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

1. m: 4, y-intercept: -3

SOLUTION:

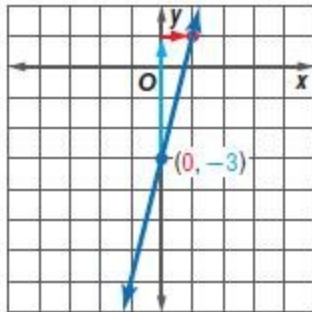The slope-intercept form of a line of slope m and y-intercept b is given by $y = mx + b$.

Here, $m = 4$ and y-intercept $= -3$.

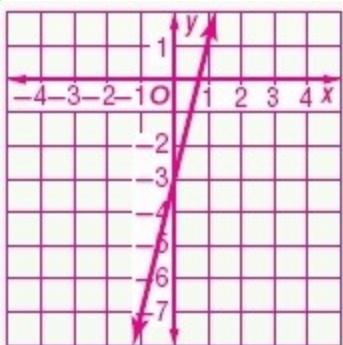$y = mx + b$ Slope-intercept form

$y = 4x + (-3)$ Substitution.

$y = 4x - 3$ Simplify.

So, the equation of the line is $y = 4x - 3$.

ANSWER:

$y = 4x - 3$

2. $m : \dfrac{1}{2}$, y-intercept: -1

SOLUTION:

The slope-intercept form of a line of slope m and y-intercept b is given by $y = mx + b$.
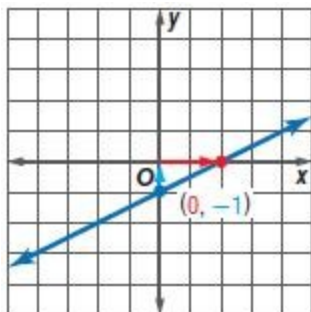
Here, $m = \dfrac{1}{2}$ and y-intercept $= -1$.

$$y = mx + b \qquad \text{Slope-intercept form}$$

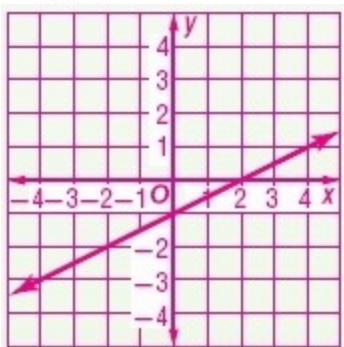$$y = \dfrac{1}{2}x + (-1) \quad \text{Substitution.}$$

$$y = \dfrac{1}{2}x - 1 \qquad \text{Simplify.}$$

So, the equation of the line is $y = \dfrac{1}{2}x - 1$.

ANSWER:

$$y = \dfrac{1}{2}x - 1$$

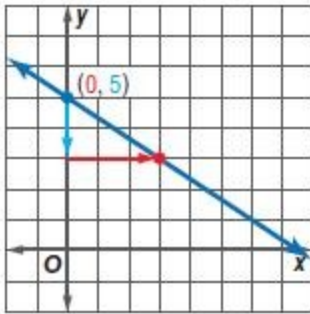3. $m: -\dfrac{2}{3}$, y-intercept: 5

SOLUTION:

The slope-intercept form of a line of slope m and y-intercept b is given by $y = mx + b$.

Here, $m = -\dfrac{2}{3}$ and y-intercept = 5.
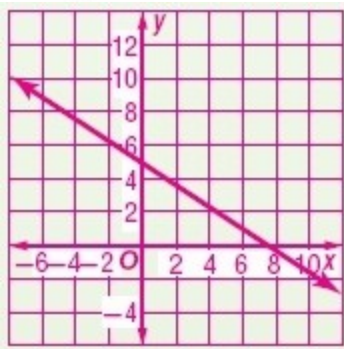
$y = mx + b$ Slope-intercept form

$y = -\dfrac{2}{3}x + 5$ Substitution.

So, the equation of the line is $y = -\dfrac{2}{3}x + 5.$

ANSWER:

$y = -\dfrac{2}{3}x + 5$

Write an equation in point-slope form of the line having the given slope that contains the given point. Then graph the line.

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

SOLUTION:

The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.
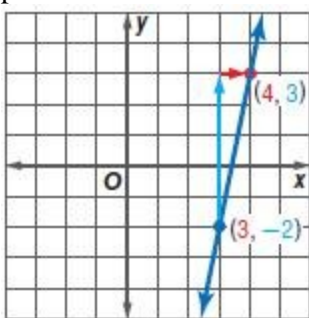
Here, $m = 5$ and $(x_1, y_1) = (3, -2)$.

$$y - y_1 = 5(x - x_1) \quad \text{Point-Slope form}$$
$$y - (-2) = 5(x - 3) \quad \text{Substitution.}$$
$$y + 2 = 5(x - 3) \quad \text{Simplify.}$$

Graph $(3, -2)$. Use the slope 5 to find another point 5 units up and 1 unit right. Then draw a line through these two points.

ANSWER:

$y + 2 = 5(x - 3)$

5. $m = \dfrac{1}{4}, (-2, -3)$

SOLUTION:

The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Here, $m = \dfrac{1}{4}$ and $(x_1, y_1) = (-2, -3)$.

$y - (-2) = \dfrac{1}{4}(x - 3)$ Point-Slope form

$y - (-3) = \dfrac{1}{4}(x - (-2))$ Substitution.

$y + 3 = \dfrac{1}{4}(x + 2)$ Simplify.

Graph (–2,–3). Use the slope $\dfrac{1}{4}$ to find another point 1 unit up and 4 units right. Then draw a line through the two points.

ANSWER:

$y + 3 = \dfrac{1}{4}(x + 2)$

6. $m = -4.25, (-4, 6)$

SOLUTION:

The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Here, $m = -4.25$ and $(x_1, y_1) = (-4, 6)$.

$$y - y_1 = m(x - x_1) \qquad \text{Point-Slope form}$$
$$y - 6 = -4.25(x - (-4)) \qquad \text{Substitution.}$$
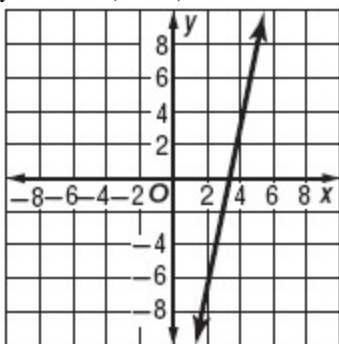$$y - 6 = 4.25(x + 4) \qquad \text{Simplify.}$$

Graph $(-4, 6)$. Use the slope -4.25 to find another point 4.25 units down and 1 units right. Then draw a line through the two points.

$y - 6 = -4.25 (x + 4)$
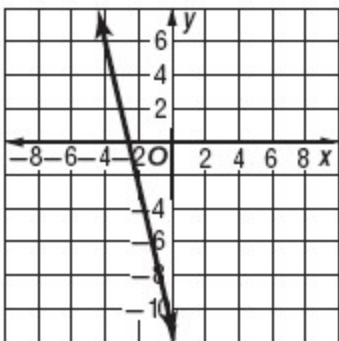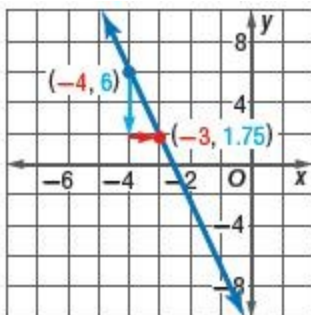
ANSWER:

$y - 6 = -4.25 (x + 4)$
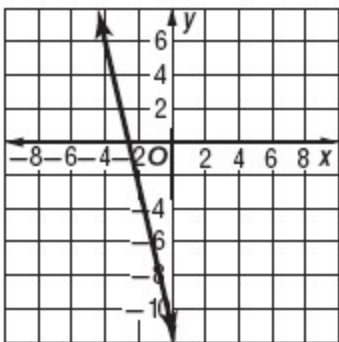
Write an equation of the line through each pair of points in slope-intercept form.

7.

x	y
0	−1
4	4

SOLUTION:

Use the slope formula to find the slope of the line.

Let $(x_1, y_1) = (0, -1)$ and $(x_2, y_2) = (4, 4)$

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

$$= \frac{4 - (-1)}{4 - 0}$$

$$= \frac{4 + 1}{4}$$

$$= \frac{5}{4}$$

Use the slope and one of the points to write the equation of the line in point-slope form.

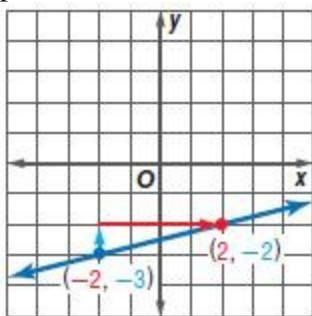The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Here, $m = \frac{5}{4}$ and $(x_1, y_1) = (0, -1)$.

$$y - y_1 = 5(x - x_1) \quad \text{Point-Slope form}$$

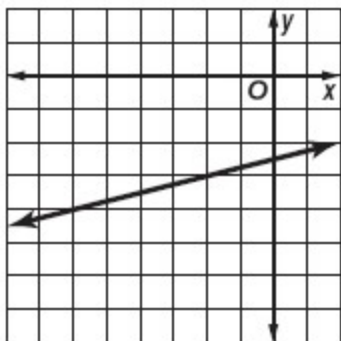$$y - (-1) = \frac{5}{4}(x - 0) \quad \text{Substitution.}$$

$$y + 1 = \frac{5}{4}x \quad \text{Simplify.}$$

$$y + 1 - 1 = \frac{5}{4}x - 1 \quad \text{−1 from each side.}$$

$$y = \frac{5}{4}x - 1 \quad \text{Simplify.}$$

ANSWER:

$$y = \frac{5}{4}x - 1$$

x	y
4	3
1	−6

8.

SOLUTION:

Use the slope formula to find the slope of the line. Let $(x_1, y_1) = (4, 3)$ and $(x_2, y_2) = (1, -6)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{-6 - 3}{1 - 4}$$
$$= \frac{-9}{-3}$$
$$= 3$$

Use the slope and one of the points to write the equation of the line in point-slope form.
The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Here, $m = 3$ and $(x_1, y_1) = (4, 3)$.

$$y - y_1 = 5(x - x_1) \qquad \text{Point-Slope form}$$
$$y - 3 = 3(x - 4) \qquad \text{Substution}$$
$$y - 3 = 3x - 12 \qquad \text{Simplify.}$$
$$y - 3 + 3 = 3x - 12 + 3 \qquad \text{Add 3 to each side.}$$
$$y = 3x - 9 \qquad \text{Simplify.}$$

ANSWER:

$y = 3x - 9$

x	y
6	5
−1	−4

9.

SOLUTION:

Use the slope formula to find the slope of the line. Let $(x_1, y_1) = (6, 5)$ and $(x_2, y_2) = (-1, -4)$.

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

$$= \frac{-4 - 5}{-1 - 6}$$

$$= \frac{-9}{-7}$$

$$= \frac{9}{7}$$

Use the slope and one of the points to write the equation of the line in point-slope form.

The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Here, $m = \frac{9}{7}$ and $(x_1, y_1) = (6, 5)$.

$$y - y_1 = m(x - x_1) \qquad \text{Point-Slope form}$$

$$y - 5 = \frac{9}{7}(x - 6) \qquad \text{Substitution.}$$

$$y - 5 = \frac{9}{7}x - \frac{54}{7} \qquad \text{Simplify.}$$

$$y - 5 + 5 = \frac{9}{7}x - \frac{54}{7} + 5 \qquad \text{Add 5 to each side.}$$

$$y = \frac{9}{7}x - \frac{54}{7} + \frac{35}{7} \qquad \text{Simplify.}$$

$$y = \frac{9}{7}x - \frac{19}{7} \qquad \text{Simplify.}$$

ANSWER:

$$y = \frac{9}{7}x - \frac{19}{7}$$

10. Write an equation in slope-intercept form for a line perpendicular to $y = -2x + 6$ containing (3, 2).

SOLUTION:

The slope of $y = -2x + 6$ is –2. The slope of a line perpendicular to this line will have the slope of $\frac{1}{2}$. Use the point-slope form to find the equation of a line that containing (3, 2) and has a slope of $\frac{1}{2}$.

$$y - 2 = \frac{1}{2}(x - 3) \quad \text{Point-Slope form}$$

$$y - 2 = \frac{1}{2}x - \frac{3}{2} \quad \text{Substitution.}$$

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

$$y = \frac{1}{2}x - \frac{3}{2} + \frac{4}{2} \quad \text{Simplify.}$$

$$y = \frac{1}{2}x - \frac{1}{2} \quad \text{Simplify.}$$

ANSWER:

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

11. Write an equation in slope-intercept form for a line parallel to $y = 4x - 5$ containing (–1, 5).

SOLUTION:

The slope of $y = 4x - 5$ is 4. The slope of a line parallel to this line will have the slope of 4. Use the point-slope form to find the equation of a line that containing (–1, 5) and has a slope of 4.

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

$$y - 5 = 4(x - (-1)) \quad \text{Substitution.}$$

$$y - 5 = 4(x + 1) \quad \text{Simplify.}$$

$$y - 5 = 4x + 4 \quad \text{Distributive Property}$$

$$y - 5 + 5 = 4x + 4 + 5 \quad \text{Add 5 to each side.}$$

$$y = 4x + 9 \quad \text{Simplify.}$$

ANSWER:

$$y = 4x + 9$$

12. **CCSS MODELING** Kameko currently subscribes to Ace Music, an online music service, but she is considering switching to another online service, Orange Tunes. The plan for each online music service is described below.

ACE MUSIC — Subscription fee $5/mo — $0.79 per song downloaded

Orange Tunes — Subscription fee $10/mo — 40 downloads per month

a. Write an equation to represent the total monthly cost for each plan.

b. Graph the equations.

c. If Kameko downloads 15 songs per month, should she keep her current plan, or change to the other plan? Explain.

SOLUTION:

a. The monthly fee for the Orange Tunes plan is $10, irrespective of the number of songs you download. The Ace Music plan has a basic charge of $5 and a download fee of $0.79 per song. So, if y is the monthly charge and x is the number of songs downloaded then the equations are

$y = 10$

$y = 0.79x + 5.$

b. Graph the lines representing the above equations on a coordinate plane.

Cost of Music Service
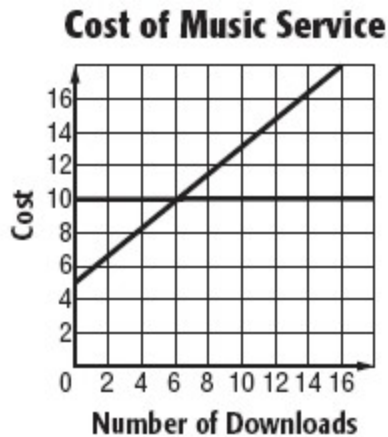
c. Determine how much she would pay Ace Music for 15 downloads in one month.

Ace Music:

$y = 0.79x + 5$	Original equation
$y = 0.79(15) + 5$	Substitute 15 for x.
$y = 11.85 + 5$	Multiply.
$y = 16.85$	Add.

She would spent $16.85 if she stays with Ace Music. Since Orange Tunes charges a flat rate per month, she would get more songs for $10 per month. She should switch to the other plan.

ANSWER:

a. $y = 10$, $y = 0.79x + 5$

b.

Cost of Music Service

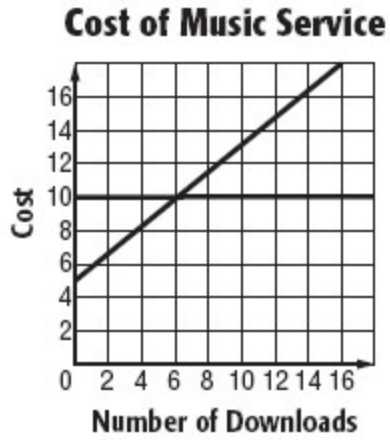**c.** She should switch to the other plan. She would spend $16.85 per month with her current plan and $10 per month with the other plan.

Write an equation in slope-intercept form of the line having the given slope and y-intercept or given points. Then graph the line.

13. m: −5, y-intercept: −2

SOLUTION:

The slope-intercept form of a line of slope m and y-intercept b is given by $y = mx + b$.

Here, $m = -5$ and y-intercept $= -2$.

$y = mx + b$	Slope-intercept form
$y = -5x + (-2)$	Substitution.
$y = -5x - 2$	Simplify.

So, the equation of the line is $y = -5x - 2$.

Graph the y-intercept, −2 . Use the slope −5 to find another point 5 units up and 1 unit left. Then draw a line through the two points.

ANSWER:

$y = -5x - 2$

14. *m*: –7, *b*: –4

SOLUTION:

The slope-intercept form of a line of slope *m* and *y*-intercept *b* is given by $y = mx + b$.
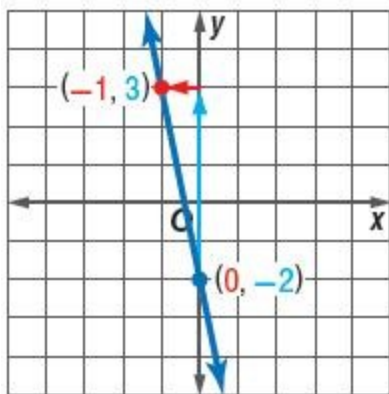
Here, $m = -7$ and *y*-intercept = –4.

$$y = mx + b \qquad \text{Slope-intercept form}$$
$$y = -7x + (-4) \quad \text{Substitution.}$$
$$y = -7x - 4 \qquad \text{Simplify.}$$

So, the equation of the line is $y = -7x - 4$.

Graph the *y*-intercept –4 Use the slope –7 to find another point 7 units up and 1 unit right. Then draw a line through the two points.

ANSWER:

$y = -7x - 4$
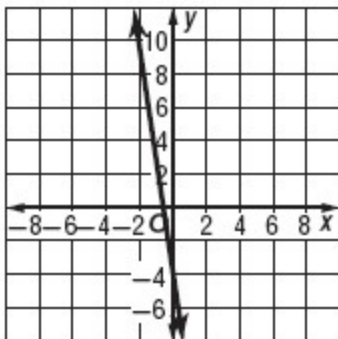
15. *m*: 9, *b*: 2

SOLUTION:

The slope-intercept form of a line of slope *m* and *y*-intercept *b* is given by $y = mx + b$.

Here, $m = 9$ and *y*-intercept $= 2$.

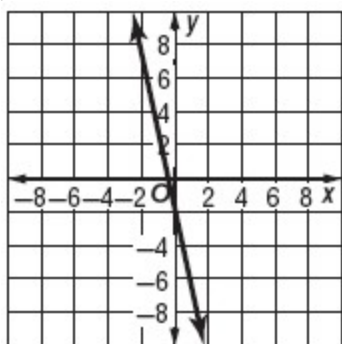$y = mx + b$ Slope-intercept form

$y = 9x + 2$ Substitution.

So, the equation of the line is $y = 9x + 2$.

Graph the *y*-intercept, 2. Use the slope 9 to find another point 9 units up and 1 unit right. Then draw a line through the two points.
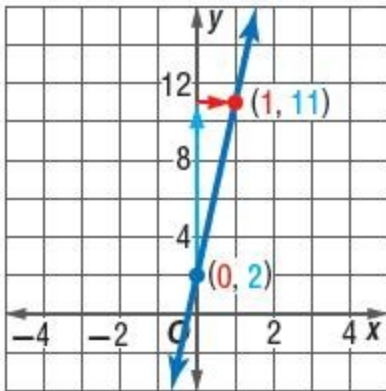
ANSWER:

$y = 9x + 2$
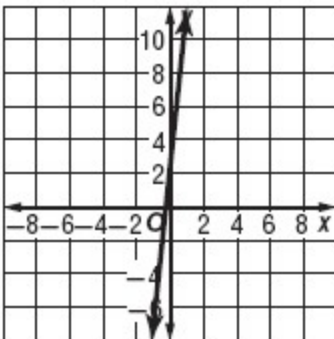
16. m: 12, y-intercept: $\dfrac{4}{5}$

    SOLUTION:

The slope-intercept form of a line of slope m and y-intercept b is given by $y = mx + b$.

Here, $m = 12$ and y-intercept $= \dfrac{4}{5}$.
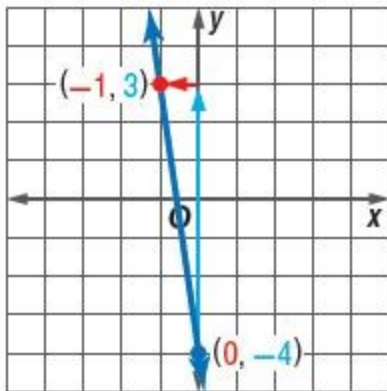
$y = mx + b$ Slope-intercept form

$y = 12x + \dfrac{4}{5}$ Substitution.

So, the equation of the line is $y = 12x + \dfrac{4}{5}$.

Graph the y-intercept, $\dfrac{4}{5}$. Use the slope 12 to find another point 12 units up and 1 unit right. Then draw a line through the two points.
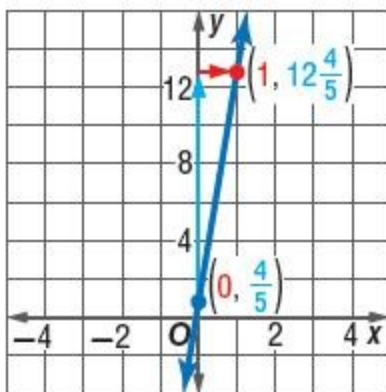
    ANSWER:

$y = 12x + \dfrac{4}{5}$
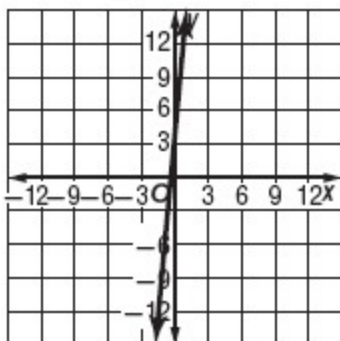
17. $m: -\dfrac{3}{4}, (0, 4)$

    SOLUTION:

The slope-intercept form of a line of slope m and y-intercept b is given by $y = mx + b$.
Use the slope and the point to write the equation of the line in point-slope form.

The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Here, $m = -\dfrac{3}{4}$ and $(x_1, y_1) = (0, 4)$.

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

$$y - 4 = -\frac{3}{4}(x - 0) \quad \text{Substitution.}$$

$$y - 4 = -\frac{3}{4}x \quad \text{Simplify.}$$

$$y - 4 + 4 = -\frac{3}{4}x + 4 \quad \text{Add 4 to each side.}$$

$$y = -\frac{3}{4}x + 4 \quad \text{Simplify.}$$

Graph $(0, 4)$. Use the slope $-\dfrac{3}{4}$ to find another point 3 units down and 4 unit right. Then draw a line through the two points.
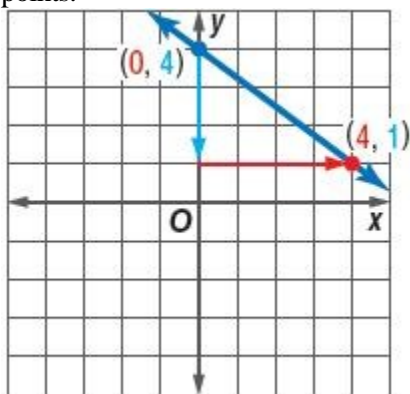
ANSWER:

$$y = -\frac{3}{4}x + 4$$
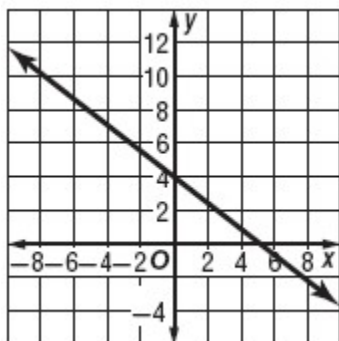
18. $m: \dfrac{5}{11}, (0, -3)$

SOLUTION:

The slope-intercept form of a line of slope m and y-intercept b is given by $y = mx + b$.
Use the slope and the point to write the equation of the line in point-slope form.

The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Here, $m = \dfrac{5}{11}$ and $(x_1, y_1) = (0, -3)$.

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

$$y - (-3) = \frac{5}{11}(x - 0) \quad \text{Substitution.}$$

$$y + 3 = \frac{5}{11}x \quad \text{Simplify.}$$

$$y + 3 - 3 = \frac{5}{11}x - 3 \quad \text{Add 4 to each side.}$$

$$y = \frac{5}{11}x - 3 \quad \text{Simplify.}$$

Graph $(0, -3)$. Use the slope $\dfrac{5}{11}$ to find another point 5 units up and 11 units right. Then draw a line through the two points.

ANSWER:

$$y = \frac{5}{11}x - 3$$
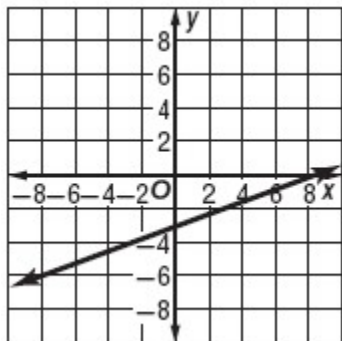
Write an equation in point-slope form of the line having the given slope that contains the given point. Then graph the line.

19. $m = 2$, (3, 11)

SOLUTION:

The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Here, $m = 2$ and $(x_1, y_1) = (3, 11)$.

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

$y - 11 = 2(x - 3)$ Substitution.

Graph (3, 11). Use the slope 2 to find another point 2 units down and 1 unit down. Then draw a line through the two points.

ANSWER:

$y - 11 = 2(x - 3)$

20. $m = 4$, $(-4, 8)$

SOLUTION:

The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Here, $m = 4$ and $(x_1, y_1) = (-4, 8)$.

$$y - y_1 = m(x - x_1) \qquad \text{Point-Slope form}$$
$$y - 8 = 4(x - (-4)) \quad \text{Substitution.}$$
$$y - 8 = 4(x + 4) \qquad \text{Simplify.}$$

Graph $(-4, 8)$. Use the slope 4 to find another point 4 units up and 1 unit right. Then draw a line through the two points.
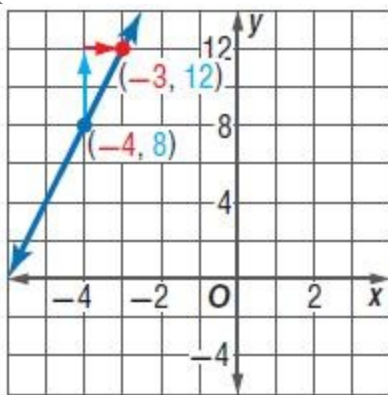
ANSWER:

$y - 8 = 4(x + 4)$
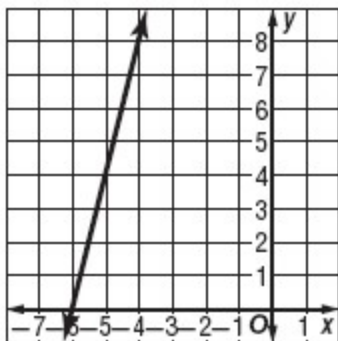
21. $m = -7$, (1, 9)

   SOLUTION:

   The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

   Here, $m = -7$ and $(x_1, y_1) = (1, 9)$.

   So, the equation of the line is
   $$y - y_1 = m(x - x_1) \quad \text{Point-Slope form}$$
   $$y - 9 = -7(x - 1) \quad \text{Substitution.}$$

   Graph (1, 9). Use the slope -7 to find another point 7 units down and 1 unit right. Then draw a line through the two points.
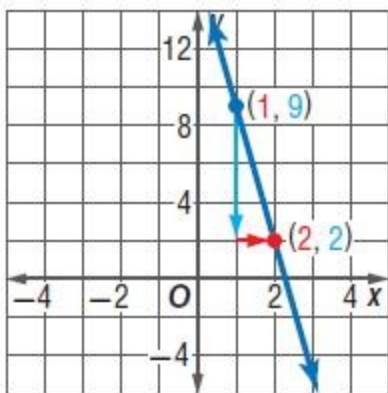
   ANSWER:

   $y - 9 = -7(x - 1)$
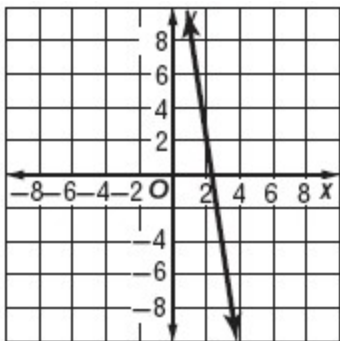
22. $m = \dfrac{5}{7}, (-2, -5)$

   SOLUTION:

   The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

   $m = \dfrac{5}{7}$ and $(x_1, y_1) = (-2, -5)$
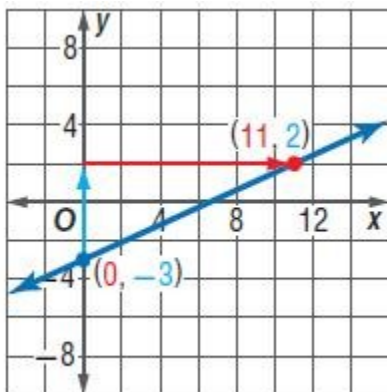
   $$y - y_1 = m(x - x_1) \qquad \text{Point-Slope form}$$
 $$y - (-5) = \frac{5}{7}(x - (-2)) \qquad \text{Substitution.}$$
   $$y + 5 = \frac{5}{7}(x + 2) \qquad \text{Simplify.}$$

   Graph $(-2, -5)$. Use the slope $\dfrac{5}{7}$ to find another point 5 units up and 7 unit right. Then draw a line through the two points.
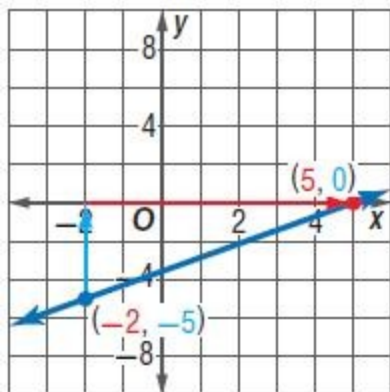
   ANSWER:

   $$y + 5 = \frac{5}{7}(x + 2)$$
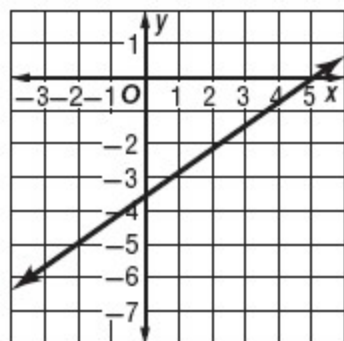
23. $m = -\dfrac{4}{5}, (-3, -6)$

SOLUTION:

The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

$m = -\dfrac{4}{5}$ and $(x_1, y_1) = (-3, -6)$

$$
\begin{aligned}
y - y_1 &= m(x - x_1) && \text{Point-Slope form} \\
y - (-6) &= -\tfrac{4}{5}(x - (-3)) && \text{Substitution.} \\
y + 6 &= -\tfrac{4}{5}(x + 3) && \text{Simplify.}
\end{aligned}
$$

Graph $(-3, -6)$. Use the slope $-\dfrac{4}{5}$ to find another point 4 units up and 5 units left. Then draw a line through the two points.
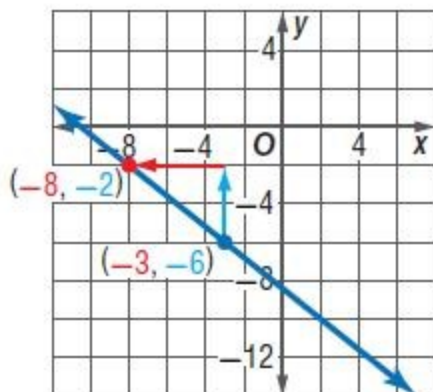
ANSWER:

$y + 6 = -\dfrac{4}{5}(x + 3)$
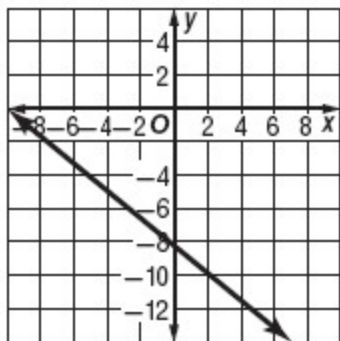
24. $m = -2.4, (14, -12)$
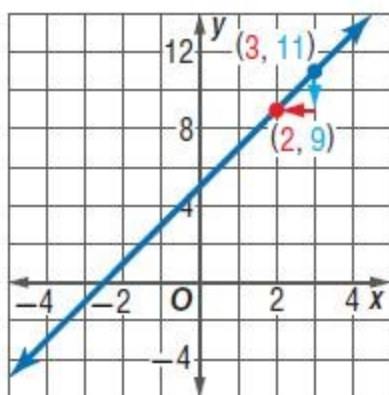
   SOLUTION:

   The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

   $m = -2.4$ and $(x_1, y_1) = (14, -12)$

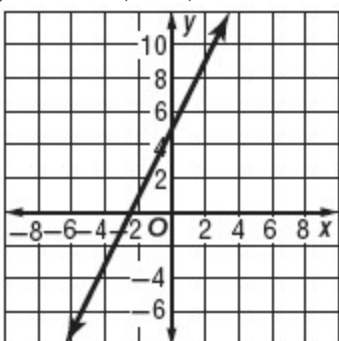 $$y - y_1 = m(x - x_1) \qquad \text{Point-Slope form}$$
   $$y - (-12) = -2.4(x - 14) \qquad \text{Substitution.}$$
   $$y + 12 = -2.4(x - 14) \qquad \text{Simplify.}$$

   Graph $(14, -12)$. Use the slope -2.4 $\left(\text{or } \dfrac{12}{5} \right)$ to find another point 12 units up and 5 units left. Then draw a line through the two points.
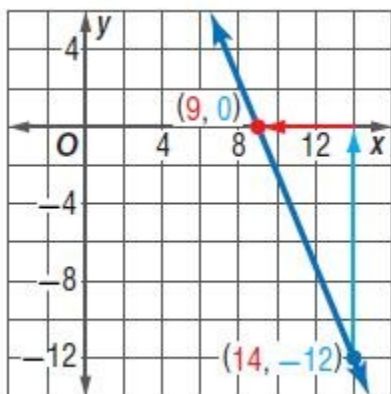
   ANSWER:

   $y + 12 = -2.4(x - 14)$
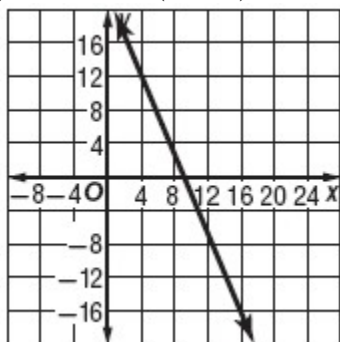
Write an equation of the line through each pair of points in slope-intercept form.

25. $(-1, -4)$ and $(3, -4)$

SOLUTION:

Use the slope formula to find the slope of the line. Let $(x_1, y_1) = (-1, -4)$ and $(x_2, y_2) = (3, -4)$

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

Use the slope and one of the points to write the equation of the line in point-slope form.
The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Here, $m = 0$ and $(x_1, y_1) = (-1, -4)$.

|	
$y - y_1 = m(x - x_1)$	Point-Slope form
$y - (-4) = 0(x - (-1))$	Substitution.
$y + 4 = 0$	Simplify.
$y + 4 - 4 = 0 - 4$	-4 to each side.
$y = -4$	Simplify.

ANSWER:

$y = -4$

26. $(2, -1)$ and $(2, 6)$

SOLUTION:

Use the slope formula to find the slope of the line. Let $(x_1, y_1) = (2, -1)$ and $(x_2, y_2) = (2, 6)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{6 - (-1)}{2 - 2}$$
$$= \frac{7}{0}$$

Division of any number by zero is undefined. So, the slope of the line is undefined. So, the line is a vertical line. The x-coordinates of both the points are 2.
So, the equation of the line is $x = 2$.

ANSWER:

$x = 2$

27. $(-3, -2)$ and $(-3, 4)$

 SOLUTION:

 Use the slope formula to find the slope of the line. Let $(x_1, y_1) = (-3, -2)$ and $(x_2, y_2) = (-3, 4)$.

 $$m = \frac{y_2 - y_1}{x_2 - x_1}$$
 $$= \frac{4 - (-2)}{-3 - (-3)}$$
 $$= \frac{6}{0}$$

 Division of any number by zero is undefined. So, the slope of the line is undefined. So, the line is a vertical line. The x-coordinates of the both the points are -3.
 So, the equation of the line is $x = -3$.

 ANSWER:

 $x = -3$

28. (0, 5) and (3, 3)

   SOLUTION:
   Use the slope formula to find the slope of the line. Let $(x_1, y_1) = (0, 5)$ and $(x_2, y_2) = (3, 3)$.

   $$m = \frac{y_2 - y_1}{x_2 - x_1}$$
   $$= \frac{3 - 5}{3 - 0}$$
   $$= \frac{-2}{3}$$
   $$= -\frac{2}{3}$$

   Use the slope and one of the points to write the equation of the line in point-slope form.
   The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

   Here, $m = -\frac{2}{3}$ and $(x_1, y_1) = (3, 3)$.

 | | |
   |---|---|
   | $y - y_1 = m(x - x_1)$ | Point-Slope form |
   | $y - 3 = -\frac{2}{3}(x - 3)$ | Substitution. |
   | $y - 3 = -\frac{2}{3}x + 2$ | Simplify. |
   | $y - 3 + 3 = -\frac{2}{3}x + 2 + 3$ | Add 3 to each side. |
   | $y = -\frac{2}{3}x + 5$ | Simplify. |

   ANSWER:
   $$y = -\frac{2}{3}x + 5$$

29. $(-12, -6)$ and $(8, 9)$

SOLUTION:

Use the slope formula to find the slope of the line. Let $(x_1, y_1) = (-12, -6)$ and $(x_2, y_2) = (8, 9)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{9 - (-6)}{8 - (-12)}$$
$$= \frac{15}{20}$$
$$= \frac{3}{4}$$

Use the slope and one of the points to write the equation of the line in point-slope form.

The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Here, $m = \frac{3}{4}$ and $(x_1, y_1) = (8, 9)$.

So, the equation of the line is

$$y - y_1 = m(x - x_1) \qquad \text{Point-Slope form}$$
$$y - 9 = \frac{3}{4}(x - 8) \qquad \text{Substitution.}$$
$$y - 9 = \frac{3}{4}x - 6 \qquad \text{Simplify.}$$
$$y - 9 + 9 = \frac{3}{4}x - 6 + 9 \qquad \text{Add 9 to each side.}$$
$$y = \frac{3}{4}x + 3 \qquad \text{Simplify.}$$

ANSWER:

$$y = \frac{3}{4}x + 3$$

30. (2, 4) and (−4, −11)

   SOLUTION:

   Use the slope formula to find the slope of the line. Let $(x_1, y_1) = (2, 4)$ and $(x_2, y_2) = (-4, -11)$.

   $$m = \frac{y_2 - y_1}{x_2 - x_1}$$
   $$= \frac{-11 - 4}{-4 - 2}$$
   $$= \frac{-15}{-6}$$
   $$= \frac{5}{2}$$

   Use the slope and one of the points to write the equation of the line in point-slope form.
   The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

   Here, $m = \dfrac{5}{2}$ and $(x_1, y_1) = (2, 4)$.

   $$y - y_1 = m(x - x_1) \qquad \text{Point-Slope form}$$
   $$y - 4 = \frac{5}{2}(x - 2) \qquad \text{Substitution.}$$
   $$y - 4 = \frac{5}{2}x - 5 \qquad \text{Simplify.}$$
   $$y - 4 + 4 = \frac{5}{2}x - 5 + 4 \quad \text{Add 4 to each side.}$$
   $$y = \frac{5}{2}x - 1 \qquad \text{Simplify.}$$

   ANSWER:

   $$y = \frac{5}{2}x - 1$$

Write an equation in slope-intercept form for each line shown or described.
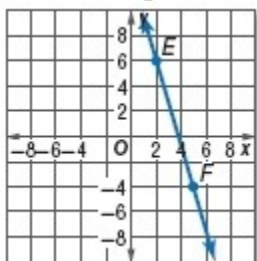
31.

SOLUTION:

The coordinates of *E* is (2, 6) and that of *F* is (5, –4)

Use the slope formula to find the slope of the line. Let $(x_1, y_1) = (2, 6)$ and $(x_2, y_2) = (5, -4)$.

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

$$= \frac{-4 - 6}{5 - 2}$$

$$= \frac{-10}{3}$$

$$= -\frac{10}{3}$$

Use the slope and one of the points to write the equation of the line in point-slope form.

The point-slope form of a line is $y - y_1 = m(x - x_1)$ where *m* is the slope and (x_1, y_1) is a point on the line.

Here, $m = -\frac{10}{3}$ and $(x_1, y_1) = (2, 6)$.

$$y - y_1 = m(x - x_1) \qquad \text{Point-Slope form}$$

$$y - 6 = -\frac{10}{3}(x - 2) \qquad \text{Substitution.}$$

$$y - 6 = -\frac{10}{3}x + \frac{20}{3} \qquad \text{Simplify.}$$

$$y - 6 + 6 = -\frac{10}{3}x + \frac{20}{3} + 6 \qquad \text{Add 6 to each side.}$$

$$y = -\frac{10}{3}x + \frac{38}{3} \qquad \text{Simplify.}$$

ANSWER:

$$y = -\frac{10}{3}x + \frac{38}{3}$$
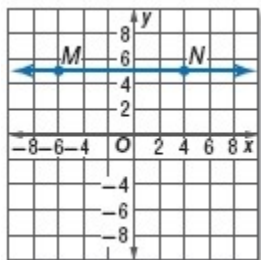
32.

SOLUTION:

The coordinates of M is (−6, 5) and that of N is (4, 5)

Use the slope formula to find the slope of the line. Let $(x_1, y_1) = (-6, 5)$ and $(x_2, y_2) = (4, 5)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{5 - 5}{4 - (-6)}$$
$$= \frac{0}{10}$$
$$= 0$$

Use the slope and one of the points to write the equation of the line in point-slope form.

The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Here, $m = 0$ and $(x_1, y_1) = (4, 5)$.

$$\begin{aligned}
y - y_1 &= m(x - x_1) && \text{Point-Slope form} \\
y - 5 &= 0(x - 0) && \text{Substitution.} \\
y - 5 &= 0 && \text{Simplify.} \\
y - 5 + 5 &= +5 && \text{Add 5 to each side.} \\
y &= 5 && \text{Simplify.}
\end{aligned}$$

ANSWER:

$y = 5$

3-4 Equations of Lines

x	−1	3
y	−2	4

33.

SOLUTION:

Use the slope formula to find the slope of the line. Let $(x_1, y_1) = (-1, -2)$ and $(x_2, y_2) = (3, 4)$.

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

$$= \frac{4 - (-2)}{3 - (-1)}$$

$$= \frac{6}{4}$$

$$= \frac{3}{2}$$

Use the slope and one of the points to write the equation of the line in point-slope form.

The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Here, $m = \frac{3}{2}$ and $(x_1, y_1) = (3, 4)$.

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

$$y - 4 = \frac{3}{2}(x - 3) \quad \text{Substitution.}$$

$$y - 4 = \frac{3}{2}x - \frac{9}{2} \quad \text{Simplify.}$$

$$y - 4 + 4 = \frac{3}{2}x - \frac{9}{2} + 4 \quad \text{Add 4 to each side.}$$

$$y = \frac{3}{2}x - \frac{1}{2} \quad \text{Simplify.}$$

ANSWER:

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

34.

x	−4	−8
y	−5	−13

SOLUTION:

Use the slope formula to find the slope of the line. Let $(x_1, y_1) = (-4, -5)$ and $(x_2, y_2) = (-8, -13)$.

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

$$= \frac{-13 - (-5)}{-8 - (-4)}$$

$$= \frac{-8}{-4}$$

$$= 2$$

Use the slope and one of the points to write the equation of the line in point-slope form.

The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Here, $m = 2$ and $(x_1, y_1) = (-4, -5)$.

$$y - y_1 = m(x - x_1) \qquad \text{Point-Slope form}$$
$$y - (-5) = 2(x - (-4)) \qquad \text{Substitution.}$$
$$y + 5 = 2x + 8 \qquad \text{Simplify.}$$
$$y + 5 - 5 = 2x + 8 - 5 \qquad \text{Subtract 5 to each side.}$$
$$y = 2x + 3 \qquad \text{Simplify.}$$

ANSWER:

$y = 2x + 3$

3-4 Equations of Lines

35. x-intercept $= 3$, y-intercept $= -2$

SOLUTION:

Find the slope using the points (3, 0) and (0, –2). Let $(x_1, y_1) = (3, 0)$ and $(x_2, y_2) = (0, -2)$.

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

Use the slope and the y-intercept to write the equation.

Here, $m = \frac{2}{3}$ and y-intercept $= -2$.

$y = mx + b$ Slope-intercept form

$y = \frac{2}{3}x + (-2)$ Substitution.

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

So, the equation of the line is $y = \frac{2}{3}x - 2$.

ANSWER:

$y = \frac{2}{3}x - 2$

36. x-intercept $= -\dfrac{1}{2}$, y-intercept $= 4$

SOLUTION:

Find the slope using the points $\left(-\dfrac{1}{2},0\right)$ and $(0, 4)$. Let $(x_1, y_1) = \left(-\dfrac{1}{2},0\right)$ and $(x_2, y_2) = (0, 4)$.

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

$$= \frac{4 - 0}{0 - \left(-\frac{1}{2}\right)}$$

$$= \frac{4}{\left(\frac{1}{2}\right)}$$

$$= 8$$

Use the slope and the y-intercept to write the equation.
Here, $m = 8$ and y-intercept $= 4$.

$y = mx + b$ Slope-intercept form

$y = 8x + 4$ Substitution.

So, the equation of the line is $y = 8x + 4$.

ANSWER:

$y = 8x + 4$

Write an equation in slope-intercept form for each line described.

37. passes through $(-7, -4)$, perpendicular to $y = \dfrac{1}{2}x + 9$

SOLUTION:

The slope of the line $y = \dfrac{1}{2}x + 9$ is $\dfrac{1}{2}$. So, the slope of the line perpendicular to the given line is -2.

Use the slope and the point to write the equation of the line in point-slope form.
The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Here, $m = -2$ and $(x_1, y_1) = (-7, -4)$.

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

$y - (-4) = -2(x - (-7))$ Substitution.

$y + 4 = -2x - 14$ Simplify.

$y + 4 - 4 = -2x - 14 - 4$ Subtract 4 to each side.

$y = -2x - 18$ Simplify.

ANSWER:

$y = -2x - 18$

38. passes through $(-1, -10)$, parallel to $y = 7$

  SOLUTION:
  The slope of the line $y = 7$ is 0. So, the slope of the line parallel to the given line is also 0.
  Use the slope and the point to write the equation of the line in point-slope form.
  The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.
  Here, $m = 0$ and $(x_1, y_1) = (-1, -10)$.

$$y - y_1 = m(x - x_1) \quad \text{Point-Slope form}$$
$$y - (-10) = 0(x - 0) \quad \text{Substitution.}$$
$$y + 10 = 0 \quad \text{Simplify.}$$
$$y + 10 - 10 = -10 \quad \text{Subtract 10 to each side.}$$
$$y = -10 \quad \text{Simplify.}$$

  ANSWER:
  $y = -10$

39. passes through $(6, 2)$, parallel to $y = -\dfrac{2}{3}x + 1$

  SOLUTION:

  The slope of the line $y = -\dfrac{2}{3}x + 1$ is $-\dfrac{2}{3}$. So, the slope of the line parallel to the given line is also $-\dfrac{2}{3}$.
  Use the slope and the point to write the equation of the line in point-slope form.
  The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

  Here, $m = -\dfrac{2}{3}$ and $(x_1, y_1) = (6, 2)$.

$$y - y_1 = m(x - x_1) \quad \text{Point-Slope form}$$
$$y - 2 = -\frac{2}{3}(x - 6) \quad \text{Substitution.}$$
$$y - 2 = -\frac{2}{3}x + 4 \quad \text{Simplify.}$$
$$y - 2 + 2 = -\frac{2}{3}x + 4 + 2 \quad \text{Add 2 to each side.}$$
$$y = -\frac{2}{3}x + 6 \quad \text{Simplify.}$$

  ANSWER:
  $y = -\dfrac{2}{3}x + 6$

40. passes through (–2, 2), perpendicular to $y = -5x - 8$

   SOLUTION:

   The slope of the line $y = -5x - 8$ is –5. So, the slope of the line perpendicular to the given line is $\frac{1}{5}$.

   Use the slope and the point to write the equation of the line in point-slope form.
   The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

   Here, $m = \frac{1}{5}$ and $(x_1, y_1) = (-2, 2)$.

   $$y - y_1 = m(x - x_1) \quad \text{Point-Slope form}$$
   $$y - 2 = \frac{1}{5}(x - (-2)) \quad \text{Substitution.}$$
   $$y - 2 = \frac{1}{5}x + \frac{2}{5} \quad \text{Simplify.}$$
   $$y - 2 + 2 = \frac{1}{5}x + \frac{2}{5} + 2 \quad \text{Add 2 to each side.}$$
   $$y = \frac{1}{5}x + \frac{12}{5} \quad \text{Simplify.}$$

   ANSWER:

   $$y = \frac{1}{5}x + \frac{12}{5}$$

41. **PLANNING** Karen is planning a graduation party for the senior class. She plans to rent a meeting room at the convention center that costs $400. There is an additional fee of $5.50 for each person who attends the party.
   a. Write an equation to represent the cost y of the party if x people attend.
   b. Graph the equation.

   c. There are 285 people in Karen's class. If $\frac{2}{3}$ of these people attend, how much will the party cost?

   d. If the senior class has raised $2000 for the party, how many people can attend?

   SOLUTION:

   a. The rent for the room is $400 and there is an additional fee of $5.50 for each person who attends the party. So, if x is the number of people attending the party and y is the total cost then the equation is $y = 5.5x + 400$.
   b. Draw the line representing the equation $y = 5.5x + 400$ on a coordinate plane.

Cost of Graduation Party
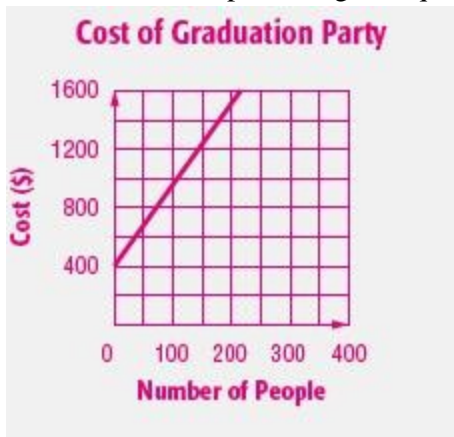
c. Two-thirds of 285 people, attended the party. That is, $\frac{2}{3}(285) = 190$ people attended the party.

Substitute $x = 190$ in the equation.
$$y = 5.5(190) + 400$$
$$= 1445$$
The party expenses will cost $1445.

d. Substitute $y = 2000$ and solve for x.
$$2000 = 5.50x + 400$$
$$1600 = 5.50x$$
$$290.91 \approx x$$

So, a total of 290 people can attend the party.

ANSWER:

a. $y = 5.5x + 400$

b.
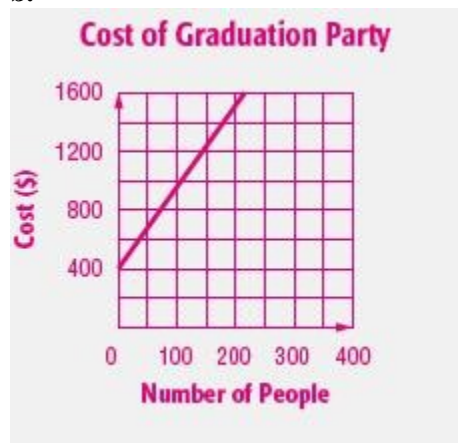
c. $1445

d. 290

42. **CCSS MODELING** Victor is saving his money to buy a new satellite radio for his car. He wants to save enough money for the radio and one year of satellite radio service before he buys it. He started saving for the radio with $50 that he got for his birthday. Since then, he has been adding $15 every week after he cashes his paycheck.
   a. Write an equation to represent Victor's savings y after x weeks.
   b. Graph the equation.
   c. How long will it take Victor to save $150?
   d. A satellite radio costs $180. Satellite radio service costs $10 per month. If Victor started saving two weeks ago, how much longer will it take him to save enough money? Explain.

   SOLUTION:

   a. He started with $50 and he has been adding $15 every week. So, the equation representing his savings y after x weeks is $y = 15x + 50$.

   b. Draw the line representing the equation $y = 15x + 50$ on a coordinate plane.

Victor's Savings

c. Substitute $y = 150$ in the equation and solve for x.

$150 = 15x + 50$

$100 = 15x$

$6.67 \approx x$

So, it will take 7 weeks to save $150.

d. If Victor started saving two weeks ago, he already has $50 + $15 + $15 or $80. For a one-year subscription to satellite service he needs to save $180 for the radio plus 12($10) for a year's worth of monthly fees which is $300 total. He still needs to save $300 − $80 or $220. Dividing $220 by $15, it will take 15 more weeks for Victor to save enough money.

ANSWER:

a. $y = 15x + 50$

b.

Victor's Savings

c. 7 wk

d. 15; If Victor started saving two weeks ago, he already has $50 + $15 + $15 or $80. He needs to save $180 + 12 ($10) or $300. He still needs to save $300 − $80 or $220. Dividing $220 by $15, it will take 15 more weeks for Victor to save enough money.

Name the line(s) on the graph shown that match each description.
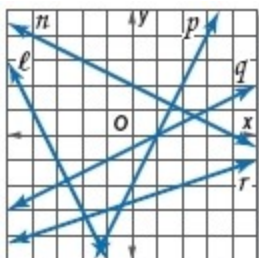
43. parallel to $y = 2x - 3$

SOLUTION:

The slope of the line $y = 2x - 3$ is 2. The slopes of the given lines can be tabulated as shown. Lines l and n can be eliminated right away since they each have a negative slope.

Line	Slope
l	$\dfrac{-2}{1} = -2$
n	$\dfrac{-2}{4} = -\dfrac{1}{2}$
p	$\dfrac{2}{1} = 2$
q	$\dfrac{3}{6} = \dfrac{1}{2}$
r	$\dfrac{1}{3}$

Of the given lines, line p has a slope of 2. So line p is parallel to $y = 2x - 3$. Note that, none of the other lines has a slope of 2.

ANSWER:

P

44. perpendicular to $y = \dfrac{1}{2}x + 7$

SOLUTION:

A line perpendicular to $y = \dfrac{1}{2}x + 7$ will have a slope of -2. The slopes of the given lines can be tabulated as shown. Lines p, q, and r, can be eliminated right away since the slopes of each of these are positive.

Line	Slope
l	$\dfrac{-2}{1} = -2$
n	$\dfrac{-2}{4} = -\dfrac{1}{2}$
p	$\dfrac{2}{1} = 2$
q	$\dfrac{3}{6} = \dfrac{1}{2}$
r	$\dfrac{1}{3}$

Here, the line l has a slope of -2. So, the line l is perpendicular to $y = \dfrac{1}{2}x + 7$. Note that, none of the other lines has a slope of -2.

ANSWER:

ℓ

45. intersecting but not perpendicular to $y = \dfrac{1}{2}x - 5$

SOLUTION:

The lines intersecting but not perpendicular to the line $y = \dfrac{1}{2}x - 5$ will have slopes other than -2 and $\dfrac{1}{2}$. The slopes of the given lines can be tabulated as shown.

Line	Slope
l	$\dfrac{-2}{1} = -2$
n	$\dfrac{-2}{4} = -\dfrac{1}{2}$
p	$\dfrac{2}{1} = 2$
q	$\dfrac{3}{6} = \dfrac{1}{2}$
r	$\dfrac{1}{3}$

Therefore, the lines n, p, and r intersect but not perpendicular to $y = \dfrac{1}{2}x - 5$.

ANSWER:

n, p, or r

Determine whether the lines are *parallel*, *perpendicular*, or *neither*.

46. $y = 2x + 4, y = 2x - 10$

SOLUTION:

The two lines have the same slope, 2. So, they are parallel.

ANSWER:

parallel

47. $y = -\dfrac{1}{2}x - 12, y = 2x + 7$

SOLUTION:

The product of the slopes of the two lines, $\left(-\dfrac{1}{2}\right)2 = -1$. So, the lines are perpendicular.

ANSWER:

perpendicular

48. $y - 4 = 3(x + 5), y + 3 = -\dfrac{1}{3}(x + 1)$

    SOLUTION:

    The equations of the lines can also be written as

    $y = 3x + 19$ and $y = -\dfrac{1}{3}x - \dfrac{10}{3}$.

    The product of the slopes of the two lines, $(3)\left(-\dfrac{1}{3}\right) = -1.$ So, the lines are perpendicular.

    ANSWER:

    perpendicular

49. $y - 3 = 6(x + 2), y + 3 = -\dfrac{1}{3}(x - 4)$

    SOLUTION:

    The equations of the lines can also be written as

    $y = 6x + 15$ and $y = -\dfrac{1}{3}x - \dfrac{5}{3}.$ The slope of the first line is 6 and that of the second line is $-\dfrac{1}{3}.$

    The two lines neither have equal slopes nor is their product –1. Therefore, the lines are neither parallel nor perpendicular.

    ANSWER:

    neither

50. Write an equation in slope-intercept form for a line containing (4, 2) that is parallel to the line $y - 2 = 3(x + 7)$.

    SOLUTION:

    Write   in slope-intercept form.

    $$y - 2 = 3(x + 7)$$

    $y - 2 = 3(x + 7)$ Original equation

    $y - 2 = 3x + 21$ Distributive Property

    $y - 2 + 2 = 3x + 21 - 2$ Subtract 2 to each side.

    $y = 3x + 19$ Simplify.

    The slope of the line is 3. So, the slope of the line parallel to the given line is also 3.

    Use the slope and the point to write the equation of the line in point-slope form.
    The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

    Here, $m = 3$ and $(x_1, y_1) = (4, 2)$.

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

    $y - 2 = 3(x - 4)$ Substitution.

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

    $y - 2 + 2 = 3x - 12 + 2$ Add2 to each side.

    $y = 3x - 10$ Simplify.

    ANSWER:

    $y = 3x - 10$

51. Write an equation for a line containing (–8, 12) that is perpendicular to the line containing the points (3, 2) and (–7, 2).

    SOLUTION:

    Use the slope formula to find the slope of the line containing the points (3, 2) and (–7, 2). Let $(x_1, y_1) = (3, 2)$ and $(x_2, y_2) = (-7, 2)$.

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

    $$= \frac{2 - 2}{-7 - 3}$$

    $$= \frac{0}{-10}$$

    $$= 0$$

    The slope of the line is zero, so it is a horizontal line. Therefore, a line perpendicular to it will be a vertical line. The x-coordinate of a point on the vertical line is –8. So, the equation of the line is $x = -8$.

    ANSWER:

    $x = -8$

52. Write an equation in slope-intercept form for a line containing (5, 3) that is parallel to the line $y + 11 = \frac{1}{2}(4x + 6)$.

SOLUTION:
Write $y + 11 = \frac{1}{2}(4x + 6)$ in slope intercept form.

$$y + 11 = \frac{1}{2}(4x + 6) \quad \text{Original equaiton}$$
$$y + 11 = 2x + 3 \quad \text{Distributive Property}$$
$$y + 11 - 11 = 2x + 3 - 11 \quad \text{Subtract 11 from each side.}$$
$$y = 2x - 8 \quad \text{Simplify.}$$

The slope of the line is 2. So, the slope of the line parallel to the given line is also 2.

Use the slope and the point to write the equation of the line in point-slope form.
The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Here, $m = 2$ and $(x_1, y_1) = (5, 3)$.
So, the equation of the line is

$$y - y_1 = m(x - x_1) \quad \text{Point-Slope form}$$
$$y - 3 = 2(x - 5) \quad \text{Substitution.}$$
$$y - 3 = 2x - 10 \quad \text{Simplify.}$$
$$y - 3 + 3 = 2x - 10 + 3 \quad \text{Add 3 to each side.}$$
$$y = 2x - 7 \quad \text{Simplify.}$$

ANSWER:
$y = 2x - 7$

53. **POTTERY** A community arts center offers pottery classes. A $40 enrollment fee covers supplies and materials, including one bag of clay. Extra bags of clay cost $15 each. Write an equation to represent the cost of the class and x bags of clay.

SOLUTION:
Since one bag of clay is included in the enrollment fee the number of bags of clay needed is x - 1. The total cost is the sum of 40 and the cost of $(x - 1)$ bags of clay at the rate $15 per bag. So, the cost C is $C = 15(x - 1) + 40$ or $C = 15x + 25$.

ANSWER:
$C = 15(x - 1) + 40$ or $C = 15x + 25$

54. **MULTIPLE REPRESENTATIONS** In Algebra 1, you learned that the solution of a system of two linear equations is an ordered pair that is a solution of both equations. Consider lines $q, r, s,$ and t with the equations given.

line $q: y = 3x + 2$ line $r: y = 0.5x - 3$ line $s: 2y = x - 6$ line $t: y = 3x - 3$

a. Tabular Make a table of values for each equation for $x = -3, -2, -1, 0, 1, 2,$ and 3. Which pairs of lines appear to represent a system of equations with one solution? no solution? infinitely many solutions? Use your tables to explain

your reasoning.

b. Graphical Graph the equations on the same coordinate plane. Describe the geometric relationship between each pair of lines, including points of intersection.

c. Analytical How could you have determined your answers to part a using only the equations of the lines?

d. Verbal Explain how to determine whether a given system of two linear equations has one solution, no solution, or infinitely many solutions using a table, a graph, or the equations of the lines.

SOLUTION:

a. Make a different table of values for each equation.

line q $y = 3x + 2$		line r $y = 0.5x - 3$	
x	y	x	y
-3	-7	-3	-4.5
-2	-4	-2	-4
-1	-1	-1	-3.5
0	2	0	-3
1	5	1	-2.5
2	8	2	-2
3	11	3	-1.5

line s $2y = x - 6$		line t $y = 3x - 3$	
x	y	x	y
-3	-4.5	-3	-12
-2	-4	-2	-9
-1	-3.5	-1	-6
0	-3	0	-3
1	-2.5	1	0
2	-2	2	3
3	-1.5	3	6

Sample answer: The system of equations represented by lines q and r and by lines q and s each appear to have one solution, since
each pairing of tables has the ordered pair $(-2, -4)$ in common.

The system of equations represented by lines r and t and by lines s and t each appear to have one solution, since each pairing of tables has the ordered pair $(0, -3)$ in common.

The system of equations represented by lines q and t appears to have no solution, since the y-values of the ordered pairs with the same x-values will always differ by 5. The system of equations represented by lines r and s appears to have infinitely many solutions since the pair of tables has all ordered pairs in common.

b. Use the table of values to plot the points and graph.

Sample answer: Lines *q* and *t* are parallel. Lines *r* and *s* coincide. Lines q and r intersect at point (–2, –4). Lines *r* and *t* intersect at point (0, –3).

c. Sample answer: Compare the slopes of the lines and their y-intercepts. Line *q* has slope 3 and *y*-intercept 2, line *r* has slope 0.5 and *y*-intercept –3, line *s* has slope 0.5 and *y*-intercept –3, and line *t* has slope 3 and *y*-intercept –3. Since lines *q* and *r* have different slopes and lines *r* and *t* have different slopes, each pair of lines intersect, and therefore each related system of equations has one solution. Since lines *q* and *t* have the same slope but different *y*-intercepts, the lines are parallel, and therefore the related system of equations has no solution. Since lines *r* and *s* have the same slope and the same *y*-intercept, the lines coincide, and therefore the related system of equations has infinitely many solutions.

d. Sample answer: A system of equations that has one solution will have only one ordered pair that is common to each table of values, a graph of intersecting lines, and equations that have different slopes.

A system of equations that has no solution will have not have any ordered pairs common to each table of values, a graph of parallel lines, and equations that have the same slope, but different *y*-intercepts.

A system of equations that has infinitely many solutions will have identical tables of values, a graph of coinciding lines, and equations that have the same slope and the same *y*-intercept.
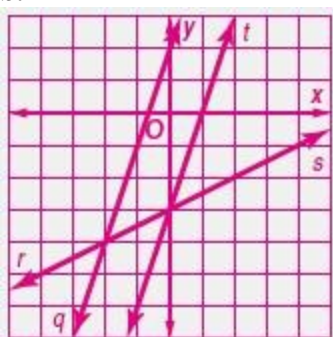
ANSWER:
a.

line q $y = 3x + 2$	
x	y
−3	−7
−2	−4
−1	−1
0	2
1	5
2	8
3	11

line r $y = 0.5x − 3$	
x	y
−3	−4.5
−2	−4
−1	−3.5
0	−3
1	−2.5
2	−2
3	−1.5

line s $2y = x − 6$	
x	y
−3	−4.5
−2	−4
−1	−3.5
0	−3
1	−2.5
2	−2
3	−1.5

line t $y = 3x − 3$	
x	y
−3	−12
−2	−9
−1	−6
0	−3
1	0
2	3
3	6

Sample answer: The system of equations represented by lines q and r and by lines q and s each appear to have one solution, since
each pairing of tables has the ordered pair (−2, −4) in common. The system of equations represented by lines r and t and by lines s and t each appear to have one solution, since each pairing of tables has the ordered pair (0, −3) in common. The system of equations represented by lines q and t appears to have no solution, since the y-values of the ordered pairs with the same x-values will always differ by 5. The system of equations represented by lines r and s appears to have infinitely many solutions since the pair of tables has all ordered pairs in common.

b.

Sample answer: Lines q and t are parallel. Lines r and s coincide. Lines q and r intersect at point (−2, −4). Lines r and t intersect at point (0, −3).

c. Sample answer: Compare the slopes of the lines and their y-intercepts. Line q has slope 3 and y-intercept 2, line r has slope 0.5 and y-intercept −3, line s has slope 0.5 and y-intercept −3, and line t has slope 3 and y-intercept −3. Since lines q and r have different slopes and lines r and t have different slopes, each pair of lines intersect, and therefore each related system of equations has one solution. Since lines q and t have the same slope but different y-intercepts, the lines are parallel, and therefore the related system of equations has no solution. Since lines r and s

have the same slope and the same y-intercept, the lines coincide, and therefore the related system of equations has infinitely many solutions.

d. Sample answer: A system of equations that has one solution will have only one ordered pair that is common to each table of

values, a graph of intersecting lines, and equations that have different slopes. A system of equations that has no solution will have not have any ordered pairs common to each table of values, a graph of parallel lines, and equations that have the same slope, but different y-intercepts. A system of equations that has infinitely many solutions will have identical tables of values, a graph of coinciding lines, and equations that have the same slope and the same y-intercept.

55. **CHALLENGE** Find the value of n so that the line perpendicular to the line with the equation $-2y + 4 = 6x + 8$ passes through the points at $(n, -4)$ and $(2, -8)$.

SOLUTION:

Write $-2y + 4 = 6x + 8$ in slope-intercept form.

$$-2y + 4 = 6x + 8 \quad \text{Original equation}$$
$$-2y + 4 - 4 = 6x + 8 - 4 \quad \text{Subtract 4 from each side.}$$
$$-2y = 6x + 4 \quad \text{Simplify.}$$
$$\frac{-2y}{-2} = \frac{6x + 4}{-2} \quad \text{Divide each side by } -2.$$
$$y = -3x - 2 \quad \text{Simplify.}$$

So, the slope of the line is –3. Use the slope formula to find the slope of the line containing the points $(n, -4)$ and $(2, -8)$. Let $(x_1, y_1) = (n, -4)$ and $(x_2, y_2) = (2, -8)$.

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

Since the two lines are perpendicular, the product of the their slopes is –1.

$$-3\left(-\frac{4}{2-n}\right) = -1 \quad \text{Product of Slopes}$$
$$\frac{12}{2-n} = -1 \quad \text{Simplify.}$$
$$12 = -1(2-n) \quad \text{Cross Multiply.}$$
$$12 = -2 + n \quad \text{Distributive Property.}$$
$$12 + 2 = -2 + 2 + n \quad \text{Add 2 to each side.}$$
$$14 = n \quad \text{Simplify.}$$

ANSWER:

14

56. **REASONING** Determine whether the points at (–2, 2), (2, 5), and (6, 8) are collinear. Justify your answer.

SOLUTION:

Find the slope of the line joining the points (–2, 2) and (2, 5). Let $(x_1, y_1) = (-2, 2)$ and $(x_2, y_2) = (2, 5)$.

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

Find the slope of the line joining the points (2, 5) and (6, 8). Let $(x_1, y_1) = (2, 5)$ and $(x_2, y_2) = (6, 8)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{8 - 5}{6 - 2}$$
$$= \frac{3}{4}$$

Since these lines have the same slope and have a point in common their equations would be the same. Therefore, the points are all on the same line and all the points are collinear.

ANSWER:

Yes; the slope of the line through the points (–2, 2) and (2, 5) is $\frac{3}{4}$. The slope of the line through the points (2, 5) and (6, 8) is $\frac{3}{4}$. Since these lines have the same slope and have a point in common their equations would be the same. Therefore, the points are all on the same line and all the points are collinear.

57. **OPEN ENDED** Write equations for two different pairs of perpendicular lines that intersect at the point at $(-3, -7)$.

    SOLUTION:

    Two perpendicular lines will have a product of their slopes equal to -1. Let Slope of one line be 2. Then the slope of the other line will be $-\dfrac{1}{2}$. Use the point $(-3, -7)$ to find the y-intercept of each line. Then solve for b_1 and b_2.

    $$-7 = 2(-3) + b_1 \quad \text{First Equation}$$
    $$-7 = -6 + b_1 \quad \text{Simplify.}$$
    $$-7 + 6 = -6 + 6 + b_1 \quad \text{Add 6 to each side.}$$
    $$-1 = +b_1 \quad \text{Simplify.}$$

    $$-7 = -\tfrac{1}{2}(-3) + b_2 \quad \text{Equation 2.}$$
    $$-7 = \tfrac{3}{2} + b_2 \quad \text{Simplify.}$$
    $$-7 - \tfrac{3}{2} = \tfrac{3}{2} - \tfrac{3}{2} + b_2 \quad \text{Subtract } \tfrac{3}{2} \text{ from each side.}$$
    $$-\tfrac{17}{2} = b_2 \quad \text{Simplify.}$$

    Therefore, the equations of the lines are
    $y = 2x - 1$ and $y = -\dfrac{1}{2}x - \dfrac{17}{2}$.

    ANSWER:

    Sample answer: $y = 2x - 1,\ y = -\dfrac{1}{2}x - \dfrac{17}{2}$

58. **CCSS CRITIQUE** Mark and Josefina wrote an equation of a line with slope -5 that passes through the point $(-2, 4)$. Is either of them correct? Explain your reasoning.

Mark	Josefina
$y - 4 = -5(x - (-2))$	$y - 4 = -5(x - (-2))$
$y - 4 = -5(x + 2)$	$y - 4 = -5(x + 2)$
$y - 4 = -5x - 10$	
$y = -5x - 6$	

    SOLUTION:

    Mark wrote the equation in slope-intercept form and Josefina wrote the equation in point-slope form. So, both are correct.

    ANSWER:

    Both; Mark wrote the equation in slope-intercept form and Josefina wrote the equation in point-slope form.

59. **WRITING IN MATH** When is it easier to use the point-slope form to write an equation of a line and when is it easier to use the slope-intercept form?
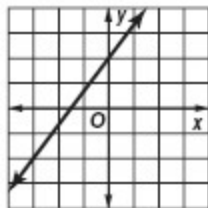
    SOLUTION:
    Sample answer: When given the slope and y-intercept, the slope-intercept form is easier to use. When given two points, the point-slope form is easier to use. When given the slope and a point, the point-slope form is easier to use.
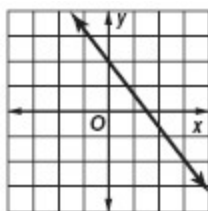
    ANSWER:
    Sample answer: When given the slope and y-intercept, the slope-intercept form is easier to use. When given two points, the point-slope form is easier to use. When given the slope and a point, the point-slope form is easier to use.

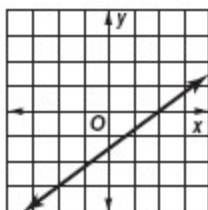60. Which graph best represents a line passing through the point $(-2, -3)$?
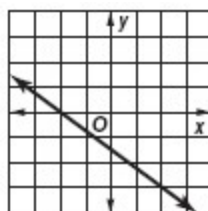   **A**

    B

    C

    D

    SOLUTION:
    The graph in option C passes through $(-2, -3)$. The correct choice is C.

    ANSWER:
    C

61. Which equation describes the line that passes through the point at (–2, 1) and is perpendicular to the line

$y = \dfrac{1}{3}x + 5$?

F $y = 3x + 7$

G $y = \dfrac{1}{3}x + 7$

H $y = -3x - 5$

J $y = -\dfrac{1}{3}x - 5$

SOLUTION:

The slope of the line $y = \dfrac{1}{3}x + 5$ is $\dfrac{1}{3}$. So, the slope of the line perpendicular to the given line is –3.

Use the slope and the point to write the equation of the line in point-slope form.

The point-slope form of a line is $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Here, $m = -3$ and $(x_1, y_1) = (-2, 1)$.

$$\begin{aligned}
y - y_1 &= m(x - x_1) &&\text{Point-Slope form} \\
y - 1 &= -3(x - (-2)) &&\text{Substitution.} \\
y - 1 &= -3x - 6 &&\text{Simplify.} \\
y - 1 + 1 &= -3x - 6 + 1 &&\text{Add 1 to each side.} \\
y &= -3x - 5 &&\text{Simplify.}
\end{aligned}$$

Therefore, the correct choice is H.

ANSWER:

H

62. **GRIDDED RESPONSE** At Jefferson College, 80% of students have cell phones. Of the students who have cell phones, 70% have computers. What percent of the students at Jefferson College have both a cell phone and a computer?

SOLUTION:

Seventy percent of the eighty percent of the students have both a cell phone and a computer.

$$\dfrac{70}{100}\left(\dfrac{80}{100}\right) = \dfrac{56}{100}$$

Therefore, 56% of the students have both a cell phone and a computer.

ANSWER:

56

63. **SAT/ACT** Which expression is equivalent to $4(x-6) - \frac{1}{2}(x^2 + 8)$?

    A $4x^2 + 4x - 28$

    B $-\frac{1}{2}x^2 + 4x - 28$

    C $-\frac{1}{2}x^2 + 6x - 24$

    D $3x - 20$

    SOLUTION:

    $$4(x-6) - \frac{1}{2}\left(x^2 + 8\right) = 4x - 24 - \frac{1}{2}x^2 - 4$$
    $$= -\frac{1}{2}x^2 + 4x - 28$$

    Therefore, the correct choice is B.

    ANSWER:

    B

Determine the slope of the line that contains the given points.

64. $J(4, 3)$, $K(5, -2)$

    SOLUTION:

    Substitute the coordinates of the points in the slope formula. Let $(x_1, y_1) = (4, 3)$ and $(x_2, y_2) = (5, -2)$.

    $$m = \frac{y_2 - y_1}{x_2 - x_1}$$
    $$= \frac{-2 - 3}{5 - 4}$$
    $$= \frac{-5}{1}$$
    $$= -5$$

    Therefore, the slope of the line is -5.

    ANSWER:

    -5

65. $X(0, 2)$, $Y(-3, -4)$

SOLUTION:

Substitute the coordinates of the points in the slope formula. Let $(x_1, y_1) = (0, 2)$ and $(x_2, y_2) = (-3, -4)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{-4 - 2}{-3 - 0}$$
$$= \frac{-6}{-3}$$
$$= 2$$

Therefore, the slope of the line is 2.

ANSWER:

2

66. $A(2, 5)$, $B(5, 1)$

SOLUTION:

Substitute the coordinates of the points in the slope formula. Let $(x_1, y_1) = (2, 5)$ and $(x_2, y_2) = (5, 1)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{1 - 5}{5 - 2}$$
$$= \frac{-4}{3}$$
$$\approx -1.3$$
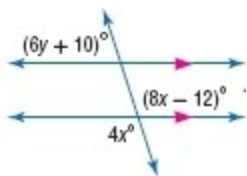
Therefore, the slope of the line is about -1.3.

ANSWER:

$-\dfrac{4}{3} \approx -1.3$

Find x and y in each figure.

67.

SOLUTION:

The angles with the measures $4x°$ and $(8x - 12)°$ are vertical angles. So, they are equal.

$$(4x)° \cong (8x - 12)° \quad \text{Vertical Angles Theorem}$$
$$4x = 8x - 12 \quad \text{Def. of congruent angles}$$
$$4x - 8x = 8x - 8x - 12 \quad \text{Subtract } 8x \text{ from each side.}$$
$$-4x = -12 \quad \text{Simplify.}$$
$$\frac{-4x}{-4} = \frac{-12}{-4} \quad \text{Divide each side by } -4$$
$$x = 3 \quad \text{Simplify.}$$

The vertical angle of the angle that measures $(6y + 10)°$ and the angle that measures $(8x - 12)°$ are supplementary.

$$(8x - 12)° + (6y + 10)° \cong 180 \quad \text{Def. of Supplementary Angles}$$
$$8x - 12 + 6y + 10 = 180 \quad \text{Def. of congruent angles}$$
$$8(3) - 12 + 6y + 10 = 180 \quad \text{Substitution.}$$
$$22 + 6y = 180 \quad \text{Simplify.}$$
$$22 - 22 + 6y = 180 - 22 \quad -22 \text{ from each side.}$$
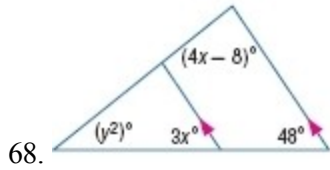$$6y = 158 \quad \text{Simplify.}$$
$$\frac{6y}{6} = \frac{158}{6} \quad \div \text{ each side by } 6$$
$$y \approx 26.33 \quad \text{Simplify.}$$

ANSWER:

$x = 3, y \approx 26.33$

68.

SOLUTION:

Use the Corresponding Angles and Triangle Sum Theorems to find x and y.

$(3x)° \cong (48)°$ Corresponding Angles Theorem

$3x = 48$ Definition of congruent angles.

$\dfrac{3x}{3} = \dfrac{48}{3}$ Divide each side by 3.

$x = 16$ Simplify.

Then

$4x - 8 = 4(16) - 8$ Substitution.

$= 64 - 8$ Simplify.

$= 56$ Simplify.

Use the Triangle Sum Theorem.

$48° + y^2° + 56 \cong 180°$ Triangle Sum Theorem

$48 + y^2 + 56 = 180$ Def. of congruent angles.

$y^2 + 104 - 104 = 180 - 104$ Subtract 104 to each side.

$y^2 = 76$ Simplify.

$\sqrt{y^2} = \sqrt{76}$ Square root of each side.

$y \approx 8.7$ Simplify.

ANSWER:

$x = 16, y = 8.7$

69. **DRIVING** Lacy's home is located at the midpoint between Newman's Gas Station and Gas-O-Rama. Newman's Gas Station is a quarter mile away from Lacy's home. How far away is Gas-O-Rama from Lacy's home? How far apart are the two gas stations?
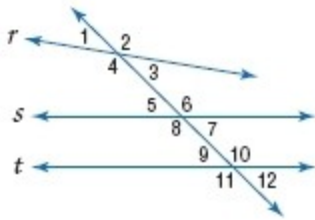
SOLUTION:

Since Lacy's home is located at the midpoint, Gas-O-Rama is also a quarter mile from Lacy's home. The two gas stations are half a mile apart.

ANSWER:

Gas-O-Rama is also a quarter mile from Lacy's home; the two gas stations are half a mile apart.

3-4 Equations of Lines

Determine the relationship between each pair of angles.

70. ∠1 and ∠12

    SOLUTION:
    alternate exterior

    ANSWER:
    alternate exterior

71. ∠7 and ∠10

    SOLUTION:
    consecutive interior

    ANSWER:
    consecutive interior

72. ∠4 and ∠8

    SOLUTION:
    corresponding

    ANSWER:
    corresponding

73. ∠2 and ∠11

    SOLUTION:
    alternate exterior

    ANSWER:
    alternate exterior