3-1 Graphing Linear Equations

Determine whether each equation is a linear equation. Write yes or no. If yes, write the equation in standard form.

1. $x = y - 5$

**SOLUTION:**
Rewrite the equation in standard form.

$x = y - 5$ \hspace{1cm} \text{Original equation}

$x - y = y - y - 5$ \hspace{1cm} \text{Subtract y from each side.}

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

The equation is now in standard form where $A = 1$, $B = -1$, and $C = -5$. This is a linear equation.

2. $-2x - 3 = y$

**SOLUTION:**
Rewrite the equation in standard form.

$-2x - 3 = y$ \hspace{1cm} \text{Original equation}

$-1(-2x - 3) = -1 \cdot y$ \hspace{1cm} \text{Multiply each side by -1.}

$2x + 3 = -y$ \hspace{1cm} \text{Simplify.}

$2x + 3 - 3 = -y - 3$ \hspace{1cm} \text{Subtract 3 from each side.}

$2x = -y - 3$ \hspace{1cm} \text{Simplify.}

$2x + y = -y + y - 3$ \hspace{1cm} \text{Add y to each side.}

$2x + y = -3$ \hspace{1cm} \text{Simplify.}

The equation is now in standard form where $A = 2$, $B = 1$, and $C = -3$. This is a linear equation.

3. $-4y + 6 = 2$

**SOLUTION:**
Rewrite the equation in standard form.

$-4y + 6 = 2$ \hspace{1cm} \text{Original equation}

$-4y + 6 - 6 = 2 - 6$ \hspace{1cm} \text{Subtract 6 from each side.}

$-4y - 4$ \hspace{1cm} \text{Simplify.}

$\frac{-4y}{-4} = \frac{-4}{-4}$ \hspace{1cm} \text{Divide each side by -4.}

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

The equation is now in standard form where $A = 0$, $B = 1$, and $C = 1$. This is a linear equation.
3-1 Graphing Linear Equations

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

\textit{SOLUTION:}

Rewrite the equation in standard form.

\[
\frac{2}{3}x - \frac{1}{3}y = 2 \quad \text{Original equation}
\]

\[
3\left(\frac{2}{3}x - \frac{1}{3}y\right) = 3 \cdot 2 \quad \text{Multiply each side by 3.}
\]

\[
2x - y = 6 \quad \text{Simplify.}
\]

The equation is now in standard form where \( A = 2, B = -1, \) and \( C = 6. \) This is a linear equation.

Find the \( x \)- and \( y \)-intercepts of the graph of each linear function. Describe what the intercepts mean.

![Graph of linear function](image.png)

5.

\textit{SOLUTION:}

The \( x \)-intercept is the point at which the \( y \)-coordinate is 0, or the line crosses the \( x \)-axis. So, the \( x \)-intercept is 25.

The \( y \)-intercept is the point at which the \( x \)-coordinate is 0, or the line crosses the \( y \)-axis. So, the \( y \)-intercept is \(-4\).

The \( x \)-intercept 25 means that after 25 minutes, the temperature is 0°F. The \( y \)-intercept \(-4\) means that at time 0, the temperature is \(-4°F\).

<table>
<thead>
<tr>
<th>Position of Scuba Diver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (s)</td>
</tr>
<tr>
<td>( x )</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>12</td>
</tr>
</tbody>
</table>

6.

\textit{SOLUTION:}

The \( x \)-intercept is the point at which the \( y \)-coordinate is 0, or the line crosses at the \( x \)-axis. So, the \( x \)-intercept is 12.

The \( y \)-intercept is the point at which the \( x \)-coordinate is 0, or the line crosses at the \( y \)-axis. So, the \( y \)-intercept is \(-24\).

The \( x \)-intercept 12 means that after 12 seconds, the scuba diver is at a depth of 0 meters, or at the surface. The \( y \)-intercept \(-24\) means that at time 0, the scuba diver is at a depth of \(-24\) meters, or 24 meters below sea level.
3-1 Graphing Linear Equations

Graph each equation by using the x- and y-intercepts.
7. \(y = 4 + x\)

**SOLUTION:**
To find the x-intercept, let \(y = 0\).

\[
\begin{align*}
  y &= 4 + x & \text{Original equation} \\
  0 &= 4 + x & \text{Replace } y \text{ with } 0. \\
  0 - 4 &= 4 - 4 + x & \text{Subtract 4 from each side.} \\
  -4 &= x & \text{Simplify.}
\end{align*}
\]

To find the y-intercept, let \(x = 0\).

\[
\begin{align*}
  y &= 4 + x & \text{Original equation} \\
  y &= 4 + 0 & \text{Replace } x \text{ with } 0. \\
  y &= 4 & \text{Simplify.}
\end{align*}
\]

So, the x-intercept is \(-4\), and the y-intercept is 4. Plot these two points and then draw a line through them.
8. $2x - 5y = 1$

**SOLUTION:**
To find the $x$-intercept, let $y = 0$.

\[
\begin{align*}
2x - 5y &= 1 \quad \text{Original equation} \\
2x - 5(0) &= 1 \quad \text{Replace } y \text{ with } 0. \\
2x &= 1 \quad \text{Simplify.} \\
2x &= 1 \quad \text{Simplify.} \\
\frac{2x}{2} &= \frac{1}{2} \quad \text{Divide each side by } 2 \\
x &= \frac{1}{2} \quad \text{Simplify.}
\end{align*}
\]

To find the $y$-intercept, let $x = 0$.

\[
\begin{align*}
2(0) - 5y &= 1 \quad \text{Original equation} \\
0 - 5y &= 1 \quad \text{Replace } x \text{ with } 0. \\
-5y &= 1 \quad \text{Simplify.} \\
-5y &= 1 \quad \text{Simplify.} \\
\frac{-5y}{-5} &= \frac{1}{-5} \quad \text{Divide each side by } -5 \\
y &= -\frac{1}{5} \quad \text{Simplify.}
\end{align*}
\]

So, the $x$-intercept is $\frac{1}{2}$, and the $y$-intercept is $-\frac{1}{5}$. Plot these two points, and then draw a line through them.
3-1 Graphing Linear Equations

Graph each equation by making a table.

9. \( x + 2y = 4 \)

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

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

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

\[ y = \frac{4-x}{2} \quad \text{Divide each side by 2.} \]

\[ y = 2 - \frac{x}{2} \quad \text{Simplify.} \]

Select values from the domain and make a table. Create ordered pairs and graph them.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y = 2 - \frac{x}{2} )</th>
<th>( y )</th>
<th>( (x, y) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-4</td>
<td>( y = 2 - \frac{-4}{2} )</td>
<td>4</td>
<td>(-4, 4)</td>
</tr>
<tr>
<td>-2</td>
<td>( y = 2 - \frac{-2}{2} )</td>
<td>3</td>
<td>(-2, 3)</td>
</tr>
<tr>
<td>0</td>
<td>( y = 2 - \frac{0}{2} )</td>
<td>2</td>
<td>(0, 2)</td>
</tr>
<tr>
<td>2</td>
<td>( y = 2 - \frac{2}{2} )</td>
<td>1</td>
<td>(2, 1)</td>
</tr>
<tr>
<td>4</td>
<td>( y = 2 - \frac{4}{2} )</td>
<td>0</td>
<td>(4, 0)</td>
</tr>
</tbody>
</table>
3-1 Graphing Linear Equations

10. \(-3 + 2y = -5\)

**SOLUTION:**
Select values from the domain and make a table. Create ordered pairs and graph them.

<table>
<thead>
<tr>
<th>(x)</th>
<th>(-3 + 2y = -5)</th>
<th>(y)</th>
<th>((x, y))</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>-3 + 2*(-1) = -5</td>
<td>-1</td>
<td>(-2, -1)</td>
</tr>
<tr>
<td>-1</td>
<td>-3 + 2*(-1) = -5</td>
<td>-1</td>
<td>(-1, -1)</td>
</tr>
<tr>
<td>0</td>
<td>-3 + 2*0 = -5</td>
<td>-1</td>
<td>(0, -1)</td>
</tr>
<tr>
<td>1</td>
<td>-3 + 2*1 = -5</td>
<td>-1</td>
<td>(1, -1)</td>
</tr>
<tr>
<td>2</td>
<td>-3 + 2*2 = -5</td>
<td>-1</td>
<td>(2, -1)</td>
</tr>
</tbody>
</table>

![Graph of \(-3 + 2y = -5\)](image)

11. \(y = 3\)

**SOLUTION:**
Select values from the domain and make a table. Create ordered pairs and graph them.

<table>
<thead>
<tr>
<th>(x)</th>
<th>(y = 3)</th>
<th>(y)</th>
<th>((x, y))</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>(y = 3)</td>
<td>3</td>
<td>(-2, 3)</td>
</tr>
<tr>
<td>-1</td>
<td>(y = 3)</td>
<td>3</td>
<td>(-1, 3)</td>
</tr>
<tr>
<td>0</td>
<td>(y = 3)</td>
<td>3</td>
<td>(0, 3)</td>
</tr>
<tr>
<td>1</td>
<td>(y = 3)</td>
<td>3</td>
<td>(1, 3)</td>
</tr>
<tr>
<td>2</td>
<td>(y = 3)</td>
<td>3</td>
<td>(2, 3)</td>
</tr>
</tbody>
</table>

![Graph of \(y = 3\)](image)

12. **CCSS REASONING** The equation \(5x + 10y = 60\) represents the number of children \(x\) and adults \(y\) who can attend the rodeo for $60.

![Rodeo Admission](image)

**a.** Use the \(x\)- and \(y\)-intercepts to graph the equation.

**b.** Describe what these values mean.
3-1 Graphing Linear Equations

**SOLUTION:**

a. To find the x-intercept, let y = 0.

\[ 5x + 10y = 60 \quad \text{Original equation} \]
\[ 5x + 10(0) = 60 \quad \text{Replace y with 0.} \]
\[ 5x + 0 = 60 \quad \text{Simplify.} \]
\[ 5x = 60 \quad \text{Simplify.} \]
\[ \frac{5x}{5} = \frac{60}{5} \quad \text{Divide each side by 5.} \]
\[ x = 12 \quad \text{Simplify.} \]

To find the y-intercept, let x = 0.

\[ 5x + 10y = 60 \quad \text{Original equation} \]
\[ 5(0) + 10y = 60 \quad \text{Replace x with 0.} \]
\[ 0 + 10y = 60 \quad \text{Simplify.} \]
\[ 10y = 60 \quad \text{Simplify.} \]
\[ \frac{10y}{10} = \frac{60}{10} \quad \text{Divide each side by 10.} \]
\[ y = 6 \quad \text{Simplify.} \]

So the x-intercept is 12 and the y-intercept is 6. Plot these points, and then draw a line through them.

b. The x-intercept means that 12 children and 0 adults can attend for $60. The y-intercept means that 0 children and 6 adults can attend for $60.

**Determine whether each equation is a linear equation. Write yes or no. If yes, write the equation in standard form.**

13. \( 5x + y^2 = 25 \)

**SOLUTION:**

Since y is squared, the equation cannot be written in standard form. So, the equation is not linear.
3-1 Graphing Linear Equations

14. \(8 + y = 4x\)

**SOLUTION:**
Rewrite the equation in standard form.

\[
\begin{align*}
8 + y &= 4x \quad \text{Original equation} \\
8 + y - y &= 4x - y \quad \text{Subtract from each side} \\
8 &= 4x - y \quad \text{Simplify} \\
4x - y &= 8
\end{align*}
\]

The equation is now in standard form where \(A = 4\), \(B = 1\), and \(C = 8\).

15. \(9xy - 6x = 7\)

**SOLUTION:**
Since there are two variables in one term, the equation cannot be written in standard form. So, the equation is not linear.

16. \(4y^2 + 9 = -4\)

**SOLUTION:**
Since \(y\) is squared, the equation cannot be written in standard form. So, the equation is not linear.

17. \(12x = 7y - 10y\)

**SOLUTION:**
Rewrite the equation in standard form.

\[
\begin{align*}
12x &= 7y - 10y \quad \text{Original equation} \\
12x &= -3y \quad \text{Simplify} \\
12x + 3y &= -3y + 3y \quad \text{Add 3y to each side} \\
12x + 3y &= 0 \quad \text{Simplify} \\
3(4x + y) &= 0 \quad \text{Distributive Property} \\
\frac{3(4x + y)}{3} &= \frac{0}{3} \quad \text{Divide each side by 3} \\
4x + y &= 0 \quad \text{Simplify}
\end{align*}
\]

The equation is now in standard form where \(A = 4\), \(B = 1\), and \(C = 0\).
18. \( y = 4x + x \)

**SOLUTION:**
Rewrite the equation in standard form.

\[
\begin{align*}
  y &= 4x + x \quad \text{Original equation} \\
  y &= 5x \quad \text{Simplify.} \\
  y - y &= 5x - y \quad \text{Subtract } y \text{ from each side.} \\
  0 &= 5x - y \quad \text{Simplify.} \\
  5x - y &= 0
\end{align*}
\]

The equation is now in standard form where \( A = 5 \), \( B = -1 \), and \( C = 0 \).

**Find the \( x \)- and \( y \)-intercepts of the graph of each linear function.**

![Graph of \( 4x + 3y = 12 \)]

19. **SOLUTION:**
The \( x \)-intercept is the point at which the \( y \)-coordinate is 0, or the line crosses the \( x \)-axis. So, the \( x \)-intercept is 3. The \( y \)-intercept is the point at which the \( x \)-coordinate is 0, or the line crosses the \( y \)-axis. So, the \( y \)-intercept is 4.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>-1</td>
</tr>
<tr>
<td>-2</td>
<td>0</td>
</tr>
<tr>
<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

20. **SOLUTION:**
The \( x \)-intercept is the point at which the \( y \)-coordinate is 0, or the line crosses the \( x \)-axis. So, the \( x \)-intercept is -2. The \( y \)-intercept is the point at which the \( x \)-coordinate is 0, or the line crosses the \( y \)-axis. So, the \( y \)-intercept is 2.
3-1 Graphing Linear Equations

Find the $x$- and $y$-intercepts of each linear function. Describe what the intercepts mean.

21. SOLUTION:
The $x$-intercept is the point at which the $y$-coordinate is 0, or the line crosses the $x$-axis. So, the $x$-intercept is 6. The $y$-intercept is the point at which the $x$-coordinate is 0, or the line crosses the $y$-axis. So, the $y$-intercept is 20. The $x$-intercept 6 means that the height of the eagle is 0 ft after 6 seconds, or that it takes 6 seconds for the eagle to land. The $y$-intercept 20 means that at time 0, the height of the eagle is 20 ft. In other words, the initial height of the eagle is 20 ft.

22. SOLUTION:
The $x$-intercept is the point at which the $y$-coordinate is 0, or the line crosses the $x$-axis. So, the $x$-intercept is 8. The $y$-intercept is the point at which the $x$-coordinate is 0, or the line crosses the $y$-axis. So, the $y$-intercept is 4. The $x$-intercept 8 means that after 8 minutes, Eva’s distance from home is 0 mi., or she is home after 8 minutes. The $y$-intercept 4 means that at time 0, Eva’s distance from home is 4 miles. In other words, she is initially 4 miles from home.
Graph each equation by using the x– and y–intercepts.

23. \( y = 4 + 2x \)

**SOLUTION:**
To find the x-intercept, let \( y = 0 \).

\[
\begin{align*}
  y &= 4 + 2x \quad \text{Original equation} \\
  0 &= 4 + 2x \quad \text{Replace } y \text{ with } 0. \\
  0 - 4 &= 4 - 4 + 2x \quad \text{Subtract } 4 \text{ from each side.} \\
  -4 &= 2x \quad \text{Simplify.} \\
  -
\]

\[
\frac{-4}{2} &= \frac{2x}{2} \quad \text{Divide each side by } 2. \\
  -2 &= x \quad \text{Simplify.}
\]

To find the y-intercept, let \( x = 0 \).

\[
\begin{align*}
  y &= 4 + 2x \quad \text{Original equation} \\
  y &= 4 + 2(0) \quad \text{Replace } x \text{ with } 0. \\
  y &= 4 + 0 \quad \text{Simplify.} \\
  y &= 4 \quad \text{Simplify.}
\]

So, the x-intercept is \(-2\), and the y-intercept is 4. Plot these two points and then draw a line through them.
24. \(5 - y = -3x\)

**SOLUTION:**
To find the \(x\)-intercept, let \(y = 0\).

\[
5 - y = -3x \quad \text{Original equation}
\]
\[
5 - 0 = -3x \quad \text{Replace } y \text{ with } 0.
\]
\[
5 = -3x \quad \text{Simplify.}
\]
\[
\frac{5}{-3} = \frac{-3x}{-3} \quad \text{Divide each side by } -3.
\]
\[
-\frac{5}{3} = x \quad \text{Simplify.}
\]

To find the \(y\)-intercept, let \(x = 0\).

\[
5 - y = -3x \quad \text{Original equation}
\]
\[
5 - y = -3(0) \quad \text{Replace } x \text{ with } 0.
\]
\[
5 - y = 0 \quad \text{Simplify.}
\]
\[
5 - y + y = 0 + y \quad \text{Add } y \text{ to each side.}
\]
\[
5 = y \quad \text{Simplify.}
\]

So, the \(x\)-intercept is \(-\frac{5}{3}\), and the \(y\)-intercept is 5. Plot these two points and then draw a line through them.
25. $x = 5y + 5$

**SOLUTION:**
To find the $x$-intercept, let $y = 0$.

\[
x = 5y + 5 \quad \text{Original equation}
\]
\[
x = 5(0) + 5 \quad \text{Replace } y \text{ with } 0.
\]
\[
x = 0 + 5 \quad \text{Simplify.}
\]
\[
x = 5 \quad \text{Simplify.}
\]

To find the $y$-intercept, let $x = 0$.

\[
x = 5y + 5 \quad \text{Original equation}
\]
\[
0 = 5y + 5 \quad \text{Replace } x \text{ with } 0.
\]
\[
0 - 5 = 5y + 5 - 5 \quad \text{Subtract 5 from each side.}
\]
\[
-5 = 5y \quad \text{Simplify.}
\]
\[
\frac{-5}{5} = \frac{5y}{5} \quad \text{Divide each side by 5.}
\]
\[
-1 = y \quad \text{Simplify.}
\]

So, the $x$-intercept is 5 and the $y$-intercept is $-1$. Plot these two points and then draw a line through them.
26. \( x + y = 4 \)

**SOLUTION:**
To find the \( x \)-intercept, let \( y = 0 \).

\[
\begin{align*}
  x + y &= 4 \quad \text{Original equation} \\
  x + 0 &= 4 \quad \text{Replace} \ y \text{ with} \ 0. \\
  x &= 4 \quad \text{Simplify.}
\end{align*}
\]

To find the \( y \)-intercept, let \( x = 0 \).

\[
\begin{align*}
  x + y &= 4 \quad \text{Original equation} \\
  0 + y &= 4 \quad \text{Replace} \ x \text{ with} \ 0. \\
  y &= 4 \quad \text{Simplify.}
\end{align*}
\]

So, the \( x \)-intercept is 4 and the \( y \)-intercept is 4. Plot these two points and then draw a line through them.
3-1 Graphing Linear Equations

27. \( x - y = -3 \)

**SOLUTION:**

To find the \( x \)-intercept, let \( y = 0 \).

\[
\begin{align*}
\text{Original equation} & \quad x - y = -3 \\
\text{Replace } y \text{ with } 0. & \quad x - 0 = -3 \\
\text{Simplify.} & \quad x = -3
\end{align*}
\]

To find the \( y \)-intercept, let \( x = 0 \).

\[
\begin{align*}
\text{Original equation} & \quad x - y = -3 \\
\text{Replace } x \text{ with } 0. & \quad 0 - y = -3 \\
\text{Simplify.} & \quad -y = -3 \\
\text{Multiply each side by } -1. & \quad -1(-y) = -1(-3) \\
\text{Simplify.} & \quad y = 3
\end{align*}
\]

So, the \( x \)-intercept is \(-3\) and the \( y \)-intercept is \(3\). Plot these two points and then draw a line through them.
3-1 Graphing Linear Equations

28. \( y = 8 - 6x \)

**SOLUTION:**
To find the \( x \)-intercept, let \( y = 0 \).

\[
\begin{align*}
y &= 8 - 6x & \text{Original equation} \\
0 &= 8 - 6x & \text{Replace } y \text{ with } 0. \\
0 + 6x &= 8 - 6x + 6x & \text{Add } 6x \text{ from each side.} \\
6x &= 8 & \text{Simplify.} \\
\frac{6x}{6} &= \frac{8}{6} & \text{Divide each side by } 6. \\
x &= \frac{4}{3} & \text{Simplify.}
\end{align*}
\]

To find the \( y \)-intercept, let \( x = 0 \).

\[
\begin{align*}
y &= 8 - 6x & \text{Original equation} \\
y &= 8 - 6(0) & \text{Replace } x \text{ with } 0. \\
y &= 8 - 0 & \text{Simplify.} \\
y &= 8 & \text{Simplify.}
\end{align*}
\]

So, the \( x \)-intercept is \( \frac{4}{3} \) and the \( y \)-intercept is 8. Plot these two points and then draw a line through them.
3-1 Graphing Linear Equations

Graph each equation by making a table.

29. \( x = -2 \)

\textbf{SOLUTION:}
Select values from the range and make a table. Create ordered pairs and graph them.

Note that every value in the range is linked to \(-2\) in the domain.

\begin{tabular}{|c|c|}
\hline
x & y \\
\hline
-2 & 0 \\
-2 & 1 \\
-2 & 2 \\
\hline
\end{tabular}

30. \( y = -4 \)

\textbf{SOLUTION:}
Select values from the domain and make a table. Create ordered pairs and graph them.

\begin{tabular}{|c|c|}
\hline
x & y \\
\hline
0 & -4 \\
1 & -4 \\
2 & -4 \\
\hline
\end{tabular}

31. \( y = -8x \)

\textbf{SOLUTION:}
Select values from the domain and make a table. Create ordered pairs and graph them.

\begin{tabular}{|c|c|}
\hline
x & y \\
\hline
-1 & 8 \\
0 & 0 \\
1 & -8 \\
\hline
\end{tabular}
3-1 Graphing Linear Equations

32. $3x = y$

**SOLUTION:**
Select values from the domain and make a table. Create ordered pairs and graph them.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
<th>$y = -(x) + 8$</th>
<th>$y$</th>
<th>$(x, y)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>(0, 0)</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>(1, 5)</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>10</td>
<td>10</td>
<td>(2, 10)</td>
</tr>
</tbody>
</table>

33. $y - 8 = -x$

**SOLUTION:**
Solve for $y$ in $y - 8 = -x$.

\[
\begin{align*}
y - 8 &= -x & \text{Original equation} \\
y - 8 + 8 &= -x + 8 & \text{Add 8 to each side} \\
y &= -x + 8 & \text{Simplify.}
\end{align*}
\]

Select values from the domain and make a table. Create ordered pairs and graph them.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y = -(x) + 8$</th>
<th>$y$</th>
<th>$(x, y)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-4</td>
<td>$(4) + 8$</td>
<td>12</td>
<td>(-4, 12)</td>
</tr>
<tr>
<td>-2</td>
<td>$(2) + 8$</td>
<td>10</td>
<td>(-2, 10)</td>
</tr>
<tr>
<td>0</td>
<td>$(0) + 8$</td>
<td>8</td>
<td>(0, 8)</td>
</tr>
<tr>
<td>1</td>
<td>$(1) + 8$</td>
<td>7</td>
<td>(1, 7)</td>
</tr>
<tr>
<td>2</td>
<td>$(2) + 8$</td>
<td>6</td>
<td>(2, 6)</td>
</tr>
<tr>
<td>4</td>
<td>$(4) + 8$</td>
<td>4</td>
<td>(4, 4)</td>
</tr>
</tbody>
</table>
3-1 Graphing Linear Equations

34. \( x = 10 - y \)

**SOLUTION:**
Solve \( x = 10 - y \) for \( y \).

\[
\begin{align*}
x &= 10 - y & \text{Original equation} \\
x + y &= 10 - y + y & \text{Add } y \text{ from each side.} \\
x - x + y &= -x + 10 & \text{Simplify} \\
x - x + y &= -x + 10 & \text{Subtract } x \text{ from each side} \\
y &= -x + 10 & \text{Simplify.}
\end{align*}
\]

Select values from the domain and make a table. Create ordered pairs and graph them.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y = -x + 10 )</th>
<th>( y )</th>
<th>( (x, y) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>(-4)</td>
<td>( y = -(-4) + 10 )</td>
<td>14</td>
<td>((-4, 14))</td>
</tr>
<tr>
<td>(-2)</td>
<td>( y = -(-2) + 10 )</td>
<td>12</td>
<td>((-2, 12))</td>
</tr>
<tr>
<td>(0)</td>
<td>( y = -(0) + 10 )</td>
<td>10</td>
<td>((0, 10))</td>
</tr>
<tr>
<td>(1)</td>
<td>( y = -(1) + 10 )</td>
<td>9</td>
<td>((1, 9))</td>
</tr>
<tr>
<td>(2)</td>
<td>( y = -(2) + 10 )</td>
<td>8</td>
<td>((2, 8))</td>
</tr>
<tr>
<td>(4)</td>
<td>( y = -(4) + 10 )</td>
<td>6</td>
<td>((4, 6))</td>
</tr>
</tbody>
</table>
3-1 Graphing Linear Equations

35. **TV RATINGS** The number of people who watch a singing competition can be given by \( p = 0.15v \), where \( p \) represents the number of people in millions who saw the show and \( v \) is the number of potential viewers in millions.

   a. Make a table of values for the points \((v, p)\).

   b. Graph the equation.

   c. Use the graph to estimate the number of people who saw the show if there are 14 million potential viewers.

   d. Explain why it would not make sense for \( v \) to be a negative number.

**SOLUTION:**

a. Select values from the domain and make a table.

<table>
<thead>
<tr>
<th>( v )</th>
<th>( p = 0.15v )</th>
<th>( p )</th>
<th>((v, p))</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>(0, 0)</td>
</tr>
<tr>
<td>2</td>
<td>0.3</td>
<td>0.3</td>
<td>(2, 0.3)</td>
</tr>
<tr>
<td>4</td>
<td>0.6</td>
<td>0.6</td>
<td>(4, 0.6)</td>
</tr>
<tr>
<td>6</td>
<td>0.9</td>
<td>0.9</td>
<td>(6, 0.9)</td>
</tr>
<tr>
<td>8</td>
<td>1.2</td>
<td>1.2</td>
<td>(8, 1.2)</td>
</tr>
<tr>
<td>10</td>
<td>1.5</td>
<td>1.5</td>
<td>(10, 1.5)</td>
</tr>
</tbody>
</table>

b. Graph the ordered pairs from the table.

![Graph of People Who Watched Singing Competition](image)

C. The table shows that the value of \( p \) increases by 0.3 as \( v \) increases by 2. So at \( v = 14 \), \( p \) would be about 2.1 million.

D. \( v < 0 \) does not make sense because there cannot be fewer than 0 viewers.

**Determine whether each equation is a linear equation. Write yes or no. If yes, write the equation in standard form.**

36. \( \frac{x}{y} + \frac{1}{y} = 7 \)

**SOLUTION:**

Because \( y \) is in the denominator of a fraction, the equation cannot be written in standard form. Multiplying each side by \( y \) in order to get \( y \) out of the denominator will lead to an \( xy \)-term. So, the equation is not linear.
3-1 Graphing Linear Equations

37. \( \frac{x}{2} = 10 + \frac{2y}{3} \)

**SOLUTION:**
Rewrite the equation in standard form.

\[
\frac{x}{2} = 10 + \frac{2y}{3} \quad \text{Original equation}
\]

\[
2 \left( \frac{x}{2} \right) = 2 \cdot 10 + 2 \left( \frac{2y}{3} \right) \quad \text{Multiply each term by 2.}
\]

\[
x = 20 + \frac{4y}{3} \quad \text{Simplify.}
\]

\[
3 \cdot x = 3 \cdot 20 + 3 \left( \frac{4y}{3} \right) \quad \text{Multiply each term by 3.}
\]

\[
3x = 60 + 4y \quad \text{Simplify.}
\]

\[
3x - 4y = 60 + 4y - 4y \quad \text{Subtract 4y from each side.}
\]

\[
3x - 4y = 60 \quad \text{Simplify.}
\]

The equation is now in standard form where \( A = 3, B = -4, \) and \( C = 60. \) The equation is linear.

38. \( 7n - 8m = 4 - 2m \)

**SOLUTION:**
Rewrite the equation in standard form.

\[
7n - 8m = 4 - 2m \quad \text{Original equation}
\]

\[
7n - 8m + 2m = 4 - 2m + 2m \quad \text{Add 2m to each side.}
\]

\[
7n - 6m = 4 \quad \text{Rearrange terms.}
\]

\[
-6m + 7n = 4 \quad \text{Simplify.}
\]

\[
-1(-6m+7n) = -1\cdot 4 \quad \text{Multiply each side by -1.}
\]

\[
6m - 7n = -4 \quad \text{Simplify.}
\]

The equation is now in standard form where \( A = 6, B = -7, \) and \( C = -4. \) The equation is linear.

39. \( 3a + b - 2 = b \)

**SOLUTION:**
Rewrite the equation in standard form.

\[
3a + b - 2 = b \quad \text{Original equation}
\]

\[
3a + b - b - 2 = b - b \quad \text{Subtract b from each side.}
\]

\[
3a - 2 = 0 \quad \text{Simplify.}
\]

\[
3a - 2 + 2 = 0 + 2 \quad \text{Add 2 to each side.}
\]

\[
3a = 2 \quad \text{Simplify.}
\]

The equation is now in standard form where \( A = 3, B = 0, \) and \( C = 2. \) The equation is linear.
3-1 Graphing Linear Equations

40. \(2r - 3rt + 5t = 1\)

**SOLUTION:**
Since there are two variables in one term, the equation cannot be written in standard form. So, the equation is not linear.

41. \(\frac{3n}{4} = \frac{2n}{3} - 5\)

**SOLUTION:**
Rewrite the equation in standard form.

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

Original equation

\[
4 \left( \frac{3n}{4} \right) = 4 \left( \frac{2n}{3} - 5 \right)
\]

Multiply each side by 4.

\[
3n = \frac{8n}{3} - 20
\]

Simplify.

\[
3 \cdot 3n = 3 \left( \frac{8n}{3} - 20 \right)
\]

Multiply each side by 3.

\[
9m = 8n - 60
\]

Simplify.

\[
9m - 8n = 8n - 8n - 60
\]

Subtract \(8n\) from each side.

\[
9m - 8n = -60
\]

Simplify.

The equation is now in standard form where \(A = 9\), \(B = -8\), and \(C = -60\). The equation is linear.
3-1 Graphing Linear Equations

42. **FINANCIAL LITERACY** James earns a monthly salary of $1200 and a commission of $125 for each car he sells.
   a. Graph an equation that represents how much James earns in a month in which he sells \( x \) cars.
   b. Use the graph to estimate the number of cars James needs to sell in order to earn $5000.

**SOLUTION:**

a. Let the equation \( y = 125x + 1200 \) represent James’s monthly salary, where \( y \) = the total monthly salary and \( x \) = the number of cars he sells.
   Choose at least two values of \( x \). Solve for \( y \) and plot the points. [Ex. (0, 1200), (1, 1325), (10, 2450)] Draw a line through the points to graph.

![Graph of James' Commission](image)

b. Let \( y = 5000 \). Solve for \( x \).

\[
\begin{align*}
  y &= 125x + 1200 & \text{Original equation} \\
  5000 &= 125x + 1200 & y = 5000 \\
  5000 - 1200 &= 125x + 1200 - 1200 & \text{Subtract.} \\
  3800 &= 125x & \text{Simplify.} \\
  \frac{3800}{125} &= \frac{125x}{125} & \text{Divide.} \\
  30.4 &= x & \text{Simplify} \\
  30.4 &= x
\end{align*}
\]

He needs to sell about 30 cars to earn $5000.
3-1 Graphing Linear Equations

Graph each equation.
43. \(2.5x - 4 = y\)

\[\text{SOLUTION:}\]
To graph the equation, find the \(x\)- and \(y\)-intercepts. Plot these two points. Then draw a line through them.
To find the \(x\)-intercept, let \(y = 0\).
\[
\begin{align*}
2.5x - 4 &= y & \text{Original equation} \\
2.5x - 4 &= 0 & \text{Replace } y \text{ with } 0. \\
2.5x - 4 + 4 &= 0 + 4 & \text{Add } 4 \text{ to each side.} \\
2.5x &= 4 & \text{Simplify.} \\
\frac{2.5x}{2.5} &= \frac{4}{2.5} & \text{Divide each side by } 2.5. \\
x &= 1.6 & \text{Simplify.}
\end{align*}
\]
To find the \(y\)-intercept, let \(x = 0\).
\[
\begin{align*}
y &= 2.5x - 4 & \text{Original equation} \\
y &= 2.5(0) - 4 & \text{Replace } x \text{ with } 0. \\
y &= 0 - 4 & \text{Simplify.} \\
y &= -4 & \text{Simplify.}
\end{align*}
\]
So, the \(x\)-intercept is 1.6 and the \(y\)-intercept is \(-4\).
3-1 Graphing Linear Equations

44. $1.25x + 7.5 = y$

**SOLUTION:**
To graph the equation, find the $x$- and $y$-intercepts. Plot these two points. Then draw a line through them.
To find the $x$-intercept, let $y = 0$.

\[
egin{align*}
1.25x + 7.5 &= y & \text{Original equation} \\
1.25x + 7.5 &= 0 & \text{Replace } y \text{ with } 0. \\
1.25x + 7.5 - 7.5 &= 0 - 7.5 & \text{Subtract 7.5 from each side.} \\
1.25x &= -7.5 & \text{Simplify.} \\
\frac{1.25x}{1.25} &= \frac{-7.5}{1.25} & \text{Divide each side by 1.25.} \\
x &= -6 & \text{Simplify.}
\end{align*}
\]

To find the $y$-intercept, let $x = 0$.

\[
egin{align*}
1.25x + 7.5 &= y & \text{Original equation} \\
1.25(0) + 7.5 &= y & \text{Replace } x \text{ with } 0. \\
0 + 7.5 &= y & \text{Simplify.} \\
7.5 &= y & \text{Simplify.}
\end{align*}
\]

So, the $x$-intercept is $-6$ and the $y$-intercept is $7.5$. 

![Graph of the line](image-url)
3-1 Graphing Linear Equations

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

**SOLUTION:**
To graph the equation, find the x- and y-intercepts. Plot these two points. Then draw a line through them.
To find the x-intercept, let \( y = 0 \).

\[
\begin{align*}
y + \frac{1}{2}x &= 3 & \text{Original equation} \\
0 + \frac{1}{2}x &= 3 & \text{Replace } y \text{ with 0.} \\
\frac{1}{2}x &= 3 & \text{Simplify.} \\
5 \left( \frac{1}{2}x \right) &= 5 \cdot 3 & \text{Multiply each side by 5.} \\
x &= 15 & \text{Simplify.}
\end{align*}
\]
To find the y-intercept, let \( x = 0 \).

\[
\begin{align*}
y + \frac{1}{2}x &= 3 & \text{Original equation} \\
y + \frac{1}{2}(0) &= 3 & \text{Replace } x \text{ with 0.} \\
y &= 3 & \text{Simplify.}
\end{align*}
\]

So, the x-intercept is 15 and the y-intercept is 3.
3-1 Graphing Linear Equations

46. $\frac{2}{3}x + y = -7$

**SOLUTION:**
To graph the equation, find the $x$- and $y$-intercepts. Plot these two points. Then draw a line through them.
To find the $x$-intercept, let $y = 0$.

\[
\frac{2}{3} x + y = -7 \quad \text{Original equation}
\]
\[
\frac{2}{3} x + 0 = -7 \quad \text{Replace } y \text{ with } 0.
\]
\[
\frac{2}{3} x = -7 \quad \text{Simplify.}
\]
\[
\frac{3}{2} \left( \frac{2}{3} x \right) = \frac{3}{2} (-7) \quad \text{Multiply each side by } \frac{3}{2}.
\]
\[
x = -\frac{21}{2} \quad \text{Simplify.}
\]
\[
x = -10\frac{1}{2}
\]

To find the $y$-intercept, let $x = 0$.

\[
\frac{2}{3} x + y = -7 \quad \text{Original equation}
\]
\[
\frac{2}{3} (0) + y = -7 \quad \text{Replace } x \text{ with } 0.
\]
\[
0 + y = -7 \quad \text{Simplify.}
\]
\[
y = -7 \quad \text{Simplify.}
\]

So, the $x$-intercept is $-10\frac{1}{2}$ and the $y$-intercept is $-7$. 

![Graph of $\frac{2}{3}x + y = -7$](image)
3-1 Graphing Linear Equations

47. $2x - 3 = 4y + 6$

**SOLUTION:**
To graph the equation, find the $x$- and $y$-intercepts. Plot these two points. Then draw a line through them.
To find the $x$-intercept, let $y = 0$.

\[
\begin{align*}
2x - 3 &= 4y + 6 & \text{Original equation} \\
2x - 3 &= 4(0) + 6 & \text{Replace } y \text{ with } 0. \\
2x - 3 &= 0 + 6 & \text{Simplify}. \\
2x - 3 + 3 &= 0 + 6 & \text{Add 3 to each side}. \\
2x &= 9 & \text{Simplify}. \\
\frac{2x}{2} &= \frac{9}{2} & \text{Divide each side by 2}. \\
x &= \frac{9}{2} & \text{Simplify}. \\
x &= 4 \frac{1}{2}
\end{align*}
\]
To find the $y$-intercept, let $x = 0$.

\[
\begin{align*}
2x - 3 &= 4y + 6 & \text{Original equation} \\
2(0) - 3 &= 4y + 6 & \text{Replace } x \text{ with } 0. \\
0 - 3 &= 4y + 6 & \text{Simplify}. \\
-3 - 6 &= 4y + 6 - 6 & \text{Subtract 6 from each side}. \\
-9 &= 4y & \text{Simplify}. \\
\frac{-9}{4} &= \frac{4y}{4} & \text{Divide each side by 4}. \\
-2 \frac{1}{4} &= y & \text{Simplify}. \\
\end{align*}
\]
So, the $x$-intercept is $4 \frac{1}{2}$ and the $y$-intercept is $-2 \frac{1}{4}$. 
3-1 Graphing Linear Equations

48. $3y - 7 = 4x + 1$

**SOLUTION:**
To graph the equation, find the $x$- and $y$-intercepts. Plot these two points. Then draw a line through them.
To find the $x$-intercept, let $y = 0$.

\[
\begin{align*}
3y - 7 &= 4x + 1 & \text{Original equation} \\
3(0) - 7 &= 4x + 1 & \text{Replace} x \text{ with 0.} \\
0 - 7 &= 4x + 1 & \text{Simplify.} \\
-7 - 1 &= 4x + 1 - 1 & \text{Subtract 1 from each side.} \\
-8 &= 4x & \text{Simplify.} \\
\frac{-8}{4} &= \frac{4x}{4} & \text{Divide each side by 4.} \\
-2 &= x & \text{Simplify.}
\end{align*}
\]
To find the $y$-intercept, let $x = 0$.

\[
\begin{align*}
3y - 7 &= 4x + 1 & \text{Original equation} \\
3y - 7 &= 4(0) + 1 & \text{Replace } x \text{ with 0.} \\
3y - 7 &= 0 + 1 & \text{Simplify.} \\
3y - 7 + 7 &= 1 + 7 & \text{Add 7 to each side.} \\
3y &= 8 & \text{Simplify.} \\
\frac{3y}{3} &= \frac{8}{3} & \text{Divide each side by 3.} \\
y &= \frac{8}{3} & \text{Simplify.} \\
y &= 2 \frac{2}{3}
\end{align*}
\]
So the $x$-intercept is $-2$ and the $y$-intercept is $2 \frac{2}{3}$.
3-1 Graphing Linear Equations

49. **CCSS REASONING** Mrs. Johnson is renting a car for vacation and plans to drive a total of 800 miles. A rental car company charges $153 for the week including 700 miles and $0.23 for each additional mile. If Mrs. Johnson has only $160 to spend on the rental car, can she afford to rent a car? Explain your reasoning.

**SOLUTION:**
To find the total cost of renting the car, find the sum of the weekly rental fee and the cost per mile times the number of miles she will drive over 700 because 700 miles are included in the weekly rental fee.
Graph the function \( y = 0.23x + 153 \), where \( x \) is the number of miles over 700. When \( x = 100 \), the cost $176.

![Graph of the equation](image)

Because Mrs. Johnson only has $160 to spend, she cannot afford to rent the car.

50. **AMUSEMENT PARKS** An amusement park charges $50 for admission before 6 p.m. and $20 for admission after 6 p.m. On Saturday, the park took in a total of $20,000.

a. Write an equation that represents the number of admissions that may have been sold. Let \( x \) represent the admissions sold before 6 p.m., and let \( y \) represent the admissions sold after 6 p.m.

b. Graph the equation.

c. Find the \( x- \) and \( y- \)intercepts of the graph. What does each intercept represent?

**SOLUTION:**
a. To find the equation that represents the total amount the park took in on Saturday, find the sum of the amount taken in by admissions sold before 6 p.m. and the amount taken in by admissions sold after 6 p.m. The equation is \( 20,000 = 50x + 20y \).

b. Solve for \( y \).

\[
20000 = 50x + 20y \\
20000 - 50x = 50x - 50x + 20y \\
20000 - 50x = 20y \\
\frac{20000 - 50x}{20} = \frac{20y}{20} \\
y = -\frac{5}{2}x + 1000
\]

To graph the function, make a table.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y = -\frac{5}{2}x + 1000 )</th>
<th>( y )</th>
<th>( (x, y) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>( y = -\frac{5}{2}(0) + 1000 )</td>
<td>1000</td>
<td>(0, 100)</td>
</tr>
</tbody>
</table>
3-1 Graphing Linear Equations

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>( y = -\frac{5}{2} \times 50 + 1000 )</td>
<td>875</td>
</tr>
<tr>
<td>100</td>
<td>( y = -\frac{5}{2} \times 100 + 1000 )</td>
<td>750</td>
</tr>
<tr>
<td>200</td>
<td>( y = -\frac{5}{2} \times 200 + 1000 )</td>
<td>500</td>
</tr>
<tr>
<td>300</td>
<td>( y = -\frac{5}{2} \times 300 + 1000 )</td>
<td>250</td>
</tr>
<tr>
<td>400</td>
<td>( y = -\frac{5}{2} \times 400 + 1000 )</td>
<td>0</td>
</tr>
</tbody>
</table>

Amusement Park Admissions

**c.** To find the \( x \)-intercept, let \( y = 0 \).

\[
20,000 = 50x + 20y \quad \text{Original equation}
\]

\[
20,000 = 50x + 20(0) \quad \text{Replace} \ y \ \text{with} \ 0.
\]

\[
20,000 = 50x + 0 \quad \text{Simplify.}
\]

\[
\frac{20,000}{50} = \frac{50x}{50} \quad \text{Divide each side by} \ 50.
\]

\[
400 = x \quad \text{Simplify.}
\]

To find the \( y \)-intercept, let \( x = 0 \).

\[
20,000 = 50x + 20y \quad \text{Original equation}
\]

\[
20,000 = 50(0) + 20y \quad \text{Replace} \ x \ \text{with} \ 0.
\]

\[
20,000 = 0 + 20y \quad \text{Simplify.}
\]

\[
\frac{20,000}{20} = \frac{20y}{20} \quad \text{Divide each side by} \ 20.
\]

\[
1000 = y \quad \text{Simplify.}
\]

So, the \( x \)-intercept of 400 means that if 0 admissions were sold after 6 p.m., 400 admissions must have been sold before 6 p.m. to equal the daily amount taken in. The \( y \)-intercept of 1000 means that if 0 admissions were sold before 6 p.m., 1000 admissions must have been sold after 6 p.m. to equal the daily amount taken in.
Find the \( x \)-intercept and \( y \)-intercept of the graph of each equation.

51. \( 5x + 3y = 15 \)

**SOLUTION:**
To find the \( x \)-intercept, let \( y = 0 \).

\[
\begin{align*}
5x + 3y &= 15 \quad \text{Original equation} \\
5x + 3(0) &= 15 \quad \text{Replace } y \text{ with } 0. \\
5x &= 15 \quad \text{Simplify} \\
x &= 3 \quad \text{Divide each side by } 5.
\end{align*}
\]

To find the \( y \)-intercept, let \( x = 0 \).

\[
\begin{align*}
5x + 3y &= 15 \quad \text{Simplify} \\
5(0) + 3y &= 15 \quad \text{Replace } x \text{ with } 0. \\
3y &= 15 \quad \text{Simplify} \\
y &= 5 \quad \text{Divide each side by } 3.
\end{align*}
\]

So, the \( x \)-intercept is 3 and the \( y \)-intercept is 5.
3-1 Graphing Linear Equations

52. \(2x - 7y = 14\)

**SOLUTION:**
To find the \(x\)-intercept, let \(y = 0\).

\[
2x - 7y = 14 \quad \text{Original equation}
\]
\[
2x - 7(0) = 14 \quad \text{Replace } y \text{ with } 0.
\]
\[
2x = 14 \quad \text{Simplify.}
\]
\[
\frac{2x}{2} = \frac{14}{2} \quad \text{Divide each side by } 2.
\]
\[
x = 7 \quad \text{Simplify.}
\]

To find the \(y\)-intercept, let \(x = 0\).

\[
2x - 7y = 14 \quad \text{Original equation}
\]
\[
2(0) - 7y = 14 \quad \text{Replace } x \text{ with } 0.
\]
\[
0 - 7y = 14 \quad \text{Simplify.}
\]
\[
-7y = 14 \quad \text{Simplify.}
\]
\[
\frac{-7y}{-7} = \frac{14}{-7} \quad \text{Divide each side by } -7.
\]
\[
y = -2 \quad \text{Simplify.}
\]

So, the \(x\)-intercept is 7 and the \(y\)-intercept is -2.
3-1 Graphing Linear Equations

53. \(2x - 3y = 5\)

**SOLUTION:**
To find the \(x\)-intercept, let \(y = 0\).

\[
\begin{align*}
2x - 3y &= 5 \quad \text{Original equation} \\
2x - 3(0) &= 5 \quad \text{Replace } y \text{ with } 0. \\
2x - 0 &= 5 \quad \text{Simplify} \\
2x &= 5 \quad \text{Simplify} \\
\frac{2x}{2} &= \frac{5}{2} \quad \text{Divide each side by } 2. \\
x &= \frac{5}{2} \quad \text{Simplify} \\
x &= 2\frac{1}{2} \quad \text{Simplify.}
\end{align*}
\]

To find the \(y\)-intercept, let \(x = 0\).

\[
\begin{align*}
2x - 3y &= 5 \quad \text{Original equation} \\
2(0) - 3y &= 5 \quad \text{Replace } x \text{ with } 0. \\
0 - 3y &= 5 \quad \text{Simplify} \\
-3y &= 5 \quad \text{Simplify} \\
\frac{-3y}{-3} &= \frac{5}{-3} \quad \text{Divide each side by } -3. \\
y &= -\frac{5}{3} \quad \text{Simplify} \\
y &= -1\frac{2}{3}
\end{align*}
\]

So, the \(x\)-intercept is \(2\frac{1}{2}\), and the \(y\)-intercept is \(-1\frac{2}{3}\).
54. $6x + 2y = 8$

**SOLUTION:**
To find the $x$-intercept, let $y = 0$.

\[
\begin{align*}
6x + 2y &= 8 & \text{Original equation} \\
6x + 2(0) &= 8 & \text{Replace } y \text{ with } 0. \\
6x &= 8 & \text{Simplify} \\
x &= \frac{8}{6} & \text{Simplify} \\
x &= \frac{4}{3} & \text{Simplify} \\
x &= 1\frac{1}{3}
\end{align*}
\]

To find the $y$-intercept, let $x = 0$.

\[
\begin{align*}
6x + 2y &= 8 & \text{Original equation} \\
6(0) + 2y &= 8 & \text{Replace } x \text{ with } 0. \\
2y &= 8 & \text{Simplify} \\
\frac{2y}{2} &= \frac{8}{2} & \text{Divide each side by 2} \\
y &= 4 & \text{Simplify}.
\end{align*}
\]

So, the $x$-intercept is $1\frac{1}{3}$ and the $y$-intercept is 4.
3-1 Graphing Linear Equations

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

**SOLUTION:**
To find the \( x \)-intercept, let \( y = 0 \).

\[
\begin{align*}
y &= \frac{1}{4}x - 3 & \text{Original equation} \\
0 &= \frac{1}{4}x - 3 & \text{Replace } y \text{ with 0.} \\
0 + 3 &= \frac{1}{4}x - 3 + 3 & \text{Add 3 to each side.} \\
3 &= \frac{1}{4}x & \text{Simplify.} \\
3 \cdot 4 &= 4 \cdot \frac{1}{4}x & \text{Multiply each side by 4.} \\
12 &= x & \text{Simplify.}
\end{align*}
\]

To find the \( y \)-intercept, let \( x = 0 \).

\[
\begin{align*}
y &= \frac{1}{4}(0) - 3 & \text{Original equation} \\
y &= 0 - 3 & \text{Replace } x \text{ with 0.} \\
y &= -3 & \text{Simplify.}
\end{align*}
\]

So, the \( x \)-intercept is 12 and the \( y \)-intercept is \(-3\).
3-1 Graphing Linear Equations

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

**SOLUTION:**
To find the \( x \)-intercept, let \( y = 0 \).

\[
\begin{align*}
  y &= \frac{2}{3}x + 1 \quad \text{Original equation} \\
  0 &= \frac{2}{3}x + 1 \quad \text{Replace } y \text{ with } 0. \\
  0 - 1 &= \frac{2}{3}x + 1 - 1 \quad \text{Subtract 1 from each side} \\
  -1 &= \frac{2}{3}x \quad \text{Simplify}.
\end{align*}
\]

\[
3(-1) = 3 \left( \frac{2}{3}x \right) \quad \text{Multiply each side by 3.}
\]

\[
-3 = 2x \quad \text{Simplify.}
\]

\[
-\frac{3}{2} = \frac{2}{2} \quad \text{Divide each side by 2.}
\]

\[
-\frac{3}{2} = x \quad \text{Simplify.}
\]

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

To find the \( y \)-intercept, let \( x = 0 \).

\[
\begin{align*}
  y &= \frac{2}{3}x + 1 \quad \text{Original equation} \\
  y &= \frac{2}{3}(0) + 1 \quad \text{Replace } x \text{ with } 0. \\
  y &= 0 + 1 \quad \text{Simplify}. \\
  y &= 1 \quad \text{Simplify}.
\end{align*}
\]

So, the \( x \)-intercept is \(-1\frac{1}{2}\) and the \( y \)-intercept is 1.

57. **ONLINE GAMES** The percent of teens who play online games can be modeled by \( p = \frac{15}{4}t + 66 \). \( p \) is the percent of students and \( t \) represents time in years since 2000.

**a.** Graph the equation.

**b.** Use the graph to estimate the percent of students playing the games in 2008.

**SOLUTION:**

**a.** Select values from the domain and make a table. Create ordered pairs and graph them.

<table>
<thead>
<tr>
<th>( t )</th>
<th>( p = \frac{15}{4}t + 66 )</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>( p = \frac{15}{4}(0) + 66 )</td>
<td>66</td>
</tr>
<tr>
<td>1</td>
<td>( p = \frac{15}{4}(1) + 66 )</td>
<td>69.75</td>
</tr>
</tbody>
</table>
b. Because \( t \) represents the time in years since 2000, \( t = 8 \) should be used for 2008. Use the graph to estimate the percent of student at \( t = 8 \).

The percent of students is about 95% 
You can solve the equation for \( t = 8 \) to verify.

\[
p = \frac{15}{4} t + 66 \quad \text{Original equation}
\]

\[
p = \frac{15}{4} (8) + 66 \quad \text{Replace with 8.}
\]

\[
p = 30 + 66 \quad \text{Simplify.}
\]

\[
p = 96 \quad \text{Simplify.}
\]
3-1 Graphing Linear Equations

So, the percent of students playing the games in 2008 is 96%.

58. MULTIPLE REPRESENTATIONS In this problem, you will explore $x$– and $y$–intercepts of graphs of linear equations.
   a. GRAPHICAL If possible, use a straightedge to draw a line on a coordinate plane with each of the following characteristics.
      1.) $x$- and $y$- intercepts
      2.) $x$- intercept, no $y$- intercepts
      3.) exactly 2 $x$- intercepts
      4.) no $x$- intercept, $y$- intercepts
      5.) exactly 2 $y$- intercepts
   
   b. ANALYTICAL For which characteristics were you able to create a line and for which characteristics were you unable to create a line? Explain.
   c. VERBAL What must be true of the $x$– and $y$–intercepts of a line?

   SOLUTION:
   a.

   1.) $x$- and $y$- intercepts

   2.) $x$- intercept, no $y$- intercepts

   3.) exactly 2 $x$- intercepts
   A straight line can not be drawn that intersects the $x$-axis exactly two times.

   4.) no $x$- intercept, $y$- intercepts
3-1 Graphing Linear Equations

5.) exactly 2 y-intercepts
A straight line can not be drawn that intersects the y-axis exactly two times.

b. I was able to draw a line with an x-intercept, an x-intercept and no y-intercept, and no x-intercept and a y-intercept. I was unable to draw a line with 2 x-intercepts or 2 y-intercepts. A line that has either 2 x-intercepts or 2 y-intercepts would not be a line.

c. Lines that are neither vertical nor horizontal cannot have more than one x- and/or y-intercept.

59. CCSS REGULARITY Copy and complete each table. State whether any of the tables show a linear relationship. Explain.

### Perimeter of a Square
<table>
<thead>
<tr>
<th>Side Length</th>
<th>Perimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

### Area of a Square
<table>
<thead>
<tr>
<th>Side Length</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

### Volume of a Cube
<table>
<thead>
<tr>
<th>Side Length</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

**SOLUTION:**
3-1 Graphing Linear Equations

Table 1:

The formula for the perimeter of a square is \( P = 4s \).

<table>
<thead>
<tr>
<th>Side Length</th>
<th>( P = 4s )</th>
<th>Perimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( P = 4(1) )</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>( P = 4(2) )</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>( P = 4(3) )</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>( P = 4(4) )</td>
<td>16</td>
</tr>
</tbody>
</table>

The table does show a linear relationship, since \( P = 4s \) is linear.

Table 2:

The formula for the area of a square is \( A = s^2 \).

<table>
<thead>
<tr>
<th>Side Length</th>
<th>( A = s^2 )</th>
<th>Perimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( A = (1)^2 )</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>( A = (2)^2 )</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>( A = (3)^2 )</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>( A = (4)^2 )</td>
<td>16</td>
</tr>
</tbody>
</table>

The table does not show a linear relationship since \( A = s^2 \) is not linear.

Table 3:

The formula for the volume of a square is \( V = s^3 \).

<table>
<thead>
<tr>
<th>Side Length</th>
<th>( V = s^3 )</th>
<th>Perimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( V = (1)^3 )</td>
<td>1</td>
</tr>
</tbody>
</table>
3-1 Graphing Linear Equations

<table>
<thead>
<tr>
<th>2</th>
<th>$V = (2)^3$</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>$V = (3)^3$</td>
<td>27</td>
</tr>
<tr>
<td>4</td>
<td>$V = (4)^3$</td>
<td>64</td>
</tr>
</tbody>
</table>

The table does not show a linear relationship since $V = s^3$ is not linear.

60. **REASONING** Compare and contrast the graphs of $y = 2x + 1$ with the domain \{1, 2, 3, 4\} and $y = 2x + 1$ with the domain of all real numbers.

**SOLUTION:**
The first graph, $y = 2x + 1$ with the domain \{1, 2, 3, 4\}, is a set of points that are not connected.

![Graph 1](image1.png)

The second graph, $y = 2x + 1$ with the domain of all real numbers, is of a line.

![Graph 2](image2.png)

The points of the first graph are points on the line in the second graph.
3-1 Graphing Linear Equations

OPEN ENDED Give an example of a linear equation of the form \(Ax + By = C\) for each condition. Then describe the graph of the equation.

61. \(A = 0\)

**SOLUTION:**
The equation \(y = 8\) is in standard form, with \(A = 0\). No matter what value of \(x\) is chosen, \(y\) will always be 8. So, the graph will be a horizontal line.

62. \(B = 0\)

**SOLUTION:**
The equation \(x = 5\) is in standard form, with \(B = 0\). No matter what value of \(y\) is chosen, \(x\) will always be 5. So, the graph will be a vertical line.

63. \(C = 0\)

**SOLUTION:**
The equation \(x - y = 0\) is in standard form, with \(A = 1\), \(B = -1\), and \(C = 0\). The \(x\)- and \(y\)-intercepts will both be 0, so the graph will pass through the point \((0, 0)\).

64. **WRITING IN MATH** Explain how to find the \(x\)-intercept and \(y\)-intercept of a graph and summarize how to graph a linear equation.

**SOLUTION:**
To find an \(x\)-intercept, let \(y = 0\) and solve the equation for \(x\).

For example, consider the example \(y = 2x + 6\).

\[
\begin{align*}
y &= 2x + 6 & \text{Original equation} \\
0 &= 2x + 6 & \text{Replace} \ x \ \text{with} \ 8. \\
0 - 6 &= 2x + 6 - 6 & \text{Subtract} \ 6 \ \text{from each side} \\
-6 &= 2x & \text{Simplify}.
\end{align*}
\]

\[
\begin{align*}
-\frac{6}{2} &= \frac{2x}{2} & \text{Divide each side by} \ 2. \\
-3 &= x & \text{Simplify}.
\end{align*}
\]

Verify the \(x\)-intercept on the graph.
3-1 Graphing Linear Equations

To find a y-intercept, let $x = 0$ and solve the equation for $y$.

For example, consider the equation $y = 2x + 6$

$y = 2x + 6$ \hspace{.5cm} \text{Original equation}

$y = 2(0) + 6$ \hspace{.5cm} \text{Replace } y \text{ with } 0.

$y = 6$ \hspace{.5cm} \text{Simplify.}

Verify the y-intercept on the graph.

![Graph of y = 2x + 6](image)

To graph a linear equation, plot the x-intercept and y-intercept and connect the points to form a line. Another way to graph an equation is to choose any value in the domain and create ordered pairs. Plot the ordered pairs and connect the points to form a line.
65. Sancho can ride 8 miles on his bicycle in 30 minutes. At this rate, about how long would it take him to ride 30 miles?
   A 8 hours
   B 6 hours 32 minutes
   C 2 hours
   D 1 hour 53 minutes

**SOLUTION:**
Understand: Let \( x \) represent the amount of time it would take Sancho to ride 30 miles.
Plan: Write a proportion for the problem.

\[
\frac{8 \text{ miles}}{30 \text{ miles}} = \frac{30 \text{ minutes}}{x}
\]

Solve:

\[
\frac{8}{30} = \frac{30}{x} \quad \text{Original equation}
\]

\[
8x = 30(30) \quad \text{Find the cross products}
\]

\[
8x = 900 \quad \text{Simplify}
\]

\[
\frac{8x}{8} = \frac{900}{8} \quad \text{Divide each side by 8}
\]

\[
x = 112.5 \quad \text{Simplify}
\]

Divide 112.5 by 60 to convert to hours.

So, at the rate of 8 miles in 30 minutes, Sancho can ride 30 miles in about 1 hour and 53 minutes. The correct choice is D.
66. **GEOMETRY** Which is a true statement about the relation graphed?

F The relation is not a function.
G Surface area is the independent quantity.
H The surface area of a cube is a function of the side length.
J As the side length of a cube increases, the surface area decreases.

**SOLUTION:**

F The relation is not a function.
False: The graph is a function because it passes the vertical line test.

G Surface area is the independent quantity.
False: The surface area is the dependent quantity since it is dependent on the side length

J As the side length of a cube increases, the surface area decreases.
False: As the side length of a cube increases, then the surface area increases.

H The surface area of a cube is a function of the side length.
Looking at the graph, as the side length increases, the surface area of a cube also increases. The side length is the x-value, or the domain. The surface area is the y-value, or the range. So, the surface area of a cube is a function of the side length. The correct choice is H.

67. **SHORT RESPONSE** Selena deposited $2000 into a savings account that pays 1.5% interest compounded annually. If she does not deposit any more money into her account, how much will she earn in interest at the end of one year?

**SOLUTION:**

Let \( n \) represent the amount of interest earned at the end of one year. To find the interest earned at the end of one year, multiply the savings by the interest rate. Use the equation \( n = 0.015 \cdot 2000 \). So, the interest earned after one year is $30.
68. A candle burns as shown in the graph. If the height of the candle is 8 centimeters, approximately how long has the candle been burning?

A 0 hours  
B 24 minutes  
C 64 minutes  
D \( \frac{1}{2} \) hours

**SOLUTION:**

According to the graph, when the candle is 8cm high, it has been burning for about \( \frac{5}{2} \) hours. The correct choice is D.
3-1 Graphing Linear Equations

69. FUNDRAISING The Madison High School Marching Band sold solid–color gift wrap for $4 per roll and print gift wrap for $6 per roll. The total number of rolls sold was 480, and the total amount of money collected was $2,340. How many rolls of each kind of gift wrap were sold?

SOLUTION:
Let x represent the number of $4 rolls and let y represent the number of $6 rolls.
4x represents the income of the $4 rolls and 6y represents the income of the $6 rolls. The sum of the incomes of the two different types of rolls should equal the total money collected, $2340.
The total amount collected can be represented by the equation 2,340 = 4x + 6y. To solve for x, rewrite y in terms of x.
Since 480 rolls have been sold, we can represent the $6 rolls as y = 480 – x.

\[
2340 = 4x + 6y \\
2340 = 4x + 6(480 - x) \\
2340 = 4x + 2880 - 6x \\
2340 = -2x + 2880 \\
2340 - 2880 = -2x + 2880 - 2880 \\
-540 = -2x \\
\frac{-540}{-2} = \frac{-2x}{-2} \\
270 = x \\
y = 480 - 270 \\
y = 210
\]

So, 270 rolls of solid wrap were sold and 210 rolls of print wrap were sold.

Solve each equation or formula for the variable specified.
70. \( S = \frac{n}{2} (A + t) \), for A

SOLUTION:
\[
S = \frac{n}{2} (A + t) \quad \text{Original equation.} \\
S = \frac{n(A+t)}{2} \quad \text{Rewrite fraction.} \\
S \cdot 2 = \frac{n(A+t)}{2} \cdot 2 \quad \text{Multiply each side by 2.} \\
2S = n(A + t) \quad \text{Simplify.} \\
\frac{2S}{n} = \frac{n(A+t)}{n} \quad \text{Divide each side by n.} \\
\frac{2S}{n} = A + t \quad \text{Simplify.} \\
\frac{2S}{n} = A + t \quad \text{Subtract t from both sides.} \\
\frac{2S}{n} - t = A \quad \text{Simplify.}
\]
71. $2g - m = 5 - gh$, for $g$

**SOLUTION:**

\[
2g - m = 5 - gh \\
2g + gh - m = 5 - gh + gh \\
2g + gh - m = 5 \\
2g + gh - m + m = 5 + m \\
2g + gh = 5 + m \\
g(2 + h) = 5 + m \\
\frac{g(2 + h)}{(2 + h)} = \frac{5 + m}{2 + h} \\
g = \frac{5 + m}{2 + h}
\]

72. $y + \frac{a}{3} = c$, for $y$

**SOLUTION:**

\[
y + \frac{a}{3} = c \\
3 \left( \frac{y + a}{3} \right) = 3 \cdot c \\
y + a = 3c \\
y + a - a = 3c - a \\
y = 3c - a
\]

73. $4z + b = 2z + c$, for $z$

**SOLUTION:**

\[
4z + b = 2z + c \\
4z - 2z + b = 2z - 2z + c \\
2z + b = c \\
2z + b - b = c - b \\
2z = c - b \\
\frac{2z}{2} = \frac{c - b}{2} \\
z = \frac{c - b}{2}
\]
3-1 Graphing Linear Equations

Evaluate each expression if \( x = 2, y = 5, \) and \( z = 7. \)

74. \( 3x^2 - 4y \)

**SOLUTION:**
Replace \( x \) with 2, \( y \) with 5, and \( z \) with 7.

\[
3x^2 - 4y = 3(2)^2 - 4(5) \quad \text{Substitute.}
\]

\[
= 3(4) - 4(5) \quad \text{Evaluate powers.}
\]

\[
= 12 - 20 \quad \text{Multiply.}
\]

\[
= -8 \quad \text{Simplify.}
\]

75. \( \frac{x-y^2}{2z} \)

**SOLUTION:**
Replace \( x \) with 2, \( y \) with 5, and \( z \) with 7.

\[
\frac{x-y^2}{2z} = \frac{2-5^2}{2\cdot7} \quad \text{Substitute.}
\]

\[
= \frac{2-25}{2\cdot7} \quad \text{Evaluate powers.}
\]

\[
= \frac{-23}{14} \quad \text{Multiply.}
\]

\[
= -\frac{23}{14} \quad \text{Simplify.}
\]

76. \( \left( \frac{y}{z} \right)^2 + \frac{xy}{2} \)

**SOLUTION:**
Replace \( x \) with 2, \( y \) with 5, and \( z \) with 7.

\[
\left( \frac{y}{z} \right)^2 + \frac{xy}{2} = \left( \frac{5}{7} \right)^2 + \frac{2\cdot5}{2} \quad \text{Substitute.}
\]

\[
= \frac{25}{49} + \frac{2\cdot5}{2} \quad \text{Evaluate powers.}
\]

\[
= \frac{25}{49} + 5 \quad \text{Multiply.}
\]

\[
= \frac{25}{49} + \frac{245}{49} \quad \text{Rewrite 5 as a fraction.}
\]

\[
= \frac{270}{49} \quad \text{Simplify.}
\]
3-1 Graphing Linear Equations

77. \( z^2 - y^3 + 5x^2 \)

\textit{SOLUTION:}
Replace \( x \) with 2, \( y \) with 5, and \( z \) with 7.

\[
\begin{align*}
z^2 - y^3 + 5x^2 &= 7^2 - 5^3 + 5 \cdot 2^2 \\
&= 49 - 125 + 5 \cdot 4 \\
&= 49 - 125 + 20 \\
&= -56
\end{align*}
\]
Substitute.  
Evaluate powers.  
Multiply.  
Simplify.