}{r - 8} \quad \text{Substitute}
\]
\[
6 = \frac{-6}{r - 8} \quad \text{Simplify}
\]
\[
6(r - 8) = -6 \left( \frac{r - 8}{r - 8} \right) \quad \text{Multiply}
\]
\[
6(r - 8) = -6 \quad \text{Distributive Property}
\]
\[
6r - 48 = -6 \quad \text{Simplify}
\]
\[
6r - 48 + 48 = -6 + 48 \quad \text{Add 48 to each side}
\]
\[
6r = 42 \quad \text{Simplify}
\]
\[
\frac{6r}{6} = \frac{42}{6} \quad \text{Divide}
\]
\[
r = 7 \quad \text{Simplify}
74. $(7, -10), (r, 4), m = -3$

**SOLUTION:**
Solve for $r$ using the formula for slope.

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
-3 = \frac{4 - (-10)}{r - 7}
\]

\[
-3 = \frac{14}{r - 7}
\]

Multiply.

\[
-3(r - 7) = 14
\]

Divide.

\[
r - 7 = \frac{14}{3}
\]

\[
r = \frac{29}{3}
\]

75. $(6, 2), (9, r), m = -1$

**SOLUTION:**
Solve for $r$ using the formula for slope.

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
-1 = \frac{r - 2}{9 - 6}
\]

Substitute.

\[
-1 = \frac{r - 2}{3}
\]

Simplify.

\[
3(-1) = 3\left(\frac{r - 2}{3}\right)
\]

Multiply.

\[
-3 = r - 2
\]

Simplify.

\[
-3 + 2 = r - 2 + 2
\]

Add.

\[
-1 = r
\]

Simplify.

76. $(9, r), (6, 3), m = -\frac{1}{3}$

**SOLUTION:**
Solve for $r$ using the formula for slope.

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
-\frac{1}{3} = \frac{3 - r}{6 - 9}
\]

Substitute.

\[
-\frac{1}{3} = \frac{3 - r}{-3}
\]

Simplify.

\[
-3 \left(-\frac{1}{3}\right) = -3 \left(\frac{3 - r}{-3}\right)
\]

Multiply.

\[
1 = 3 - r
\]

Divide.

\[
1 - 3 = 3 - 3 - r
\]

Subtract.

\[
-2 = - r
\]

Simplify.

\[
2 = r
\]

77. $(5, r), (2, -3), m = \frac{4}{3}$

**SOLUTION:**
Solve for $r$ using the formula for slope.

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
\frac{4}{3} = \frac{r - 2}{2 - 5}
\]

Substitute.

\[
\frac{4}{3} = \frac{3 - r}{-3}
\]

Simplify.

\[
-3 \left(\frac{4}{3}\right) = -3 \left(\frac{3 - r}{-3}\right)
\]

Multiply.

\[
-4 = -3 - r
\]

Simplify.

\[
-4 + 3 = -3 + 3 - r
\]

Add.

\[
-1 = - r
\]

Simplify.

\[
1 = r
\]

Divide.
4-3 Writing Equations in Point-Slope Form

Write an equation in point-slope form for the line that passes through the given point with the slope provided. Then graph the equation.

1. \((-2, 5)\), slope \(-6\)

**SOLUTION:**
Write the equation in point-slope form.

\[ y - y_1 = m(x - x_1) \]
\[ y - 5 = -6(x - (-2)) \]
\[ y - 5 = -6(x + 2) \]

To graph the equation, plot the point given in the problem \((-2, 5)\). The slope is \(\frac{\text{rise}}{\text{run}} = \frac{-6}{1}\). From \((-2, 5)\), move down 6 units and right 1 unit. Plot the point. Draw a line through the two points.

2. \((-2, -8)\), slope \(\frac{5}{6}\)

**SOLUTION:**
Write the equation in point-slope form.

\[ y - y_1 = m(x - x_1) \]
\[ y - (-8) = \frac{5}{6}(x - (-2)) \]
\[ y + 8 = \frac{5}{6}(x + 2) \]

To graph the equation, plot the point given in the problem \((-2, -8)\). The slope is \(\frac{\text{rise}}{\text{run}} = \frac{5}{6}\). From \((-2, -8)\), move up 5 units and right 6 units. Plot the point. Draw a line through the two points.
### 4-3 Writing Equations in Point-Slope Form

3. \((4, 3), \text{ slope } -\frac{1}{2}\)

**SOLUTION:**
Write the equation in point-slope form.

\[ y - y_1 = m(x - x_1) \]
\[ y - 3 = -\frac{1}{2}(x - 4) \]

To graph the equation, plot the point given in the problem \((4, 3)\). The slope is \(\frac{\text{rise}}{\text{run}} = -\frac{1}{2}\). From \((4, 3)\), move down 1 unit and right 2 units. Plot the point. Draw a line through the two points.

![Graph of the line](image)

Write each equation in standard form.
4. \(y + 2 = \frac{7}{8}(x - 3)\)

**SOLUTION:**
\[
\begin{align*}
y + 2 &= \frac{7}{8}(x - 3) & \text{Original equation} \\
y + 2 &= \frac{7}{8}x - \frac{21}{8} & \text{Distributive Property} \\
8(y + 2) &= 8\left(\frac{7}{8}x - \frac{21}{8}\right) & \text{Multiply each side by 8} \\
8y + 16 &= 7x - 21 & \text{Distributive Property} \\
8y + 16 - 16 &= 7x - 21 - 16 & \text{Subtract 16 from each side} \\
8y &= 7x - 37 & \text{Simplify} \\
8y - 7x &= 7x - 7x - 37 & \text{Subtract } 7x \text{ from each side} \\
-7x + 8y &= -37 & \text{Simplify} \\
7x - 8y &= -37 & \text{Multiply each side by } -1.
\end{align*}
\]

5. \(y + 7 = -5(x + 3)\)

**SOLUTION:**
\[
\begin{align*}
y + 7 &= -5(x + 3) & \text{Original equation} \\
y + 7 &= -5x - 15 & \text{Distributive Property} \\
y + 7 + 5x &= -5x - 15 & \text{Add } 5x \text{ to each side} \\
y + 7 + 5x &= -15 & \text{Simplify} \\
5x + y + 7 &= -15 - 7 & \text{Subtract } 7 \text{ from each side} \\
5x + y &= -22 & \text{Simplify}.
\end{align*}
\]

6. \(y + 2 = \frac{5}{3}(x + 6)\)

**SOLUTION:**
\[
\begin{align*}
y + 2 &= \frac{5}{3}(x + 6) & \text{Original equation} \\
y + 2 &= \frac{5}{3}x + 10 & \text{Distributive Property} \\
3(y + 2) &= 3\left(\frac{5}{3}x + 10\right) & \text{Multiply each side by 3} \\
3y + 6 &= 5x + 30 & \text{Simplify} \\
3y + 6 &= 5x + 30 & \text{Simplify} \\
-5x + 3y + 6 &= -5x - 5x + 30 & \text{Subtract } 5x \text{ from each side} \\
-5x + 3y + 6 &= 30 & \text{Simplify} \\
-5x + 3y + 6 - 6 &= 30 - 6 & \text{Subtract 6 from each side} \\
-5x + 3y &= 24 & \text{Simplify} \\
5x - 3y &= -24 & \text{Multiply each side by } -1.
\end{align*}
\]

Write each equation in slope-intercept form.
7. \(y - 10 = 4(x + 6)\)

**SOLUTION:**
\[
\begin{align*}
y - 10 &= 4(x + 6) & \text{Original equation} \\
y - 10 &= 4x + 24 & \text{Distributive Property} \\
y - 10 + 10 &= 4x + 24 + 10 & \text{Add 10 to each side} \\
y &= 4x + 34 & \text{Simplify}.
\end{align*}
\]

8. \(y - 7 = -\frac{3}{4}(x + 5)\)

**SOLUTION:**
\[
\begin{align*}
y - 7 &= -\frac{3}{4}(x + 5) & \text{Original equation} \\
y - 7 &= -\frac{3}{4}x - \frac{15}{4} & \text{Distributive Property} \\
y - 7 + 7 &= -\frac{3}{4}x - \frac{15}{4} + 7 & \text{Add 7 to each side} \\
y &= -\frac{3}{4}x + \frac{15}{4} + \frac{28}{4} & \text{Simplify and rewrite 7 as a fraction with a denominator of 4} \\
y &= -\frac{3}{4}x + \frac{43}{4} & \text{Simplify}.
\end{align*}
\]

9. \(y - 9 = x + 4\)

**SOLUTION:**
\[
\begin{align*}
y - 9 &= x + 4 & \text{Original equation} \\
y - 9 + 9 &= x + 4 + 9 & \text{Add 9 to each side} \\
y &= x + 13 & \text{Simplify}.
\end{align*}
\]
10. **GEOMETRY** Use right triangle $FGH$.

![Right Triangle FGH](image)

---

a. Write an equation in point-slope form for the line containing $GH$.

b. Write the standard form of the line containing $GH$.

**SOLUTION:**

a. Find two points that are on $GH$. G has the coordinates (-3, 7) and H has the coordinates (4, 1). Find the slope of the line containing the given points.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7 - 1}{-3 - 4} = \frac{6}{-7} = -\frac{6}{7}$$

Use the slope and either of the two points to write the equation in point-slope form.

$$y - y_1 = m(x - x_1) \quad \text{Point-slope formula}$$

$$y - 7 = -\frac{6}{7}(x + 3) \quad \text{Replace } x_1 \text{ with } -3 \text{ and } y_1 \text{ with } 7$$

$$y - 7 = -\frac{6}{7}(x + 3) \quad \text{Simplify}$$

b. Write the equation in standard form.

$$y - 7 = -\frac{6}{7}(x + 3) \quad \text{Original equation}$$

$$y - 7 = -\frac{6}{7}x - \frac{18}{7} \quad \text{Distributive Property}$$

$$7(y - 7) = 7\left(-\frac{6}{7}x - \frac{18}{7}\right) \quad \text{Multiply each side by 7}$$

$$7y - 49 = -6x - 18 \quad \text{Simplify}$$

$$7y + 6x - 49 = -6x + 6x - 18 \quad \text{Add } 6x \text{ to each side}$$

$$6x + 7y - 49 = -18 + 49 \quad \text{Simplify}$$

$$6x + 7y = 31 \quad \text{Add } 49 \text{ to each side}$$

$$6x + 7y = 31 \quad \text{Simplify}$$
12. \((2, -1), m = -3\)

**SOLUTION:**
Write the equation in point-slope form.

\[ y - y_1 = m(x - x_1) \]
\[ y - (-1) = -3(x - 2) \]
\[ y + 1 = -3(x - 2) \]

To graph the equation, plot the point given in the problem \((2, -1)\). The slope is \(\frac{\text{rise}}{\text{run}} = -\frac{3}{1}\). From \((2, -1)\), move down 3 units and right 1 unit. Plot the point. Draw a line through the two points.

13. \((-6, -3), m = -1\)

**SOLUTION:**
Write the equation in point-slope form.

\[ y - y_1 = m(x - x_1) \]
\[ y - (-3) = -1(x - 6) \]
\[ y + 3 = -1(x + 6) \]

To graph the equation, plot the point given in the problem \((-6, -3)\). The slope is \(\frac{\text{rise}}{\text{run}} = -\frac{1}{1}\). From \((-6, -3)\), move down 1 unit and right 1 unit. Plot the point. Draw a line through the two points.
14. \((-7, 6), \, m = 0\)

**SOLUTION:**
Write the equation in point-slope form.

\[ y - y_1 = m(x - x_1) \]
\[ y - 6 = 0(x - (-7)) \]
\[ y - 6 = 0(x + 7) \]
\[ y - 6 = 0 \]

To graph the equation, plot the point given in the problem \((-7, 6)\). The slope is 0. Draw a line through the points with \(y\)-coordinate 6.

15. \((-2, 11), \, m = \frac{4}{3}\)

**SOLUTION:**
Write the equation in point-slope form.

\[ y - y_1 = m(x - x_1) \]
\[ y - 11 = \frac{4}{3}(x - (-2)) \]
\[ y - 11 = \frac{4}{3}(x + 2) \]

To graph the equation, plot the point given in the problem \((-2, 11)\). The slope is \(\frac{\text{rise}}{\text{run}} = \frac{4}{3}\). From \((-2, 11)\), move up 4 units and right 3 units. Plot the point. Draw a line through the two points.
4-3 Writing Equations in Point-Slope Form

16. \((-8, -6), m = \frac{-5}{8}\)

**SOLUTION:**
Write the equation in point-slope form.

\[ y - y_1 = m(x - x_1) \]
\[ y - (-6) = \frac{-5}{8}(x - (-8)) \]
\[ y + 6 = \frac{-5}{8}(x + 8) \]

To graph the equation, plot the point given in the problem \((-8, -6)\). The slope is \(\frac{\text{rise}}{\text{run}} = \frac{-5}{8}\). From \((-8, -6)\), move down 5 units and right 8 units. Plot the point. Draw a line through the two points.

![Graph of the equation](image)

17. \((-2, -9), m = \frac{-7}{5}\)

**SOLUTION:**
Write the equation in point-slope form.

\[ y - y_1 = m(x - x_1) \]
\[ y - (-9) = \frac{-7}{5}(x - (-2)) \]
\[ y + 9 = \frac{-7}{5}(x + 2) \]

18. \((-6, 0)\), horizontal line

**SOLUTION:**
Write the equation in point-slope form. An equation whose graph is a horizontal line has a slope of 0.

\[ y - y_1 = m(x - x_1) \]
\[ y - 0 = 0(x - (-6)) \]
\[ y = 0 \]

**Write each equation in standard form.**

19. \(y - 10 = 2(x - 8)\)

**SOLUTION:**
- \(\frac{\text{Original equation}}{\text{Original equation}}\)
- \(\frac{\text{Distributive Property}}{\text{Distributive Property}}\)
- \(\frac{\text{Subtract 2x from each side}}{\text{Subtract 2x from each side}}\)
- \(\frac{\text{Simplify}}{\text{Simplify}}\)
- \(\frac{\text{Add 10 to each side}}{\text{Add 10 to each side}}\)
- \(\frac{\text{Simplify}}{\text{Simplify}}\)
- \(\frac{\text{Multiply each side by \(-1\)}}{\text{Multiply each side by \(-1\)}}\)
- \(\frac{\text{Simplify}}{\text{Simplify}}\)

\[ 2x - y = 6 \]

20. \(y - 6 = -3(x + 2)\)

**SOLUTION:**
- \(\frac{\text{Original equation}}{\text{Original equation}}\)
- \(\frac{\text{Distributive Property}}{\text{Distributive Property}}\)
- \(\frac{\text{Add 3x to each side}}{\text{Add 3x to each side}}\)
- \(\frac{\text{Simplify}}{\text{Simplify}}\)
- \(\frac{\text{Add 6 to each side.}}{\text{Add 6 to each side.}}\)
- \(\frac{\text{Simplify}}{\text{Simplify}}\)

\[ 3x + y = 6 \]

21. \(y - 9 = -6(x + 9)\)

**SOLUTION:**
- \(\frac{\text{Original equation}}{\text{Original equation}}\)
- \(\frac{\text{Distributive Property}}{\text{Distributive Property}}\)
- \(\frac{\text{Add 6x to each side.}}{\text{Add 6x to each side.}}\)
- \(\frac{\text{Simplify}}{\text{Simplify}}\)
- \(\frac{\text{Add 9 to each side.}}{\text{Add 9 to each side.}}\)
- \(\frac{\text{Simplify}}{\text{Simplify}}\)

\[ 6x + y = -45 \]
22. \( y + 4 = \frac{2}{3}(x + 7) \)

**SOLUTION:**

\[
\begin{align*}
 y + 4 &= \frac{2}{3}(x + 7) & \text{Original equation} \\
 y + 4 &= \frac{2}{3}x + \frac{14}{3} & \text{Distributive Property} \\
 3(y + 4) &= 2x + 14 & \text{Multiply each side by 3.} \\
 3y + 12 &= 2x + 14 & \text{Simplify} \\
 3y + 12 - 2x &= 2x + 14 - 2x & \text{Subtract } 2x \text{ from each side} \\
 -2x + 3y + 12 &= 14 - 12 & \text{Simplify} \\
 -2x + 3y &= 2 & \text{Subtract 12 from each side} \\
 & & \text{Simplify} \\
 -1(-2x + 3y) &= -1 \cdot 2 & \text{Multiply each side by } -1. \\
 2x - 3y &= -2 & \text{Simplify.}
\end{align*}
\]

23. \( y + 7 = \frac{0}{10}(x + 3) \)

**SOLUTION:**

\[
\begin{align*}
 y + 7 &= \frac{0}{10}(x + 3) & \text{Original equation} \\
 y + 7 &= \frac{0}{10}x + \frac{3}{10} & \text{Distributive Property} \\
 10(y + 7) &= 10\left(\frac{0}{10}x + \frac{3}{10}\right) & \text{Multiply each side by 10.} \\
 10y + 70 &= 0x + 3 & \text{Simplify.} \\
 10y + 70 &= 0x + 3 & \text{Add 0x.} \\
 10y &= -3 & \text{Subtract 70 from each side} \\
 y &= -\frac{3}{10} & \text{Subtract 10y from each side} \\
 & & \text{Simplify.} \\
 -1(-10y) &= -1(-\frac{3}{10}) & \text{Multiply each side by } -1. \\
 10y &= 3 & \text{Simplify.}
\end{align*}
\]

24. \( y + 7 = -\frac{3}{2}(x + 1) \)

**SOLUTION:**

\[
\begin{align*}
 y + 7 &= -\frac{3}{2}(x + 1) & \text{Original equation} \\
 y + 7 &= -\frac{3}{2}x - \frac{3}{2} & \text{Distributive Property} \\
 2(y + 7) &= 2\left(-\frac{3}{2}x - \frac{3}{2}\right) & \text{Multiply each side by 2.} \\
 2y + 14 &= -3x - 3 & \text{Simplify} \\
 2y + 3x + 14 &= -3x + 3 & \text{Add 3x to each side.} \\
 3x + 2y + 14 &= -3 & \text{Simplify} \\
 3x + 2y + 14 &= -14 & \text{Subtract 14 from each side} \\
 3x + 2y &= -17 & \text{Subtract 14 from each side} \\
 & & \text{Simplify.}
\end{align*}
\]

25. \( 2y + 3 = -\frac{1}{3}(x - 2) \)

**SOLUTION:**

\[
\begin{align*}
 2y + 3 &= -\frac{1}{3}(x - 2) & \text{Original equation} \\
 2y + 3 &= -\frac{1}{3}x + \frac{2}{3} & \text{Distributive Property} \\
 3(2y + 3) &= 3\left(-\frac{1}{3}x + \frac{2}{3}\right) & \text{Multiply each side by 3.} \\
 6y + 9 &= -x + 2 & \text{Simplify} \\
 6y + x + 9 &= -x + x + 2 & \text{Add } x \text{ to each side.} \\
 x + 6y + 9 &= 2 & \text{Simplify} \\
 x + 6y + 9 &= -2 + 9 & \text{Subtract 9 from each side} \\
 x + 6y &= 7 & \text{Simplify.}
\end{align*}
\]

26. \( 4y - 5x = 3(4x - 2y + 1) \)

**SOLUTION:**

\[
\begin{align*}
 4y - 5x &= 3(4x - 2y + 1) & \text{Original equation} \\
 4y - 5x &= 12x - 6y + 3 & \text{Distributive Property} \\
 -5x - 4y + 5x - 12x &= -6y + 12x - 6y + 3 & \text{Subtract } 12x \text{ from each side} \\
 -17x + 4y &= -6y + 3 & \text{Simplify} \\
 -17x + 4y + 6y &= -6y + 3 + 6y & \text{Add } 6y \text{ to each side} \\
 -17x + 10y &= 3 & \text{Simplify} \\
 -17x - 10y &= -3 & \text{Multiply by } -1.
\end{align*}
\]

Write each equation in slope-intercept form.

27. \( y - 6 = -2(x - 7) \)

**SOLUTION:**

\[
\begin{align*}
 y - 6 &= -2(x - 7) & \text{Original equation} \\
 y - 6 &= -2x + 14 & \text{Simplify} \\
 y + 6 + 2x &= -2x + 14 + 2x + 6 & \text{Subtract } -2x \text{ from each side} \\
 y &= -2x + 20 & \text{Simplify.}
\end{align*}
\]

28. \( y - 11 = 3(x + 4) \)

**SOLUTION:**

\[
\begin{align*}
 y - 11 &= 3(x + 4) & \text{Original equation} \\
 y - 11 &= 3x + 12 & \text{Simplify} \\
 y - 11 + 11 &= 3x + 11 + 11 & \text{Subtract } 11 \text{ from each side} \\
 y &= 3x + 23 & \text{Simplify.}
\end{align*}
\]

29. \( y + 5 = -6(x + 7) \)

**SOLUTION:**

\[
\begin{align*}
 y + 5 &= -6(x + 7) & \text{Original equation} \\
 y + 5 &= -6x - 42 & \text{Simplify} \\
 y + 5 + 6 &= -6x - 42 + 6 & \text{Subtract } 6 \text{ from each side} \\
 y &= -6x - 47 & \text{Simplify.}
\end{align*}
\]

30. \( y - 1 = \frac{4}{5}(x + 5) \)

**SOLUTION:**

\[
\begin{align*}
 y - 1 &= \frac{4}{5}(x + 5) & \text{Original equation} \\
 y - 1 &= \frac{4}{5}x + \frac{4}{5} & \text{Simplify} \\
 y - 1 + 1 &= \frac{4}{5}x + 4 + 1 & \text{Subtract } 1 \text{ from each side} \\
 y &= \frac{4}{5}x + 5 & \text{Simplify.}
\end{align*}
\]
35. **MOVIE RENTALS** The number of copies of a movie rented at a video kiosk decreased at a constant rate of 5 copies per week. The 6th week after the movie was released, 4 copies were rented. How many copies were rented during the second week?

**SOLUTION:**
The slope is $-5$, since the number or copies rented decreases 5 copies per week. Use the data from week 6 as a data point on the graph. It would be $(6, 4)$. Use the Point-slope form to find the equation.

$$y - y_1 = m(x - x_1) \quad \text{Point-slope form}$$
$$y - 4 = -5(x - 6) \quad \text{Substitute}$$
$$y - 4 = -5x + 30 \quad \text{Distributive Property}$$
$$y - 4 + 4 = -5x + 30 + 4 \quad \text{Add 4 to each side}$$
$$y = -5x + 34 \quad \text{Simplify}$$

Use the equation to find the value of $y$ when $x$ is 2.

$$y = -5x + 34 \quad \text{Original equation}$$
$$y = -5(2) + 34 \quad \text{Replace } x \text{ with } 2.$$
$$y = -10 + 34 \quad \text{Simplify}$$
$$y = 24 \quad \text{Simplify}.$$

So, 24 movies were rented during the second week.
4-3 Writing Equations in Point-Slope Form

36. CCSS REASONING  A company offers premium cable for $39.95 per month plus a one-time setup fee. The total cost for setup and 6 months of service is $264.70.

a. Write an equation in point-slope form to find the total price $y$ for any number of months $x$. (Hint: The point (6, 264.70) is a solution to the equation.)

**SOLUTION:**

\[ y - 264.70 = 39.95(x - 6) \]

b. Write the equation in slope-intercept form.

**SOLUTION:**

\[ y = 39.95x + 25 \]

c. The setup fee is the constant, or $y$-intercept, which is $25.

Write an equation for the line described in standard form.

37. through (−1, 7) and (8, −2)

**SOLUTION:**

First, find the slope.

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \quad \text{Slope formula} \]
\[ m = \frac{-2 - 7}{8 - (-1)} \quad (x_1, y_1) = (-1, 7), (x_2, y_2) = (8, -2) \]
\[ m = \frac{-9}{9} \quad m = -1 \quad \text{Simplify} \]

Write the equation in point-slope formula and change to standard form.

\[ y - y_1 = m(x - x_1) \quad \text{Point-slope form} \]
\[ y - (-2) = -1(x - 8) \quad m = -1, (x_1, y_1) = (8, -2) \]
\[ y + 2 = -x + 8 \quad \text{Distributive Property} \]
\[ x + y + 2 = 8 \quad \text{Add} x \text{to each side} \]
\[ x + y = 6 \quad \text{Subtract} 2 \text{from each side} \]

38. through (−4, 3) with $y$-intercept 0

**SOLUTION:**

First, find the slope of the line.

\[ y = mx + b \quad \text{Slope-intercept form} \]
\[ 3 = m(-4) + 0 \quad \text{Substitute} \]
\[ 3 = -4m \quad \text{Simplify} \]
\[ -\frac{3}{4} = m \quad \text{Divide} \]

Use the point-slope form to write the equation in standard form.

\[ y - y_1 = m(x - x_1) \quad \text{Point-slope form} \]
\[ y - 3 = -\frac{3}{4}(x - (-4)) \quad m = -\frac{3}{4}, (x_1, y_1) = (-4, 3) \]
\[ y - 3 = -\frac{3}{4}x + 3 \quad \text{Simplify} \]
\[ 4y - 12 = -3x + 12 \quad \text{Multiply each side by} 4 \]
\[ 4y - 12 = -3x - 12 \quad \text{Distributive Property} \]
\[ 3x + 4y - 12 = -12 \quad \text{Add} 3x \text{to each side} \]
\[ 3x + 4y = 0 \quad \text{Add} 12 \text{to each side} \]

39. with $x$-intercept 4 and $y$-intercept 5

**SOLUTION:**

Find the slope of the line passing through (4, 0) and (0, 5).

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \quad \text{Slope formula} \]
\[ m = \frac{5 - 0}{0 - 4} \quad (x_1, y_1) = (4, 0), (x_2, y_2) = (0, 5) \]
\[ m = -\frac{5}{4} \quad \text{Simplify} \]

Use the slope-intercept form to write the equation in standard form.

\[ y = mx + b \quad \text{Slope-intercept form} \]
\[ y = -\frac{5}{4}x + 5 \quad m = -\frac{5}{4}, b = 5 \]
\[ 4y = 4\left(-\frac{5}{4}x + 5\right) \quad \text{Multiply each side by} 4 \]
\[ 4y = -5x + 20 \quad \text{Simplify} \]
\[ 5x + 4y = 20 \quad \text{Add} 5x \text{to each side} \]
4-3 Writing Equations in Point-Slope Form

Write an equation in point-slope form for each line.

40. 
\[ y - y_1 = m(x - x_1) \]
\[ y - 3 = 4(x - 1) \]

**SOLUTION:**
\[ y - y_1 = m(x - x_1) \]
\[ y - 3 = 4(x - 1) \]

41. 
\[ m = \frac{3}{2} \]
\[ (-4, -1) \]

**SOLUTION:**
\[ y - y_1 = m(x - x_1) \]
\[ y - (-1) = \frac{3}{2}(x - (-4)) \]
\[ y + 1 = \frac{3}{2}(x + 4) \]

42. 
\[ m = \frac{4}{3} \]
\[ (-3, 7) \]

**SOLUTION:**
\[ y - y_1 = m(x - x_1) \]
\[ y - 7 = \frac{4}{3}(x - (-3)) \]
\[ y - 7 = \frac{4}{3}(x + 3) \]

Write each equation in slope-intercept form.

43. 
\[ y + \frac{3}{5} = x - \frac{2}{5} \]

**SOLUTION:**
\[ y + \frac{3}{5} = x - \frac{2}{5} \]
\[ y + \frac{3}{5} - \frac{2}{5} = x - \frac{2}{5} - \frac{2}{5} \]
\[ y = x - 1 \]

44. 
\[ y - \frac{7}{2} = \frac{1}{2}(x - 4) \]

**SOLUTION:**
\[ y - \frac{7}{2} = \frac{1}{2}(x - 4) \]
\[ y - \frac{7}{2} = \frac{1}{2}x - 2 \]
\[ y - \frac{7}{2} + \frac{7}{2} = \frac{1}{2}x - 2 + \frac{7}{2} \]
\[ y = \frac{1}{2}x + \frac{3}{2} \]

45. 
\[ y + \frac{1}{3} = \frac{5}{6}(x + \frac{2}{5}) \]

**SOLUTION:**
\[ y + \frac{1}{3} = \frac{5}{6}(x + \frac{2}{5}) \]
\[ y + \frac{1}{3} = \frac{5}{6}x + \frac{1}{3} \]
\[ y + \frac{1}{3} - \frac{1}{3} = \frac{5}{6}x + \frac{1}{3} - \frac{1}{3} \]
\[ y = \frac{5}{6}x \]
4-3 Writing Equations in Point-Slope Form

46. Write an equation in point-slope form, slope-intercept form, and standard form for a line that passes through \((-2, 8)\) with slope \(\frac{8}{5}\).

**SOLUTION:**

Point-Slope Form:

\[ y - y_1 = m(x - x_1) \]

\[ y - 8 = \frac{8}{5}(x + 2) \]

Slope-Intercept Form:

\[ y - 8 = \frac{8}{5}(x + 2) \]

Standard Form:

\[ y - 8 = \frac{8}{5}(x + 2) \]

47. Line \(\ell\) passes through \((-9, 4)\) with slope \(\frac{4}{7}\). Write an equation in point-slope form, slope-intercept form, and standard form for line \(\ell\).

**SOLUTION:**

Point-Slope Form:

\[ y - y_1 = m(x - x_1) \]

\[ y - 4 = \frac{4}{7}(x + 9) \]

Slope-Intercept Form:

\[ y - 4 = \frac{4}{7}(x + 9) \]

Standard Form:

\[ y - 4 = \frac{4}{7}(x + 9) \]

48. **WEATHER** Barometric pressure is a linear function of altitude. The barometric pressure is 598 millimeters of mercury (mmHg) at an altitude of 1.8 kilometers. The pressure is 577 millimeters of mercury at 2.1 kilometers.

a. Write a formula for the barometric pressure as a function of the altitude.

b. What is the altitude if the pressure is 657 millimeters of mercury?

**SOLUTION:**

a. Find the slope of the line containing the points (1.8, 598) and (2.1, 577).
49. WHICH ONE DOESN’T BELONG? Identify the equation that does not belong. Explain your reasoning.

\[
\begin{align*}
&y - 5 = 3(x - 1) \quad y + 1 = 3(x + 1) \\
&y + 4 = 3(x + 1) \quad y - 8 = 3(x - 2)
\end{align*}
\]

**SOLUTION:**

Rearrange each equation into slope-intercept form.

\[
\begin{align*}
&y - 5 = 3(x - 1) \quad y = 3x + 2 \\
&y + 1 = 3(x + 1) \quad y = 3x + 2 \\
&y + 4 = 3(x + 1) \quad y = 3x - 1 \\
&y - 8 = 3(x - 2) \quad y = 3x + 2
\end{align*}
\]

The equation \( y + 4 = 3(x + 1) \) does not belong with the other three because it has a different \( y \)-intercept and therefore produces the graph of a different line.
4-3 Writing Equations in Point-Slope Form

50. CCSS CRITIQUE Juana thinks that \( f(x) \) and \( g(x) \) have the same slope but different intercepts. Sabrina thinks that \( f(x) \) and \( g(x) \) describe the same line. Is either of them correct? Explain your reasoning.

The graph of \( g(x) \) is the line that passes through \((3, -7)\) and \((-6, 4)\).

**SOLUTION:**

Find the slope of \( g(x) \).

\[
m = \frac{y_2-y_1}{x_2-x_1}
\]

\[
m = \frac{-4 - (-7)}{-6 - 3} = \frac{3}{-9} = -\frac{1}{3}
\]

Use the point-slope form to write the equation of \( g(x) \) in slope-intercept form.

\[
y - y_1 = m(x - x_1)
\]

\[
y - (-7) = -\frac{1}{3}(x - 3)
\]

\[
y + 7 = -\frac{1}{3}x + 1
\]

\[
y = -\frac{1}{3}x + 4
\]

51. OPEN ENDED Describe a real-life scenario that has a constant rate of change and a value of \( y \) for a particular value of \( x \). Represent this situation using an equation in point-slope form and an equation in slope-intercept form.

**SOLUTION:**

Jocari spent $14 to go to an amusement park and ride ponies. The price she paid included admission. The 5 pony rides cost $2 each. Let \( x \) = number of pony rides and \( y \) be the total cost. Then use the point (5, 14) and \( m = 2 \) to write the equation.

\[
y - y_1 = m(x - x_1)\quad \text{Point-Slope form}
\]

\[
y - 14 = 2(x - 5)\quad \text{Substitute}
\]

Use the point-slope form to find the equation in slope-intercept form.

\[
y - 14 = 2(x - 5)\quad \text{Point-Slope form}
\]

\[
y = 2x - 10
\]

\[
y + 14 = 2x - 10 + 14\quad \text{Add 14 to each side}
\]

\[
y = 2x + 4\quad \text{Simplify}
\]

52. REASONING Write an equation for the line that passes through \((-4, 8)\) and \((3, -7)\). What is the slope? Where does the line intersect the \( x \)-axis? the \( y \)-axis?

**SOLUTION:**

Find the slope of the line containing the given points.

\[
m = \frac{y_2-y_1}{x_2-x_1}
\]

\[
m = \frac{8 - (-7)}{-4 - 3}
\]

\[
m = \frac{15}{-7}
\]

\[
m = -\frac{15}{7}
\]

The line for \( g(x) \) has a \( y \)-intercept of \(-\frac{10}{3}\). The \( y \)-intercept for \( f(x) \) is \(-4\). The lines appear to have the same slope but different intercepts. They cannot be the same line. Therefore, Juana is correct.
4-3 Writing Equations in Point-Slope Form

\[ y = mx + b \quad \text{Slope-intercept form} \]

\[ 8 = -\frac{15}{7}(-4) + b \quad \text{Substitute} \]

\[ 8 = \frac{60}{7} + b \]

\[ 8 - \frac{60}{7} = \frac{60}{7} + b \quad \text{Add } \frac{60}{7} \text{ to each side} \]

\[ \frac{56}{7} - \frac{60}{7} = b \quad \text{Rewrite } 8 \text{ as a fraction} \]

\[ \frac{56}{7} - \frac{60}{7} = b \quad \text{with a denominator of 7} \]

\[ -\frac{4}{7} = b \quad \text{Simplify} \]

Write the equation in slope-intercept form.

\[ y = mx + b \]

\[ y = -\frac{15}{7}x - \frac{4}{7} \]

The slope is \( m = -\frac{15}{7} \).

The line intersects the y-axis is \( -\frac{4}{7} \).

The y-value is 0 when the line intersects the x-axis:

\( y = -\frac{15}{7}x - \frac{4}{7} \)

\[ 0 = -\frac{15}{7}x - \frac{4}{7} \quad \text{Replace } y \text{ with } 0 \]

\[ \frac{4}{7} = -\frac{15}{7}x \quad \text{Multiply both sides by } -\frac{7}{15} \]

\[ \frac{4}{15} = x \quad \text{Simplify} \]

So the line intersects the x-axis at: \( -\frac{4}{15} \)

53. \textbf{CHALLENGE} Write an equation in point-slope form for the line that passes through the points \((f, g)\) and \((h, j)\).

\textbf{SOLUTION:}

First find the slope.

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \quad \text{Slope formula} \]

\[ m = \frac{j - g}{h - f} \quad \text{Let } (f, g) = (x_1, y_1) \text{ and } (h, j) = (x_2, y_2) \]

Use the slope and point to find the equation in point-slope form.

\[ y - y_1 = m(x - x_1) \quad \text{Point-slope form} \]

\[ y - g = \frac{j - g}{h - f}(x - f) \quad \text{Let } (f, g) = (x_1, y_1) \text{ and } \frac{j - g}{h - f} = m \]

54. \textbf{WRITING IN MATH} Why do we represent linear equations in more than one form?

\textbf{SOLUTION:}

Sample answer: Depending on what information is given and what the problem is, it might be easier to represent a linear equation in one form over another. For example, if you are given the slope and the y-intercept, you could represent the equation in slope-intercept form. A line that has a slope of 3 and a y-intercept of 2 has an equation of \( y = 3x + 2 \). If you are given a point and the slope, you could represent the equation in point-slope form. A line through \((2, 5)\) with a slope of \(-3\) has an equation of \( y - 5 = -3(x - 2) \). If you are trying to graph an equation using the x- and y-intercepts, you could represent the equation in standard form. The graph of \( 2x + 4y = 12 \) has an x-intercept of 6 \([2(6) + 4(0) = 12]\) and a y-intercept of 3 \([2(0) + 4(3) = 12]\). You will see other instances in future lessons when one form of a linear equation is more useful than the other forms.
55. Which statement is most strongly supported by the graph?

A  You have $100 and spend $5 weekly.

B  You have $100 and save $5 weekly.

C  You need $100 for a new CD player and plan to save $5 weekly.

D  You need $100 for a new CD player and plan to spend $5 weekly.

**SOLUTION:**
Write an equation for each of the choices.

| You have $100 and plan to spend $5 each week. | 100 - 5x |
| You have $100 and plan to save $5 each week. | 100 + 5x |
| You need $100 for a new CD player and plan to save $5 each week. | 5x - 100 |
| You need $100 for a new CD player and plan to spend $5 each week. | -100 - 5x |

The y-intercept is 100, which means that choices C and D can be eliminated. The slope is positive on the graph, so the correct choice is B.

56. **SHORT RESPONSE** A store offers customers a $5 gift certificate for every $75 they spend. How much would a customer have to spend to earn $35 worth of gift certificates?

**SOLUTION:**
Let \( x \) represent how much the customer would have to spend.

\[
\frac{5}{75} = \frac{35}{x}
\]

\[
5(x) = 35(75)
\]

\[
x = 2625
\]

\[
\frac{5x}{5} = \frac{2625}{5}
\]

\[
x = 525
\]

Therefore, the customer would have to spend $525 to earn $35 worth of gift certificates.

57. **GEOMETRY** Which triangle is similar to \( \triangle ABC \)?

**SOLUTION:**
To determine if triangles are similar, check the ratio of the three pairs of corresponding sides. If the ratio is constant for all three side pairs, then the triangles...
4-3 Writing Equations in Point-Slope Form

are similar.
Check triangle F:
\[
\frac{8.6}{6.4} = 1.34375 \\
\frac{15}{10} = 1.5
\]
These two pairs of corresponding sides do not have the same ratio, so these triangles are not similar.
Check triangle G:
\[
\frac{8.6}{5} = 1.72 \\
\frac{15}{8} = 1.875
\]
These two pairs of corresponding sides do not have the same ratio, so these triangles are not similar.
Check triangle H:
\[
\frac{8.6}{6} = 1.43 \\
\frac{15}{11.5} = 1.304
\]
These two pairs of corresponding sides do not have the same ratio, so these triangles are not similar.
Check triangle J:
\[
\frac{8.6}{4.3} = 2 \\
\frac{15}{7.5} = 2 \\
\frac{18}{9} = 2
\]
All three pairs of corresponding sides have the same ratio, therefore, the triangles are similar. The correct choice is J.

58. In a class of 25 students, 6 have blue eyes, 15 have brown hair, and 3 have blue eyes and brown hair. How many students have neither blue eyes nor brown hair?

A 4  
B 7  
C 10  
D 22  

SOLUTION:
There are 6 + 15 = 21 students that have brown hair or blue eyes; however, 3 of those students have brown hair and blue eyes. So, the total number of students that have either blue eyes or brown hair is 21 – 3 = 18. That means that there are 25 – 18 = 7 students that have neither brown hair nor blue eyes.

So, the correct choice is B.
4-3 Writing Equations in Point-Slope Form

Write an equation of the line that passes through each pair of points.

59. (4, 2), (–2, –4)

**SOLUTION:**
Find the slope of the line containing the given points.

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
\[ = \frac{-4 - 2}{-2 - 4} \]
\[ = \frac{-6}{-6} \]
\[ = 1 \]

Use the slope and either of the two points to find the y-intercept.

\[ y = mx + b \]
\[ 2 = 1(4) + b \]
\[ 2 = 4 + b \]
\[ 2 - 4 = 4 - 4 + b \]
\[ -2 = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = x - 2 \]

60. (3, –2), (6, 4)

**SOLUTION:**
Find the slope of the line containing the given points.

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
\[ = \frac{4 - (-2)}{6 - 3} \]
\[ = \frac{6}{3} \]
\[ = 2 \]

Use the slope and either of the two points to find the y-intercept.

\[ y = mx + b \]
\[ 4 = 2(6) + b \]
\[ 4 = 12 + b \]
\[ 4 - 12 = 12 - 12 + b \]
\[ -8 = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = 2x - 8 \]
4-3 Writing Equations in Point-Slope Form

61. \((-1, 3), (2, -3)\)

**SOLUTION:**
Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]
\[
= \frac{3 - (-3)}{-1 - 2}
\]
\[
= \frac{6}{-3}
\]
\[
= -2
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]
\[
3 = -2(-1) + b
\]
\[
3 = 2 + b
\]
\[
3 - 2 = 2 - 2 + b
\]
\[
1 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]
\[
y = -2x + 1
\]

62. \((2, -2), (3, 2)\)

**SOLUTION:**
Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]
\[
= \frac{2 - (-2)}{3 - 2}
\]
\[
= \frac{4}{1}
\]
\[
= 4
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]
\[
2 = 4(3) + b
\]
\[
2 = 12 + b
\]
\[
2 - 12 = 12 - 12 + b
\]
\[
-10 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]
\[
y = 4x - 10
\]
4-3 Writing Equations in Point-Slope Form

63. \((7, -2), (-4, -2)\)

**SOLUTION:**
Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - (-2)}{7 - (-4)} = \frac{0}{11} = 0
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]
\[
-2 = 0(7) + b
\]
\[
-2 = 0 + b
\]
\[
-2 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]
\[
y = 0x - 2
\]
\[
y = -2
\]

64. \((0, 5), (-3, 5)\)

**SOLUTION:**
Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - 5}{0 - (-3)} = \frac{0}{3} = 0
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]
\[
5 = 0(0) + b
\]
\[
5 = 0 + b
\]
\[
5 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]
\[
y = 0x + 5
\]
\[
y = 5
\]

Write an equation in slope-intercept form of the line with the given slope and y-intercept.

65. slope: \(-2\), y-intercept: 6

**SOLUTION:**

\[
y = mx + b
\]
\[
y = -2x + 6
\]

66. slope: 3, y-intercept: \(-5\)

**SOLUTION:**

\[
y = mx + b
\]
\[
y = 3x - 5
\]
4-3 Writing Equations in Point-Slope Form

67. slope: \( \frac{1}{2} \), y-intercept: 3

**SOLUTION:**
\[ y = mx + b \]
\[ y = \frac{1}{2}x + 3 \]

68. slope: \(-\frac{3}{5}\), y-intercept: 12

**SOLUTION:**
\[ y = mx + b \]
\[ y = -\frac{3}{5}x + 12 \]

69. slope: 0, y-intercept: 3

**SOLUTION:**
\[ y = mx + b \]
\[ y = 0x + 3 \]
\[ y = 3 \]

70. slope: -1, y-intercept: 0

**SOLUTION:**
\[ y = mx + b \]
\[ y = -1x + 0 \]
\[ y = -x \]

71. **THEATER** The Coral Gables Actors’ Playhouse has 7 rows of seats in the orchestra section. The number of seats in the rows forms an arithmetic sequence, as shown in the table. On opening night, 368 tickets were sold for the orchestra section. Was the section oversold?

<table>
<thead>
<tr>
<th>Rows</th>
<th>Number of Seats</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>76</td>
</tr>
<tr>
<td>6</td>
<td>68</td>
</tr>
<tr>
<td>5</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>52</td>
</tr>
<tr>
<td>3</td>
<td>44</td>
</tr>
<tr>
<td>2</td>
<td>36</td>
</tr>
<tr>
<td>1</td>
<td>28</td>
</tr>
<tr>
<td>Total Seats</td>
<td>364</td>
</tr>
</tbody>
</table>

Since 368 tickets were sold and there are only 364 seats available, so the section was oversold.

Solve each equation or formula for the variable specified.

72. \( y = mx + b \), for \( m \)

**SOLUTION:**
\[ y = mx + b \] **Slope-intercept form**
\[ y - b = mx + b - b \] **Subtract \( b \) from each side**
\[ y - b = mx \] **Simplify.**
\[ \frac{y - b}{x} = mx \] **Divide each side by \( x \).**
\[ \frac{y - b}{x} = m \] **Simplify.**

73. \( v = r + at \), for \( a \)

**SOLUTION:**
\[ v = r + at \] **Original equation**
\[ v = r - r + at \] **Subtract \( r \) from each side**
\[ v - r = at \] **Simplify.**
\[ \frac{v - r}{t} = \frac{at}{t} \] **Divide each side by \( t \).**
\[ \frac{v - r}{t} = a \] **Simplify.**
**4-3 Writing Equations in Point-Slope Form**

74. $km + 5x = 6y$, for $m$

**SOLUTION:**

\[
\begin{align*}
km + 5x &= 6y & \text{Original equation} \\
km + 5x - 6y - 5x &= 0 & \text{Subtract } 6y \text{ from each side} \\
km - 6y - 5x &= 0 & \text{Simplify} \\
\frac{km}{k} - \frac{6y-5x}{k} &= 0 & \text{Divide each side by } k \\
m &= \frac{6y}{k} - \frac{5x}{k} & \text{Simplify}
\end{align*}
\]

75. $4b - 5 = -t$, for $b$

**SOLUTION:**

\[
\begin{align*}
4b - 5 &= -t & \text{Original equation} \\
4b - 5 + 5 &= -t + 5 & \text{Add } 5 \text{ to each side} \\
4b &= -t + 5 & \text{Simplify} \\
\frac{4b}{4} &= \frac{-t + 5}{4} & \text{Divide each side by } 4 \\
b &= -\frac{t+5}{4} & \text{Simplify}
\end{align*}
\]
Write an equation in slope-intercept form for the line that passes through the given point and is parallel to the graph of the given equation.

1. \((-1, 2), y = \frac{1}{2}x - 3\)

**SOLUTION:**
The slope of the line with equation \(y = \frac{1}{2}x - 3\) is \(\frac{1}{2}\).
The line parallel to \(y = \frac{1}{2}x - 3\) has the same slope, \(\frac{1}{2}\).

\[
\begin{align*}
\quad & y - y_1 = m(x - x_1) \quad \text{Point-slope form} \\
\quad & y - 2 = \frac{1}{2}(x - (-1)) \\
\quad & y - 2 = \frac{1}{2}(x + 1) \quad \text{Substitute.} \\
\quad & y - 2 = \frac{1}{2}x + \frac{1}{2} \quad \text{Simplify} \\
\quad & y - 2 + 2 = \frac{1}{2}x + 2 \quad \text{Add 2 to each side.} \\
\quad & y = \frac{1}{2}x + \frac{1}{2} \quad \text{Simplify} \\
\end{align*}
\]

2. \((0, 4), y = -4x + 5\)

**SOLUTION:**
The slope of the line with equation \(y = -4x + 5\) is \(-4\).
The line parallel to \(y = -4x + 5\) has the same slope, \(-4\).

\[
\begin{align*}
\quad & y - y_1 = m(x - x_1) \quad \text{Point-slope form} \\
\quad & y - 4 = -4(x - 0) \quad \text{Substitute.} \\
\quad & y - 4 = -4x + 0 \quad \text{Distributive Property} \\
\quad & y - 4 + 4 = -4x + 0 + 4 \quad \text{Add 4 to each side} \\
\quad & y = -4x + 4 \quad \text{Simplify.} \\
\end{align*}
\]

3. **GARDENS** A garden is in the shape of a quadrilateral with vertices \(A(-2, 1), B(3, -3), C(5, 7),\) and \(D(-3, 4)\). Two paths represented by \(\overline{AC}\) and \(\overline{BD}\) cut across the garden. Are the paths perpendicular? Explain.

![Diagram of a garden with paths AC and BD]

**SOLUTION:**
Find the slope of \(\overline{AC}\).

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 7}{-2 - 5} = \frac{-6}{-7} = \frac{6}{7}
\]

Find the slope of \(\overline{BD}\).

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-3 - 4}{3 - (-3)} = \frac{-7}{6}
\]

The slope of \(\overline{BD}\) is the opposite reciprocal of the slope of \(\overline{AC}\), so the two paths are perpendicular.
4-4 Parallel and Perpendicular Lines

4. CCSS PRECISION A square is a quadrilateral that has opposite sides parallel, consecutive sides that are perpendicular, and diagonals that are perpendicular. Determine whether the quadrilateral is a square. Explain.

**SOLUTION:**

Sides $\overline{EH}$ and $\overline{FG}$ are both vertical line segments and have undefined slopes, so they are parallel. Sides $\overline{EF}$ and $\overline{HG}$ are both horizontal line segments and have a slope of 0, so they are parallel.

Side $\overline{EG}$ has a slope of $-1$ (down 1 unit, right 1 unit).

Side $\overline{FH}$ has a slope of 1 (up 1 unit, right 1 unit).

Since the slopes of $\overline{EG}$ and $\overline{FH}$ are opposite reciprocals, they are perpendicular. The quadrilateral is a square.

Determine whether the graphs of the following equations are parallel or perpendicular. Explain.

5. $y = -2x$, $2y = x$, $4y = 2x + 4$

**SOLUTION:**

The slope of the first equation is $-2$. Write the second two equations in slope-intercept form.

$2y = x$

$\frac{2y}{2} = \frac{x}{2}$

$y = \frac{1}{2}x$

The slope of the second equation is $\frac{1}{2}$.

$4y = 2x + 4$

$\frac{4y}{4} = \frac{2x + 4}{4}$

$y = \frac{1}{2}x + 1$

The slope of the third equation is $\frac{1}{2}$.

The slope of $y = -2x$ is the opposite reciprocal of the slope of $2y = x$ and $4y = 2x + 4$, so it is perpendicular to the other two graphs. And, the slopes of $2y = x$ and $4y = 2x + 4$ are equal, so they are parallel.
4-4 Parallel and Perpendicular Lines

6. \( y = \frac{1}{2} x, 3y = x, y = -\frac{1}{2} x \)

**SOLUTION:**
The slope of the first equation is \( \frac{1}{2} \). Write the second equation in slope-intercept form.

\[
3y = x \\
\frac{3y}{3} = \frac{x}{3} \\
y = \frac{1}{3} x
\]

The slope of the second equation is \( \frac{1}{3} \). The slope of the third equation is \( -\frac{1}{2} \).
None of the slopes are equal or opposite reciprocals, so none of the graphs of the equations are parallel or perpendicular.

**Write an equation in slope-intercept form for the line that passes through the given point and is perpendicular to the graph of the equation.**

7. \((-2, 3), y = -\frac{1}{2} x - 4\)

**SOLUTION:**
The slope of the line with equation \( y = -\frac{1}{2} x - 4 \) is \(-\frac{1}{2}\). The slope of the perpendicular line is the opposite reciprocal of \(-\frac{1}{2}\), or 2.

\[
y - y_1 = m(x - x_1) \quad \text{Point-slope form} \\
y - 3 = 2(x + 2) \quad \text{Substitute} \\
y - 3 = 2x + 4 \quad \text{Simplify} \\
y - 3 + 3 = 2x + 4 + 3 \quad \text{Add 3 to each side} \\
y = 2x + 7 \quad \text{Simplify.}
\]

8. \((-1, 4), y = 3x + 5\)

**SOLUTION:**
The slope of the line with equation \( y = 3x + 5 \) is 3. The slope of the perpendicular line is the opposite reciprocal of 3, or \(-\frac{1}{3}\).

\[
y - y_1 = m(x - x_1) \quad \text{Point-slope form} \\
y - 4 = -\frac{1}{3}(x - (-1)) \quad \text{Substitute} \\
y - 4 = -\frac{1}{3}x + 1 \quad \text{Simplify.} \\
y - 4 - 4 = -\frac{1}{3}x + \frac{1}{3} + 4 \quad \text{Add 4 to each side} \\
y = -\frac{1}{3}x + \frac{3}{3} \quad \text{Simplify.}
\]

9. \((2, 3), 2x + 3y = 4\)

**SOLUTION:**
Write the equation in slope-intercept form.

\[
\begin{align*}
2x + 3y &= 4 & \text{Original equation} \\
2x + 3y &= 4 - 2x & \text{Subtract 2x from each side} \\
3y &= -2x + 4 & \text{Simplify} \\
\frac{3y}{3} &= -\frac{2x}{3} + 4 & \text{Divide each side by 3} \\
y &= -\frac{2}{3}x + 1 \frac{3}{4} & \text{Simplify.}
\end{align*}
\]

The slope of the line with equation \( 2x + 3y = 4 \) is \(-\frac{2}{3}\). The slope of the perpendicular line is the opposite reciprocal of \(-\frac{2}{3}\), or \(\frac{3}{2}\).

\[
y - y_1 = m(x - x_1) \quad \text{Point-slope form} \\
y - 3 = \frac{3}{2}(x - 2) \quad \text{Substitute} \\
y - 3 = \frac{3}{2}x - 3 \quad \text{Distributive Property} \\
y - 3 + 3 = \frac{3}{2}x - 3 + 3 \quad \text{Add 3 to each side} \\
y = \frac{3}{2}x \quad \text{Simplify.}
\]
10. (3, 6), \(3x - 4y = -2\)

**SOLUTION:**
Write the equation in slope-intercept form.

\[
\begin{align*}
3x - 4y &= -2 \quad \text{Original equation} \\
3x - 3x - 4y &= -2 - 3x \quad \text{Subtract 3x from each side} \\
-4y &= -3x - 2 \quad \text{Simplify} \\
\frac{-4y}{-4} &= \frac{-3x - 2}{-4} \quad \text{Divide each side by -4.} \\
y &= \frac{3}{4}x + \frac{1}{2} \quad \text{Simplify.}
\end{align*}
\]

The slope of the line with equation \(3x - 4y = -2\) is \(\frac{3}{4}\). The slope of the perpendicular line is the opposite reciprocal of \(\frac{3}{4}\), or \(-\frac{4}{3}\).

Write an equation in slope-intercept form for the line that passes through the given point and is parallel to the graph of given equation.

11. (3, -2), \(y = x + 4\)

**SOLUTION:**
The slope of the line with equation \(y = x + 4\) is 1. The line parallel to \(y = x + 4\) has the same slope, 1.

\[
\begin{align*}
y - y_1 &= m(x - x_1) \quad \text{Point-slope form} \\
y - (-2) &= 1(x - 3) \quad \text{Substitute.} \\
y + 2 &= x - 3 \quad \text{Simplify.} \\
y + 2 - 2 &= x - 3 - 2 \quad \text{Subtract.} \\
y &= x - 5 \quad \text{Simplify.}
\end{align*}
\]

12. (4, -3), \(y = 3x - 5\)

**SOLUTION:**
The slope of the line with equation \(y = 3x - 5\) is 3. The line parallel to \(y = 3x - 5\) has the same slope, 3.

\[
\begin{align*}
y - y_1 &= m(x - x_1) \quad \text{Point-slope form} \\
y - (-3) &= 3(x - 4) \quad \text{Substitute.} \\
y - (-3) &= 3x - 12 \quad \text{Distributive Property} \\
y + 3 &= 3x - 12 \quad \text{Simplify.} \\
y - 3 + 3 &= 3x - 12 - 3 \quad \text{Subtract.} \\
y &= 3x - 15 \quad \text{Simplify.}
\end{align*}
\]

13. (0, 2), \(y = -5x + 8\)

**SOLUTION:**
The slope of the line with equation \(y = -5x + 8\) is -5. The line parallel to \(y = -5x + 8\) has the same slope, -5.

\[
\begin{align*}
y - y_1 &= m(x - x_1) \quad \text{Point-slope form} \\
y - 2 &= -5(x - 0) \quad \text{Substitute.} \\
y - 2 &= -5x + 0 \quad \text{Distributive Property} \\
y - 2 + 2 &= -5x + 0 + 2 \quad \text{Add 2 to each side.} \\
y &= -5x + 2 \quad \text{Simplify.}
\end{align*}
\]

14. (-4, 2), \(y = \frac{-1}{2}x + 6\)

**SOLUTION:**
The slope of the line with equation \(y = \frac{-1}{2}x + 6\) is \(-\frac{1}{2}\). The line parallel to \(y = \frac{-1}{2}x + 6\) has the same slope, \(-\frac{1}{2}\).

\[
\begin{align*}
y - y_1 &= m(x - x_1) \quad \text{Point-slope form} \\
y - 2 &= -\frac{1}{2}[x - (-4)] \quad \text{Substitute.} \\
y - 2 &= -\frac{1}{2}[x + 4] \quad \text{Simplify.} \\
y - 2 &= -\frac{1}{2}x - 2 \quad \text{Distributive Property} \\
y - 2 + 2 &= -\frac{1}{2}x - 2 + 2 \quad \text{Add 2 to each side.} \\
y &= -\frac{1}{2}x \quad \text{Simplify.}
\end{align*}
\]
4-4 Parallel and Perpendicular Lines

15. \((-2, 3), y = \frac{-3}{4}x + 4\)

**SOLUTION:**
The slope of the line with equation 
\(y = \frac{-3}{4}x + 4\) is \(-\frac{3}{4}\). The line parallel to 
\(y = \frac{-3}{4}x + 4\) has the same slope, \(-\frac{3}{4}\). Use the 
point-slope form formula to find the equation for the 
parallel line.

\[
\begin{align*}
  y - y_1 &= m(x - x_1) \quad \text{Point-slope form} \\
  y - 3 &= -\frac{3}{4}[x - (-2)] \quad \text{Substitute} \\
  y - 3 &= -\frac{3}{4}[x + 2] \quad \text{Simplify} \\
  y - 3 &= -\frac{3}{4}x - \frac{3}{2} \quad \text{Distributive property} \\
  y - 3 + 3 &= -\frac{3}{4}x - \frac{3}{2} + 3 \quad \text{Add 3 to each side} \\
  y &= -\frac{3}{4}x + 1\frac{1}{2} \quad \text{Simplify}
\end{align*}
\]

16. \((9, 12), y = 13x - 4\)

**SOLUTION:**
The slope of the line with equation \(y = 13x - 4\) is 13. 
The line parallel to \(y = 13x - 4\) has the same slope, 13.

\[
\begin{align*}
  y - y_1 &= m(x - x_1) \quad \text{Point-slope form} \\
  y - 12 &= 13(x - 9) \quad \text{Substitute} \\
  y - 12 &= 13x - 117 \quad \text{Distributive Property} \\
  y - 12 + 12 &= 13x - 117 + 12 \quad \text{Add 12 to each side} \\
  y &= 13x - 105 \quad \text{Simplify}
\end{align*}
\]

17. **GEOMETRY** A trapezoid is a quadrilateral that 
has exactly one pair of parallel opposite sides. Is 
\(ABCD\) a trapezoid? Explain.

\[
\begin{align*}
  A & \quad B & \quad C & \quad D \\
  \text{(up 1 unit, right 3 units)} & \quad \text{(up 1 unit, right 3 units)} & \quad \text{(up 1 unit, right 3 units)} & \quad \text{(up 1 unit, right 3 units)}
\end{align*}
\]

**SOLUTION:**
Use the graph to determine the slope of each segment 
of the quadrilateral. The line containing \(AD\) and the 
line containing \(BC\) have the same slope, \(\frac{1}{3}\) (up 1 unit, 
right 3 units). Therefore one pair of sides is parallel. 
The slope of \(AB\) is undefined and the slope of 
\(CD\) is \(-\frac{5}{3}\), so they are not parallel. \(ABCD\) is a 
trapezoid.

18. **GEOMETRY** \(CDEF\) is a kite. Are the diagonals of 
the kite perpendicular? Explain your reasoning.

\[
\begin{align*}
  O & \quad C & \quad D & \quad E \\
  \text{(up 2 units, right 3 units)} & \quad \text{(down 3 units, right 2 units)} & \quad \text{(up 2 units, right 3 units)} & \quad \text{(down 3 units, right 2 units)}
\end{align*}
\]

**SOLUTION:**
Use the graph to determine the slope of each 
diagonal. The slope of \(CE\) is \( \frac{2}{3} \) (up 2 units, right 3 
units) and the slope of \(DF\) is \( -\frac{3}{2} \) (down 3 units, 
right 2 units). The diagonals are perpendicular 
because the slopes are opposite reciprocals.
19. Determine whether the graphs of \( y = -6x + 4 \) and \( y = \frac{1}{6}x \) are perpendicular. Explain.

**SOLUTION:**
The slope of \( y = -6x + 4 \) is \(-6\). The slope of \( y = \frac{1}{6}x \) is \(\frac{1}{6}\). The slopes are opposite reciprocals, so \( y = -6x + 4 \) and \( y = \frac{1}{6}x \) are perpendicular.

20. **MAPS** On a map, Elmwood Drive passes through \( R (4, -11) \) and \( S (0, -9) \), and Taylor Road passes through \( J (6, -2) \) and \( K (4, -5) \). If they are straight lines, are the two streets perpendicular? Explain.

**SOLUTION:**
Find the slope of Elmwood Drive (\( \overline{RS} \)).

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-9 - (-11)}{0 - 4} = \frac{2}{-4} = -\frac{1}{2}
\]

Find the slope of Taylor Road (\( \overline{JK} \)).

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - (-2)}{4 - 6} = \frac{-3}{-2} = \frac{3}{2}
\]

The two streets are not perpendicular because their slopes are not opposite reciprocals.

---

**CCSS PERSEVERANCE** Determine whether the graphs of the following equations are parallel or perpendicular. Explain.

21. \( 2x - 8y = -24, 4x + y = -2, x - 4y = 4 \)

**SOLUTION:**
Write the equations in slope-intercept form.

**Equation 1:**
\[
2x - 8y = -24 \\
2x - 2x - 8y = -24 - 2x \\
-8y = -2x - 24 \\
\frac{-8y}{-8} = \frac{-2x - 24}{-8} \\
y = \frac{1}{4}x + 3
\]
The slope of \( 2x - 8y = -24 \) is \(\frac{1}{4}\).

**Equation 2:**
\[
4x + y = -2 \\
4x - 4x + y = -2 - 4x \\
y = -4x - 2
\]
The slope of \( 4x + y = -2 \) is \(-4\).

**Equation 3:**
\[
x - 4y = 4 \\
x - x - 4y = 4 - x \\
-4y = -x + 4 \\
\frac{-4y}{-4} = \frac{-x + 4}{-4} \\
y = \frac{1}{4}x - 1
\]
The slope of \( x - 4y = 4 \) is \(\frac{1}{4}\).

The slope of \( 2x - 8y = -24 \) is the opposite reciprocal of the slope of \( 2x - 8y = -24 \) and \( x - 4y = 4 \), so it is perpendicular to the other two graphs. And, the slopes of \( 2x - 8y = -24 \) and \( x - 4y = 4 \) are equal, so they are parallel.
22. \(3x - 9y = 9, 3y = x + 12, 2x - 6y = 12\)

**SOLUTION:** Write the equations in slope-intercept form.

**Equation 1:**

\[
3x - 9y = 9 \quad \text{Original equation 1}
\]
\[
3x - 3x - 9y = 9 - 3x \quad \text{Subtract 3x from each side}
\]
\[
-9y = -3x + 9 \quad \text{Simplify}
\]
\[
-\frac{y}{3} = \frac{x}{3} + \frac{1}{3} \quad \text{Divide each side by } -9.
\]
\[
y = \frac{1}{3}x - 1 \quad \text{Simplify}
\]

The slope of \(3x - 9y = 9\) is \(\frac{1}{3}\).

**Equation 2:**

\[
3y = x + 12 \quad \text{Original equation 2}
\]
\[
\frac{3y}{3} = \frac{x + 12}{3} \quad \text{Divide each side by 3}
\]
\[
y = \frac{1}{3}x + 4 \quad \text{Simplify}
\]

The slope of \(3y = x + 12\) is \(\frac{1}{3}\).

**Equation 3:**

\[
2x - 6y = 12 \quad \text{Original equation 3}
\]
\[
2x - 3x - 6y = 12 - 2x \quad \text{Subtract 2x from each side}
\]
\[
-6y = -2x + 12 \quad \text{Simplify}
\]
\[
-\frac{6y}{-6} = \frac{-2x + 12}{-6} \quad \text{Divide each side by } -6.
\]
\[
y = \frac{1}{3}x - 2 \quad \text{Simplify}
\]

The slope of \(2x - 6y = 12\) is \(\frac{1}{3}\).

The slopes of \(3x - 9y = 9\), \(3y = x + 12\), and \(2x - 6y = 12\) are all equal, so they are all parallel.

23. \((-3, -2), y = -2x + 4\)

**SOLUTION:** The slope of the line with equation \(y = -2x + 4\) is \(-2\). The slope of the perpendicular line is the opposite reciprocal of \(-2\), or \(\frac{1}{2}\).

\[
y - y_1 = m(x - x_1) \quad \text{Point-slope form}
\]
\[
y - (-2) = \frac{1}{2}[x - (-3)] \quad \text{Substitute}
\]
\[
y + 2 = \frac{1}{2}[x + 3] \quad \text{Simplify}
\]
\[
y + 2 = \frac{1}{2}x + \frac{3}{2} \quad \text{Distributive Property}
\]
\[
y + 2 - 2 = \frac{1}{2}x + \frac{3}{2} - 2 \quad \text{Subtract}
\]
\[
y = \frac{1}{2}x - \frac{1}{2} \quad \text{Simplify}
\]

24. \((-5, 2), y = \frac{1}{2}x - 3\)

**SOLUTION:** The slope of the line with equation \(y = \frac{1}{2}x - 3\) is \(\frac{1}{2}\). The slope of the perpendicular line is the opposite reciprocal of \(\frac{1}{2}\), or \(-2\).

\[
y - y_1 = m(x - x_1) \quad \text{Point-slope form}
\]
\[
y - 2 = -2[x - (-5)] \quad \text{Substitute}
\]
\[
y - 2 = -2x + 10 \quad \text{Simplify}
\]
\[
y - 2 + 2 = -2x + 10 + 2 \quad \text{Add 2 to each side}
\]
\[
y = -2x + 8 \quad \text{Simplify}
25. \((-4, 5), \ y = \frac{1}{3}x + 6\)

**SOLUTION:**

The slope of the line with equation \(y = \frac{1}{3}x + 6\) is \(\frac{1}{3}\).

The slope of the perpendicular line is the opposite reciprocal of \(\frac{1}{3}\), or \(-3\).

\[
\begin{align*}
  y - y_1 &= m(x - x_1) & \text{Point-slope form} \\
  y - 5 &= -3[x - (-4)] & \text{Substitute} \\
  y - 5 &= -3(x + 4) & \text{Simplify} \\
  y - 5 &= -3x - 12 & \text{Distributive Property} \\
  y - 5 + 5 &= -3x - 12 + 5 & \text{Add 5 to each side} \\
  y &= -3x - 7 & \text{Simplify}
\end{align*}
\]

26. \((2, 6), y = -\frac{1}{4}x + 3\)

**SOLUTION:**

The slope of the line with equation \(y = -\frac{1}{4}x + 3\) is \(-\frac{1}{4}\). The slope of the perpendicular line is the opposite reciprocal of \(-\frac{1}{4}\), or \(4\).

\[
\begin{align*}
  y - y_1 &= m(x - x_1) & \text{Point-slope form} \\
  y - 6 &= 4(x - 2) & \text{Substitute} \\
  y - 6 &= 4x - 8 & \text{Distributive Property} \\
  y - 6 + 6 &= 4x - 8 + 6 & \text{Add 6 to each side} \\
  y &= 4x - 2 & \text{Simplify}
\end{align*}
\]

27. \((3, 8), y = 5x - 3\)

**SOLUTION:**

The slope of the line with equation \(y = 5x - 3\) is \(5\). The slope of the perpendicular line is the opposite reciprocal of \(5\), or \(-\frac{1}{5}\).

\[
\begin{align*}
  y - y_1 &= m(x - x_1) & \text{Point-slope form} \\
  y - 8 &= -\frac{1}{5}(x - 3) & \text{Substitute} \\
  y - 8 &= -\frac{1}{5}x + \frac{3}{5} & \text{Distributive Property} \\
  y - 8 + 8 &= -\frac{1}{5}x + \frac{3}{5} + 8 & \text{Add 8 to each side} \\
  y &= -\frac{1}{5}x + \frac{53}{5} & \text{Simplify}
\end{align*}
\]

28. \((4, -2), y = 3x + 5\)

**SOLUTION:**

The slope of the line with equation \(y = 3x + 5\) is \(3\). The slope of the perpendicular line is the opposite reciprocal of \(3\), or \(-\frac{1}{3}\).

\[
\begin{align*}
  y - y_1 &= m(x - x_1) & \text{Point-slope form} \\
  y - (-2) &= -\frac{1}{3}(x - 4) & \text{Substitute} \\
  y - (-2) &= -\frac{1}{3}x + \frac{1}{3} & \text{Distributive Property} \\
  y + 2 &= -\frac{1}{3}x + \frac{1}{3} & \text{Simplify} \\
  y + 2 - 2 &= -\frac{1}{3}x + \frac{1}{3} - 2 & \text{Subtract} \\
  y &= -\frac{1}{3}x - \frac{5}{3} & \text{Simplify}
\end{align*}
\]

Write an equation in slope-intercept form for a line perpendicular to the graph of the equation that passes through the \(x\)-intercept of that line.

29. \(y = -\frac{1}{2}x - 4\)

**SOLUTION:**

The slope of the equation is \(-\frac{1}{2}\), so the slope of the perpendicular line would be the opposite reciprocal, or \(2\). Find the \(x\)-intercept.

\[
\begin{align*}
  y &= -\frac{1}{2}x - 4 & \text{Original equation} \\
  0 &= -\frac{1}{2}x - 4 & \text{Replace } y \text{ with } 0 \\
  0 + 4 &= -\frac{1}{2}x - 4 + 4 & \text{Add 4 to each side} \\
  4 &= -\frac{1}{2}x & \text{Simplify} \\
  -2(4) &= -2\left(-\frac{1}{2}x\right) & \text{Multiply each side by } -2 \\
  -8 &= x & \text{Simplify}
\end{align*}
\]

Use the \(x\)-intercept \((-8, 0)\) and the slope, \(2\), to find the perpendicular line.

\[
\begin{align*}
  y - y_1 &= m(x - x_1) & \text{Point-slope form} \\
  y - 0 &= 2[x - (-8)] & \text{Substitute} \\
  y - 0 &= 2[x + 8] & \text{Simplify} \\
  y &= 2x + 16 & \text{Distributive Property}
\end{align*}
\]
30. \( y = \frac{2}{3} x - 6 \)

**SOLUTION:**

The slope of the equation is \( \frac{2}{3} \), so the slope of the perpendicular line would be the opposite reciprocal, or \(-\frac{3}{2}\). Find the x-intercept.

\[
\begin{align*}
0 &= \frac{2}{3} x - 6 \\
0 + 6 &= \frac{2}{3} x - 6 + 6 \\
6 &= \frac{2}{3} x \\
\frac{3}{2}(6) &= \frac{3}{2} \left( \frac{2}{3} x \right) \\
9 &= x \\
\end{align*}
\]

Use the x-intercept (9, 0) and the slope, \(-\frac{3}{2}\), to find the perpendicular line.

\[
\begin{align*}
y - y_1 &= m(x - x_1) & \text{Point-slope form} \\
y - 0 &= -\frac{3}{2}(x - 9) & \text{Substitute} \\
y &= -\frac{3}{2}x + \frac{27}{2} & \text{Distributive Property}
\end{align*}
\]

31. \( y = 5x + 3 \)

**SOLUTION:**

The slope of the equation is 5, so the slope of the perpendicular line would be the opposite reciprocal, or \(-\frac{1}{5}\). Find the x-intercept.

\[
\begin{align*}
y &= 5x + 3 \\
0 &= 5x + 3 & \text{Replace y with 0.} \\
0 - 3 &= 5x + 3 - 3 & \text{Subtract 3 from each side} \\
-3 &= 5x & \text{Simplify} \\
-\frac{3}{5} &= \frac{5x}{5} & \text{Divide each side by 5.} \\
-\frac{3}{5} &= x & \text{Simplify.}
\end{align*}
\]

Use the x-intercept \((-\frac{3}{5}, 0)\) and the slope, \(-\frac{1}{5}\), to find the perpendicular line.

\[
\begin{align*}
y - y_1 &= m(x - x_1) & \text{Point-slope form} \\
y - 0 &= -\frac{1}{5} \left[ x - \left( -\frac{3}{5} \right) \right] & \text{Substitute} \\
y - 0 &= -\frac{1}{5} x + \frac{3}{5} & \text{Simplify} \\
y &= -\frac{1}{5} x - \frac{3}{25} & \text{Distributive Property}
\end{align*}
\]
32. Write an equation in slope-intercept form for the line that is perpendicular to the graph of $3x + 2y = 8$ and passes through the $y$-intercept of that line.

**SOLUTION:**
Write the equation in slope-intercept form to find the slope.

\[
\begin{align*}
3x + 2y &= 8 & \text{Original equation} \\
3x - 3x + 2y &= 8 - 3x & \text{Subtract } 3x \text{ from each side} \\
2y &= -3x + 8 & \text{Simplify} \\
\frac{2y}{2} &= \frac{-3x + 8}{2} & \text{Divide each side by } 2 \\
y &= -\frac{3}{2}x + 4 & \text{Simplify}
\end{align*}
\]

The slope of the equation is $-\frac{3}{2}$, so the slope of the perpendicular line would be the opposite reciprocal, or $\frac{2}{3}$. Find the $y$-intercept.

\[
\begin{align*}
y &= -\frac{3}{2}x + 4 & \text{Original equation} \\
y &= -\frac{3}{2}(0) + 4 & \text{Replace } x \text{ with } 0. \\
y &= 4 & \text{Simplify}
\end{align*}
\]

Use the $y$-intercept $(0, 4)$ and the slope, $\frac{2}{3}$, to find the perpendicular line.

\[
\begin{align*}
y - y_1 &= m(x - x_1) & \text{Point-slope form} \\
y - 4 &= \frac{2}{3}(x - 0) & \text{Substitute} \\
y - 4 &= \frac{2}{3}x - 0 & \text{Distributive Property} \\
y - 4 + 4 &= \frac{2}{3}x - 0 + 4 & \text{Add } 4 \text{ to each side} \\
y &= \frac{2}{3}x + 4 & \text{Simplify}
\end{align*}
\]

Determine whether the graphs of each pair of equations are parallel, perpendicular, or neither.

33. $y = 4x + 3$

   \[4x + y = 3\]

   **SOLUTION:**
Write the second equation in slope-intercept form.

\[
\begin{align*}
4x + y &= 3 & \text{Original equation} \\
4x - 4x + y &= 3 - 4x & \text{Subtract} \\
y &= -4x + 3 & \text{Simplify}
\end{align*}
\]

The slope of $y = 4x + 3$ is 4 and the slope of $4x + y = 3$ is $-4$. They are neither equal nor opposite reciprocals, so the graphs of the equations are neither parallel nor perpendicular.

34. $y = -2x$

   \[2x + y = 3\]

   **SOLUTION:**
Write the second equation in slope-intercept form.

\[
\begin{align*}
2x + y &= 3 & \text{Original equation 2} \\
2x - 2x + y &= 3 - 2x & \text{Subtract} \\
y &= -2x + 3 & \text{Simplify}
\end{align*}
\]

The slope of the both equations is $-2$ so the graphs of the equations are parallel.
35. $3x + 5y = 10$
$5x - 3y = -6$

**SOLUTION:**
Write the equations in slope-intercept form.

\[
3x + 5y = 10 \quad \text{Original equation 1}
\]

\[
3x - 3x + 5y = 10 - 3x \quad \text{Subtract } 3x \text{ from each side}
\]

\[
y = -\frac{3}{5}x + 10 \quad \text{Simplify.}
\]

\[
\frac{5y}{3} = -\frac{3x+10}{3} \quad \text{Divide each side by } 5.
\]

\[
y = -\frac{3}{5}x + 2 \quad \text{Simplify.}
\]

\[
5x - 3y = -6 \quad \text{Original equation 2}
\]

\[
5x - 5x - 3y = -6 - 5x \quad \text{Subtract } 5x \text{ from each side}
\]

\[
-3y = -5x - 6 \quad \text{Simplify}
\]

\[
\frac{-3y}{3} = -\left(\frac{5x+6}{3}\right) \quad \text{Divide each side by } -3.
\]

\[
y = \frac{5}{3}x + 2 \quad \text{Simplify.}
\]

The slope of the $3x + 5y = 10$ is $-\frac{3}{5}$ and the slope of $5x - 3y = -6$ is $\frac{5}{3}$. They are opposite reciprocals, so the graphs of the equations are perpendicular.

36. $-3x + 4y = 8$
$-4x + 3y = -6$

**SOLUTION:**
Write the equations in slope-intercept form.

\[
-3x + 4y = 8 \quad \text{Original equation}
\]

\[
-3x + 3x + 4y = 8 + 3x \quad \text{Add } 3x \text{ to each side}
\]

\[
4y = 3x + 8 \quad \text{Simplify}
\]

\[
\frac{4y}{4} = \frac{3x+8}{4} \quad \text{Divide each side by } 4
\]

\[
y = \frac{3}{4}x + 2 \quad \text{Simplify.}
\]

\[
-4x + 3y = -6 \quad \text{Original equation}
\]

\[
-4x + 4x + 3y = -6 + 4x \quad \text{Add } 4x \text{ to each side}
\]

\[
3y = 4x - 6 \quad \text{Simplify}
\]

\[
\frac{3y}{3} = \frac{4x-6}{3} \quad \text{Divide each side by } 3
\]

\[
y = \frac{4}{3}x - 2 \quad \text{Simplify.}
\]

The slope of the first equation is $\frac{3}{4}$ and the slope of the second equation is $\frac{4}{3}$. They are neither equal nor opposite reciprocals, so the graphs of the equations are neither parallel nor perpendicular.

37. $2x + 5y = 15$
$3x + 5y = 15$

**SOLUTION:**
Write the equations in slope-intercept form.

\[
2x + 5y = 15 \quad \text{Original equation 1}
\]

\[
2x - 2x + 5y = 15 - 2x \quad \text{Subtract } 2x \text{ from each side}
\]

\[
y = -\frac{2}{5}x + 15 \quad \text{Simplify}
\]

\[
\frac{3y}{5} = -\frac{2x+15}{5} \quad \text{Divide each side by } 5.
\]

\[
y = -\frac{2}{5}x + 3 \quad \text{Simplify}
\]

\[
3x + 5y = 15 \quad \text{Original equation 2}
\]

\[
3x - 3x + 5y = 15 - 3x \quad \text{Subtract } 3x \text{ from each side}
\]

\[
y = -\frac{3}{5}x + 15 \quad \text{Simplify}
\]

\[
\frac{3y}{5} = -\frac{3x+15}{5} \quad \text{Divide each side by } 5.
\]

\[
y = -\frac{3}{5}x + 3 \quad \text{Simplify}
\]

The slope of the first equation is $-\frac{2}{5}$ and the slope of the second equation is $-\frac{3}{5}$. They are neither equal nor opposite reciprocals, so the graphs of the equations are neither parallel nor perpendicular.

38. $2x + 7y = -35$
$4x + 14y = -42$

**SOLUTION:**
Write the equations in slope-intercept form.

\[
2x + 7y = -35 \quad \text{Original equation 1}
\]

\[
2x - 2x + 7y = -35 - 2x \quad \text{Subtract } 2x \text{ from each side}
\]

\[
y = -\frac{2}{7}x - 35 \quad \text{Simplify}
\]

\[
\frac{7y}{7} = -\frac{2x+35}{7} \quad \text{Divide each side by } 7.
\]

\[
y = -\frac{2}{7}x - 5 \quad \text{Simplify}
\]

\[
4x + 14y = -42 \quad \text{Original equation 2}
\]

\[
4x - 4x + 14y = -42 -4x \quad \text{Subtract } 4x \text{ from each side}
\]

\[
14y = -4x -42 \quad \text{Simplify}
\]

\[
\frac{14y}{14} = -\frac{4x+42}{14} \quad \text{Divide each side by } 14
\]

\[
y = -\frac{4}{7}x - 3 \quad \text{Simplify}
\]

The slope of the both equations is $-\frac{2}{7}$ so the graphs of the equations are parallel.
4-4 Parallel and Perpendicular Lines

39. Write an equation in slope-intercept form for the line that is parallel to the graph of \( y = 7x - 3 \) and passes through the origin.

**SOLUTION:**
The slope of the line with equation \( y = 7x - 3 \) is 7. The line parallel to \( y = 7x - 3 \) has the same slope, 7. The origin is the point \((0, 0)\).

\[
y - y_1 = m(x - x_1)
\]

\[
y - 0 = 7(x - 0)
\]

\[
y = 7x
\]

40. **EXCAVATION** Scientists excavating a dinosaur mapped the site on a coordinate plane. If one bone lies from \((-5, 8)\) to \((10, -1)\) and a second bone lies from \((-10, -3)\) to \((-5, -6)\), are the bones parallel? Explain.

**SOLUTION:**
Find the slope of the first bone.

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
= \frac{-1 - 8}{10 - (-5)}
\]

\[
= \frac{-9}{15}
\]

\[
= -\frac{3}{5}
\]

Find the slope of the second bone.

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
= \frac{-6 - (-3)}{-5 - (-10)}
\]

\[
= \frac{-3}{5}
\]

The two bones are parallel because their slopes are both \(-\frac{3}{5}\).

41. **ARCHAEOLOGY** In the ruins of an ancient civilization, an archaeologist found pottery at \((2, 6)\) and hair accessories at \((4, -1)\). A pole is found with one end at \((7, 10)\) and the other end at \((14, 12)\). Is the pole perpendicular to the line through the pottery and the hair accessories? Explain.

**SOLUTION:**
Find the slope of the line through the pottery and hair accessories.

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
= \frac{-1 - 6}{4 - 2}
\]

\[
= \frac{7}{2}
\]

Find the slope of the pole.

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
= \frac{12 - 10}{14 - 7}
\]

\[
= \frac{2}{7}
\]

The slope of the line through the pottery and hair accessories is \(-\frac{7}{2}\) and the slope of the pole is \(\frac{2}{7}\). They are opposite reciprocals, so they are perpendicular.
4-4 Parallel and Perpendicular Lines

42. **GRAPHICS** To create a design on a computer, Andeana must enter the coordinates for points on the design. One line segment she drew has endpoints of (−2, 1) and (4, 3). The other coordinates that Andeana entered are (2, −7) and (8, −3). Could these points be the vertices of a rectangle? Explain.

**SOLUTION:**
Find the slope of the first line segment she drew.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-7 - 1}{2 - (-2)} = \frac{-8}{4} = -2
\]

Find the slope of the line segments that would be drawn between the other coordinates Andeana entered.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-3 - (-7)}{8 - 2} = \frac{4}{6} = \frac{2}{3}
\]

The slopes of these two line segments are not equal, so they are not parallel. Opposite sides of a rectangle must be parallel, so the points are not vertices of a rectangle.

43. **MULTIPLE REPRESENTATIONS** In this problem, you will explore parallel and perpendicular lines.

**a. GRAPHICAL** Graph the points \(A(−3, 3), B(3, 5),\) and \(C(−4, 0)\) on a coordinate plane.

**b. ANALYTICAL** Determine the coordinates of a fourth point \(D\) that would form a parallelogram. Explain your reasoning.

**c. ANALYTICAL** What is the minimum number of points that could be moved to make the parallelogram a rectangle? Describe which points should be moved and explain why.

---

**SOLUTION:**

**a.** To plot point \(A\), start at the origin, go 3 units to the left and 3 units up. To plot point \(B\), start at the origin, go 3 units to the right and 5 units up. To plot point \(C\), start at the origin and go 4 units to the left.

**b.** Looking at the graph, the slope of \(AB\) is \(\frac{1}{3}\) (up 1 unit, right 3 units). To form a parallelogram, \(CD\) would have to have the same slope as \(AB\), \(\frac{1}{3}\).

So, using the same slope as \(AB\), find the \(y\)-intercept using the fact that \(CD\) using the coordinate of \(C\).

Then write an equation for \(CD\).

\[y = \frac{1}{3}x + b\]  
**Slope-intercept form of \(CD\)**

\[0 = \frac{1}{3}(-4) + b\]  
Replace \((x, y)\) with \((-4, 0)\)

\[0 = -\frac{4}{3} + b\]  
Add \(-\frac{4}{3}\) to each side

\[b = \frac{4}{3}\]  
Simplify.

\[y = \frac{1}{3}x + \frac{4}{3}\]  
Add \(-\frac{4}{3}\) to each side

Looking at the graph, the slope of \(AC\) is 3 (up 3 units, right 1 unit). To form a parallelogram, \(BD\) would have to have the same slope as \(AC\), 3.

So, using the same slope as \(AC\), find the \(y\)-intercept and write an equation for \(BD\).

\[y = 3x + b\]  
**Slope-intercept form of \(BD\)**

\[5 = 3(3) + b\]  
Replace \((x, y)\) with \((3, 5)\)

\[5 = 9 + b\]  
Add 9 to each side

\[5 - 9 = 9 - 9 + b\]  
Subtract 9 from each side

\[-4 = b\]  
Simplify.

\[y = 3x - 4\]  
**\(BD\) in slope-intercept form**

Find a point that is found on both equations. Set the equations equal to each other to find the \(x\)-coordinate. Then substitute that value into one of the
4-4 Parallel and Perpendicular Lines

Write an equation in slope-intercept form for the line that passes through the given point and is parallel to the given line. The line passes through (3, 0), and the slope is -2. Let the line pass through (3, 0) and have the same slope as the given line.

\[ y = mx + b \]

where \( m = -2 \) and \( (3, 0) \) is a point on the line.

Substitute the point into the slope-intercept form to find the y-coordinate:

\[ 0 = -2(3) + b \]

\[ 0 = -6 + b \]

\[ b = 6 \]

So, the equation of the line is:

\[ y = -2x + 6 \]

45. REASONING Which key features of the graphs of two parallel lines are the same, and which are different? Which key features of the graphs of two perpendicular lines are the same, and which are different?

SAMPLE ANSWER:

Parallel lines: similarities: The domain and range are all real numbers, the functions are both either increasing or decreasing on the entire domain, the end behavior is the same, and the lines will have the same slope; differences: x- and y-intercepts are different. Any point on one line will not be on the other.

Perpendicular lines: similarities: The domain and range are all real numbers, and the lines have one point in common; differences: One function is increasing and the other is decreasing on the entire domain, as x increases, y increases for one function and decreases for the other and as x decreases, y increases for one function and decreases for the other. The lines will have slopes that are opposite reciprocals.
46. **OPEN ENDED** Graph a line that is parallel and a line that is perpendicular to \( y = 2x - 1 \).

**SOLUTION:**
To graph a line that is parallel to \( y = 2x - 1 \), draw a line with the slope of 2 that has a \( y \)-intercept other than \(-1\). To graph a line that is perpendicular to \( y = 2x - 1 \), draw a line with the slope of \(-\frac{1}{2}\).

Sample answer:

![Graph of parallel and perpendicular lines](image)

47. **CCSS CRITIQUE** Carmen and Chase are finding an equation of the line that is perpendicular to the graph of \( y = \frac{1}{3}x + 2 \) and passes through the point \((-3, 5)\). Is either of them correct? Explain your reasoning.

**SOLUTION:**
Both students used the formula correctly and used the correct point, but only Carmen used the correct slope for a line that is perpendicular to \( y = \frac{1}{3}x + 2 \). The correct slope is \(-3\) because it is the opposite reciprocal of the slope of the original line.

<table>
<thead>
<tr>
<th>Carmen</th>
<th>Chase</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y - 5 = \frac{3}{5}(x - (-3)) )</td>
<td>( y - 5 = 3(x - (-3)) )</td>
</tr>
<tr>
<td>( y = \frac{3}{5}x + 9 + 5 )</td>
<td>( y = 3x + 9 + 5 )</td>
</tr>
<tr>
<td>( y = -3x - 4 )</td>
<td>( y = 3x + 14 )</td>
</tr>
</tbody>
</table>

48. **WRITING IN MATH** Illustrate how you can determine whether two lines are parallel or perpendicular. Write an equation for the graph that is parallel and an equation for the graph that is perpendicular to the line shown. Explain your reasoning.

**SOLUTION:**
Sample answer: If two equations have the same slope, then the lines are parallel. If the product of their slopes equals \(-1\), then the lines are perpendicular. The graph of \( y = \frac{3}{2}x \) is parallel to the graph of \( y = \frac{3}{2}x + 1 \) because they have the same slope, \( \frac{3}{2} \). The graph of \( y = -\frac{2}{3}x \) is perpendicular to the graph of \( y = \frac{3}{2}x + 1 \) because the product of their slopes is \(-1\).
4-4 Parallel and Perpendicular Lines

49. Which of the following is an algebraic translation of the following phrase?

\[ 5 \text{ less than the quotient of a number and 8} \]

A \[ 5 - \frac{n}{8} \]

B \[ \frac{n}{8} - 5 \]

C \[ 5 - \frac{8}{n} \]

D \[ \frac{8}{n} - 5 \]

**SOLUTION:**
Rewrite the phrase so it is easier to translate. The *quotient of a number and 8* means a number divided by 8. 5 less than this means 5 is subtracted from this.

\[
\begin{align*}
\text{a number} & \quad \text{minus} & \quad \text{five} \\
\text{divided by} & \quad \text{eight} & \\
\frac{n}{8} & \quad - & \quad 5 \\
\end{align*}
\]

So, the correct choice is B.

50. A line through which two points would be parallel to a line with a slope of \( \frac{3}{4} \)?

F \( (0, 5) \) and \((−4, 2)\)

G \( (0, 2) \) and \( (−4, 1) \)

H \( (0, 0) \) and \( (0, −2) \)

J \( (0, −2) \) and \( (−4, −2) \)

**SOLUTION:**
Find the slope of the points for choice F.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 5}{-4 - 0} = \frac{3}{4}
\]

This is the same slope as that of the given line, so the correct choice is F.

51. Which equation best fits the data in the table?

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>11</td>
</tr>
</tbody>
</table>

A \( y = x + 4 \)

B \( y = 2x + 3 \)

C \( y = 7 \)

D \( y = 4x - 5 \)

**SOLUTION:**
Substitute the \( x \)-values from the table into each equation to determine if \( y \)-value is the same.

Choice A:

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y = x + 4 )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( y = (1) + 4 )</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>( y = (2) + 4 )</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>( y = (3) + 4 )</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>( y = (4) + 4 )</td>
<td>8</td>
</tr>
</tbody>
</table>

Choice B:

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y = 2x + 3 )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( y = 2(1) + 3 )</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>( y = 2(2) + 3 )</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>( y = 2(3) + 3 )</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>( y = 2(4) + 3 )</td>
<td>11</td>
</tr>
</tbody>
</table>

Choice C:

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y = 7 )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( y = 7 )</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>( y = 7 )</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>( y = 7 )</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>( y = 7 )</td>
<td>7</td>
</tr>
</tbody>
</table>

Choice D:

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y = 4x - 5 )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( y = 4(1) - 5 )</td>
<td>−1</td>
</tr>
<tr>
<td>2</td>
<td>( y = 4(2) - 5 )</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>( y = 4(3) - 5 )</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>( y = 4(4) - 5 )</td>
<td>11</td>
</tr>
</tbody>
</table>

Equation B is true for all values in the table. So, the correct choice is B.
### 4-4 Parallel and Perpendicular Lines

52. **SHORT RESPONSE**  Tyler is filling his 6000-gallon pool at a constant rate. After 4 hours, the pool contained 800 gallons. How many total hours will it take to completely fill the pool?

**SOLUTION:**

Use proportion to find the number of hours to fill a 6000-gallon pool.

\[ \frac{4}{800} = \frac{x}{6000} \quad \text{Proportion} \]

\[ 4(6000) = 800x \quad \text{Find the cross products} \]

\[ 24,000 = 800x \quad \text{Simplify} \]

\[ \frac{24,000}{800} = \frac{800x}{800} \quad \text{Divide each side by 800} \]

\[ 30 = x \quad \text{Simplify} \]

So, it will take 30 hours to completely fill the pool.

Write each equation in standard form.

53. **y − 13 = 4 (x − 2)**

**SOLUTION:**

\[ y − 13 = 4x − 8 \]

\[ y = 4x + 5 \]

\[ −4x + y = 5 \]

\[ 4x − y = −5 \]

54. **y − 5 = −2 (x + 2)**

**SOLUTION:**

\[ y − 5 = −2x − 4 \]

\[ y = −2x + 1 \]

\[ 2x + y = 1 \]

55. **y + 3 = −5 (x + 1)**

**SOLUTION:**

\[ y + 3 = −5x − 5 \]

\[ y = −5x − 8 \]

\[ 5x + y = −8 \]

56. **y + 7 = \frac{1}{2} (x + 2)**

**SOLUTION:**

\[ y + 7 = \frac{1}{2}x + 1 \]

\[ y = \frac{1}{2}x − 6 \]

\[ 2y = 2(\frac{1}{2}x − 6) \]

\[ 2y = x − 12 \]

\[ −x + 2y = −12 \]

\[ x − 2y = 12 \]

57. **y − 1 = \frac{5}{6} (x − 4)**

**SOLUTION:**

\[ y − 1 = \frac{5}{6}x − \frac{10}{6} \quad \text{Original equation} \]

\[ y − 1 = \frac{5}{6}x − \frac{5}{3} \quad \text{Distributive Property} \]

\[ 6(y − 1) = 6\left(\frac{5}{6}x − \frac{5}{3}\right) \quad \text{Multiply each side by 6} \]

\[ 6y − 6 = 5x − 20 \quad \text{Distributive Property} \]

\[ 6y − 6 + 5 = 5x − 20 + 6 \quad \text{Add 6 to each side} \]

\[ 6y − 5x = −14 \quad \text{Simplify} \]

\[ −5x + 6y = −5x − 14 \quad \text{Subtract 5x from each side} \]

\[ −5x + 6y = −14 \quad \text{Simplify} \]

\[ 5x − 6y = 14 \quad \text{Simplify} \]

58. **y − 2 = −\frac{2}{5} (x − 8)**

**SOLUTION:**

\[ y − 2 = −\frac{2}{5}x + \frac{16}{5} \]

\[ 5(y − 2) = 5\left(−\frac{2}{5}x + \frac{16}{5}\right) \]

\[ 5y − 10 = −2x + 16 \]

\[ 5y = −2x + 26 \]

\[ 2x + 5y = 26 \]
4-4 Parallel and Perpendicular Lines

59. **CANOE RENTAL** Latanya and her friends rented a canoe for 3 hours and paid a total of $45.

![Canoe Rental Sign]

Daily rates

**plus** $10 per hour

**a.** Write a linear equation to find the total cost C of renting the canoe for h hours.

**b.** How much would it cost to rent the canoe for 8 hours?

**SOLUTION:**

**a.** Find the constant daily rate.

\[ y = mx + b \]

45 = 10(3) + b

45 = 30 + b

15 = b

Write the equation.

\[ C = 10h + 15 \]

**b.** \[ C = 10(8) + 15 \]

\[ C = 80 + 15 \]

\[ C = 95 \]

So, the cost to rent a canoe for 8 hours is $95.

**Write an equation of the line that passes through each point with the given slope.**

60. \((5, -2), m = 3\)

**SOLUTION:**

Find the y-intercept.

\[ y = mx + b \]

\[-2 = 3(5) + b \]

\[-2 = 15 + b \]

\[-17 = b \]

Write the equation in slope-intercept form.

\[ y = 3x - 17 \]

61. \((-5, 4), m = -5\)

**SOLUTION:**

Find the y-intercept.

\[ y = mx + b \]

\[ 4 = -5(-5) + b \]

\[ 4 = 25 + b \]

\[-21 = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]

\[ y = -5x - 21 \]

62. \((3, 0), m = -2\)

**SOLUTION:**

Find the y-intercept.

\[ y = mx + b \]

\[ 0 = -2(3) + b \]

\[ 0 = -6 + b \]

\[ 6 = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]

\[ y = -2x + 6 \]

63. \((3, 5), m = 2\)

**SOLUTION:**

Find the y-intercept.

\[ y = mx + b \]

\[ 5 = 2(3) + b \]

\[ 5 = 6 + b \]

\[-1 = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]

\[ y = 2x - 1 \]

64. \((-3, -1), m = -3\)

**SOLUTION:**

Find the y-intercept.

\[ y = mx + b \]

\[-1 = -3(-3) + b \]

\[-1 = 9 + b \]

\[-10 = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]

\[ y = -3x - 10 \]
4-4 Parallel and Perpendicular Lines

65. \((-2, 4), m = -5\)

**SOLUTION:**
Find the \(y\)-intercept.
\[ y = mx + b \]
\[ 4 = -5(-2) + b \]
\[ 4 = 10 + b \]
\[ -6 = b \]
Write the equation in slope-intercept form.
\[ y = mx + b \]
\[ y = -5x - 6 \]

Simplify each expression. If not possible, write simplified.

66. \(13m + m\)

**SOLUTION:**
\[ 13m + m = 14m \]

67. \(14a^2 + 13b^2 + 27\)

**SOLUTION:**
There are no like terms to be combined. The expression is already simplified.

68. \(3(x + 2x)\)

**SOLUTION:**
\[ 3(x + 2x) = 3x + 6x \]
\[ = 9x \]

69. **FINANCIAL LITERACY** At a Farmers’ Market, merchants can rent a small table for $5.00 and a large table for $8.50. One time, 25 small and 10 large tables were rented. Another time, 35 small and 12 large were rented.

a. Write an algebraic expression to show the total amount of money collected.

b. Evaluate the expression.

**SOLUTION:**

a. \(25(5) + 10(8.5) + 35(5) + 12(8.5)\)

b. \(25(5) + 10(8.5) + 35(5) + 12(8.5) = 125 + 85 + 175 + 102 \)
\[ = 487 \]

So the total amount of money collected is $487.

Express each relation as a graph. Then determine the domain and range.

70. \{(3, 8), (3, 7), (2, -9), (1, -9), (-5, -3)\}

**SOLUTION:**
Plot the points.

The domain is all \(x\) values of the relation, and the range is all \(y\) values of the relation. So, the domain is \{-5, 1, 2, 3\} and the range is \{-9, -3, 7, 8\}.

71. \{(3, 4), (4, 3), (2, 2), (5, -4), (-4, 5)\}

**SOLUTION:**
Plot the points.

The domain is all \(x\) values of the relation, and the range is all \(y\) values of the relation. So, the domain is \{-4, 2, 3, 4, 5\} and the range is \{-4, 2, 3, 4, 5\}.

72. \{(0, 2), (-5, 1), (0, 6), (-1, 9), (-4, -5)\}

**SOLUTION:**
Plot the points.

The domain is all \(x\) values of the relation, and the range is all \(y\) values of the relation. So, the domain is \{-5, -4, -1, 0\} and the range is \{-5, 1, 2, 6, 9\}.
73. \{ (-7, 6), (-3, -4), (4, -5), (-2, 6), (-3, 2) \}

**SOLUTION:**

Plot the points.

![Graph with points plotted](image)

The domain is all \( x \) values of the relation, and the range is all \( y \) values of the relation. So, the domain is \{ -7, -3, 4, -2 \} and the range is \{ 6, -4, -5, 2 \}.
Determine whether each graph shows a positive, negative, or no correlation. If there is a positive or negative correlation, describe its meaning in the situation.

### 1.

**SOLUTION:**
The graph shows a positive correlation. As the time you practice free throws increases, the number of free throws you will make increases.

### 2.

**SOLUTION:**
The graph shows a positive correlation. As the temperature gets warmer, the more lemonade you will sell.

### 3. CCSS SENSE-MAKING

The table shows the median age of females when they were first married.

<table>
<thead>
<tr>
<th>Year</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>24.8</td>
</tr>
<tr>
<td>1997</td>
<td>25.0</td>
</tr>
<tr>
<td>1998</td>
<td>25.0</td>
</tr>
<tr>
<td>1999</td>
<td>25.1</td>
</tr>
<tr>
<td>2000</td>
<td>25.1</td>
</tr>
<tr>
<td>2001</td>
<td>25.1</td>
</tr>
<tr>
<td>2002</td>
<td>25.3</td>
</tr>
<tr>
<td>2003</td>
<td>25.3</td>
</tr>
<tr>
<td>2005</td>
<td>25.5</td>
</tr>
<tr>
<td>2006</td>
<td>25.9</td>
</tr>
</tbody>
</table>

**Source:** U.S. Bureau of Census

a. Make a scatter plot and determine what relationship exists, if any, in the data. Identify the independent and the dependant variables.

b. Draw a line of fit for the scatter plot.

c. Write an equation in slope-intercept form for the line of fit.

d. Predict what the median age of females when they are first married will be in 2016.

e. Do you think the equation can give a reasonable estimate for the year 2056? Explain.

**SOLUTION:**
a and b.

The graph shows a positive correlation. The independent variable is the year and the dependent variable is the median age of females when they were first married.

c. Sample answer: Using (1996, 24.8) and (2006, 25.9) and rounding, \( y = 0.11x - 194.8 \)

d. Sample answer:
\[
\begin{align*}
y &= 0.11x + 25.24 \\
y &= 0.11(16) + 25.24 \\
y &= 1.76 + 25.24 \\
y &= 27 \\
\end{align*}
\]
So, the median age of females when they are first married in 2016 will be 27.

e. Sample answer:
\[
\begin{align*}
y &= 0.11x + 25.24 \\
y &= 0.11(56) + 25.24 \\
\end{align*}
\]
4-5 Scatter Plots and Lines of Fit

\[ y = 6.16 + 25.24 \]
\[ y = 31.4 \]

Yes, the equation can give a reasonable estimate. According to the equation, the median age of females in 2056 when they are first married would be 31.4, which is likely.

**Determine whether each graph shows a positive, negative, or no correlation. If there is a positive or negative correlation, describe its meaning in the situation.**

4. **SOLUTION:**
The graph shows a positive correlation. As the number of tickets you buy increases, the more game prizes you will win.

5. **SOLUTION:**
The graph shows a negative correlation. As the NBA player gets taller, his 3-point shooting percentage gets lower.

6. **SOLUTION:**
The graph shows a positive correlation. As the number of years of formal education you receive increases, the higher your salary will be.

7. **SOLUTION:**
There is no correlation. The various vehicles give too many varying results for there to be a correlation between the speed of the vehicle and the miles per gallon.

8. **MILK** Refer to the scatter plot of gallons of milk consumption per person for selected years.

   a. Use the points (2, 21.75) and (4, 21) to write the slope-intercept form of an equation for the line of fit.

   b. Predict the milk consumption in 2015.

   c. Predict in what year milk consumption will be 10 gallons.
d. Is it reasonable to use the equation to estimate the consumption of milk for any year? Explain.

**SOLUTION:**

a. Find the slope of the line containing the given points.

\[ m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{21.75 - 21}{2 - 4} = \frac{-0.75}{-2} = 0.375 \]

Use the slope and either of the two points to find the y-intercept.

\[ y = mx + b \]

21 = -0.375(4) + b
21 = -1.5 + b

22.5 = b

Write the equation in slope-intercept form for the line of fit.

\[ y = -0.375x + 22.5 \]

b. Substitute 20 for \( x \) in the equation found in part a to predict how much milk will be consumed in 2020.

\[ y = -0.375(20) + 22.5 \]

\[ y = -7.5 + 22.5 \]

\[ y = 15 \]

In 2020, about 15 gallons of milk will be consumed.

c. Substitute 10 for \( y \) into the equation from part a to find the year that milk consumption will be 10 gallons.

\[ y = -0.375x + 22.5 \]

10 = -0.375x + 22.5

-12.5 = -0.375x

\[ \frac{-12.5}{-0.375} = x \]

33.3 = x

In the year 2033, the milk consumption will be 10 gallons.

d. Yes; if the current trend continues, the consumption of milk will continue to decrease.

9. **FOOTBALL** Use the scatter plot.

![Buffalo Bills Average Game Attendance Chart]

a. Use the points (5, 71,205) and (9, 69,611) to write the slope-intercept form of an equation for the line of fit shown in the scatter plot.

b. Predict the average attendance at a game in 2020.

c. Can you use the equation to make a decision about the average attendance in any given year in the future? Explain.

**SOLUTION:**

a. Find the slope of the line containing the given points.

\[ m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{71,205 - 68,611}{5 - 9} = \frac{2594}{-4} = -648.5 \]

Use the slope and either of the two points to find the y-intercept.

\[ y = mx + b \]

71,205 = -648.5(5) + b
71,205 = -3242.5 + b
74,447.5 = b

Write the equation in slope-intercept form for the line of fit.
4-5 Scatter Plots and Lines of Fit

\[ y = mx + b \]
\[ y = -648.5x + 74,447.5 \]

b. Substitute 20 for \( x \) in the equation from part a.
\[ y = -648.5(20) + 74,447.5 \]
\[ y = -12,970 + 74,447.5 \]
\[ y = 61,477.5 \]

The average attendance at a Buffalo Bills game in 2020 will be 61,478 people.

c. No you cannot use this equation to make predictions about future attendance because the average attendance will fluctuate with other variables such as how good the team is that year.

10. CCSS SENSE-MAKING The Body Mass Index (BMI) is a measure of body fat using height and weight. The heights and weights of twelve men with normal BMI are given in the table shown.

<table>
<thead>
<tr>
<th>Height (in.)</th>
<th>Weight (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td>115</td>
</tr>
<tr>
<td>63</td>
<td>124</td>
</tr>
<tr>
<td>65</td>
<td>120</td>
</tr>
<tr>
<td>67</td>
<td>134</td>
</tr>
<tr>
<td>67</td>
<td>140</td>
</tr>
<tr>
<td>68</td>
<td>138</td>
</tr>
<tr>
<td>68</td>
<td>144</td>
</tr>
<tr>
<td>68</td>
<td>152</td>
</tr>
<tr>
<td>69</td>
<td>147</td>
</tr>
<tr>
<td>72</td>
<td>155</td>
</tr>
<tr>
<td>73</td>
<td>168</td>
</tr>
</tbody>
</table>

a. Make a scatter plot comparing the height in inches to the weight in pounds.

b. Draw a line of fit for the data.

c. Write the slope-intercept form of an equation for the line of fit.

d. Predict the normal weight for a man who is 84 inches tall.
e. A man’s weight is 188 pounds. Use the equation of the line of fit to predict the height of the man.

**SOLUTION:**

\[ y = mx + b \]

e. Answers will vary depending on which points the student picks. Sample answer: Choose two points on the best fit line: (62, 115) and (69, 147). Calculate the slope.

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]

\[ = \frac{147 - 115}{69 - 62} \]

\[ = \frac{32}{7} \]

\[ = 4.57 \]

Use the slope and either of the two points to find the y-intercept.

\[ y = mx + b \]

\[ y = 4.57(69) + b \]

\[ 147 = 315.33 + b \]

\[ 147 - 315.33 = 315.33 - 315.33 + b \]

\[ -168.33 = b \]

\[ y = 4.57x - 168.33 \]

d. Let \( x = 84 \) inches. Substitute this into the equation.

\[ y = 4.57x - 168.33 \]

\[ = 4.57(84) - 168.33 \]

\[ = 383.88 - 168.33 \]

\[ = 215.55 \]

Sample answer: 215.6 lb

e. If a man’s weight is 188 lbs, substitute \( y = 188 \) and find \( x \).
4-5 Scatter Plots and Lines of Fit

\[ y = 4.57x - 168.33 \]

\[ 188 = 4.57x - 168.33 \]

\[ 188 + 168.33 = 4.57x - 168.33 + 168.33 \]

\[ 356.33 = 4.57x \]

\[ \frac{356.33}{4.57} = \frac{4.57x}{4.57} \]

\[ 77.97 = x \]

Sample answer: about 78 in.

11. GEYSERS The time to the next eruption of Old Faithful can be predicted by using the duration of the current eruption.

<table>
<thead>
<tr>
<th>Duration (min)</th>
<th>1.5</th>
<th>2</th>
<th>2.5</th>
<th>3</th>
<th>3.5</th>
<th>4</th>
<th>4.5</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interval (sec)</td>
<td>48</td>
<td>55</td>
<td>70</td>
<td>72</td>
<td>74</td>
<td>82</td>
<td>85</td>
<td>100</td>
</tr>
</tbody>
</table>

a. Identify the independent and the dependant variables. Make a scatter plot and determine what relationship, if any, exists in the data. Draw a line of fit for the scatter plot.

b. Let \( x \) represent the duration of the previous interval. Let \( y \) represent time between eruptions. Write the slope-intercept form of the equation for the line of fit. Predict the interval after a 7.5-minute eruption.

c. Make a critical judgment about using the equation to predict the duration of the next eruption. Would the equation be a useful model?

SOLUTION:

a. The independent variable is the duration of the eruptions and the dependent variable is the interval between eruptions.

There is a positive correlation between the independent and dependent variables.

b. Sample answer using (2, 55) and (4, 82):

Calculate the slope.

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]

\[ = \frac{82 - 55}{4 - 2} \]

\[ = \frac{27}{2} \]

\[ = 13.5 \]

Use the slope and either of the two points to find the \( y \)-intercept.

\[ y = mx + b \]

\[ 82 = 13.5(4) + b \]

\[ 82 = 54 + b \]

\[ 82 - 54 = 54 - 54 + b \]

\[ 28 = b \]

So the equation is: \( y = 13.5x + 28 \)

To find the interval after an eruption of 7.5 minutes, let \( x = 7.5 \)

\[ y = 13.5(7.5) + 28 \]

\[ = 101.25 + 28 \]

\[ = 129.25 \]

Sample answer: about 129.25 min

c. The duration of an eruption is the independent variable and therefore is not dependent on the previous interval. Only the interval, the dependent variable) can be predicted by the length of the eruption.

12. COLLECT DATA Use a tape measure to measure both the foot size and the height in inches of ten individuals.

a. Record your data in a table.

b. Make a scatter plot and draw a line of fit for the data.

c. Write an equation for the line of fit.

d. Make a conjecture about the relationship between foot size and height.

SOLUTION:

a. Consider the following sample data.
### 4-5 Scatter Plots and Lines of Fit

<table>
<thead>
<tr>
<th>Length of foot (in.)</th>
<th>Height (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.2</td>
<td>70.9</td>
</tr>
<tr>
<td>12.2</td>
<td>72.8</td>
</tr>
<tr>
<td>12.6</td>
<td>73.8</td>
</tr>
<tr>
<td>10.2</td>
<td>61.0</td>
</tr>
<tr>
<td>11.0</td>
<td>66.3</td>
</tr>
<tr>
<td>10.0</td>
<td>62.0</td>
</tr>
<tr>
<td>10.2</td>
<td>67.3</td>
</tr>
<tr>
<td>12.0</td>
<td>68.9</td>
</tr>
<tr>
<td>12.6</td>
<td>68.7</td>
</tr>
<tr>
<td>12.2</td>
<td>71.5</td>
</tr>
</tbody>
</table>

b. Use a graphing calculator to create a scatter plot.

Select **EDIT** from the **STAT** menu. Enter length of foot in **L1** and height in **L2**. From the **STAT PLOT** option, turn the Plot on, select a scatter plot and indicate **L1** for **Xlist** and **L2** for **Ylist**. Use the **ZoomStat** option from the **ZOOM** menu to change the viewing window.

![Scatter Plot](image)

**c.** Use points (10.2, 61) and (12.2, 72.8) to determine the equation.

Find the slope.

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
= \frac{72.8 - 61}{12.2 - 10.2}
\]

\[
= \frac{11.8}{2}
\]

\[
= 5.9
\]

Use the point-slope form to find the equation.

\[y - y_1 = m(x - x_1)\]  \hspace{1cm} \text{Point-slope form}

\[y - 61 = 5.9(x - 10.2)\]  \hspace{1cm} \text{Substitute}

\[y - 61 = 5.9x - 60.16\]  \hspace{1cm} \text{Distributive Property}

\[y - 16 + 61 = 5.9x - 60.18 + 61\]  \hspace{1cm} \text{Add 61 to each side}

\[y = 5.9x + 0.82\]  \hspace{1cm} \text{Simplify}

---

d. There seems to be a general trend that taller people have larger feet.

13. **OPEN ENDED** Describe a real-life situation that can be modeled using a scatter plot. Decide whether there is a **positive**, **negative**, or **no** correlation. Explain what this correlation means.

**SOLUTION:**

The salary of an individual and the years of experience that they have; this would be a positive correlation because the more experience an individual has, the higher the salary would probably be.

Consider the following sample data for years of experience vs salary.

![Scatter Plot](image)

The data show a positive correlation. Salary increases as years of experience increases.
4-5 Scatter Plots and Lines of Fit

14. **WHICH ONE DOESN’T BELONG?** Analyze the following situations and determine which one does not belong.

- hours worked and amount of money earned
- height of an athlete and favorite color
- seedlings that grow an average of 2 centimeters each week
- number of photos stored on a camera and memory used

**SOLUTION:**

- hours worked and amount of money earned: As hours worked increase, the amount of money increase. This situation has a positive correlation.
- height of an athlete and favorite color: The height of an athlete has no relationship with favorite color. This situation has no correlation.
- seedlings that grow an average of 2 centimeters each week: As the number of weeks increases, the height will increase. This situation has a positive correlation.
- number of photos stored on a camera and memory used: As the number of photos stored on the camera increase, amount of memory used on the camera increases.

Height and favorite color does not belong. The other situations have a positive correlation, this has no correlation.

15. **CCSS ARGUMENTS** Determine which line of fit is better for the scatter plot. Explain your reasoning.

**SOLUTION:**

Line \(g\) has the same number of points above the line and below the line. Line \(f\) is close to 2 of the points, but for the rest of the data there are 3 points above and 3 points below the line. Whenever there is no line that can be drawn through all the points or even close to all the points, many different lines of fit can be drawn that are close to the points. Therefore, neither line \(g\) nor line \(f\) is a better line of fit for this scatter plot.

16. **REASONING** What can make a scatter plot and line of fit more useful for accurate predictions? Does an accurate line of fit always predict what will happen in the future? Explain.

**SOLUTION:**

The more data you have, the more accurate the scatter plot and line of fit will be. No, even an accurate line of fit cannot always predict what will happen in the future because trends can change and a line of fit assumes that the same pattern or trend will continue indefinitely.
17. **WRITING IN MATH** Make a scatter plot that shows the height and age of an oak tree. Explain how you could use the scatter plot to predict the age of an oak tree given its height. How can the information from a scatter plot be used to identify trends and make decisions?

**SOLUTION:**
Sample answer: You can visualize a line to determine whether the data has a positive or negative correlation. The graph below shows the ages and heights of oak trees. To predict the age of a tree given its height, write a linear equation for the line of fit. Then substitute the height of the tree and solve for the corresponding age. You can use the pattern in the scatter plot to make decisions. After you have the best fit line, you can predict the height of an oak tree at a specific age or you can estimate the age of an oak tree when it reaches a certain height.

18. Which equation best describes the relationship between the values of \( x \) and \( y \) in the table?

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>-7</td>
</tr>
<tr>
<td>0</td>
<td>-5</td>
</tr>
<tr>
<td>2</td>
<td>-1</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

- **A** \( y = x - 5 \)
- **B** \( y = 2x - 5 \)
- **C** \( y = 3x - 7 \)
- **D** \( y = 4x - 7 \)

**SOLUTION:**
Choose two points and calculate the slope.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - (-1)}{0 - 2} = \frac{-4}{-2} = 2
\]

Now find the \( y \)-intercept with any point.

\[
y = mx + b\]
\[
-7 = 2(-1) + b\]
\[
-7 = -2 + b\]
\[
-5 = b
\]

The equation that best represents the relationship between \( x \) and \( y \) is \( y = 2x - 5 \), so the correct choice is B.
19. **STATISTICS** Mr. Hernandez collected data on the heights and average stride lengths of a random sample of high school students. He then made a scatter plot. What kind of correlation did he most likely see?

- **F** positive
- **G** constant
- **H** negative
- **J** no

**SOLUTION:**
Mr. Hernandez most likely saw a positive correlation. As the height of the student increases, the length of the stride would also increase. So the correct choice is **F**.

20. **GEOMETRY** Mrs. Aguilar’s rectangular bedroom measures 13 feet by 11 feet. She wants to purchase carpet for the bedroom that costs $2.95 per square foot, including tax. How much will the carpet cost?

- **A** $70.80
- **B** $141.60
- **C** $145.95
- **D** $421.85

**SOLUTION:**
Calculate the area of the bedroom.

\[ A = lw \]
\[ A = (13)(11) \]
\[ A = 143 \]

The cost is $2.95 per square foot.
\[ 2.95 \cdot 143 = 421.85 \]
It will cost $421.85, so the correct choice is **D**.

21. **SHORT RESPONSE** Nikia bought a one-month membership to a fitness center for $35. Each time she goes, she rents a locker for $0.25. If she spent $40.50 at the fitness center last month, how many days did she go?

**SOLUTION:**
Let \( t \) represent the number of times Nikia goes to the gym.

\[
\begin{align*}
40.50 &= 0.25t + 35 \\
40.50 - 35 &= 0.25t + 35 - 35 \\
5.50 &= 0.25t \\
\frac{5.50}{0.25} &= \frac{0.25t}{0.25} \\
22 &= t
\end{align*}
\]

So, Nikia went to the Fitness Center 22 days last month.

**Determine whether the graphs of each pair of equations are parallel, perpendicular, or neither.**

22. \( y = -2x + 11 \)
\( y + 2x = 23 \)

**SOLUTION:**
Rearrange the second equation into slope-intercept form.

\[
\begin{align*}
y + 2x &= 23 \\
y + 2x - 2x &= 23 - 2x \\
y &= -2x + 23
\end{align*}
\]

The lines have the same slope but different intercepts, so the lines are parallel.
23. $3y = 2x + 14$
$2x + 3y = 2$

**SOLUTION:**
Rearrange both equations into slope-intercept form.

\[
\begin{align*}
3y &= 2x + 14 \\
3y &= 2x + 14 \\
\frac{3y}{3} &= \frac{2x + 14}{3} \\
\frac{3y}{3} &= \frac{2x + 14}{3} \\
y &= \frac{2}{3}x + \frac{14}{3} \\
y &= \frac{2}{3}x + \frac{14}{3}
\end{align*}
\]

The answer is neither because the slopes are neither the same nor negative reciprocals.

24. $y = -5x$
$y = 5x - 18$

**SOLUTION:**
The answer is neither because the slopes are neither the same nor negative reciprocals.

25. $y = 3x + 2$
$y = -x - 2$

**SOLUTION:**
The slopes are negative reciprocals, so the lines are perpendicular.

**Write each equation in standard form.**

26. $y - 13 = 4(x - 2)$

**SOLUTION:**

\[
\begin{align*}
y - 13 &= 4(x - 2) & \text{Original equation} \\
y - 13 &= 4x - 8 & \text{Distributive Property} \\
y - 4x &= 13 - 8 & \text{Subtract 4x from each side} \\
y - 4x &= 5 & \text{Simplify} \\
y - 4x &= -4 & \text{Add 13 to each side} \\
-4x + y &= 5 & \text{Simplify} \\
-4(-4x + y) &= -4(5) & \text{Multiply each side by -1} \\
4x - y &= -5 & \text{Simplify}
\end{align*}
\]

27. $y - 5 = -2(x + 2)$

**SOLUTION:**

\[
\begin{align*}
y - 5 &= -2(x + 2) & \text{Original equation} \\
y - 5 &= -2x - 4 & \text{Distributive Property} \\
y + 2x &= -2x - 4 & \text{Add 2x to each side} \\
2x + y &= -4 & \text{Simplify} \\
2x + y - 5 &= -4 + 5 & \text{Add 5 to each side} \\
2x + y &= 1 & \text{Simplify}
\end{align*}
\]

28. $y + 3 = -5(x + 1)$

**SOLUTION:**

\[
\begin{align*}
y + 3 &= -5(x + 1) & \text{Original equation} \\
y + 3 &= -5x - 5 & \text{Distributive Property} \\
y + 5x &= -5 - 3 & \text{Add 5x to each side} \\
5x + y &= -8 & \text{Simplify} \\
5x + y - 3 &= -5 - 3 & \text{Subtract 3 from each side} \\
5x + y &= -2 & \text{Simplify}
\end{align*}
\]

29. $y + 7 = \frac{1}{2}(x + 2)$

**SOLUTION:**

\[
\begin{align*}
y + 7 &= \frac{1}{2}(x + 2) & \text{Original equation} \\
y + 7 &= \frac{1}{2}x + 1 & \text{Distributive Property} \\
2y + 14 &= x + 2 & \text{Multiply each side by 2} \\
2y + 14 &= x + 2 & \text{Distributive Property} \\
2y &= x - 2y + 2 & \text{Subtract 2y from each side} \\
14 &= x + 2y + 2 & \text{Simplify} \\
12 &= x + 2y & \text{Subtract 2 to each side} \\
x - 2y &= 12 & \text{Simplify}
\end{align*}
\]

30. $y - 1 = \frac{5}{6}(x - 4)$

**SOLUTION:**

\[
\begin{align*}
y - 1 &= \frac{5}{6}(x - 4) & \text{Original equation} \\
y - 1 &= \frac{5x}{6} - \frac{20}{6} & \text{Distributive Property} \\
6y - 6 &= 5x - 20 & \text{Multiply each side by 6} \\
6y - 6 &= 5x - 20 & \text{Distributive Property} \\
6y - 6 &= 6y - 20 & \text{Subtract 6y from each side} \\
-6 &= 5x - 6y - 20 & \text{Simplify} \\
-6 + 20 &= 5x - 6y + 20 & \text{Subtract 20 to each side} \\
14 &= 5x - 6y & \text{Simplify}
\end{align*}
\]
4-5 Scatter Plots and Lines of Fit

31. \( y - 2 = -\frac{2}{5}(x - 8) \)

\[ \text{SOLUTION:} \]
\[ y - 2 = -\frac{2}{5}(x - 8) \quad \text{Original equation} \]
\[ y - 2 = -\frac{2x}{5} + \frac{16}{5} \quad \text{Distributive Property} \]
\[ 5(y - 2) = 5\left(-\frac{2x}{5} + \frac{16}{5}\right) \quad \text{Multiply each side by 5} \]
\[ 5y - 10 = -2x + 16 \quad \text{Distributive Property} \]
\[ 5y + 2x - 10 = -2x + 2x + 16 \quad \text{Add } 2x \text{ to each side} \]
\[ 2x + 5y - 10 = 16 \quad \text{Simplify} \]
\[ 2x + 5y - 10 + 10 = 16 + 10 \quad \text{Add 10 to each side.} \]
\[ 2x + 5y = 26 \quad \text{Simplify} \]

Graph each equation.

32. \( y = 2x + 3 \)

\[ \text{SOLUTION:} \]
To graph the equation, plot the y-intercept (0, 3).
Then move up 2 units and right 1 unit. Plot the point.
Draw a line through the two points.

33. \( 4x + y = -1 \)

\[ \text{SOLUTION:} \]
First, rewrite the equation in slope-intercept form by solving for \( y \).
\[ 4x + y = -1 \]
\[ 4x + y - 4x = -1 - 4x \]
\[ y = -4x - 1 \]
To graph the equation, plot the y-intercept (0, -1).
Then move down 4 units and right 1 unit. Plot the point. Draw a line through the two points.
34. \(3x + 4y = 7\)

**SOLUTION:**
First, rewrite the equation in slope-intercept form by solving for \(y\).

\[
3x + 4y = 7
\]

\[
3x + 4y - 3x = 7 - 3x
\]

\[
4y = 7 - 3x
\]

\[
4y \cdot \frac{1}{4} = \frac{7 - 3x}{4}
\]

\[
y = \frac{7}{4} - \frac{3}{4}x
\]

To graph the equation, plot the \(y\)-intercept \((0, \frac{7}{4})\).
Then move down 3 units and right 4 unit. Plot the point. Draw a line through the two points.

35. (3, 4), (10, 8)

**SOLUTION:**

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
= \frac{8 - 4}{10 - 3}
\]

\[
= \frac{4}{7}
\]

36. (−4, 7), (3, 5)

**SOLUTION:**

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
= \frac{5 - 7}{3 - (-4)}
\]

\[
= \frac{-2}{7}
\]

37. (3, 7), (−2, 4)

**SOLUTION:**

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
= \frac{7 - 4}{3 - (-2)}
\]

\[
= \frac{3}{5}
\]

38. (−3, 2), (−3, 4)

**SOLUTION:**

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
= \frac{4 - 2}{-3 - (-3)}
\]

\[
= \frac{2}{0}
\]

So the slope is undefined.

39. (−2, −6), (−1, 10)

**SOLUTION:**

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
= \frac{10 - (-6)}{-1 - (-2)}
\]

\[
= \frac{16}{1}
\]

\[
= 16
\]
40. (1, −5), (−3, −5)

**SOLUTION:**

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - (-5)}{-3 - 1} = \frac{0}{-4} = 0
\]

41. **DRIVING** Latisha drove 248 miles in 4 hours. At that rate, how long will it take her to drive an additional 93 miles?

**SOLUTION:**

Let \( t \) represent the time to drive.

\[
\frac{4}{248} = \frac{t}{93}
\]

\( t(248) = 4(93) \)

\( 248t = 372 \)

\( \frac{248t}{248} = \frac{372}{248} \)

\( t = 1.5 \)

It will take another 1.5 hours.

Express each relation as a graph. Then determine the domain and range.

42. \{(4, 5), (5, 4), (−2, −2), (4, −5), (−5, 4)\}

**SOLUTION:**

\[
D = \{4, 5, -2, -5\};
R = \{5, -2, -5, 4\}
\]

43. \{(7, 6), (3, 4), (4, 5), (−2, 6), (−3, 2)\}

**SOLUTION:**

\[
D = \{7, 3, 4, -2, -3\};
R = \{6, 4, 5, 2\}
\]
1. **POTTERY** A local university is keeping track of the number of art students who use the pottery studio each day.

<table>
<thead>
<tr>
<th>Day</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>10</td>
<td>15</td>
<td>18</td>
<td>15</td>
<td>13</td>
<td>19</td>
<td>20</td>
</tr>
</tbody>
</table>

**a.** Write an equation of the regression line and find the correlation coefficient.

**b.** Graph the residual plot and determine if the regression line models the data well.

**SOLUTION:**

**Step 1:** Enter the data by pressing STAT and selecting the EDIT option. Enter the day into List 1 (L1). These will represent the x-values. Enter the number of students into List 2 (L2). These will represent the y-values.

**Step 2:** Perform the regression by pressing STAT and selecting the CALC option. Scroll down to LinReg(ax + b) and press ENTER.

\[ y = ax + b \\
\text{a = 1.178571429} \\
b = 11 \\
r^2 = .515625 \\
r = .7180703308 \]

Substitute the values in for a and b to write the equation of the regression line.

So, the equation is \( y = 1.18x + 11 \).

Identify the value of r on the calculator to find the correlation coefficient.

So, 0.7181 is the correlation coefficient.

**b.** Turn on Plot2 under the STAT PLOT menu and choose scatter plot. Use L1 for the Xlist and RESID for the Ylist. You can obtain RESID by pressing 2nd STAT and selecting RESID from the list of names. Graph the scatter plot of the residuals by pressing ZOOM and choosing ZoomStat.

The residuals appear to be randomly scattered, so the regression line fits the data reasonably well.

2. **COMPUTERS** The table below shows the percent of Americans with a broadband connection at home in a recent year. Use linear extrapolation and a regression equation to estimate the percentage of 60-year-olds with broadband at home.

<table>
<thead>
<tr>
<th>Age</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>40</td>
<td>42</td>
<td>36</td>
<td>35</td>
<td>36</td>
<td>32</td>
</tr>
</tbody>
</table>

**SOLUTION:**

Use a calculator to find the equation of the regression line.

\[ y = ax + b \\
\text{a = -0.3371428571} \\
b = 49.47619048 \\
r^2 = .7670216673 \\
r = -.8757977319 \]

\[ y = -0.34x + 49.48 \]

Substitute 60 into the equation.

\[ y = -0.34x + 49.48 \]
\[ y = -0.34(60) + 49.48 \]
\[ y = -20.4 + 49.48 \]
\[ y = 29.08 \]
\[ y \approx 29 \]

So, about 29% of 60-year-olds have broadband at home.
3. VACATION The Smiths want to rent a house on the lake that sleeps eight people. The cost of the house per night is based on how close it is to the water.

To estimate the cost of a rental 1.75 miles from the lake?

SOLUTION:

b. What would you estimate is the cost of a rental 1.75 miles from the lake?

SOLUTION:
a. Use a calculator to find and graph the equation of the median fit line.

\[ y = -271.88x + 554.48 \]

b. To estimate the cost of a rental 1.75 miles from the lake, evaluate the equation of the median-fit line for \( x = 1.75 \).

\[ y = -271.88(1.75) + 554.48 \]
\[ y = -475.79 + 554.48 \]
\[ y = 78.69 \]

An estimate of the cost of a rental 1.75 miles from the lake is $78.69.

4. SKYSCRAPERS The table ranks the ten tallest buildings in the world.

To find the correlation coefficient.

SOLUTION:

Use a calculator to find the equation of the regression line.

\[ y = -2.75x + 102.53 \]

Use a calculator to find the correlation coefficient.

\(-0.6071\)
5. **MUSIC** The table gives the number of annual violin auditions held by a youth symphony each year since 2004. Let \( x \) be the number of years since 2004.

<table>
<thead>
<tr>
<th>Year</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditions</td>
<td>22</td>
<td>19</td>
<td>25</td>
<td>37</td>
<td>32</td>
<td>35</td>
<td>42</td>
</tr>
</tbody>
</table>

**SOLUTION:**

Use a calculator to find the equation of the regression line.

\[
\begin{align*}
  y &= 3.54x + 19.68 \\
  a &= 3.535714286 \\
  b &= 19.67857143 \\
  r^2 &= 0.8113410596 \\
  r &= 0.900744725
\end{align*}
\]

6. **RETAIL** The table gives the sales of jeans at a clothing chain since 2004. Let \( x \) be the number of years since 2004.

<table>
<thead>
<tr>
<th>Year</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales (Millions of Dollars)</td>
<td>6.64</td>
<td>7.6</td>
<td>14.9</td>
<td>15.4</td>
<td>17.7</td>
<td>21.2</td>
<td>23.1</td>
</tr>
</tbody>
</table>

a. Write an equation of the regression line.

b. Graph and analyze the residual plot.

**SOLUTION:**

a. Use a calculator to find the equation of the regression line.

\[
\begin{align*}
  y &= 3.317142857x + 5.197142857 \\
  a &= 3.317142857 \\
  b &= 5.197142857 \\
  r^2 &= 0.9761895019 \\
  r &= 0.9880293827
\end{align*}
\]

The equation is about \( y = 3.32x + 5.20 \).

b. Use a calculator to graph the residual plot for the data.

The residuals appear to be randomly scattered. Therefore, the regression line fits the data well.
7. MARATHON The number of entrants in the Boston Marathon every five years since 1975 is shown. Let \( x \) be the number of years since 1975.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrant</td>
<td>2845</td>
<td>5677</td>
<td>5594</td>
<td>4012</td>
<td>9416</td>
<td>17010</td>
<td>20430</td>
<td>26725</td>
</tr>
</tbody>
</table>

a. Find an equation for the median-fit line.

b. According to the equation, how many entrants were there in 2003?

SOLUTION:
a. Let \( x = 0 \) for 1975. Use a calculator to find the equation of the median-fit line.

\[
\text{Med-Med} \quad y = ax + b \\
a = 601.44 \\
b = 1236.13333
\]

\[
y = 601.44x + 1236.13
\]

b. To estimate the number of entrants in 2003, evaluate the equation for the median-fit line for \( x = 2003 - 1975 = 28 \).

\[
y = 601.44x + 1236.13 = 601.44(28) + 1236.13 = 16840.32 + 1236.13 = 18076.45 \approx 18076
\]

There were about 18,076 entrants in 2003.

8. CAMPING A campground kept a record of the number of campsites rented over the week of July 4 for several years. Let \( x \) be the number of years since 2000.

<table>
<thead>
<tr>
<th>Year</th>
<th>2000</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days Rented</td>
<td>34</td>
<td>18</td>
<td>53</td>
<td>68</td>
<td>47</td>
<td>37</td>
<td>55</td>
</tr>
</tbody>
</table>

a. Find an equation for the regression line.

b. To predict the number of campsites that will be rented in 2012, evaluate the regression equation for \( x = 12 \).

\[
y = 3.07x + 32.71
\]

\[
y = 3.07(12) + 32.71 = 36.84 + 32.71 = 69.55 \approx 70
\]

There will be about 70 campsites rented in 2012.

c. To predict the number of campsites that will be rented in 2020, evaluate the regression equation for \( x = 20 \).

\[
y = 3.07x + 32.71
\]

\[
y = 3.07(20) + 32.71 = 61.4 + 32.71 = 94.11 \approx 94
\]

There will be about 94 campsites rented in 2020.

9. ICE CREAM An ice cream company keeps a count of the tubs of cookie dough ice cream
delivered to each of their stores in a particular area.

<table>
<thead>
<tr>
<th>Store Size (h²)</th>
<th>2100</th>
<th>2225</th>
<th>3135</th>
<th>3669</th>
<th>4507</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tubs (hundreds)</td>
<td>110</td>
<td>102</td>
<td>215</td>
<td>312</td>
<td>265</td>
</tr>
</tbody>
</table>

a. Find an equation for the median-fit line.

b. Graph the points and the median-fit line.

c. How many tubs would be delivered to a 1500-square-foot store? a 5000-square-foot store?

**SOLUTION:**

a. Use a calculator to find an equation for the median-fit line.

![Med-Med](image)

\[
y = 0.095x - 94.58
\]

b. Plot the points and the equation.

There are about 48 tubs delivered to a 1500-square-foot store.

To estimate the number of tubs to be delivered to a 5000-square-foot store, evaluate the regression equation for \(x = 5000\).

\[
y = 0.095(5000) - 94.58
\]

\[y = 475 - 94.58\]

\[y = 380.42\]

\[y \approx 380\]

There are about 380 tubs delivered to a 5000-square-foot store.

10. **CCSS SENSE-MAKING** The prices of the eight top-selling brands of jeans at Jeanie’s Jeans are given in the table below.

<table>
<thead>
<tr>
<th>Sales Rank</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price ($)</td>
<td>43</td>
<td>44</td>
<td>50</td>
<td>61</td>
<td>64</td>
<td>105</td>
<td>108</td>
<td>78</td>
</tr>
</tbody>
</table>

a. Find the equation for the regression line.

b. According to the equation, what would be the price of a pair of the 12th best-selling brand?

c. Is this a reasonable prediction? Explain.

**SOLUTION:**

a. Use a calculator to find an equation for the regression line.

**Step 1:** Enter the data by pressing **STAT** and selecting the **EDIT** option. Enter the sales rank into List 1 (L1). These will represent the \(x\)-values. Enter the price into List 2 (L2). These will represent the \(y\)-values.

**Step 2:** Perform the regression by pressing **STAT** and selecting the **CALC** option. Scroll
A local university is keeping track of the number of art students who use the pottery studio each day. To find the number of people in 2020, let $x$ be the years starting with $x = 1$ for 2005 and let $y$ be the attendance (in millions). Then graph the scatter plot.

**SOLUTION:**

To graph the equation, plot the point. Draw a line through the two points.

The equation is about $y = 9.8x + 28.79$

To graph the equation, plot the point. Draw a line through the two points.

The equation is about $y = 9.8x + 28.79$

The price of a pair of the 12th bestselling brands of jeans would be about $146.39.

**c.** Sample answer: No; the correlation between sales rank and price is too weak to make any reasonable prediction. The 12th bestselling brand of jeans could just as easily be a poorly made pair of jeans selling for $15.

11. **STATE FAIRS** The table shows the total attendance, in millions of people, at the Minnesota State Fair from 2005 to 2009.

<table>
<thead>
<tr>
<th>Year</th>
<th>Attendance (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>1.633</td>
</tr>
<tr>
<td>2006</td>
<td>1.681</td>
</tr>
<tr>
<td>2007</td>
<td>1.682</td>
</tr>
<tr>
<td>2008</td>
<td>1.693</td>
</tr>
<tr>
<td>2009</td>
<td>1.790</td>
</tr>
</tbody>
</table>

**b.** Use the calculator to graph the residual plot for

The equation is about $y = 0.0326x + 1.598$.

Use $Y=$ to enter the equation into the calculator and graph the best-fit line with the scatter plot.

**b.** Use the calculator to graph the residual plot for

The equation is about $y = 0.0326x + 1.598$.
4-6 Regression and Median-Fit Lines

the data.

All the residuals appear to almost be on the line. Therefore, the regression line is a good fit for the data.

c. **Method 1:** To find the number of people in 2020, substitute 16 for *x*.
   \[ y = 0.0326x + 1.598 \]
   \[ y = 0.0326(16) + 1.598 \]
   \[ y = 0.5216 + 1.598 \]
   \[ y = 2.1196 \]
   \[ y \approx 2.12 \]

**Method 2:** Copy the equation to the Y= list and graph. Use the value option to find the value of *y* when *x* = 16.

So, there will be about 2.12 million people in 2020.

12. **FIREFIGHTERS** The table shows statistics from the U.S. Fire Administration.

<table>
<thead>
<tr>
<th>Age</th>
<th>Number of Firefighters</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>40,919</td>
</tr>
<tr>
<td>25</td>
<td>245,516</td>
</tr>
<tr>
<td>35</td>
<td>330,516</td>
</tr>
<tr>
<td>45</td>
<td>296,665</td>
</tr>
<tr>
<td>55</td>
<td>167,087</td>
</tr>
<tr>
<td>65</td>
<td>54,559</td>
</tr>
</tbody>
</table>

a. Find an equation for the median-fit line.

b. Graph the points and the median-fit line.

c. Does the median-fit line give you an accurate picture of the number of firefighters? Explain.

**SOLUTION:**

**Step 1:** Enter the data by pressing **STAT** and selecting the **EDIT** option. Enter age into List 1 (*L1*). These will represent the *x*-values. Enter the number of firefighters into List 2 (*L2*). These will represent the *y*-values.

**Step 2:** Perform the regression by pressing **STAT** and selecting the **CALC** option. Scroll down to **Med-Med** and press **ENTER**.

\[ y = -841.42x + 223288 \]

b. Plot the points and graph the median fit line.
4-6 Regression and Median-Fit Lines

![Graph showing the relationship between age and the number of firefighters (1950-2005).](image)

**c.** No, the median-fit line does not give an accurate picture of the number of firefighters. The points show no linear correlation; therefore a line cannot accurately portray the data.

**13. ATHLETICS** The table shows the total number of teens who participated in high school athletics in various years.

<table>
<thead>
<tr>
<th>Year Since 1970</th>
<th>1</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Athletes</td>
<td>3,980,932</td>
<td>6,356,913</td>
<td>5,286,681</td>
<td>6,709,232</td>
<td>7,159,904</td>
</tr>
</tbody>
</table>

**a.** Find an equation for the regression line.

**b.** According to the equation, how many participated in 1988?

**SOLUTION:**

**a.** Use a calculator to find an equation for the regression line.

**Step 1:** Enter the data by pressing **STAT** and selecting the **EDIT** option. Let the year 1970 be represented by 0. Enter the years since 1970 into List 1 (L1). These will represent the x-values. Enter the number of athletes into List 2 (L2). These will represent the y-values.

**Step 2:** Perform the regression by pressing **STAT** and selecting the **CALC** option. Scroll down to **LinReg(ax+b)** and press **ENTER**.

The equation obtained is:

\[
y = 87,390.5x + 4,018,431
\]

**b.** To estimate the number of participants in 1988, evaluate the regression equation for \( x = 18 \) because 1988 is 18 years after 1970.

1988 \( y = 87,390.5(18) + 4,018,431 \)

1988 \( y = 1,573,029 + 4,018,431 \)

1988 \( y = 5,591,460 \)

There were about 5,591,460 participants in 1988.

**14. ART** A count was kept on the number of paintings that sold at an auction by the year in which they were painted. Let \( x \) be the number of years since 1950.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Paintings Sold</td>
<td>8</td>
<td>5</td>
<td>25</td>
<td>21</td>
<td>9</td>
<td>22</td>
</tr>
</tbody>
</table>

**a.** Find the equation for the linear regression line.

**b.** How many paintings were sold that were painted in 1961?

**c.** Is the linear regression equation an accurate model of the data? Explain why or why not.

**SOLUTION:**

**a.** Use a calculator to find an equation for the regression line.

**Step 1:** Enter the data by pressing **STAT** and selecting the **EDIT** option. Let \( x = 0 \) for the year 1950. Enter the years since 1950 into List 1 (L1). These will represent the x-values. Enter the number of painting sold into List 2 (L2). These will represent the y-values.
Step 2: Perform the regression by pressing \texttt{STAT} and selecting the \texttt{CALC} option. Scroll down to \texttt{LinReg}(\textit{ax+ b}) and press \texttt{ENTER}.

\begin{center}
\begin{tabular}{ccc}
\texttt{LinReg} & \texttt{y=ax+b} & \texttt{ENTER}\\
\hline
\texttt{a=4457142857} & \texttt{b=9.428571429} & \texttt{r^2=0.2349034749} \\
\texttt{r=.4846684175} & & \\
\end{tabular}
\end{center}

\[y = 0.446x + 9.43\]

b. To estimate the number of paintings sold in 1961, evaluate the regression equation for 1961 when \( x =11 \).

\[y = 0.446(11) + 9.43\]
\[y = 4.906 + 9.43\]
\[y = 14.336\]
\[y \approx 14\]

There were about 14 paintings sold in 1961.

c. No, the correlation coefficient is 0.48, so the linear model is not a good fit for the data. It does not appear from the data that there is a relationship between the number of paintings sold and the year they were painted.

15. CCSS ARGUMENTS Below are the results of the World Superpipe Championships in 2008.

<table>
<thead>
<tr>
<th>Men</th>
<th>Score</th>
<th>Rank</th>
<th>Women</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shawn White</td>
<td>93.00</td>
<td>1</td>
<td>Torah Bright</td>
<td>86.67</td>
</tr>
<tr>
<td>Mason Aguirre</td>
<td>90.33</td>
<td>2</td>
<td>Kelly Clark</td>
<td>93.00</td>
</tr>
<tr>
<td>Jance Korp</td>
<td>85.33</td>
<td>3</td>
<td>Soko Yamaoka</td>
<td>85.00</td>
</tr>
<tr>
<td>Luke Mithani</td>
<td>85.00</td>
<td>4</td>
<td>Ellery Hollingsworth</td>
<td>79.33</td>
</tr>
<tr>
<td>Kier Dillon</td>
<td>81.33</td>
<td>5</td>
<td>Sophie Rodriguez</td>
<td>71.00</td>
</tr>
</tbody>
</table>

Find an equation of the regression line for each, and graph them on the same coordinate plane. Compare and contrast the men’s and women’s graphs.

\textbf{SOLUTION:}

Use a calculator to find an equation of the regression line for each set of data.

\textbf{Men:} \( y = -2.92x + 95.92 \)

\textbf{Women:} \( y = -7x + 106 \)

Graph the equations on the same coordinate plane.

The women’s scores are typically lower than the men’s.

16. REASONING For a class project, the scores that 10 randomly selected students earned on the first 8 tests of the school year are given. Explain how to find a line of best fit. Could it be used to predict the scores of other students? Explain your reasoning.

\textbf{SOLUTION:}

Apply a linear regression model to the data. Use the number of each test as the independent variable and the score on each test as the dependent variable. If there is no correlation, the \( r \) value will not be close to 1 or \(-1\). If this is the case, the line of fit could not be used to predict the scores of the other students.
17. **OPEN ENDED** For 10 different people, measure their heights and the lengths of their heads from chin to top. Use these data to generate a linear regression equation and a median-fit equation. Make a prediction using both of the equations.

**SOLUTION:**
Student should gather and record data and use a calculator to find the equation of linear regression and a median-fit equation. Students should make predictions based on both equations.

Sample data:

<table>
<thead>
<tr>
<th>Chin to Top of Head Measure</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.8</td>
<td>70.9</td>
</tr>
<tr>
<td>9.1</td>
<td>72.8</td>
</tr>
<tr>
<td>9.3</td>
<td>73.8</td>
</tr>
<tr>
<td>7.5</td>
<td>61.0</td>
</tr>
<tr>
<td>8.4</td>
<td>66.3</td>
</tr>
<tr>
<td>7.8</td>
<td>62.0</td>
</tr>
<tr>
<td>8.5</td>
<td>67.3</td>
</tr>
<tr>
<td>8.8</td>
<td>68.9</td>
</tr>
<tr>
<td>8.3</td>
<td>68.7</td>
</tr>
<tr>
<td>8.9</td>
<td>71.5</td>
</tr>
</tbody>
</table>

Median-fit (Store in Y1)

\[
y = ax + b \\
a = 8.307692308 \\
b = -3.120512821
\]

\[
y = 8.31x - 3.12
\]

Linear regression (Store in Y2)

\[
y = ax + b \\
a = 7.38896648 \\
b = 5.218226257 \\
r^2 = 0.9419823891 \\
r = 0.9705577722
\]

\[
y = 7.39x + 5.22
\]

Find the height of a student with chin to top of head measure of 8.1. Use the **value** option from the **CALC** menu. Use the up arrow to move from one line to another.

The median-fit line predicts a student’s height of 64.17 inches and the linear regression line predicts a height of 65.07.
18. **WRITING IN MATH** How are lines of fit and linear regression similar? different?

**SOLUTION:**
Sample answer: Both lines of fit and linear regression are used to model data. However, you could have numerous lines of fit, while linear regression results in one line of best fit. If linear regression is used, you can also use the correlation coefficient to see how closely the model fits the data. For example, the scatter plot below displays the points (1, 10), (2, 17), (3, 15), (4, 20), (5, 28), (6, 19), and (7, 25).

![Graph of points with lines of fit](image)

A line of fit could be drawn through (1, 10) and (5, 25). The equation of this line of fit is $y = \frac{15}{4}x + \frac{25}{4}$. Another line of fit may pass through (2, 15) and (7, 25). The equation of this line of fit is $y = 2x + 11$. More lines of fit that come close to the points could be drawn.

Use a calculator to find the equation of the regression line for this data.

![Calculator output](image)

The only regression line for this data has an equation of about $y = 2.2x + 10.3$.

19. **GEOMETRY** Sam is putting a border around a poster. $x$ represents the poster’s width, and $y$ represents the poster’s length. Which equation represents how much border Sam will use if he doubles the length and the width?

- **A** $4xy$
- **B** $(x + y)^4$
- **C** $4(x + y)$
- **D** $16(x + y)$

**SOLUTION:**
The perimeter of the room is found by $P = 2l + 2w$. $y$ is the length and $x$ is the width, so $P = 2y + 2x$. But Sam wants to double the border, so the perimeter becomes:

$$2(2x + 2y) = 4x + 4y = 4(x + y)$$

So, the correct choice is C.

20. **SHORT RESPONSE** Tatiana wants to run 5 miles at an average pace of 9 minutes per mile. After 4 miles, her average pace is 9 minutes 10 seconds. In how many minutes must she complete the final mile to reach her goal?

**SOLUTION:**
Tatiana ran each of the first 4 miles in 10 more seconds than she planned. So to reach her goal, she must run the last mile in 40 seconds less than she planned.

$9\text{ min} - 40\text{ s} = 8\text{ min and 20 s.}$
21. What is the slope of the line that passes through (1, 3) and (−3, 1)?

F $-2$

G $\frac{-1}{2}$

H $\frac{1}{2}$

J 2

**SOLUTION:**

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

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

$$= \frac{-2}{-4}$$

$$= \frac{1}{2}$$

So, the correct choice is H.

22. What is an equation of the line that passes through (0, 1) and has a slope of 3?

A $y = 3x - 1$

B $y = 3x - 2$

C $y = 3x + 4$

D $y = 3x + 1$

**SOLUTION:**

Find the $y$-intercept.

$$y = mx + b$$

$$1 = 3(0) + b$$

$$1 = b$$

The equation is $y = 3x + 1$. So, the correct choice is D.

23. **USED CARS** Gianna wants to buy a specific make and model of a used car. She researched prices from dealers and private sellers and made the graph shown.

**a.** Describe the relationship in the data.

**b.** Use the line of fit to predict the price of a car that is 7 years old.

**c.** Is it reasonable to use this line of fit to predict the price of a 10-year old car? Explain.

**SOLUTION:**

**a.** Because $y$ decreases as $x$ increases, there is a negative correlation in the data.

**b.** Find $x = 7$ on the graph and follow the line up to the line of fit. According to the graph, the price of a car that is 7 years old would be about $3600.

**c.** No, it would not be reasonable to use this line of fit to predict the price of a 10-year old car, because according to the line of fit, the cost would be $0 and that doesn’t make sense.
24. GEOMETRY A quadrilateral has sides with equations \( y = -2x, 2x + y = 6, y = \frac{1}{2}x + 6, \) and \( x - 2y = 9. \) Is the figure a rectangle? Explain your reasoning.

**SOLUTION:**
Write all of the equations in slope-intercept form.

Equation 1: \( y = -2x \)

Equation 2:
\[
2x + y = 6 \\
2x - 2y + y = -2x + 6 \\
y = -2x + 6
\]

Equation 3:
\[
y = \frac{1}{2}x + 6
\]

Equation 4:
\[
x - 2y = 9 \\
x - x - 2y = -x + 9 \\
2y = -x + 9 \\
\frac{-2y}{-2} = \frac{-x + 9}{-2} \\
y = \frac{1}{2}x - \frac{9}{2}
\]

Find the slope of each line

<table>
<thead>
<tr>
<th>Equation</th>
<th>Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y = -2x )</td>
<td>-2</td>
</tr>
<tr>
<td>( y = -2x + 6 )</td>
<td>-2</td>
</tr>
<tr>
<td>( y = 0.5x + 6 )</td>
<td>( \frac{1}{2} )</td>
</tr>
<tr>
<td>( y = 0.5x - 4.5 )</td>
<td>( \frac{1}{2} )</td>
</tr>
</tbody>
</table>

The slope of opposite sides are equal (−2 and −2; and 0.5 and 0.5), so they are parallel. Also, the slope of consecutive sides are opposite reciprocals (−2 and 0.5; and −2 and 0.5), so they are perpendicular. So, the figure is a rectangle.

25. \( y - 2 = 3(x - 1) \)

**SOLUTION:**
Write each equation in standard form.

**Original equation**
\[
y - 2 = 3(x - 1)
\]
**Step 1:** Distributive Property
\[
y - 2 = 3x - 3
\]
**Step 2:** Subtract 3x to each side
\[
y - 2x = -3 - 2
\]
**Step 3:** Add 2 to each side
\[
y - 2x = -1
\]
**Step 4:** Multiply each side by −1
\[
3x - y = 1
\]

26. \( y - 5 = 6(x + 1) \)

**SOLUTION:**
Write each equation in standard form.

**Original equation**
\[
y - 5 = 6(x + 1)
\]
**Step 1:** Distributive Property
\[
y - 5 = 6x + 6
\]
**Step 2:** Subtract 6x from each side
\[
y - 5x = 6
\]
**Step 3:** Subtract 5 from each side
\[
y - 5x = 1
\]
**Step 4:** Multiply each side by −1
\[
6x - y = -11
\]

27. \( y + 2 = -2(x - 5) \)

**SOLUTION:**
Write each equation in standard form.

**Original equation**
\[
y + 2 = -2(x - 5)
\]
**Step 1:** Distributive Property
\[
y + 2 = -2x + 10
\]
**Step 2:** Add 2x to each side
\[
y + y + 2 = -2x + 2x + 10
\]
**Step 3:** Simplify
\[
y + 2y + 2 = 10
\]
**Step 4:** Subtract 2 from each side
\[
y + 2y = 8
\]

28. \( y + 3 = \frac{1}{2}(x + 4) \)

**SOLUTION:**
Write each equation in standard form.

**Original equation**
\[
y + 3 = \frac{1}{2}(x + 4)
\]
**Step 1:** Distributive Property
\[
y + 3 = \frac{1}{2}x + 2
\]
**Step 2:** Multiply each side by 2
\[
2(y + 3) = 2(\frac{1}{2}x + 2)
\]
**Step 3:** Simplify
\[
y + 2y + 6 = x + 4
\]
**Step 4:** Subtract x from each side
\[
y + 2y + 6 = x + 4
\]
**Step 5:** Simplify
\[
-x + 2y + 6 = 4 - 6
\]
**Step 6:** Subtract 6 from each side
\[
-x + 2y = -2
\]
**Step 7:** Multiply each side by −1
\[
x - 2y = 2
\]
29. \( y - 1 = \frac{2}{3}(x + 9) \)

**SOLUTION:**

\[
\begin{align*}
\quad \ y - 1 &= \frac{2}{3}(x + 9) & \text{Original equation} \\
\quad \ y - 1 &= \frac{2}{3}x + 6 & \text{Distributive Property} \\
\quad 3(y - 1) &= 3\left(\frac{2}{3}x + 6\right) & \text{Multiply each side by } 3. \\
\quad 3y - 3 &= 2x + 18 & \text{Distributive Property} \\
\quad -2x + 3y - 3 &= 2x - 2x + 18 & \text{Subtract } 2x \text{ from each side} \\
\quad -2x + 3y - 3 &= 18 & \text{Simplify} \\
\quad -2x + 3y - 3 + 3 &= 18 + 3 & \text{Add } 3 \text{ to each side} \\
\quad -2x + 3y &= 21 & \text{Simplify} \\
\quad -1(-2x + 3y) &= -2x - 1 & \text{Multiply each side by } -1. \\
\quad 2x - 3y &= -21 & \text{Simplify}
\end{align*}
\]

Find the slope of the line that passes through each pair of points.

30. \( y + 3 = -\frac{1}{4}(x + 2) \)

**SOLUTION:**

\[
\begin{align*}
\quad \ y + 3 &= -\frac{1}{4}(x + 2) & \text{Original equation} \\
\quad \ y + 3 &= -\frac{1}{4}x - \frac{1}{2} & \text{Distributive Property} \\
\quad 4(y + 3) &= 4\left(-\frac{1}{4}x - \frac{1}{2}\right) & \text{Multiply each side by } 4 \quad \quad \text{Add } 1 \text{ to each side} \\
\quad 4y + 12 &= -x - 2 & \text{Simplify} \\
\quad x + 4y + 12 &= -x + x + 2 & \text{Add } x \text{ to each side} \\
\quad x + 4y + 12 &= 2 & \text{Simplify} \\
\quad x + 4y &= 2 - 12 & \text{Subtract } 12 \text{ from each side} \\
\quad x + 4y &= -10 & \text{Simplify}
\end{align*}
\]

31. \((3, 4), (10, 8)\)

**SOLUTION:**

\[
\begin{align*}
\quad m &= \frac{y_2 - y_1}{x_2 - x_1} & \text{Original equation} \\
\quad &= \frac{8 - 4}{10 - 3} & \text{Distributive Property} \\
\quad &= \frac{4}{7}
\end{align*}
\]

32. \((-4, 7), (3, 5)\)

**SOLUTION:**

\[
\begin{align*}
\quad m &= \frac{y_2 - y_1}{x_2 - x_1} & \text{Original equation} \\
\quad &= \frac{5 - 7}{3 - (-4)} & \text{Distributive Property} \\
\quad &= \frac{-2}{7}
\end{align*}
\]

33. \((3, 7), (-2, 4)\)

**SOLUTION:**

\[
\begin{align*}
\quad m &= \frac{y_2 - y_1}{x_2 - x_1} & \text{Original equation} \\
\quad &= \frac{4 - 7}{-2 - 3} & \text{Distributive Property} \\
\quad &= \frac{-3}{-5} & \text{Simplify} \\
\quad &= \frac{3}{5} & \text{Simplify}
\end{align*}
\]

34. \((-3, 2), (-3, 4)\)

**SOLUTION:**

\[
\begin{align*}
\quad m &= \frac{y_2 - y_1}{x_2 - x_1} & \text{Original equation} \\
\quad &= \frac{4 - 2}{-3 - (-3)} & \text{Distributive Property} \\
\quad &= \frac{2}{0} & \text{Simplify}
\end{align*}
\]

The slope is undefined.

**If \( f(x) = x^2 - x + 1 \), find each value.**

35. \( f(-1) \)

**SOLUTION:**

\[
\begin{align*}
\quad f(x) &= x^2 - x + 1 \\
\quad f(-1) &= (-1)^2 - (-1) + 1 \\
\quad &= 1 + 1 + 1 & \text{Simplify} \\
\quad &= 3 & \text{Simplify}
\end{align*}
\]

36. \( f(5) = -3 \)

**SOLUTION:**

\[
\begin{align*}
\quad f(x) &= x^2 - x + 1 \\
\quad f(5) &= 5^2 - 5 + 1 \\
\quad &= 25 - 5 + 1 & \text{Simplify} \\
\quad &= 21 & \text{Simplify} \\
\quad f(5) - 3 &= 21 - 3 & \text{Subtract } 3 \text{ from both sides} \\
\quad &= 18 & \text{Simplify}
\end{align*}
\]
4-6 Regression and Median-Fit Lines

37. \( f(a) \)

**SOLUTION:**

\[
  f(x) = x^2 - x + 1 \\
  f(a) = a^2 - a + 1
\]

38. \( f(b^2) \)

**SOLUTION:**

\[
  f(x) = x^2 - x + 1 \\
  f\left(b^2\right) = \left(b^2\right)^2 - \left(b^2\right) + 1 \\
  f\left(b^2\right) = b^4 - b^2 + 1
\]

**Graph each equation.**

39. \( y = x + 2 \)

**SOLUTION:**

To graph the equation, plot the y-intercept \((0, 2)\).

Then move up 1 unit and right 1 unit. Plot the point.

Draw a line through the two points.

40. \( x + 5y = 4 \)

**SOLUTION:**

Write the equation in slope-intercept form.

\[
  x + 5y = 4 \\
  5y = -x + 4 \\
  y = -\frac{1}{5}x + \frac{4}{5}
\]

To graph the equation, plot the y-intercept \(0, \frac{4}{5}\).

Then move down 1 unit and right 5 units. Plot the point. Draw a line through the two points.
4-6 Regression and Median-Fit Lines

41. $2x - 3y = 6$

**SOLUTION:**
Write the equation in slope-intercept form.

\[
2x - 3y = 6 \\
-3y = -2x + 6 \\
-3y = -2x + 6 \\
-3 = -3 \\
y = \frac{2}{3}x - 2
\]

To graph the equation, plot the $y$-intercept $(0, -2)$. Then move up 2 units and right 3 units. Plot the point. Draw a line through the two points.

42. $5x + 2y = 6$

**SOLUTION:**
Write the equation in slope-intercept form.

\[
5x + 2y = 6 \\
2y = -5x + 6 \\
\frac{2y}{2} = \frac{-5x + 6}{2} \\
y = -\frac{5}{2}x + 3
\]

To graph the equation, plot the $y$-intercept $(0, 3)$. Then move down 5 units and right 2 units. Plot the point. Draw a line through the two points.
4-7 Inverse Linear Functions

Find the inverse of each relation.
1. \{(4, −15), (−8, −18), (−2, −16.5), (3, −15.25)\}

**SOLUTION:**
To find the inverse, exchange the coordinates of the ordered pairs.

\[(4, −15) → (−15, 4)\]
\[(-8, −18) → (−18, −8)\]
\[(-2, −16.5) → (−16.5, −2)\]
\[(3, −15.25) → (−15.25, 3)\]

The inverse is \{ (−15, 4), (−18, −8), (−16.5, −2), (−15.25, 3) \}.

2. \[
\begin{array}{c|c|c|c|c}
\hline
x & -3 & 0 & 1 & 6 \\
\hline
y & 11.8 & 3.7 & 1 & -12.5 \\
\hline
\end{array}
\]

**SOLUTION:**
Write the coordinates as ordered pairs. Then exchange the coordinates.

\[(-3, 11.8) → (11.8, −3)\]
\[(0, 3.7) → (3.7, 0)\]
\[(1, 1) → (1, 1)\]
\[(6, −12.5) → (−12.5, 6)\]

The inverse is \{ (11.8, −3), (3.7, 0), (1, 1), (−12.5, 6) \}.

Graph the inverse of each relation.
3. \[
\begin{array}{c}
\text{Graph shows a weak positive correlation. This means}
\end{array}
\]

**SOLUTION:**
The graph of the relation passes through the points at (-5, 1), (0, 2), and (5, 3).

To find points through which the inverse passes, exchange the coordinates of the ordered pairs

\[(-5, 1) → (1, −5)\]
\[(0, 2) → (2, 0)\]
\[(5, 3) → (3, 5)\]

Graph these points and then draw a line that passes through them.
4-7 Inverse Linear Functions

Find the inverse of each function.

5. \( f(x) = -2x + 7 \)

**SOLUTION:**

\[
\begin{align*}
\text{Original equation:} & \quad f(x) = -2x + 7 \\
\text{Replace } f(x) & \quad \text{with } y. \\
\text{Interchange } x & \quad \text{and } y. \\
x - 7 &= -2y \quad \text{Subtract 7 from each side.} \\
\frac{x - 7}{-2} &= y \quad \text{Divide each side by } -2. \\
\frac{x - 7}{-2} &= f^{-1}(x) \quad \text{Replace } y \text{ with } f^{-1}(x). \\
\end{align*}
\]

Write the final equation in slope-intercept form.

\[
\begin{align*}
\text{So, } f^{-1}(x) &= \frac{1}{2}x + \frac{7}{2}.
\end{align*}
\]
6. \( f(x) = \frac{2}{3}x + 6 \)

**SOLUTION:**

\[
\begin{align*}
  f(x) &= \frac{2}{3}x + 6 \quad \text{Original equation} \\
  y &= \frac{2}{3}x + 6 \quad \text{Replace } f(x) \text{ with } y. \\
  x &= \frac{2}{3}y + 6 \quad \text{Interchange } x \text{ and } y. \\
  3x &= 2y + 18 \quad \text{Multiply each side by 3} \\
  3x – 18 &= 2y \quad \text{Subtract 18 from each side} \\
  \frac{3x – 18}{2} &= y \quad \text{Divide each side by 2} \\
  \frac{3x – 18}{2} &= f^{-1}(x) \quad \text{Replace } y \text{ with } f(x).
\end{align*}
\]

Write the final equation in slope-intercept form. So,

\[
f^{-1}(x) = \frac{3}{2}x – 9.
\]

7. **CCSS REASONING** Dwayne and his brother purchase season tickets to the Cleveland Crusaders games. The ticket package requires a one-time purchase of a personal seat license costing $1200 for two seats. A ticket to each game costs $70. The cost \( C(x) \) in dollars for Dwayne for the first season is \( C(x) = 600 + 70x \), where \( x \) is the number of games Dwayne attends.

**a.** Find the inverse function.

**b.** What do \( x \) and \( C^{-1}(x) \) represent in the context of the inverse function?

**c.** How many games did Dwayne attend if his total cost for the season was $950?

**SOLUTION:**

\[
\begin{align*}
  C(x) &= 600 + 70x \quad \text{Original equation} \\
  y &= 600 + 70x \quad \text{Replace } C(x) \text{ with } y. \\
  x &= 600 + 70y \quad \text{Interchange } x \text{ and } y. \\
  x – 600 &= 70y \quad \text{Subtract 600 from each side} \\
  \frac{x – 600}{70} &= y \quad \text{Divide each side by 70} \\
  y &= \frac{x – 600}{70} \quad \text{Replace } y \text{ with } C^{-1}(x). \\
  C^{-1}(x) &= \frac{3}{70}x – \frac{600}{70} \quad \text{Slope-intercept form}.
\end{align*}
\]

**b.** \( x \) is Dwayne’s total cost, and \( C^{-1}(x) \) is the number of games Dwayne attended. 

**c.** Evaluate \( C^{-1}(950) \).

\[
C^{-1}(950) = \frac{1}{70}x – \frac{600}{70}
\]

\[
C^{-1}(950) = \frac{950}{70} – \frac{600}{70}
\]

\[
C^{-1}(950) = \frac{350}{70}
\]

\[
C^{-1}(950) = 5
\]

So, Dwayne attended 5 games.

**Find the inverse of each relation.**

8. \( \{(−5, 13), (6, 10.8), (3, 11.4), (−10, 14)\} \)

**SOLUTION:**

To find the inverse, exchange the coordinates of the ordered pairs.

\( (−5, 13) \rightarrow (13, −5) \)

\( (6, 10.8) \rightarrow (10.8, 6) \)

\( (3, 11.4) \rightarrow (11.4, 3) \)

\( (−10, 14) \rightarrow (14, −10) \)

The inverse is \( \{(13, −5), (10.8, 6), (11.4, 3), (14, −10)\} \).

9. \( \{(−4, −49), (8, 35), (−1, −28), (4, 7)\} \)

**SOLUTION:**

To find the inverse, exchange the coordinates of the ordered pairs.

\( (−4, −49) \rightarrow (−49, −4) \)

\( (8, 35) \rightarrow (35, 8) \)

\( (−1, −28) \rightarrow (−28, −1) \)

\( (4, 7) \rightarrow (7, 4) \)

The inverse is \( \{ (−49, −4), (35, 8), (−28, −1), (7, 4) \} \).
4-7 Inverse Linear Functions

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>-8</td>
<td>-36.4</td>
</tr>
<tr>
<td>-2</td>
<td>-15.4</td>
</tr>
<tr>
<td>1</td>
<td>-4.9</td>
</tr>
<tr>
<td>5</td>
<td>9.1</td>
</tr>
<tr>
<td>11</td>
<td>30.1</td>
</tr>
</tbody>
</table>

10. **SOLUTION:**
Write the coordinates as ordered pairs. Then exchange the coordinates of each pair.

(-8, -36.4) → (-36.4, -8)

(-2, -15.4) → (-15.4, -2)

(1, -4.9) → (-4.9, 1)

(5, 9.1) → (9.1, 5)

(11, 30.1) → (30.1, 11)

The inverse is {(-36.4, -8), (-15.4, -2), (-4.9, 1), (9.1, 5), (30.1, 11)}.

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>7.4</td>
</tr>
<tr>
<td>-1</td>
<td>4.0</td>
</tr>
<tr>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>3</td>
<td>-2.8</td>
</tr>
<tr>
<td>5</td>
<td>-6.2</td>
</tr>
</tbody>
</table>

11. **SOLUTION:**
Write the coordinates as ordered pairs. Then exchange the coordinates of each pair.

(-3, 7.4) → (7.4, -3)

(-1, 4) → (4, -1)

(1, 0.6) → (0.6, 1)

(3, -2.8) → (-2.8, 3)

(5, -6.2) → (-6.2, 5)

The inverse is {(7.4, -3), (4, -1), (0.6, 1), (-2.8, 3), (-6.2, 5)}. 
Graph the inverse of each relation.

12. **SOLUTION:**
The graph of the relation passes through the points at \((-3, -2), (0, -1),\) and \((3, 0)\).

To find points through which the inverse passes, exchange the coordinates of the ordered pairs:

\((-3, -2) \rightarrow (-2, -3)\)

\((0, -1) \rightarrow (-1, 0)\)

\((3, 0) \rightarrow (0, 3)\)

Graph these points and then draw a line that passes through them.

13. **SOLUTION:**
The graph of the relation passes through the points at \((-4, -3), (-2, -2), (0, -1), (2, 0),\) and \((4, 1)\)

To find points through which the inverse passes, exchange the coordinates of the ordered pairs:

\((-4, -3) \rightarrow (-3, -4)\)

\((-2, -2) \rightarrow (-2, -2)\)

\((0, -1) \rightarrow (-1, 0)\)

\((2, 0) \rightarrow (0, 2)\)

\((4, 1) \rightarrow (1, 4)\)

Graph these points and then draw a line that passes through them.
4-7 Inverse Linear Functions

Find the inverse of each function.

14. \( f(x) = 25 + 4x \)

**SOLUTION:**

\[
f(x) = 25 + 4x \quad \text{Original equation}
\]

\[
y = 25 + 4x \quad \text{Replace } f(x) \text{ with } y.
\]

\[
x = 25 + 4y \quad \text{Interchange } x \text{ and } y.
\]

\[
x - 25 = 4y \quad \text{Subtract.}
\]

\[
\frac{x - 25}{4} = y \quad \text{Divide each side by 4.
}\]

\[
\frac{x - 25}{4} = f^{-1}(x) \quad \text{Replace } y \text{ with } f^{-1}(x).
\]

Write the final equation in slope-intercept form.

So,

\[
f^{-1}(x) = \frac{1}{4}x - \frac{25}{4}.
\]

15. \( f(x) = 17 - \frac{1}{3}x \)

**SOLUTION:**

\[
f(x) = 17 - \frac{1}{3}x \quad \text{Original equation}
\]

\[
y = 17 - \frac{1}{3}x \quad \text{Replace } f(x) \text{ with } y.
\]

\[
x = 17 - \frac{1}{3}y \quad \text{Interchange } x \text{ and } y.
\]

\[
x - 17 = -\frac{1}{3}y \quad \text{Subtract 17 from each side}
\]

\[
-3x + 51 = y \quad \text{Multiply each side by } -3
\]

\[
-3x + 51 = f^{-1}(x) \quad \text{Replace } y \text{ with } f^{-1}(x).
\]

So,

\[
f^{-1}(x) = -3x + 51.
\]

16. \( f(x) = 4(x + 17) \)

**SOLUTION:**

\[
f(x) = 4(x + 17) \quad \text{Original equation}
\]

\[
y = 4(x + 17) \quad \text{Replace } f(x) \text{ with } y.
\]

\[
x = 4(y + 17) \quad \text{Interchange } x \text{ and } y.
\]

\[
\frac{x}{4} = y + 17 \quad \text{Divide each side by 4.}
\]

\[
\frac{x}{4} - 17 = y \quad \text{Subtract 17 from each side}
\]

\[
\frac{x}{4} - 17 = f^{-1}(x) \quad \text{Replace } y \text{ with } f^{-1}(x).
\]

Write the final equation in slope-intercept form.

So,

\[
f^{-1}(x) = \frac{1}{4}x - 17.
\]

17. \( f(x) = 12 - 6x \)

**SOLUTION:**

\[
f(x) = 12 - 6x \quad \text{Original equation}
\]

\[
y = 12 - 6x \quad \text{Replace } f(x) \text{ with } y.
\]

\[
x = 12 - 6y \quad \text{Interchange } x \text{ and } y.
\]

\[
x - 12 = -6y \quad \text{Subtract 12 from each side}
\]

\[
\frac{x - 12}{-6} = y \quad \text{Divide each side by } -6.
\]

\[
\frac{x - 12}{-6} = f^{-1}(x) \quad \text{Replace } y \text{ with } f^{-1}(x).
\]

Write the final equation in slope-intercept form.

So,

\[
f^{-1}(x) = -\frac{1}{6}x + 2.
\]

18. \( f(x) = \frac{2}{3}x + 10 \)

**SOLUTION:**

\[
f(x) = \frac{2}{3}x + 10 \quad \text{Original equation}
\]

\[
y = \frac{2}{3}x + 10 \quad \text{Replace } f(x) \text{ with } y.
\]

\[
x = \frac{2}{3}y + 10 \quad \text{Interchange } x \text{ and } y.
\]

\[
5x = 2y + 50 \quad \text{Multiply each side by } 5.
\]

\[
\frac{5x - 50}{2} = y \quad \text{Subtract 50 from each side}
\]

\[
\frac{5x - 50}{2} = f^{-1}(x) \quad \text{Divide each side by } 2.
\]

\[
\frac{5x - 50}{2} = f^{-1}(x) \quad \text{Replace } y \text{ with } f(x).
\]

Write the final equation in slope-intercept form.

So,

\[
f^{-1}(x) = \frac{5}{2}x - 25.
\]
4-7 Inverse Linear Functions

19. \( f(x) = -16 - \frac{4}{3}x \)

**SOLUTION:**

\[
\begin{align*}
 f(x) &= -16 - \frac{4}{3}x \quad \text{Original equation} \\
 y &= -16 - \frac{4}{3}x \quad \text{Replace } f(x) \text{ with } y. \\
 x &= -16 - \frac{4}{3}y \quad \text{Interchange } x \text{ and } y \\
 3x &= -48 - 4y \quad \text{Multiply each side by 3} \\
 3x + 48 &= -4y \quad \text{Add 48 to each side} \\
 \frac{3x + 48}{-4} &= y \quad \text{Divide each side by } -4 \\
 \frac{3x + 48}{-4} &= f^{-1}(x) \quad \text{Replace } y \text{ with } f(x)
\end{align*}
\]

Write the final equation in slope-intercept form.

So, \( f^{-1}(x) = -\frac{3}{4}x - 12 \).

20. **DOWNLOADS** An online music subscription service allows members to download songs for \$0.99 each after paying a monthly service charge of \$3.99. The total monthly cost \( C(x) \) of the service in dollars is \( C(x) = 3.99 + 0.99x \), where \( x \) is the number of songs downloaded.

a. Find the inverse function.

b. What do \( x \) and \( C^{-1}(x) \) represent in the context of the inverse function?

c. How many songs were downloaded if a member’s monthly bill is \$27.75?

**SOLUTION:**

a. \[
\begin{align*}
 C(x) &= 3.99 + 0.99x \quad \text{Original equation} \\
 y &= 3.99 + 0.99x \quad \text{Replace } C(x) \text{ with } y. \\
 x &= 3.99 + 0.99y \quad \text{Interchange } x \text{ and } y \\
 x - 3.99 &= 0.99y \quad \text{Subtract 3.99 from each side} \\
 \frac{x - 3.99}{0.99} &= y \quad \text{Divide each side by 0.99} \\
 y &= \frac{x - 3.99}{0.99} \quad \text{Replace } y \text{ with } C^{-1}(x). \\
 C^{-1}(x) &= \frac{x - 3.99}{0.99}
\end{align*}
\]

b. \( x \) is the total monthly cost of the service, and \( C^{-1}(x) \) is the number of songs downloaded.

c. Evaluate \( C^{-1}(27.75) \).

\[
\begin{align*}
 C^{-1}(x) &= \frac{x - 3.99}{0.99} \\
 C^{-1}(27.75) &= \frac{27.75 - 3.99}{0.99} \\
 C^{-1}(27.75) &= \frac{23.76}{0.99} \\
 C^{-1}(27.75) &= 24
\end{align*}
\]

So, 24 songs were downloaded.
21. LANDSCAPING  At the start of the mowing season, Chuck collects a one-time maintenance fee of $10 from his customers. He charges the Fosters $35 for each cut. The total amount collected from the Fosters in dollars for the season is \( C^{-1}(x) = 10 + 35x \), where \( x \) is the number of times Chuck mows the Fosters’ lawn.

a. Find the inverse function.

b. What do \( x \) and \( C^{-1}(x) \) represent in the context of the inverse function?

c. How many times did Chuck mow the Fosters’ lawn if he collected a total of $780 from them?

**SOLUTION:**

\[ C(x) = 10 + 35x \]  
Original equation
\[ y = 10 + 35x \]  
Replace \( C(x) \) with \( y \).
\[ x = 10 + 35y \]  
Interchange \( x \) and \( y \).
\[ x - 10 = 35y \]  
Subtract 10 from each side.
\[ \frac{x - 10}{35} = y \]  
Divide each side by 35.
\[ y = \frac{x - 10}{35} \]  
Replace \( y \) with \( C^{-1}(x) \).
\[ C^{-1}(x) = \frac{x - 10}{35} \]  
Slope-intercept form

b. is the total amount collected from the Fosters, and \( C^{-1}(x) \) is the number of times Chuck mowed the Fosters’ lawn.

c. Evaluate \( C^{-1}(780) \).

\[ C^{-1}(780) = \frac{780}{35} - \frac{2}{7} \]
\[ C^{-1}(780) = \frac{780 - 10}{35} \]
\[ C^{-1}(780) = \frac{770}{35} \]
\[ C^{-1}(780) = 22 \]

So, Chuck mowed the Foster’s lawn 22 times.

---

22. \( 3y - 12x = -72 \)

**SOLUTION:**

\[ 3y - 12x = -72 \]  
Original equation
\[ 3x - 12y = -72 \]  
Interchange \( x \) and \( y \).
\[ -12y = -3x - 72 \]  
Subtract 3x from each side.
\[ y = \frac{1}{4}x + 6 \]  
Divide each side by \(-12\).
\[ f^{-1}(y) = \frac{1}{4}x + 6 \]  
Replace \( y \) with \( f^{-1}(x) \).

23. \( x + 5y = 15 \)

**SOLUTION:**

\[ x + 5y = 15 \]  
Original equation
\[ y + 5x = 15 \]  
Interchange \( x \) and \( y \).
\[ y = -5x + 15 \]  
Subtract 5x from each side.
\[ f^{-1}(y) = -5x + 15 \]  
Replace \( y \) with \( f^{-1}(x) \).

24. \( -42 + 6y = x \)

**SOLUTION:**

\[ -42 + 6y = x \]  
Original equation
\[ -42 + 6x = y \]  
Interchange \( x \) and \( y \).
\[ y = 6x - 42 \]  
Replace \( y \) with \( f^{-1}(x) \).

25. \( 3y + 24 = 2x \)

**SOLUTION:**

\[ 3y + 24 = 2x \]  
Original equation
\[ 3x + 24 = 2y \]  
Interchange \( x \) and \( y \).
\[ \frac{3}{2}x + 12 = y \]  
Divide each side by 2.
\[ y = \frac{3}{2}x + 12 \]  
Replace \( y \) with \( f^{-1}(x) \).

26. \( -7y + 2x = -28 \)

**SOLUTION:**

\[ -7y + 2x = -28 \]  
Original equation
\[ -7x + 2y = -28 \]  
Interchange \( x \) and \( y \).
\[ 2y = -7x - 28 \]  
Add 7x to each side.
\[ y = \frac{7}{2}x - 14 \]  
Divide each side by 2.
\[ f^{-1}(x) = \frac{7}{2}x - 14 \]  
Replace \( y \) with \( f^{-1}(x) \).
27. $3y - x = 3$

**SOLUTION:**

$3y - x = 3$  
Original equation

$3x - y = 3$  
Interchange $x$ and $y$.

$-y = -3x + 3$  
Subtract $3x$ from each side

$y = 3x - 3$  
Divide each side by $-1$.

$f^{-1}(x) = 3x - 3$  
Replace $y$ with $f^{-1}(x)$.

28. $f(x) = x + 4$

**SOLUTION:**

$f(x) = x + 4$  
$y = x + 4$

$x = y + 4$  
$\frac{x - 4}{y} = \frac{y}{y}$

$f^{-1}(x) = x - 4$  
This equation is shown on graph D.

29. $f(x) = 4x + 4$

**SOLUTION:**

$f(x) = 4x + 4$

$y = 4x + 4$

$x = 4y + 4$  
$\frac{x - 4}{4} = \frac{y}{4}$

$\frac{x}{4} - 1 = y$  
$f^{-1}(x) = \frac{1}{4}x - 1$

This equation is shown on graph B.

30. $f(x) = \frac{1}{4}x + 1$

**SOLUTION:**

$f(x) = \frac{1}{4}x + 1$

$y = \frac{1}{4}x + 1$

$x = \frac{1}{4}y + 1$

$x - 1 = \frac{1}{4}y$

$4x - 4 = y$

$f^{-1}(x) = 4x - 4$

This equation is shown on graph C.

31. $f(x) = \frac{1}{4}x - 1$

**SOLUTION:**

$f(x) = \frac{1}{4}x - 1$

$y = \frac{1}{4}x - 1$

$x = \frac{1}{4}y - 1$

$x + 1 = \frac{1}{4}y$

$4x + 4 = y$

$f^{-1}(x) = 4x + 4$

This equation is shown on graph A.
4-7 Inverse Linear Functions

Write an equation for the inverse function \( f^{-1}(x) \) that satisfies the given conditions.

32. slope of \( f(x) \) is 7; graph of \( f^{-1}(x) \) contains the point (13, 1)

**SOLUTION:**

Write an equation for \( f(x) \) in terms of \( x \) and \( y \).

\[
(y - y_1) = m(x - x_1) \quad \text{Point–slope form}
\]

\[
(y - y_1) = 7(x - x_1) \quad \text{Replace } m \text{ with 7.}
\]

Find the inverse of \( f(x) \).

\[
\frac{1}{7}(x - 13) + y = y_1
\]

Add

\[
y = \frac{1}{7}(x - 13) + 1
\]

\[
y = \frac{1}{7}x - \frac{13}{7} + 1
\]

Distributive Property

\[
y = \frac{1}{7}x + \frac{4}{7}
\]

Add

\[
y = \frac{1}{7}x + \frac{4}{7}
\]

Replace \( y \) with \( f^{-1}(x) \).

33. graph of \( f(x) \) contains the points (−3, 6) and (6, 12)

**SOLUTION:**

If the graph of \( f(x) \) contains the points (−3, 6) and (6, 12), then the graph of \( f^{-1}(x) \) contains the points (6, −3) and (12, 6). Find the slope of the line that passes through these points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
m = \frac{6 - (−3)}{12 - 6}
\]

\[
m = \frac{9}{6} \text{ or } \frac{3}{2}
\]

Choose (12, 6) and find the \( y \)-intercept of the line.

\[
y = mx + b
\]

\[
6 = \frac{3}{2}(12) + b
\]

\[
6 = 18 + b
\]

\[
−12 = b
\]

The line that passes through (6, −3) and (12, 6) is
4-7 Inverse Linear Functions

An equation for \( f^{-1}(x) \) is

\[
y = \frac{3}{2}x - 12
\]

\[
f^{-1}(x) = \frac{3}{2}x - 12
\]

34. graph of \( f(x) \) contains the point (10, 16); graph of \( f^{-1}(x) \) contains the point (3, -16)

**SOLUTION:**
If the graph of \( f(x) \) contains the point (10, 16), then the graph of \( f^{-1}(x) \) contains the point (16, 10). Find the slope of the line that passes through (16, 10) and (3, -16).

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]

\[
= \frac{-16 - 10}{3 - 16}
\]

\[
= \frac{-26}{-13}
\]

\[
= 2
\]

Choose (3, -16) and find the \( y \)-intercept of the line.

\[
y = mx + b
\]

\[
-16 = 2(3) + b
\]

\[
-16 = 6 + b
\]

\[
-22 = b
\]

The line that passes through (16, 10) and (3, -16) is

\[
y = 2x - 22
\]

An equation for \( f^{-1}(x) \) is

\[
f^{-1}(x) = 2x - 22
\]

35. slope of \( f(x) \) is 4; \( f^{-1}(5) = 2 \)

**SOLUTION:**
Write an equation for \( f(x) \) in terms of \( x \) and \( y \).

\[
(y - y_1) = m(x - x_1)
\]

Point-slope form

\[
(y - y_1) = 4(x - x_1)
\]

Replace \( m \) with 4

Find the inverse of \( f(x) \).

\[
(y - y_1) = 4(x - x_1)
\]

Original equation

\[
(x - x_1) = 4(y - y_1)
\]

Interchange \( x \) and \( y \).

\[
\frac{1}{4}(x - x_1) = (y - y_1)
\]

Multiply each side by \( \frac{1}{4} \).

\[
\frac{1}{4}(x - 5) = (y - 2)
\]

\[
x_1 = 5, y_1 = 2
\]

\[
\frac{1}{4}(x - 5) + 2 = u
\]

Add 2 to each side.

\[
y = \frac{1}{4}x - \frac{3}{4}
\]

\[
y = \frac{1}{4}x + \frac{3}{4}
\]

Distributive Property

\[
y = \frac{1}{4}x + \frac{3}{4}
\]

Add

\[
f^{-1}(x) = \frac{1}{4}x + \frac{3}{4}
\]

Replace \( y \) with \( f^{-1}(x) \).

36. **CELL PHONES** Mary Ann pays a monthly fee for her cell phone package which includes 700 minutes. She gets billed an additional charge for every minute she uses the phone past the 700 minutes. During her first month, Mary Ann used 26 additional minutes and her bill was $37.79. During her second month, Mary Ann used 38 additional minutes and her bill was $41.39.

a. Write a function that represents the total monthly cost \( C(x) \) of Mary Ann’s cell phone package, where \( x \) is the number of additional minutes used.

b. Find the inverse function.

c. What do \( x \) and \( C^{-1}(x) \) represent in the context of the inverse function?

d. How many additional minutes did Mary Ann use if her bill for her third month was $48.89?

**SOLUTION:**
a. \( C(x) = 0.3x + 29.99 \)

b.
### 4-7 Inverse Linear Functions

Given the function \( C(x) = 0.3x + 29.99 \),

\[
\begin{align*}
C'(x) &= \frac{x - 29.99}{0.3} \\
&= \frac{x - 29.99}{0.3} \\
C^{-1}(x) &= \frac{x - 29.99}{0.3} \\
\end{align*}
\]

c. \( x \) is Mary Ann’s total monthly cost, and \( C^{-1}(x) \) is the number of additional minutes used.

d. Evaluate \( C^{-1}(48.89) \).

\[
C^{-1}(48.89) = \frac{48.89 - 29.99}{0.3} = \frac{18.90}{0.3} = 63
\]

So, Mary Ann used 63 additional minutes.

37. **MULTIPLE REPRESENTATIONS** In this problem, you will explore the domain and range of inverse functions.

a. **Algebraic** Write a function for the area \( A(x) \) of the rectangle shown.

b. **Graphical** Graph \( A(x) \). Describe the domain and range of \( A(x) \) in the context of the situation.

c. **Algebraic** Write the inverse of \( A(x) \). What do \( x \) and \( A^{-1}(x) \) represent in the context of the situation?

d. **Graphical** Graph \( A^{-1}(x) \). Describe the domain and range of \( A^{-1}(x) \) in the context of the situation.

e. **Logical** Determine the relationship between the domains and ranges of \( A(x) \) and \( A^{-1}(x) \).

**SOLUTION:**

a. \( A(x) = 8(x - 3) \) or \( A(x) = 8x - 24 \)

b.
4-7 Inverse Linear Functions

38. **CHALLENGE** If \( f(x) = 5x + a \) and \( f^{-1}(10) = -1 \), find \( a \).

**SOLUTION:**

Find the inverse of \( f(x) \).

\[
\begin{align*}
f(x) &= 5x + a \\
y &= 5x + a \\
x &= 5y + a \\
x - a &= 5y \\
\frac{x-a}{5} &= y \\
y &= \frac{x-a}{5} \\
f^{-1}(x) &= \frac{x-a}{5}
\end{align*}
\]

If \( f^{-1}(10) = -1 \), then an ordered pair of \( f^{-1}(x) \) is \((10, -1)\). Evaluate \( f^{-1}(x) \) for \((10, -1)\).

\[
\begin{align*}
f^{-1}(x) &= \frac{x-a}{5} \\
y &= \frac{x-a}{5} \\
10 &= \frac{10-a}{5} \\
-5 &= 10 - a \\
-15 &= -a \\
15 &= a
\end{align*}
\]

39. **CHALLENGE** If \( f(x) = \frac{1}{a}x + 7 \) and \( f^{-1}(x) = 2x - b \), find \( a \) and \( b \).

**SOLUTION:**

Write the inverse of \( f(x) = \frac{1}{a}x + 7 \).

\[
\begin{align*}
f(x) &= \frac{1}{a}x + 7 \\
y &= \frac{1}{a}x + 7 \\
x &= \frac{1}{a}y + 7 \\
x - 7 &= \frac{1}{a}y \\
a(x - 7) &= y
\end{align*}
\]

So, \( f^{-1}(x) = ax - 7a \). Compare this equation to the given equation, \( f^{-1}(x) = 2x - b \). Because both equations represent the same line, the values for slope \( m \) are equal. Thus, \( a = 2 \). Like slope, the values for the \( y \)-intercept \( b \) are equal. So, \( 7a = b \). Substitute \( a = 2 \) into this equation. Thus, \( b = 14 \).

**CCSS ARGUMENTS** Determine whether the following statements are sometimes, always, or never true. Explain your reasoning.

40. If \( f(x) \) and \( g(x) \) are inverse functions, then \( f(a) = b \) and \( g(b) = a \).

**SOLUTION:**

Always; sample answer: If \( f(a) = b \), then the graph of \( f(x) \) includes the point \((a, b)\). If \( f(x) \) and \( g(x) \) are inverses, then the graph of \( g(x) \) includes the point \((b, a)\). If \((b, a)\) is included on the graph of \( g(x) \), then \( g(b) = a \).

41. If \( f(a) = b \) and \( g(b) = a \), then \( f(x) \) and \( g(x) \) are inverse functions.

**SOLUTION:**

Sometimes; sample answer: \( f(x) \) and \( g(x) \) do not need to be inverse functions for \( f(a) = b \) and \( g(b) = a \). For example, if \( f(x) = 2x + 10 \), then \( f(2) = 14 \) and if \( g(x) = x - 12 \), then \( g(14) = 2 \), but \( f(x) \) and \( g(x) \) are not inverse functions. However, if \( f(x) \) and \( g(x) \) are inverse functions, then \( f(a) = b \) and \( g(b) = a \).
4-7 Inverse Linear Functions

42. **OPEN ENDED** Give an example of a function and its inverse. Verify that the two functions are inverses by graphing the functions and the line \( y = x \) on the same coordinate plane.

**SOLUTION:**
Sample answer:
\[
\begin{align*}
\text{If } f(x) &= 2x + 6, \quad \text{then } f^{-1}(x) = \frac{1}{2}x - 3
\end{align*}
\]

43. **WRITING IN MATH** Explain why it may be helpful to find the inverse of a function.

**SOLUTION:**
Sample answer: A situation may require substituting values for the dependent variable into a function. By finding the inverse of the function, the dependent variable becomes the independent variable. This makes the substitution an easier process.

44. Which equation represents a line that is perpendicular to the graph and passes through the point at (2, 0)?

**A** \( y = 3x - 6 \)

**B** \( y = -3x + 6 \)

**C** \( y = -\frac{1}{3}x + \frac{2}{3} \)

**D** \( y = \frac{1}{3}x - \frac{2}{3} \)

**SOLUTION:**
Find the slope of the line in the graph. The line passes through the points \((-1, 1)\) and \((0, 4)\). Find the slope of the line.

\[
m = \frac{x_2 - x_1}{y_2 - y_1} = \frac{4 - 1}{0 - (-1)} = \frac{3}{1} = 3
\]

The slope of the line shown in the graph is 3. So, a line that is perpendicular to the one shown in the graph will have a slope of \(-\frac{1}{3}\). Use the point slope formula to find the equation of the perpendicular line if it passes through the point \((2, 0)\).

\[
y - y_1 = m(x - x_1)
\]

\[
y - 0 = -\frac{1}{3}(x - 2)
\]

\[
y = -\frac{1}{3}x + \frac{2}{3}
\]

So, the equation that represents a line that is perpendicular to the line shown in the graph and passes through \((2, 0)\) is \(y = -\frac{1}{3}x + \frac{2}{3}\). So, the correct choice is C.
4.7 Inverse Linear Functions

45. A giant tortoise travels at a rate of 0.17 mile per hour. Which equation models the time \( t \) it would take the giant tortoise to travel 0.8 mile?

\[ F \quad t = \frac{0.8}{0.17} \]

\[ G \quad t = (0.17)(0.8) \]

\[ H \quad t = \frac{0.17}{0.8} \]

\[ J \quad 0.8 = \frac{0.17}{t} \]

**SOLUTION:**
To find the time \( t \) it would take the tortoise to travel 0.8 mile, use the formula \( d = rt \), where \( d \) = distance and \( r \) = rate. Then, solve for \( t \).

\[ d = rt \]
\[ 0.8 = 0.17t \]
\[ \frac{0.8}{0.17} = t \]

So, the correct choice is F.

46. GEOMETRY If \( \Delta JKL \) is similar to \( \Delta JNM \) what is the value of \( a \)?

\[ \text{A} \quad 62.5 \]

\[ \text{B} \quad 105 \]

\[ \text{C} \quad 125 \]

\[ \text{D} \quad 155.5 \]

**SOLUTION:**
Triangle \( JMN \) is similar to triangle \( JKL \) because \( \angle M \) and \( \angle L \) are right angles, \( \angle K \) and \( \angle M \) are marked congruent and \( \angle KJL \) and \( \angle MJN \) are vertical angles. Similar triangles congruent corresponding angles and proportional corresponding sides.

Use a proportion to find the value of \( a \).

\[ \frac{27}{35} = \frac{81}{a} \]
\[ 27a = 35(81) \]
\[ 27a = 2835 \]
\[ a = 105 \]

So, the correct choice is B.
47. **GRIDDED RESPONSE**  What is the difference in the value of $2.1(x + 3.2)$, when $x = 5$ and when $x = 3$?

**SOLUTION:**
Evaluate $2.1(x + 3.2)$, when $x = 5$.

$2.1(x + 3.2) = 2.1(5 + 3.2)$

$= 2.1(8.2)$

$= 17.22$

Evaluate $2.1(x + 3.2)$, when $x = 3$.

$2.1(x + 3.2) = 2.1(3 + 3.2)$

$= 2.1(6.2)$

$= 13.02$

Find the difference of the results.

$17.22 - 13.02 = 4.2$

So, the difference is 4.2.

48. Write an equation of the regression line for the data in each table.

<table>
<thead>
<tr>
<th>$x$</th>
<th>1</th>
<th>3</th>
<th>5</th>
<th>7</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>3</td>
<td>8</td>
<td>15</td>
<td>18</td>
<td>21</td>
</tr>
</tbody>
</table>

**SOLUTION:**
Use a calculator to find the equation of the regression line.

**Step 1:** Enter the data into the lists by pressing \( \text{STAT} \) and selecting the \( \text{EDIT} \) option. Enter the $x$ values in List 1 ($L_1$) and the $y$ values in List 2 ($L_2$).

**Step 2:** Perform the regression by pressing \( \text{STAT} \) and selecting the \( \text{CALC} \) option. Scroll down to \( \text{LinReg}(ax + b) \) and press \( \text{ENTER} \).

\[ \text{LinReg} \]

\[ y = ax + b \]

\[ a = 2.3 \]

\[ b = 1.5 \]

\[ r^2 = .9706422018 \]

\[ r = .9852117548 \]

The equation of the regression line is $y = 2.3x + 1.5$. 
4-7 Inverse Linear Functions

<table>
<thead>
<tr>
<th>x</th>
<th>3</th>
<th>5</th>
<th>7</th>
<th>9</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>7.2</td>
<td>23.5</td>
<td>41.2</td>
<td>56.4</td>
<td>73.1</td>
</tr>
</tbody>
</table>

49. SOLUTION:
Use a calculator to find the equation of the regression line.

Step 1: Enter the data into the lists by pressing STAT and selecting the EDIT option. Enter the x values in List 1 (L₁) and the y values in List 2 (L₂).

Step 2: Perform the regression by pressing STAT and selecting the CALC option. Scroll down to LinReg(ax + b) and press ENTER.

\[
\begin{align*}
\text{LinReg} \\
y &= ax + b \\
a &= 8.235 \\
b &= -17.365 \\
r^2 &= .9995950191 \\
r &= .999797489
\end{align*}
\]

The equation of the regression line is \( y = 8.235x - 17.365 \).

50. SOLUTION:
Use a calculator to find the equation of the regression line.

Step 1: Enter the data into the lists by pressing STAT and selecting the EDIT option. Enter the x values in List 1 (L₁) and the y values in List 2 (L₂).

Step 2: Perform the regression by pressing STAT and selecting the CALC option. Scroll down to LinReg(ax + b) and press ENTER.

\[
\begin{align*}
\text{LinReg} \\
y &= ax + b \\
a &= 10.7 \\
b &= 10.1 \\
r^2 &= .9880048326 \\
r &= .9939843221
\end{align*}
\]

The equation of the regression line is \( y = 10.7x + 10.1 \).
51. **SOLUTION:**
Use a calculator to find the equation of the regression line.

**Step 1:** Enter the data into the lists by pressing STAT and selecting the EDIT option. Enter the \( x \) values in List 1 \( (L_1) \) and the \( y \) values in List 2 \( (L_2) \).

**Step 2:** Perform the regression by pressing STAT and selecting the CALC option. Scroll down to LinReg\((ax + b)\) and press ENTER.

![LinReg](image)

The equation of the regression line is \( y = 0.325x + 0.89 \).

52. **TESTS**
Determine whether the graph below shows a positive, a negative, or no correlation. If there is a correlation, describe its meaning.

![Test Scores](image)

**SOLUTION:**
In general, the test scores increase as the amount of time spent studying increases. The regression line for this data has a positive slope and a correlation coefficient close to 0.5. Since 0.5 is not close to 1, the equation is not a good fit of the data. So, the graph shows a weak positive correlation. This means the more you study, the better your test score is likely to be.

**Suppose \( y \) varies directly as \( x \).**
53. If \( y = 2.5 \) when \( x = 0.5 \), find \( y \) when \( x = 20 \).

**SOLUTION:**
Find the constant of variation, \( k \).

\[
y = kx
\]

\[
2.5 = k (0.5)
\]

\[
5 = k
\]

So, the direct variation equation is \( y = 5x \).

\[
y = kx
\]

\[
= 5(20)
\]

\[
= 100
\]

So, \( y = 100 \) when \( x = 5 \).
4-7 Inverse Linear Functions

54. If \( y = -6.6 \) when \( x = 9.9 \), find \( y \) when \( x = 6.6 \).

\[ \text{SOLUTION:} \]
Find the constant of variation, \( k \).

\[
y = kx  
-6.6 = k (9.9)  
\frac{-2}{3} = k  
\]
So, the direct variation equation is \( y = \frac{-2}{3} x \).

\[
y = kx  
= \frac{-2}{3} (6.6)  
= -4.4  
\]
So, \( y = -4.4 \) when \( x = 6.6 \).

55. If \( y = 2.6 \) when \( x = 0.25 \), find \( y \) when \( x = 1.125 \).

\[ \text{SOLUTION:} \]
Find the constant of variation, \( k \).

\[
y = kx  
2.6 = k (0.25)  
10.4 = k  
\]
So, the direct variation equation is \( y = 10.4x \).

\[
y = kx  
= 10.4 (1.125)  
= 11.7  
\]
So, \( y = 11.7 \) when \( x = 1.125 \).

56. If \( y = 6 \) when \( x = 0.6 \), find \( x \) when \( y = 12 \).

\[ \text{SOLUTION:} \]
Find the constant of variation, \( k \).

\[
y = kx  
6 = k (0.6)  
10 = k  
\]
So, the direct variation equation is \( y = 10x \).

\[
y = kx  
12 = 10x  
1.2 = x  
\]
So, \( x = 1.2 \) when \( y = 12 \).

Solve each equation.

57. \( 104 = k - 67 \)

\[ \text{SOLUTION:} \]

\[
104 = k - 67  
104 + 67 = k - 67 + 67  
171 = k  
\]

58. \( -4 + x = -7 \)

\[ \text{SOLUTION:} \]

\[
-4 + x = -7  
-4 + 4 + x = -7 + 4  
x = -3  
\]

59. \( \frac{m}{7} = -11 \)

\[ \text{SOLUTION:} \]

\[
\frac{m}{7} = -11  
7 \left( \frac{m}{7} \right) = 7 (-11)  
m = -77  
\]
4-7 Inverse Linear Functions

60. \( \frac{2}{3} p = 14 \)

**SOLUTION:**

\[
\frac{2}{3} p = 14 \\
\frac{3}{2} \left( \frac{2}{3} p \right) = \frac{3}{2} (14) \\
p = 21
\]

61. \(-82 = 18 - n\)

**SOLUTION:**

\[-82 = 18 - n \]
\[-82 - 18 = -n + 18 - 18 \]
\[-100 = -n \]
\[100 = n\]

62. \( \frac{9}{t} = -27\)

**SOLUTION:**

\[
\frac{9}{t} = -27 \\
t \left( \frac{9}{t} \right) = t \left( -27 \right) \\
9 = -27t \\
-\frac{1}{3} = t\]
Write an equation in slope-intercept form for each graph shown.

1. SOLUTION:
You need to find the slope and y-intercept to write the equation. The line crosses the y-axis at (0, 7), so the y-intercept is 7. To get from (0, 7) to (−1, 4), go down 3 units and left 1 unit. The slope is 3. The equation of the graph in slope-intercept form is \( y = 3x + 7 \).

2. SOLUTION:
You need to find the slope and y-intercept to write the equation. The line crosses the y-axis at (0, 2), so the y-intercept is 2. To get from (0, 2) to (5, 5), go up 3 units and right 5 units. The slope is \( \frac{3}{5} \). The equation of the graph in slope-intercept form is \( y = \frac{3}{5}x + 2 \).

Graph each equation.

3. \( y = 2x + 3 \)

SOLUTION:
To graph the equation, plot the y-intercept (0, 3). Then move up 2 units and right 1 unit. Plot the point. Draw a line through the two points.

4. \( y = \frac{1}{3}x - 2 \)

SOLUTION:
To graph the equation, plot the y-intercept (0, −2). Then move up 1 unit and right 3 units. Plot the point. Draw a line through the two points.
5. BOATS  Write an equation in slope-intercept form for the total rental cost $C$ for a pontoon boat used for $t$ hours.

SOLUTION:
The rate of $60$ per hour represents the rate or slope. The cleaning fee is a constant $20$, no matter how many hours you rent the boat. So, the total cost $C$ for a boat used for $t$ hours can be written as $C = 60t + 20$.

Write an equation of the line with the given conditions.
6. $(2, 5)$; slope $3$

SOLUTION:
Find the $y$-intercept.
\[ y = mx + b \]
\[ 5 = 3(2) + b \]
\[ 5 = 6 + b \]
\[-1 = b \]
Write the equation in slope-intercept form.
\[ y = mx + b \]
\[ y = 3x - 1 \]

7. $(-3, -1)$, slope $\frac{1}{2}$

SOLUTION:
Find the $y$-intercept.
\[ y = mx + b \]
\[ -1 = \frac{1}{2}(-3) + b \]
\[ -1 = -\frac{3}{2} + b \]
\[ \frac{1}{2} = b \]
Write the equation in slope-intercept form.
\[ y = mx + b \]
\[ y = \frac{1}{2}x + \frac{1}{2} \]

8. $(-3, 4), (1, 12)$

SOLUTION:
Find the slope of the line containing the given points.
\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
\[ = \frac{12 - 4}{1 - (-3)} \]
\[ = \frac{8}{4} \]
\[ = 2 \]
Use the slope and either of the two points to find the $y$-intercept.
\[ y = mx + b \]
\[ 12 = 2(1) + b \]
\[ 12 = 2 + b \]
\[ 10 = b \]
Write the equation in slope-intercept form.
\[ y = mx + b \]
\[ y = 2x + 10 \]

9. $(-1, 6), (2, 4)$

SOLUTION:
Find the slope of the line containing the given points.
\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
\[ = \frac{4 - 6}{2 - (-1)} \]
\[ = \frac{-2}{3} \]
\[ = -\frac{2}{3} \]
Use the slope and either of the two points to find the $y$-intercept.
\[ y = mx + b \]
\[ 4 = -\frac{2}{3}(2) + b \]
\[ 4 = -\frac{4}{3} + b \]
\[ \frac{16}{3} = b \]
Write the equation in slope-intercept form.
\[ y = mx + b \]
\[ y = -\frac{2}{3}x + \frac{16}{3} \]
Mid-Chapter Quiz

10. (2, 1), slope 0

**SOLUTION:**
Find the $y$-intercept.

$y = mx + b$

$1 = 0(2) + b$

$1 = b$

Write the equation in slope-intercept form.

$y = mx + b$

$y = 0x + 1$

$y = 1$

11. **MULTIPLE CHOICE** Write an equation of the line that passes through the point (0, 0) and has slope $-4$.

A $y = x - 4$
B $y = x + 4$
C $y = -4x$
D $y = 4 - x$

**SOLUTION:**
Find the $y$-intercept.

$y = mx + b$

$0 = -4(0) + b$

$0 = 0 + b$

$0 = b$

Write the equation in slope-intercept form.

$y = mx + b$

$y = -4x + 0$

$y = -4x$

So, the correct choice is C.

12. (1, 4), $m = 6$

**SOLUTION:**

$y - y_1 = m(x - x_1)$

$y - 4 = 6(x - 1)$

13. (-2, -1), $m = -3$

**SOLUTION:**

$y - y_1 = m(x - x_1)$

$y - (-1) = -3(x - (-2))$

$y + 1 = -3(x + 2)$

14. Write an equation in point-slope form for the line that passes through the point (8, 3), $m = -2$.

**SOLUTION:**

$y - y_1 = m(x - x_1)$

$y - 3 = -2(x - 8)$

15. Write $y + 3 = \frac{1}{2}(x - 5)$ in standard form.

**SOLUTION:**

$y + 3 = \frac{1}{2}(x - 5)$  
Original equation

$2(y + 3) = 2\left(\frac{1}{2}(x - 5)\right)$  
Multiply each side by 2.

$2y + 6 = x - 5$  
Distribute Property

$-x + 2y + 6 = -x - 5$  
Subtract $x$ from each side

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

$-x + 2y = 1$  
Subtract 6 from each side

$-x + 2y = 1$  
Simplify

$-x + 2y = -11$  
Multiply each side by $-1$.  
Simplify

$-x - 2y = 11$  
Simplify

16. Write $y + 4 = -7(x - 3)$ in slope-intercept form.

**SOLUTION:**

$y + 4 = -7(x - 3)$

$y + 4 = -7x + 21$

$y = -7x + 17$

Write each equation in standard form.

17. $y - 5 = -2(x - 3)$

**SOLUTION:**

$y - 5 = -2(x - 3)$

$y - 5 = -2x + 6$

$2x + y - 5 = 6$

$2x + y = 11$
18. \( y + 4 = \frac{2}{3}(x - 3) \)

**SOLUTION:**

1. \( y + 4 = \frac{2}{3}(x - 3) \)  
2. \( 3(y + 4) = 3\left(\frac{2}{3}\right)(x - 3) \)  
3. \( 3y + 12 = 2(x - 3) \)  
4. \( 3y + 12 = 2x - 6 \)  
5. \( -2x + 3y + 12 = -2x - 6 \)  
6. \( -2x + 3y + 12 = -6 \)  
7. \( -2x + 3y = -18 - 12 \)  
8. \( -2x + 3y = -30 \)  
9. \( -1(-2x + 3y) = -1(-10) \)  
10. \( 2x - 3y = 10 \)  

**Write each equation in slope-intercept form.**

19. \( y - 3 = 4(x + 3) \)

**SOLUTION:**

1. \( y - 3 = 4(x + 3) \)  
2. \( y - 3 = 4x + 12 \)  
3. \( y = 4x + 15 \)

20. \( y + 1 = \frac{1}{2}(x - 8) \)

**SOLUTION:**

1. \( y + 1 = \frac{1}{2}(x - 8) \)  
2. \( y + 1 = \frac{1}{2}x - 4 \)  
3. \( y = \frac{1}{2}x - 5 \)

21. **MULTIPLE CHOICE**  
Determine whether the graphs of the pair of equations are **parallel**, **perpendicular**, or **neither**.

**y = -6x + 8**

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

**F parallel**  
**G perpendicular**  
**H neither**  
**J not enough information**

**SOLUTION:**

Find the slopes of each equation. The first equation has a slope of \(-6\). Write the second equation in slope-intercept form to find the slope.

\[
3x + \frac{1}{2}y = -3
\]

\[
2 \left( 3x + \frac{1}{2}y \right) = 2(-3)
\]

\[
6x + y = -6
\]

\[
y = -6x - 6
\]

The slope of the second equation is \(-6\). Because the two equations have the same slope, they are parallel. The correct choice is F.

22. \((3, -4); y = -\frac{1}{3}x - 5\)

**SOLUTION:**

The slope of the line with equation \(y = -\frac{1}{3}x - 5\) is \(-\frac{1}{3}\). The slope of the perpendicular line is the opposite reciprocal of \(-\frac{1}{3}\), or 3.

\[
y - y_1 = m(x - x_1)
\]

\[
y - (-4) = 3(x - 3)
\]

\[
y + 4 = 3x - 9
\]

\[
y = 3x - 13
\]
23. (0, -3); \ y = -2x + 4

\textbf{SOLUTION:}

The slope of the line with equation \( y = -2x + 4 \) is \(-2\). The slope of the perpendicular line is the opposite reciprocal of \(-2\), or \(\frac{1}{2}\).

\[ y - y_1 = m(x - x_1) \]
\[ y - (-3) = \frac{1}{2} (x - 0) \]
\[ y + 3 = \frac{1}{2} x \]
\[ y = \frac{1}{2} x - 3 \]

24. (-4, -5); \ -4x + 5y = -6

\textbf{SOLUTION:}

Write the equation in slope-intercept form.
\[-4x + 5y = -6 \]
\[ 5y = 4x - 6 \]
\[ y = \frac{4}{5}x - \frac{6}{5} \]

The slope of the line with equation \(-4x + 5y = -6\) is \(\frac{4}{5}\). The slope of the perpendicular line is the opposite reciprocal of \(\frac{4}{5}\), or \(-\frac{5}{4}\).

\[ y - y_1 = m(x - x_1) \]
\[ y - (-5) = -\frac{5}{4} (x - (-4)) \]
\[ y + 5 = -\frac{5}{4} x - 5 \]
\[ y = -\frac{5}{4} x - 10 \]

25. (-1, -4); \ -x - 2y = 0

\textbf{SOLUTION:}

Write the equation in slope-intercept form.
\[-x - 2y = 0 \]
\[ -2y = x \]
\[ y = -\frac{1}{2} x \]

The slope of the line with equation \(-x - 2y = 0\) is \(-\frac{1}{2}\). The slope of the perpendicular line is the opposite reciprocal of \(-\frac{1}{2}\), or 2.

\[ y - y_1 = m(x - x_1) \]
\[ y - (-4) = 2(x - (-1)) \]
\[ y + 4 = 2x + 2 \]
\[ y = 2x - 2 \]
1. Graph \( y = 2x - 3 \).

**SOLUTION:**
The slope-intercept form of a line is \( y = mx + b \), where \( m \) is the slope, and \( b \) is the \( y \)-intercept.

\[ y = mx + b \\
\]
\[ y = 2x - 3 \\
\]
Plot the \( y \)-intercept (0, \(-3\)). The slope is \( \frac{\text{rise}}{\text{run}} = \frac{2}{1} \). From (0, \(-3\)), move up 2 units and right 1 unit. Plot the point. Draw a line through the two points.

![Graph of y = 2x - 3](image)

2. **MULTIPLE CHOICE** A popular pizza parlor charges $12 for a large cheese pizza plus $1.50 for each additional topping. Write an equation in slope-intercept form for the total cost \( C \) of a pizza with \( t \) toppings.

A \( C = 12t + 1.50 \)

B \( C = 13.50t \)

C \( C = 12 + 1.50t \)

D \( C = 1.50t - 12 \)

**SOLUTION:**
The cost of the additional products is the rate or the slope, so you can eliminate choices A and B. The price of the large pizza is a constant at $12. Choice D, subtracts 12 from each order, so you can eliminate this choice. The equation is \( C = 12 + 1.50t \), so the correct choice is C.

Write an equation of a line in slope-intercept form that passes through the given point and has the given slope.

3. \((-4, 2)\); slope \(-3\)

**SOLUTION:**
Find the \( y \)-intercept.

\[ y = mx + b \\
\]
\[ 2 = -3(-4) + b \\
\]
\[ 2 = 12 + b \\
\]
\[ -10 = b \\
\]
Write the equation in slope-intercept form.

\[ y = mx + b \\
\]
\[ y = -3x - 10 \\
\]

4. \((3, -5)\); slope \(\frac{2}{3}\)

**SOLUTION:**
Find the \( y \)-intercept.

\[ y = mx + b \\
\]
\[ -5 = \frac{2}{3}(3) + b \\
\]
\[ -5 = 2 + b \\
\]
\[ -7 = b \\
\]
Write the equation in slope-intercept form.

\[ y = mx + b \\
\]
\[ y = \frac{2}{3}x - 7 \\
\]
Write an equation of the line in slope-intercept form that passes through the given points.
5. (1, 4), (3, 10)

**SOLUTION:**
Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{10 - 4}{3 - 1} = \frac{6}{2} = 3
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]
\[
10 = 3(3) + b
\]
\[
10 = 9 + b
\]
\[
10 - 9 = 9 - 9 + b
\]
\[
1 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]
\[
y = 3x + 1
\]

6. (2, 5), (−2, 8)

**SOLUTION:**
Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8 - 5}{-2 - 2} = -\frac{3}{4}
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]
\[
5 = \frac{3}{4}(-2) + b
\]
\[
5 = \frac{3}{2} + b
\]
\[
8 - \frac{3}{2} = \frac{3}{2} - \frac{3}{2} + b
\]
\[
\frac{13}{2} = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]
\[
y = -\frac{3}{4}x + \frac{13}{2}
\]
7. (0, 4), (−3, 0)

**SOLUTION:**
Find the slope of the line containing the given points.

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
\[ = \frac{0 - 4}{-3 - 0} \]
\[ = \frac{-4}{-3} \]
\[ = \frac{4}{3} \]

Use the slope and either of the two points to find the y-intercept.

\[ y = mx + b \]
\[ 4 = \frac{4}{3} (0) + b \]
\[ 4 = 0 + b \]
\[ 4 = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = \frac{4}{3} x + 4 \]

8. (7, −1), (9, −4)

**SOLUTION:**
Find the slope of the line containing the given points.

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
\[ = \frac{-1 - (-4)}{9 - 7} \]
\[ = \frac{3}{2} \]

Use the slope and either of the two points to find the y-intercept.

\[ y = mx + b \]
\[ -1 = \frac{3}{2} (7) + b \]
\[ -1 = \frac{21}{2} + b \]
\[ -1 + \frac{21}{2} = \frac{21}{2} + \frac{19}{2} \]
\[ \frac{19}{2} = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = -\frac{3}{2} x + \frac{19}{2} \]
9. **PAINTING** The data in the table show the size of a room in square feet and the time it takes to paint the room in minutes.

<table>
<thead>
<tr>
<th>Room Size (square feet)</th>
<th>Painting Time (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>160</td>
</tr>
<tr>
<td>150</td>
<td>220</td>
</tr>
<tr>
<td>200</td>
<td>270</td>
</tr>
<tr>
<td>400</td>
<td>500</td>
</tr>
<tr>
<td>500</td>
<td>680</td>
</tr>
</tbody>
</table>

a. Use the points (100, 160) and (500, 680) to write an equation in slope-intercept form.

b. Predict the amount of time required to paint a room measuring 750 square feet.

**SOLUTION:**

a. Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{680 - 160}{500 - 100} = \frac{520}{400} = 1.3
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]

\[
160 = 1.3(100) + b
\]

\[
160 = 130 + b
\]

\[
160 - 130 = 130 - 130 + b
\]

\[
30 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]

\[
y = 1.3x + 30
\]

b. Substitute 750 for x into the equation from part a.

\[
y = 1.3x + 30
\]

\[
y = 1.3(750) + 30
\]

\[
y = 975 + 30
\]

\[
y = 1005
\]

So it will take 1005 minutes to paint a room that measures 750 square feet.

10. **SALARY** The table shows the relationship between years of experience and teacher salary.

<table>
<thead>
<tr>
<th>Years Experience</th>
<th>Salary (thousands of dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28</td>
</tr>
<tr>
<td>5</td>
<td>31</td>
</tr>
<tr>
<td>10</td>
<td>42</td>
</tr>
<tr>
<td>15</td>
<td>49</td>
</tr>
<tr>
<td>20</td>
<td>64</td>
</tr>
</tbody>
</table>

a. Write an equation for the best-fit line.

b. Find the correlation coefficient and explain what it tells us about the relationship between experience and teacher salary.

**SOLUTION:**

a. Use a calculator to find the equation of the regression line.

\[
y = 1.89x + 23.57
\]

b. Use a calculator to find the correlation coefficient. It is 0.98. This means that there is a strong positive correlation between years of experience and salary.
Write an equation in slope-intercept form for the line that passes through the given point and is parallel to the graph of each equation.

11. \((2, -3), y = 4x - 9\)

**SOLUTION:**
The slope of the line with equation \(y = 4x - 11\) is 4. The line parallel to \(y = 4x - 11\) has the same slope, 4.

Find the \(y\)-intercept.

\[
y = mx + b \\
-3 = 4(2) + b \\
-3 = 8 + b \\
-11 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b \\
y = 4x - 11
\]

12. \((-5, 1), y = -3x + 2\)

**SOLUTION:**
The slope of the line with equation \(y = -3x + 2\) is \(-3\). The line parallel to \(y = -3x + 2\) has the same slope, \(-3\).

Find the \(y\)-intercept.

\[
y = mx + b \\
1 = -3(-5) + b \\
1 = 15 + b \\
-14 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b \\
y = -3x - 14
\]

Write an equation in slope-intercept form for the line that passes through the given point and is perpendicular to the graph of the equation.

13. \((1, 4), y = -2x + 5\)

**SOLUTION:**
The slope of the line with equation \(y = -2x + 5\) is \(-2\). The slope of the perpendicular line is the opposite reciprocal of \(-2\), or \(\frac{1}{2}\).

Find the \(y\)-intercept.

\[
y = mx + b \\
4 = \frac{1}{2}(1) + b \\
4 = \frac{1}{2} + b \\
\frac{7}{2} = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b \\
y = \frac{1}{2}x + \frac{7}{2}
\]
14. \((-3, 6), y = \frac{1}{4} x + 2\)

**SOLUTION:**

The slope of the line with equation \(y = \frac{1}{4} x + 2\) is \(\frac{1}{4}\).

The slope of the perpendicular line is the opposite reciprocal of \(\frac{1}{4}\), or \(-4\).

Find the \(y\)-intercept.

\[
y = mx + b
\]
\[
6 = -4(-3) + b
\]
\[
6 = 12 + b
\]
\[
-6 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]
\[
y = -4x - 6
\]

15. **MULTIPLE CHOICE** The graph shows the relationship between outside temperature and daily ice cream cone sales. What type of correlation is shown?

![Graph of ice cream cone sales vs. temperature](image)

- **F** positive correlation
- **G** negative correlation
- **H** no correlation
- **J** not enough information

**SOLUTION:**

As the temperature gets larger, the number of ice cream cones sold also gets larger. This shows that there is a positive correlation, so the correct choice is **F**.
16. **ADOPTION** The table shows the number of children from Russia adopted by U.S. citizens.

<table>
<thead>
<tr>
<th>Years Since 2000</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Children</td>
<td>442</td>
<td>731</td>
<td>1254</td>
<td>1724</td>
<td>2237</td>
</tr>
</tbody>
</table>

a. Write the slope-intercept form of the equation for the line of fit.

b. Predict the number of children from Russia who will be adopted in 2025.

**SOLUTION:**

a. Use a calculator to find the equation of the regression line.

\[
y = 466.3x - 1978.5
\]

b. There will be about about 9679 children adopted from Ethiopia in 2025.

Find the inverse of each function.

17. \( f(x) = -5x - 30 \)

**SOLUTION:**

\[
f(x) = -5x - 30 \quad \text{Original equation}
\]
\[
y = -5x - 30 \quad \text{Replace } f(x) \text{ with } y.
\]
\[
x = -5y \quad \text{Interchange } x \text{ and } y.
\]
\[
x + 30 = -5y \quad \text{Add 30 to each side}
\]
\[
-\frac{1}{5}x - 6 = y \quad \text{Divide each side by } -5
\]
\[
-\frac{1}{5}x - 6 = f^{-1}(x) \quad \text{Replace } y \text{ with } f^{-1}(x).
\]

Write the final equation in slope-intercept form. So, \( f^{-1}(x) = -\frac{1}{5}x - 6 \).

18. \( f(x) = 4x + 10 \)

**SOLUTION:**

\[
f(x) = 4x + 10 \quad \text{Original equation}
\]
\[
y = 4x + 10 \quad \text{Replace } f(x) \text{ with } y.
\]
\[
x = 4y + 10 \quad \text{Interchange } x \text{ and } y.
\]
\[
x - 10 = 4y \quad \text{Subtract 10 from each side}
\]
\[
\frac{1}{4}x - \frac{5}{2} = y \quad \text{Divide each side by } 4
\]
\[
\frac{1}{4}x - \frac{5}{2} = f^{-1}(x) \quad \text{Replace } y \text{ with } f^{-1}(x).
\]

Write the final equation in slope-intercept form. So, \( f^{-1}(x) = \frac{1}{4}x - \frac{5}{2} \).

19. \( f(x) = \frac{1}{6}x - 2 \)

**SOLUTION:**

\[
f(x) = \frac{1}{6}x - 2 \quad \text{Original equation}
\]
\[
y = \frac{1}{6}x - 2 \quad \text{Replace } f(x) \text{ with } y.
\]
\[
x = \frac{1}{6}y - 2 \quad \text{Interchange } x \text{ and } y.
\]
\[
x + 2 = \frac{1}{6}y \quad \text{Add 2 to each side}
\]
\[
6x + 12 = y \quad \text{Multiply each side by } 6
\]
\[
6x + 12 = f^{-1}(x) \quad \text{Replace } y \text{ with } f^{-1}(x).
\]

Write the final equation in slope-intercept form. So, \( f^{-1}(x) = 6x + 12 \).
20. \( f(x) = \frac{3}{4}x + 12 \)

**SOLUTION:**

\[
\begin{align*}
  f(x) &= \frac{3}{4}x + 12 \quad \text{Original equation} \\
  y &= \frac{3}{4}x + 12 \quad \text{Replace } f(x) \text{ with } y \\
  x &= \frac{3}{4}y + 12 \quad \text{Interchange } x \text{ and } y. \\
  x - 12 &= \frac{3}{4}y \quad \text{Subtract 12 from each side} \\
  \frac{4}{3}x - 16 &= y \quad \text{Multiply each side by } \frac{4}{3} \\
  \frac{4}{3}x - 16 &= f^{-1}(x) \quad \text{Replace } y \text{ with } f^{-1}(x).
\end{align*}
\]

Write the final equation in slope-intercept form. So, \( f^{-1}(x) = \frac{4}{3}x - 16 \).
1. Given points $M(-1, 7), N(3, -5), O(6, 1)$, and $P(-3, -2)$, determine two segments that are perpendicular to each other.

**SOLUTION:**

Find the slope of $\overline{MN}$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - 7}{3 - (-1)} = \frac{-12}{4} = -3$$

Find the slope of $\overline{OP}$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - 1}{-3 - 6} = \frac{-3}{-9} = \frac{1}{3}$$

The two segments $\overline{MN}$ and $\overline{OP}$ are perpendicular because their slopes are opposite reciprocals.

2. Write the equation of a line that is parallel to $4x + 2y = 8$ and has a $y$-intercept of 5.

**SOLUTION:**

Write the equation in slope-intercept form.

\[
\begin{align*}
4x + 2y &= 8 \\
4x - 4x + 2y &= 8 - 4x \\
2y &= -4x + 8 \\
\frac{2y}{2} &= \frac{-4x + 8}{2} \\
y &= -2x + 4
\end{align*}
\]

The equation of a line parallel to $4x + 2y = 8$ will have the same slope, $-2$. Write the equation in slope-intercept form where $m = -2$ and $b = 5$.

$$y = -2x + 5$$
3. Three vertices of a quadrilateral are shown on the coordinate grid. Determine a fourth vertex that would result in a trapezoid.

**SOLUTION:**
Find the slope of the line from (3, −6) to (−5, 4).

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]
\[
= \frac{4 - (-6)}{-5 - 3}
\]
\[
= \frac{10}{-8}
\]
\[
= -\frac{5}{4}
\]

To form a trapezoid, the line from (6, 1) to the new point would have to have the same slope as the line from (3, −6) to (−5, 4), $-\frac{5}{4}$. Choose an x value and use the formula for slope to find a y value so that $m = -\frac{5}{4}$.

\[
m = \frac{y_2 - y_1}{x_2 - x_1}
\]
\[
-\frac{5}{4} = \frac{1 - y}{6 - 2}
\]
\[
-\frac{5}{4} = \frac{1 - y}{4}
\]
\[
-5 = 1 - y
\]
\[
6 = y
\]

So to form a trapezoid, a fourth vertex could be (2, 6).
1. What is the rate of change represented in the graph?

A $\frac{-2}{5}$

B $\frac{-5}{6}$

C $\frac{-6}{5}$

D $\frac{5}{2}$

**SOLUTION:**

The rate of change represented in the graph is the slope of the line.

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]  
\[ m = \frac{-2 - 4}{5 - 0} \]  
\[ (x_1, y_1) = (0, 4), \]  
\[ (x_2, y_2) = (5, -2) \]

\[ m = \frac{-6}{5} \]  
\[ m = \frac{-6}{5} \text{ or } \frac{6}{-5} \]  
\[ \text{Simplify.} \]

So, the correct choice is C.

2. The table below shows the cost for renting a bicycle at a bike shop located in Venice Beach. What is a function that can represent this sequence?

<table>
<thead>
<tr>
<th>Number of Hours</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
</tr>
</tbody>
</table>

\[ F f(n) = 4n + 10 \]

\[ G f(n) = 4n + 6 \]

\[ H f(n) = 10n + 4 \]

\[ J f(n) = 10n - 6 \]

**SOLUTION:**

First find the slope.

\[ m = \frac{x_2 - x_1}{y_2 - y_1} \]  
\[ m = \frac{-2 - 10}{4 - 1} \]  
\[ (x_1, y_1) = (1, 10), \]  
\[ (x_2, y_2) = (4, 22) \]

\[ m = \frac{12}{3} \]  
\[ m = 4 \]  
\[ \text{Simplify} \]

Next, use the slope and one of the ordered pairs to find the y-intercept, \( b \).

\[ y - y_1 = m(x - x_1) \]  
\[ y - 10 = 4(x - 1) \]

\[ m = 4, \]  
\[ (x_1, y_1) = (4, 22) \]

\[ y - 22 = 4x - 4 \]  
\[ y = 4x + 6 \]  
\[ \text{Simplify} \]

\[ f(n) = 4n + 6 \]  
\[ \text{Replace} \] 
\[ y = 4n + 6 \]  
\[ \text{with } f(n) \]  
\[ \text{and } x \text{ with } n \]

The function is \( f(n) = 4n + 6 \), so the correct choice is G.
3. Jaime bought a car in 2005 for $28,500. By 2008, the car was worth $23,700. Based on a linear model, what will the value of the car be in 2012?

A $17,300  

B $17,550  

C $18,100  

D $18,475  

**SOLUTION:**
Use the ordered pairs (0, 28,500) and (3, 23,700) where 0 and 3 represent the number of years Jaime has owned the car. Since the model is linear, calculate the slope.

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
\[ m = \frac{28,500 - 23,700}{3 - 0} \]
\[ m = \frac{4800}{3} \]
\[ m = -1600 \]

Find the y-intercept.

\[ y = mx + b \]
\[ 28,500 = -1600(0) + b \]
\[ 28,500 = b \]

Write the equation in slope-intercept form. 2012 is 7 years after 2005, so solve for \( y \) when \( x = 7 \).

\[ y = mx + b \]
\[ y = -1600x + 28,500 \]
\[ y = -1600(7) + 28,500 \]
\[ y = -11,200 + 28,500 \]
\[ y = 17,300 \]

So, the correct choice is A.

4. If the graph of a line has a positive slope and a negative y-intercept, what happens to the x-intercept if the slope and the y-intercept are doubled?

F The x-intercept becomes four times larger.  

G The x-intercept becomes twice as large.  

H The x-intercept becomes one-fourth as large.  

J The x-intercept remains the same.  

**SOLUTION:**
Try a sample equation to see how doubling the slope and y-intercept effects the y-intercept.

Sample equation: \( y = x - 1 \)

Sample equation with slope and y-intercept doubled: \( y = 2x - 2 \)

The x-intercept is not changed. Therefore, the correct answer is J.

5. Which absolute value equation has the graph below as its solution?

A \( |x - 3| = 11 \)  

B \( |x - 4| = 12 \)  

C \( |x - 1| = 3 \)  

D \( |x - 12| = 4 \)  

**SOLUTION:**
A \( |x - 3| = 11 \)
Case 1:
\[ x - 3 = 11 \]
\[ x - 3 + 3 = 11 + 3 \]
\[ x = 14 \]

Case 2:
\[ x - 3 = -11 \]
\[ x - 3 + 3 = -11 + 3 \]
\[ x = -8 \]

The solution set is (14, -8). Therefore, A is not the correct choice.

Case 1:
\[ |x - 4| = 12 \]
\[ x - 4 = 12 \]
\[ x - 4 + 4 = 12 + 4 \]
\[ x = 16 \]

Case 2:
\[ x - 4 = -12 \]
\[ x - 4 + 4 = -12 + 4 \]
\[ x = -8 \]

The solution set is (16, -8). Therefore, B is not the correct choice.

Case 1:
\[ |x - 1| = 3 \]
\[ x - 1 = 3 \]
\[ x - 1 + 1 = 3 + 1 \]
\[ x = 4 \]

Case 2:
\[ x - 1 = -3 \]
\[ x - 1 + 1 = -3 + 1 \]
\[ x = 8 \]

The solution set is (14, 8). Therefore, C is the correct choice. Since C is correct, we do not need to check Choice D.

6. The table below shows the relationship between certain temperatures in degrees Fahrenheit and degrees Celsius. Which of the following linear equations correctly models this relationship?

<table>
<thead>
<tr>
<th>Celsius (C)</th>
<th>Fahrenheit (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10°</td>
<td>50°</td>
</tr>
<tr>
<td>15°</td>
<td>59°</td>
</tr>
<tr>
<td>20°</td>
<td>68°</td>
</tr>
<tr>
<td>25°</td>
<td>77°</td>
</tr>
<tr>
<td>30°</td>
<td>86°</td>
</tr>
</tbody>
</table>

F \[ F = \frac{8}{5}C + 35 \]
G \[ F = \frac{4}{5}C + 42 \]
H \[ F = \frac{9}{5}C + 32 \]
J \[ F = \frac{12}{5}C + 26 \]

**SOLUTION:**
Find the slope of the equation represented by the table.

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
\[ m = \frac{59 - 50}{15 - 10} \]
\[ m = \frac{9}{5} \]

Find the y-intercept.

\[ y = mx + b \]
\[ 50 = \frac{9}{5}(10) + b \]
\[ 50 = 18 + b \]
\[ 32 = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = \frac{9}{5}x + 32 \]

Therefore, \( F = \frac{9}{5}C + 32 \) and H is the correct choice.
7. What is the equation of the line graphed below?

Express your answer in point slope form using the point \((-8, 3)\).

**SOLUTION:**

Find the slope using \((-8, 3)\) and \((4, 0)\).

\[
m = \frac{y_2 - y_1}{x_2 - x_1} \quad \text{Slope formula}
\]

\[
m = \frac{0 - 3}{4 - (-8)} \quad \text{Substitute}
\]

\[
m = \frac{-3}{12} \quad \text{Simplify}
\]

\[
m = -\frac{1}{4} \quad \text{Reduce fraction}
\]

Use the slope and \((-8, 3)\) to write the equation in point-slope form.

\[
y - y_1 = m(x - x_1) \quad \text{Point-slope form}
\]

\[
y - 3 = -\frac{1}{4}(x - (-8)) \quad \text{Substitute}
\]

\[
y - 3 = -\frac{1}{4}(x + 8) \quad \text{Simplify}
\]

8. **GRIDDED RESPONSE** The linear equation below is a best fit model for the peak depth of the Mad River when \(x\) inches of rain fall. What would you expect the peak depth of the river to be after a storm that produces \(\frac{3}{4}\) inches of rain? Round your answer to the nearest tenth of a foot if necessary.

\[
y = 2.5x + 14.8
\]

**SOLUTION:**

\[
y = 2.5\left(\frac{3}{4}\right) + 14.8
\]

\[
y = 4.375 + 14.8
\]

\[
y = 19.175
\]

\[
y \approx 19.2
\]

The peak depth of the river would be about 19.2 feet. Since the answer is to be in feet, divide 19.2 by 12. The answer therefore is about 1.6 feet.

9. Jacob formed an advertising company in 1992. Initially, the company only had 14 employees. In 2008, the company had grown to a total of 63 employees. Find the percent of change in the number of employees working at Jacob’s company. Round to the nearest tenth of a percent if necessary.

**SOLUTION:**

Subtract the original amount from the final amount to find the amount of change: \(63 - 14 = 49\). Since the new amount is greater than the original, this is a percent of increase.

\[
\frac{49}{14} = \frac{r}{100}
\]

\[
49(100) = 14r
\]

\[
4900 = 14r
\]

\[
\frac{4900}{14} = \frac{14r}{14}
\]

\[
350 = r
\]

Therefore, the percent of increase is 350%.
10. The table shows the total amount of rain during a storm.

<table>
<thead>
<tr>
<th>Hour</th>
<th>Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.45</td>
</tr>
<tr>
<td>2</td>
<td>0.9</td>
</tr>
<tr>
<td>3</td>
<td>1.35</td>
</tr>
<tr>
<td>4</td>
<td>1.8</td>
</tr>
</tbody>
</table>

**a.** Write an equation to fit the data in the table.

**b.** Describe the relationship between the hour and the amount of rain received.

**SOLUTION:**
The difference between the amounts of inches of rainfall. This suggests a linear equation. First find the slope using points (1, 0.45) and (2, 0.9).

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0.9 - 0.45}{2 - 1} = 0.45
\]

Find the y-intercept.

\[
y = mx + b
\]

\[
0.9 = 0.45(2) + b
\]

\[
0.9 - 0.9 = 0.9 - 0.9 + b
\]

\[
b = 0
\]

Write the equation in slope-intercept form.

\[
y = 0.45x
\]

**b.** Since the equation is in the form \( y = kx \) and passes through \((0, 0)\) it is proportional. Therefore the amount of rain is proportional to the hour.

11. The electrician charges a $25 consultation fee plus $35 per hour for labor.

**a.** Copy and complete the following table showing the charges for jobs that take 1, 2, 3, 4, or 5 hours.

<table>
<thead>
<tr>
<th>Hours, ( h )</th>
<th>Total Cost, ( C )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(35)(1) + 25</td>
</tr>
<tr>
<td>2</td>
<td>(35)(2) + 25</td>
</tr>
<tr>
<td>3</td>
<td>(35)(3) + 25</td>
</tr>
<tr>
<td>4</td>
<td>(35)(4) + 25</td>
</tr>
<tr>
<td>5</td>
<td>(35)(5) + 25</td>
</tr>
</tbody>
</table>

**b.** Write an equation in slope-intercept form for the total cost of a job that takes \( h \) hours.

**c.** If the electrician bills in quarter hours, how much would it cost for a job that takes 3 hours 15 minutes to complete?

**SOLUTION:**

**a.**

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{95 - 60}{2 - 1} = 35
\]

\[
m = \frac{35}{1}
\]

\[
m = 35
\]

Find the y-intercept.

\[
y = mx + b
\]

\[
60 = 35(1) + b
\]

\[
60 = 35 + b
\]

\[
60 - 35 = 35 - 35 + b
\]

\[
25 = b
\]

Write the equation in slope-intercept form.
Standardized Test Practice - Cumulative, Chapter 1-4

\[ y = mx + b \]
\[ y = 35x + 25 \]

Therefore, the equation in slope-intercept form for the total cost of a job that takes \( h \) hours is
\[ C = 35h + 25. \]

c. 3 hours 15 minutes = 3.25 hours = \( h \)

\[ C = 35h + 25 \]
\[ C = 35(3.25) + 25 \]
\[ C = 113.75 + 25 \]
\[ C = 138.75 \]

The cost for the job is $138.75.

12. Explain how you can determine whether two lines are parallel or perpendicular.

**SOLUTION:**

Sample answer: compare the slopes of the lines. If two lines have the same slope, they are parallel. If their slopes are opposite reciprocals, they are perpendicular.
State whether each sentence is true or false. If false, replace the underlined term to make a true sentence.

1. The y-intercept is the y-coordinate of the point where the graph crosses the y-axis.

   SOLUTION:
   The y-intercept is the point where the graph crosses the y-axis. So, the statement is true.

2. The process of using a linear equation to make predictions about values that are beyond the range of the data is called **linear regression**.

   SOLUTION:
   The statement is false. The process of using a linear equation to make predictions about values that are beyond the range of the data is called linear extrapolation. Linear regression is an algorithm to find a precise line of fit for a set of data.

3. An **inverse relation** is the set of ordered pairs obtained by exchanging the x-coordinates with the y-coordinates of each ordered pair of a relation.

   SOLUTION:
   This is the definition of an inverse function. Therefore, the statement is true.

4. The **correlation coefficient** describes whether the correlation between the variables is positive or negative and how closely the regression equation is modeling the data.

   SOLUTION:
   The correlation coefficient describes whether the correlation between the variables is positive or negative and how closely the equation is modeling the data. So, the statement is true.

5. Lines in the same plane that do not intersect are called **parallel** lines.

   SOLUTION:
   Lines in the same plane that do not intersect are called parallel lines. So, the statement is true.

6. Lines that intersect at **acute** angles are called perpendicular lines.

   SOLUTION:
   The statement is false. Lines that intersect at right angles are called perpendicular lines. Acute angles have measures less than 90.

7. A(n) **constant function** can generate ordered pairs for an inverse relation.

   SOLUTION:
   A constant function has the same function value for every element of the domain. An inverse function can generate ordered pairs for an inverse relation. So, the statement is false. Replace constant function with inverse function to make it a true statement.

8. The **range** of a relation is the range of its inverse function.

   SOLUTION:
   The range of a relation is the domain of the inverse of the relation. The statement is false.

9. An equation of the form \( y = mx + b \) is in **point-slope form**.

   SOLUTION:
   An equation in point slope form looks like \( y - y_1 = m(x - x_1) \). An equation in slope intercept form looks like \( y = mx + b \). The statement is false.
Write an equation of a line in slope-intercept form with the given slope and \( y \)-intercept. Then graph the equation.

10. slope: 3, \( y \)-intercept: 5

**SOLUTION:**
The slope-intercept form of a line is \( y = mx + b \), where \( m \) is the slope, and \( b \) is the \( y \)-intercept.

\[
y = mx + b \\\ny = 3x + 5
\]

To graph the equation, plot the \( y \)-intercept \((0, 5)\). Then move down 3 units and left 1 unit. Plot the point. Draw a line through the two points.

11. slope: \(-2\), \( y \)-intercept: \(-9\)

**SOLUTION:**
The slope-intercept form of a line is \( y = mx + b \), where \( m \) is the slope, and \( b \) is the \( y \)-intercept.

\[
y = mx + b \\\ny = -2x + (-9) \\\ny = -2x - 9
\]

To graph the equation, plot the \( y \)-intercept \((0, -9)\). Then move down 2 units and right 1 unit. Plot the point. Draw a line through the two points.
12. slope: \( \frac{2}{3} \), y-intercept: 3

**SOLUTION:**
The slope-intercept form of a line is \( y = mx + b \), where \( m \) is the slope, and \( b \) is the y-intercept.

\[
y = \frac{2}{3}x + 3
\]

To graph the equation, plot the y-intercept (0, 3). Then move up 2 units and right 3 units. Plot the point. Draw a line through the two points.

13. slope: \( -\frac{5}{8} \), y-intercept: -2

**SOLUTION:**
The slope-intercept form of a line is \( y = mx + b \), where \( m \) is the slope, and \( b \) is the y-intercept.

\[
y = -\frac{5}{8}x + (-2)
\]

\[
y = -\frac{5}{8}x - 2
\]

To graph the equation, plot the y-intercept (0, -2). Then move down 5 units and right 8 units. Plot the point. Draw a line through the two points.

14. \( y = 4x - 2 \)

**SOLUTION:**
To graph the equation, plot the y-intercept (0, -2). Then move up 4 units and right 1 unit. Plot the point. Draw a line through the two points.
15. \( y = -3x + 5 \)

**SOLUTION:**
To graph the equation, plot the y-intercept \((0, 5)\). Then move down 3 units and right 1 unit. Plot the point. Draw a line through the two points.

![Graph of linear equation](image)

16. \( y = \frac{1}{2}x + 1 \)

**SOLUTION:**
To graph the equation, plot the y-intercept \((0, 1)\). Then move up 1 unit and right 2 units. Plot the point. Draw a line through the two points.

![Graph of linear equation](image)

17. \( 3x + 4y = 8 \)

**SOLUTION:**
First, rewrite the equation in slope-intercept form by solving for \( y \).

\[
\begin{align*}
3x + 4y &= 8 \\
3x + 4y - 3x &= 8 - 3x \\
4y &= 8 - 3x \\
\frac{4y}{4} &= \frac{-3x + 8}{4} \\
y &= -\frac{3}{4}x + 2
\end{align*}
\]

To graph the equation, plot the y-intercept \((0, 2)\). Then down 3 units and right 4 units. Plot the point. Draw a line through the two points.

![Graph of linear equation](image)

18. **SKI RENTAL** Write an equation in slope-intercept form for the total cost of skiing for \( h \) hours with one lift ticket.

**SOLUTION:**
The rate of $5 per hour represents the rate or slope. The cost of the lift ticket is a constant $15, no matter how many hours you ski. So, the total cost of skiing for \( h \) hours can be written as \( y = 5h + 15 \).
Write an equation of the line that passes through the given point and has the given slope.

19. (1, 2), slope 3

**SOLUTION:**
Find the y-intercept.

\[ y = mx + b \]
\[ 2 = 3(1) + b \]
\[ 2 = 3 + b \]
\[ -1 = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = 3x - 1 \]

20. (2, -6), slope -4

**SOLUTION:**
Find the y-intercept.

\[ y = mx + b \]
\[ -6 = -4(2) + b \]
\[ -6 = -8 + b \]
\[ 2 = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = -4x + 2 \]

21. (-3, -1), slope \( \frac{2}{5} \)

**SOLUTION:**
Find the y-intercept.

\[ y = mx + b \]
\[ -1 = \frac{2}{5}(-3) + b \]
\[ -1 = -\frac{6}{5} + b \]
\[ \frac{1}{5} = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = \frac{2}{5}x + \frac{1}{5} \]

22. (5, -2), slope \( -\frac{1}{3} \)

**SOLUTION:**
Find the y-intercept.

\[ y = mx + b \]
\[ -2 = -\frac{1}{3}(5) + b \]
\[ -2 = -\frac{5}{3} + b \]
\[ -\frac{1}{3} = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = -\frac{1}{3}x - \frac{1}{3} \]
Write an equation of the line that passes through the given points.
23. (2, -1), (5, 2)

**SOLUTION:**
Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - (-1)}{5 - 2} = \frac{3}{3} = 1
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]

\[
2 = 1(5) + b
\]

\[
2 = 5 + b
\]

\[
-3 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]

\[
y = x - 3
\]

24. (-4, 3), (1, 13)

**SOLUTION:**
Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{13 - 3}{1 - (-4)} = \frac{10}{5} = 2
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]

\[
13 = 2(1) + b
\]

\[
13 = 2 + b
\]

\[
11 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]

\[
y = 2x + 11
\]
25. (3, 5), (5, 6)

**SOLUTION:**
Find the slope of the line containing the given points.

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
\[ = \frac{6 - 5}{5 - 3} \]
\[ = \frac{1}{2} \]

Use the slope and either of the two points to find the y-intercept.

\[ y = mx + b \]
\[ 5 = \frac{1}{2}(3) + b \]
\[ 5 = \frac{3}{2} + b \]
\[ 7 = b \]
\[ \frac{7}{2} = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = \frac{1}{2}x + \frac{7}{2} \]

26. (2, 4), (7, 2)

**SOLUTION:**
Find the slope of the line containing the given points.

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
\[ = \frac{2 - 4}{7 - 2} \]
\[ = \frac{-2}{5} \]

Use the slope and either of the two points to find the y-intercept.

\[ y = mx + b \]
\[ 4 = -\frac{2}{5}(2) + b \]
\[ 4 = -\frac{4}{5} + b \]
\[ \frac{24}{5} = b \]

Write the equation in slope-intercept form.

\[ y = mx + b \]
\[ y = -\frac{2}{5}x + \frac{24}{5} \]
27. **CAMP** In 2005, a camp had 450 campers. Five years later, the number of campers rose to 750. Write a linear equation that represents the number of campers that attend camp.

**SOLUTION:**
Let \( x \) be the number of years since 2005. Two points on the line are (0, 450) and (5, 750). Find the slope of the line.

\[
m = \frac{\frac{y_2 - y_1}{x_2 - x_1}}{x_2 - x_1} = \frac{750 - 450}{5 - 0} = \frac{300}{5} = 60
\]

Use the slope and either of the two points to find the \( y \)-intercept.

\[
y = mx + b
\]
\[
450 = 60(0) + b
\]
\[
450 = 0 + b
\]
\[
450 = b
\]

Write the equation in slope-intercept form.

\[
y = mx + b
\]
\[
y = 60x + 450
\]

The number of campers that attend camp can be represented by the linear equation \( y = 60x + 450 \).

**Write an equation in point-slope form for the line that passes through the given point with the slope provided.**

28. (6, 3), slope 5

**SOLUTION:**
\[
y - y_1 = m(x - x_1)
\]
\[
y - 3 = 5(x - 6)
\]

29. (−2, 1), slope −3

**SOLUTION:**
\[
y - y_1 = m(x - x_1)
\]
\[
y - 1 = -3(x - (-2))
\]
\[
y - 1 = -3(x + 2)
\]

30. (−4, 2), slope 0

**SOLUTION:**
\[
y - y_1 = m(x - x_1)
\]
\[
y - 2 = 0(x - (-4))
\]
\[
y - 2 = 0
\]

**Write each equation in standard form.**
31. \( y - 3 = 5(x - 2) \)

**SOLUTION:**
\[
y - 3 = 5(x - 2)
\]
\[
y - 3 = 5x - 10
\]
\[
-5x + y - 3 = -10
\]
\[
-5x + y = -7
\]
\[
5x - y = 7
\]

32. \( y - 7 = -3(x + 1) \)

**SOLUTION:**
\[
y - 7 = -3(x + 1)
\]
\[
y - 7 = -3x - 3
\]
\[
3x + y - 7 = -3
\]
\[
3x + y = 4
\]

33. \( y + 4 = \frac{1}{2}(x - 3) \)

**SOLUTION:**
\[
y + 4 = \frac{1}{2}(x - 3)
\]
\[
y + 4 = \frac{1}{2}x - \frac{3}{2}
\]
\[
-\frac{1}{2}x + y + 4 = -\frac{3}{2}
\]
\[
-\frac{1}{2}x + y = -\frac{11}{2}
\]
\[
x - 2y = 11
\]
34. \( y - 9 = \frac{4}{5}(x + 2) \)

**SOLUTION:**

\[
\begin{align*}
y - 9 &= \frac{4}{5}(x + 2) \\
y - 9 &= \frac{4}{5}x - \frac{8}{5} \\
\frac{4}{5}x + y - 9 &= -\frac{8}{5} \\
\frac{4}{5}x + y &= \frac{37}{5} \\
4x + 5y &= 37
\end{align*}
\]

Write each equation in slope-intercept form.

35. \( y - 2 = 3(x - 5) \)

**SOLUTION:**

\[
\begin{align*}
y - 2 &= 3(x - 5) \\
y - 2 &= 3x - 15 \\
y &= 3x - 13
\end{align*}
\]

36. \( y - 12 = -2(x - 3) \)

**SOLUTION:**

\[
\begin{align*}
y - 12 &= -2(x - 3) \\
y - 12 &= -2x + 6 \\
y &= -2x + 18
\end{align*}
\]

37. \( y + 3 = 5(x + 1) \)

**SOLUTION:**

\[
\begin{align*}
y + 3 &= 5(x + 1) \\
y + 3 &= 5x + 5 \\
y &= 5x + 2
\end{align*}
\]

38. \( y - 4 = \frac{1}{2}(x + 2) \)

**SOLUTION:**

\[
\begin{align*}
y - 4 &= \frac{1}{2}(x + 2) \\
y - 4 &= \frac{1}{2}x + 1 \\
y &= \frac{1}{2}x + 5
\end{align*}
\]

Write an equation in slope-intercept form for the line that passes through the given point and is parallel to the graph of each equation.

39. \( (2, 5), y = x - 3 \)

**SOLUTION:**

The slope of the line with equation \( y = x - 3 \) is 1. The line parallel to \( y = x - 3 \) has the same slope, 1.

\[
\begin{align*}
y - y_1 &= m(x - x_1) \\
y - 5 &= 1(x - 2) \\
y - 5 &= x - 2 \\
y &= x + 3
\end{align*}
\]

40. \( (0, 3), y = 3x + 5 \)

**SOLUTION:**

The slope of the line with equation \( y = 3x + 5 \) is 3. The line parallel to \( y = 3x + 5 \) has the same slope, 3.

\[
\begin{align*}
y - y_1 &= m(x - x_1) \\
y - 3 &= 3(x - 0) \\
y - 3 &= 3x - 0 \\
y - 3 &= 3x \\
y &= 3x + 3
\end{align*}
\]

41. \( (-4, 1), y = -2x - 6 \)

**SOLUTION:**

The slope of the line with equation \( y = -2x - 6 \) is \(-2\). The line parallel to \( y = -2x - 6 \) has the same slope, \(-2\).

\[
\begin{align*}
y - y_1 &= m(x - x_1) \\
y - 1 &= -2(x - (-4)) \\
y - 1 &= -2(x + 4) \\
y - 1 &= -2x - 8 \\
y &= -2x - 7
\end{align*}
\]
42. \((-5, -2), y = \frac{-1}{2}x + 4\)

**SOLUTION:**

The slope of the line with equation \(y = \frac{-1}{2}x + 4\) is \(-\frac{1}{2}\). The line parallel to \(y = \frac{-1}{2}x + 4\) has the same slope, \(-\frac{1}{2}\).

\[
y - y_i = m(x - x_i)
\]

\[
y - (-2) = \frac{-1}{2}(x - (-5))
\]

\[
y + 2 = \frac{-1}{2}(x + 5)
\]

\[
y + 2 = \frac{-1}{2}x - \frac{5}{2}
\]

\[
y = \frac{-1}{2}x - \frac{9}{2}
\]

Write an equation in slope-intercept form for the line that passes through the given point and is perpendicular to the graph of the given equation.

43. \((2, 4), y = 3x + 1\)

**SOLUTION:**

The slope of the line with equation \(y = 3x + 1\) is 3. The slope of the perpendicular line is the opposite reciprocal of 3, or \(-\frac{1}{3}\).

\[
y - y_i = m(x - x_i)
\]

\[
y - 4 = \frac{-1}{3}(x - 2)
\]

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

\[
y = \frac{-1}{3}x + \frac{14}{3}
\]

44. \((1, 3), y = -2x - 4\)

**SOLUTION:**

The slope of the line with equation \(y = -2x - 4\) is -2. The slope of the perpendicular line is the opposite reciprocal of -2, or \(\frac{1}{2}\).

\[
y - y_i = m(x - x_i)
\]

\[
y - 3 = \frac{1}{2}(x - 1)
\]

\[
y - 3 = \frac{-1}{2}x + \frac{1}{2}
\]

\[
y = \frac{1}{2}x + \frac{5}{2}
\]

45. \((-5, 2), y = \frac{1}{3}x + 4\)

**SOLUTION:**

The slope of the line with equation \(y = \frac{1}{3}x + 4\) is \(\frac{1}{3}\). The slope of the perpendicular line is the opposite reciprocal of \(\frac{1}{3}\), or -3.

\[
y - y_i = m(x - x_i)
\]

\[
y - 2 = -3(x - (-5))
\]

\[
y - 2 = -3(x + 5)
\]

\[
y - 2 = -3x - 15
\]

\[
y = -3x - 13
\]

46. \((3, 0), y = \frac{-1}{2}x\)

**SOLUTION:**

The slope of the line with equation \(y = \frac{-1}{2}x\) is \(\frac{-1}{2}\). The slope of the perpendicular line is the opposite reciprocal of \(\frac{-1}{2}\), or 2.

\[
y - y_i = m(x - x_i)
\]

\[
y - 0 = 2(x - 3)
\]

\[
y = 2x - 6
\]
47. Determine whether the graph shows a **positive**, a **negative**, or no correlation. If there is a positive or negative correlation, describe its meaning.

![Graph](image)

**SOLUTION:**
The graph shows a positive correlation. As the number of hours spent studying increases, the test scores increase.

48. **ATTENDANCE** A scatter plot of data compares the number of years since a business has opened and its annual number of sales. It contains the ordered pairs (2, 650) and (5, 1280). Write an equation in slope-intercept form for the line of fit for this situation.

**SOLUTION:**
Find the slope of the line containing the given points.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1280 - 650}{5 - 2} = \frac{630}{3} = 210
\]

Use the slope and either of the two points to find the y-intercept.

\[
y = mx + b
\]

\[
650 = 210(2) + b
\]

\[
650 = 420 + b
\]

\[
230 = b
\]

Write the equation in slope-intercept form for the line of fit.

\[
y = mx + b
\]

\[
y = 210x + 230
\]

49. **SALE** The table shows the number of purchases made at an outerwear store during a sale. Write an equation of the regression line. Then estimate the number of sales on day 10 of the sale.

<table>
<thead>
<tr>
<th>Days Since Sale Began</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Sales ($)</td>
<td>15</td>
<td>21</td>
<td>32</td>
<td>30</td>
<td>40</td>
<td>38</td>
<td>51</td>
</tr>
</tbody>
</table>

**SOLUTION:**
Use a calculator to find the equation of the regression line.

\[
y = 5.36x + 11
\]

To estimate the number of sales on day 10 of the sale, evaluate the regression equation for \(x = 10\).

\[
y = 5.36(10) + 11
\]

\[
y = 53.6 + 11
\]

\[
y = 64.6
\]

\[
y \approx 65
\]

The number of sales on day 10 of the sale should be about 65.
50. MOVIES  The table shows ticket sales at a certain theater during the first week after a movie opened. Write an equation of the regression line. Then estimate the daily ticket sales on the 15th day.

<table>
<thead>
<tr>
<th>Days Since Movie Opened</th>
<th>Daily Ticket Sales ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>85</td>
</tr>
<tr>
<td>2</td>
<td>92</td>
</tr>
<tr>
<td>3</td>
<td>89</td>
</tr>
<tr>
<td>4</td>
<td>78</td>
</tr>
<tr>
<td>5</td>
<td>65</td>
</tr>
<tr>
<td>6</td>
<td>68</td>
</tr>
<tr>
<td>7</td>
<td>55</td>
</tr>
</tbody>
</table>

**SOLUTION:**
Use a calculator to find the equation of the regression line.

\[
y = -5.79x + 99.14
\]

To estimate the daily ticket sales on the 15th day, evaluate the regression equation for \(x = 15\).

\[
y = -5.79(15) + 99.14 \\
y = -86.85 + 99.14 \\
y = 12.29
\]

The daily ticket sales on the 15th day after a movie opens is $12.29.

---

Find the inverse of each relation.
51. \{(7, 3.5), (6.2, 8), (−4, 2.7), (−12, 1.4)\}

**SOLUTION:**
To find the inverse, exchange the coordinates of the ordered pairs.

\[(7, 3.5) → (3.5, 7)\]
\[(6.2, 8) → (8, 6.2)\]
\[(-4, 2.7) → (2.7, -4)\]
\[(-12, 1.4) → (1.4, -12)\]

The inverse is \{(3.5, 7), (8, 6.2), (2.7, -4), (1.4, -12)\}.

52. \{(1, 9), (13, 26), (−3, 4), (−11, −2)\}

**SOLUTION:**
To find the inverse, exchange the coordinates of the ordered pairs.

\[(1, 9) → (9, 1)\]
\[(13, 26) → (26, 13)\]
\[(-3, 4) → (4, -3)\]
\[(-11, -2) → (-2, -11)\]

The inverse is \{(9, 1), (26, 13), (4, -3), (-2, -11)\}. 
Find the inverse of each function

55. \( f(x) = \frac{5}{11}x + 10 \)

**SOLUTION:**

\[
\begin{align*}
 \text{Original equation} \\
 y &= \frac{5}{11}x + 10 \\
 x &= \frac{5}{11}y + 10 \\
 1x &= 5y + 110 \\
 5x - 110 &= 5y \\
 \frac{5}{5}x - 22 &= y \\
 \frac{5}{5}x - 22 &= f^{-1}(x)
\end{align*}
\]

Write the final equation in slope-intercept form. So, \( f^{-1}(x) = \frac{11}{5}x - 22 \).
56. \( f(x) = 3x + 8 \)

**SOLUTION:**

\[
f(x) = 3x + 8 \quad \text{Original equation}
\]

\[
y = 3x + 8 \quad \text{Replace } f(x) \text{ with } y.
\]

\[
x = 3y + 8 \quad \text{Interchange } x \text{ and } y.
\]

\[
x - 8 = 3y \quad \text{Subtract 8 from each side}
\]

\[
\frac{1}{3}x - \frac{8}{3} = y \quad \text{Divide each side by 3.}
\]

\[
\frac{1}{3}x - \frac{8}{3} = f^{-1}(x) \quad \text{Replace } y \text{ with } f^{-1}(x).
\]

Write the final equation in slope-intercept form. So,

\[
f^{-1}(x) = \frac{1}{3}x - \frac{8}{3}.
\]

57. \( f(x) = -4x - 12 \)

**SOLUTION:**

\[
f(x) = -4x - 12 \quad \text{Original equation}
\]

\[
y = -4x - 12 \quad \text{Replace } f(x) \text{ with } y.
\]

\[
x = -4y - 12 \quad \text{Interchange } x \text{ and } y.
\]

\[
x + 12 = -4y \quad \text{Add 12 to each side}
\]

\[
-\frac{1}{4}x - 3 = y \quad \text{Divide each side by } -4
\]

\[
-\frac{1}{4}x - 3 = f^{-1}(x) \quad \text{Replace } y \text{ with } f^{-1}(x).
\]

Write the final equation in slope-intercept form. So,

\[
f^{-1}(x) = -\frac{1}{4}x - \frac{3}{4}.
\]

58. \( f(x) = \frac{1}{4}x - 7 \)

**SOLUTION:**

\[
f(x) = \frac{1}{4}x - 7 \quad \text{Original equation}
\]

\[
y = \frac{1}{4}x - 7 \quad \text{Replace } f(x) \text{ with } y.
\]

\[
x = \frac{1}{4}y - 7 \quad \text{Interchange } x \text{ and } y.
\]

\[
x + 7 = \frac{1}{4}y \quad \text{Add 7 to each side}
\]

\[
4x + 28 = y \quad \text{Multiply each side by 4}
\]

\[
4x + 28 = f^{-1}(x) \quad \text{Replace } y \text{ with } f^{-1}(x).
\]

Write the final equation in slope-intercept form. So, 

\[
f^{-1}(x) = \frac{1}{4}x - 7.
\]

59. \( f(x) = -\frac{2}{3}x + \frac{1}{4} \)

**SOLUTION:**

\[
f(x) = -\frac{2}{3}x + \frac{1}{4} \quad \text{Original equation}
\]

\[
y = -\frac{2}{3}x + \frac{1}{4} \quad \text{Replace } f(x) \text{ with } y.
\]

\[
x = -\frac{2}{3}y + \frac{1}{4} \quad \text{Interchange } x \text{ and } y.
\]

\[
x - \frac{1}{4} = -\frac{2}{3}y \quad \text{Subtract } \frac{1}{4} \text{ from each side}
\]

\[
-\frac{2}{3}x + \frac{1}{3} = y \quad \text{Multiply each side by } -\frac{3}{2}
\]

\[
-\frac{2}{3}x + \frac{1}{3} = f^{-1}(x) \quad \text{Replace } y \text{ with } f^{-1}(x).
\]

Write the final equation in slope-intercept form. So,

\[
f^{-1}(x) = -\frac{3}{2}x + \frac{3}{8}.
\]

60. \( f(x) = -3x + 3 \)

**SOLUTION:**

\[
f(x) = -3x + 3 \quad \text{Original equation}
\]

\[
y = -3x + 3 \quad \text{Replace } f(x) \text{ with } y.
\]

\[
x = -3y + 3 \quad \text{Interchange } x \text{ and } y
\]

\[
x - 3 = -3y \quad \text{Subtract 3 from each side}
\]

\[
-\frac{1}{3}x + 1 = y \quad \text{Divide each side by } -3.
\]

\[
-\frac{1}{3}x + 1 = f^{-1}(x) \quad \text{Replace } y \text{ with } f^{-1}(x).
\]

Write the final equation in slope-intercept form. So,

\[
f^{-1}(x) = -\frac{1}{3}x + 1.
\]