4-1 Graphing Equations in Slope-Intercept Form

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

1. slope: 2, y-intercept: 4

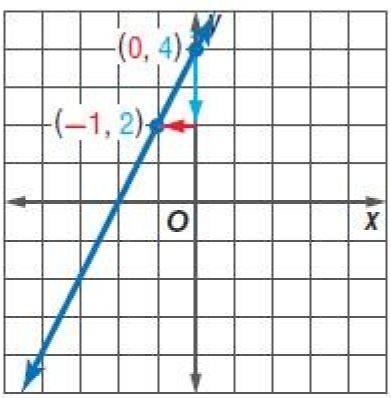
SOLUTION:

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

$y = mx + b$ Slope-intercept form

$y = 2x + 4$ Replace m with 2 and b with 4.

Plot the y-intercept (0, 4). The slope is $\frac{\text{rise}}{\text{run}} = \frac{2}{1}$. From (0, 4), move down 2 units and left 1 unit.(Note that we can move up and to the right, or down and to the left. Normally we would move up and to the right, but moving down and to the left keeps the point near the origin.) Plot the point. Draw a line through the two points.



2. slope: −5, y-intercept: 3

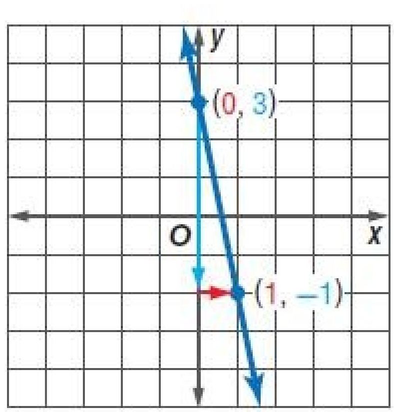
SOLUTION:

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

$y = mx + b$ Slope-intercept form

$y = -5x + 3$ Replace m with -5 and b with 3.

Plot the y-intercept (0, 3). The slope is $\frac{\text{rise}}{\text{run}} = \frac{-5}{1}$. From (0, 3), move down –5 units and right 1 unit. Plot the point. Draw a line through the two points.



3. slope: $\frac{3}{4}$, y-intercept: −1

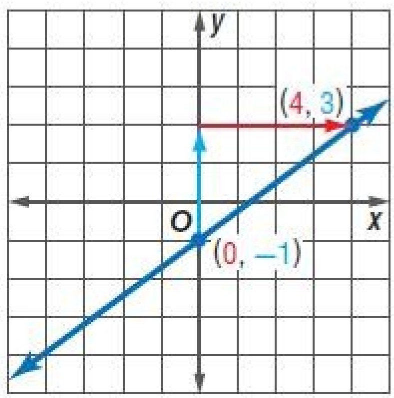
SOLUTION:

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

$y = mx + b$ Slope-intercept form

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

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



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

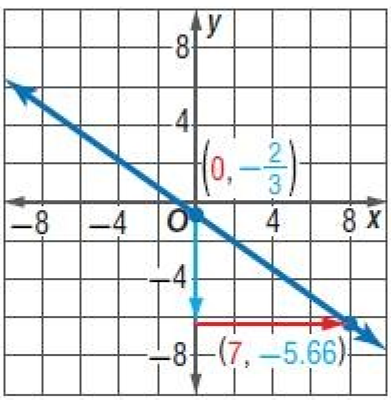
SOLUTION:

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

$y = mx + b$ Slope-intercept form

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

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



Graph each equation.

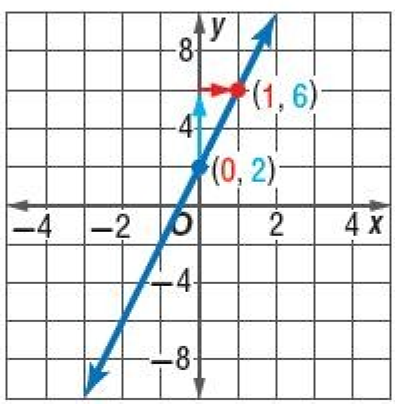
5. $-4x + y = 2$

SOLUTION:

Rewrite the equation in slope-intercept form.

$$\begin{aligned} -4x + y &= 2 && \text{Original equation} \\ -4x + 4x + y &= 2 + 4x && \text{Add } 4x \text{ to each side.} \\ y &= 4x + 2 && \text{Simplify.} \end{aligned}$$

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



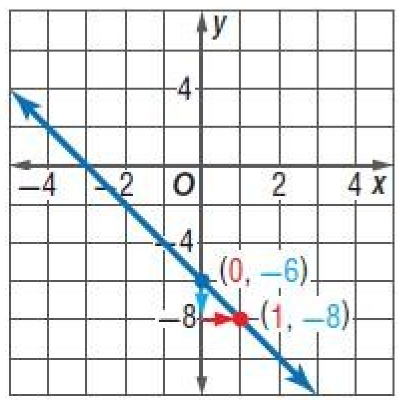
6. $2x + y = -6$

SOLUTION:

Rewrite the equation in slope-intercept form.

$$\begin{aligned} 2x + y &= -6 && \text{Original equation} \\ 2x - 2x + y &= -6 - 2x && \text{Subtract } 2x \text{ from each side.} \\ y &= -2x - 6 && \text{Simplify.} \end{aligned}$$

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



4-1 Graphing Equations in Slope-Intercept Form

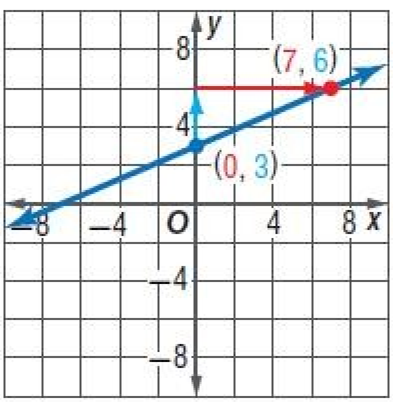
7. $-3x + 7y = 21$

SOLUTION:

Rewrite the equation in slope-intercept form.

$$\begin{aligned} -3x + 7y &= 21 && \text{Original equation} \\ -3x + 3x + 7y &= 21 + 3x && \text{Add } 3x \text{ to each side.} \\ 7y &= 3x + 21 && \text{Simplify.} \\ \frac{7y}{7} &= \frac{3x+21}{7} && \text{Divide each side by 7.} \\ y &= \frac{3}{7}x + 3 && \text{Simplify.} \end{aligned}$$

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



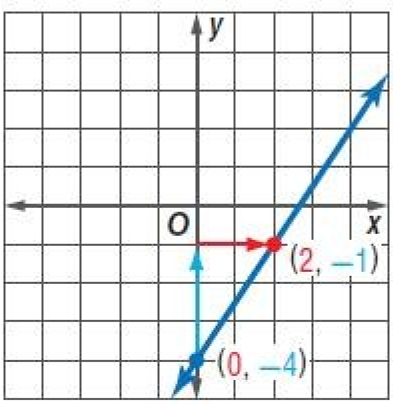
8. $6x - 4y = 16$

SOLUTION:

Rewrite the equation in slope-intercept form.

$$\begin{aligned} 6x - 4y &= 16 && \text{Original equation} \\ 6x - 6x - 4y &= 16 - 6x && \text{Subtract } 6x \text{ from each side.} \\ -4y &= -6x + 16 && \text{Simplify.} \\ \frac{-4y}{-4} &= \frac{-6x+16}{-4} && \text{Divide each side by } -4. \\ y &= \tfrac{3}{2}x - 4 && \text{Simplify.} \end{aligned}$$

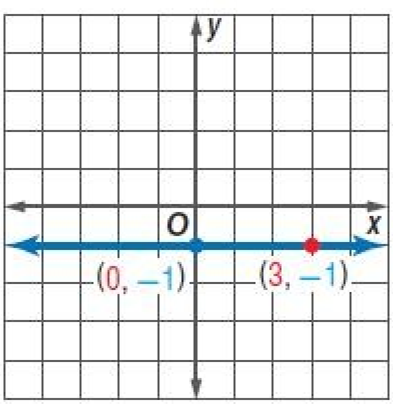
The slope is $\frac{3}{2}$, and the y-intercept is −4. Plot the y-intercept (0, −4). The slope is $\frac{\text{rise}}{\text{run}} = \frac{3}{2}$. From (0, −4), move up 3 units and right 2 units. Plot the point. Draw a line through the two points.



9. $y = -1$

SOLUTION:

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



10. $15y = 3$

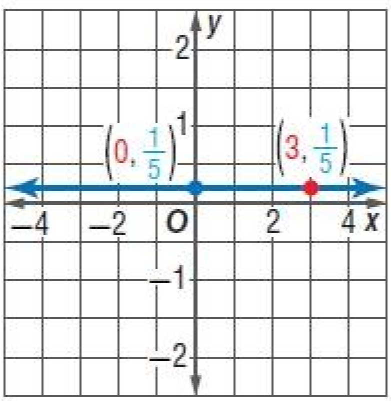
SOLUTION:

$15y = 3$ Original equation

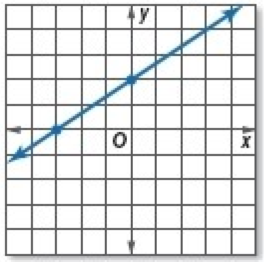
$\frac{15y}{15} = \frac{3}{15}$ Divide each side by 15.

$y = \frac{1}{5}$ Simplify.

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



Write an equation in slope-intercept form for each graph shown.

11. 

SOLUTION:

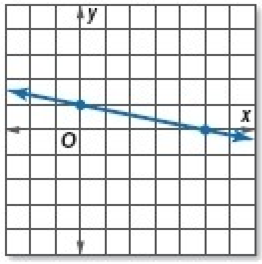
Use the two points (–3, 0) and (0, 2).
Find the slope of the line containing the given points.

$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{0-2}{-3-0} \\ &= \frac{-2}{-3} \\ &= \frac{2}{3} \end{aligned}$$

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

Write the equation in slope-intercept form.

$$\begin{aligned} y &= mx + b \\ y &= \frac{2}{3}x + 2 \end{aligned}$$

12. 

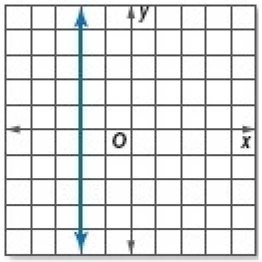
SOLUTION:
Use the two points (5, 0) and (0, 1).
Find the slope of the line containing the given points.

$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{0-1}{5-0} \\ &= -\frac{1}{5} \end{aligned}$$

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

Write the equation in slope-intercept form.

$$y = mx + b$$
$$y = -\tfrac{1}{5}x + 1$$

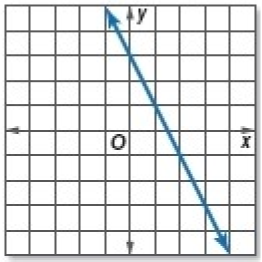
13. 

SOLUTION:

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

$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{0 - 2}{-2 - (-2)} \\ &= \frac{-2}{0} \end{aligned}$$

This means that the slope is undefined. Because the slope is undefined, it is not possible write and equation in slope intercept form.

14. 

SOLUTION:

Use the two points (2, –1) and (0, 3).
Find the slope of the line containing the given points.

$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{3-(-1)}{0-2} \\ &= \frac{4}{-2} \\ &= -2 \end{aligned}$$

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

Write the equation in slope-intercept form.

$$\begin{aligned} y &= mx + b \\ y &= -2x + 3 \end{aligned}$$

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

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

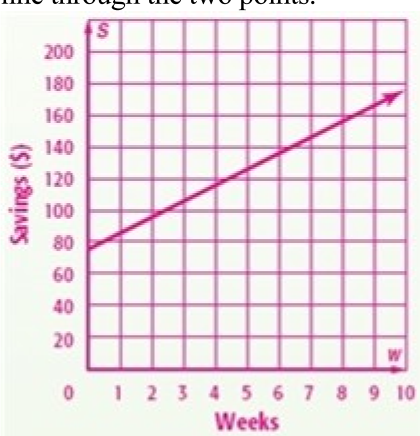
b. Graph the equation.

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

SOLUTION:

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

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



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

$$S = 10w + 75$$
$$S = 10(8) + 75$$
$$S = 80 + 75$$
$$S = 155$$

So, Rondell has saved \$155 after 8 weeks.

16. **CCSS REASONING** Ana is driving from her home in Miami, Florida, to her grandmother's house in New York City. On the first day, she will travel 240 miles to Orlando, Florida, to pick up her cousin. Then they will travel 350 miles each day.

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

b. Graph the equation.

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

SOLUTION:

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

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

c.

$m = 350d + 240$	Original equation
$1343 = 350d + 240$	Replace m with 1343.
$1343 - 240 = 350d + 240 - 240$	Subtract 240 from each side.
$1103 = 350d$	Simplify.
$\frac{1103}{350} = \frac{350d}{350}$	Divide each side by 350.
$3.15 \approx d$	Simplify.

So, it will take about 4 days.

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

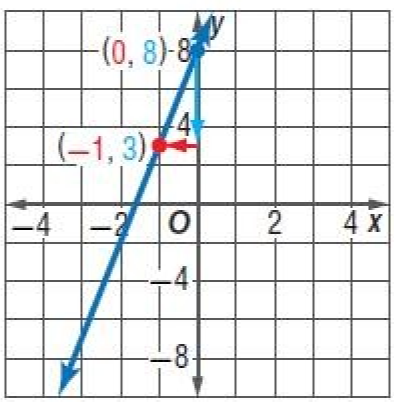
17. slope: 5, *y*-intercept: 8

SOLUTION:

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

$y = mx + b$ Slope-intercept form
$y = 5x + 8$ Replace with 5 and b with 8.

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



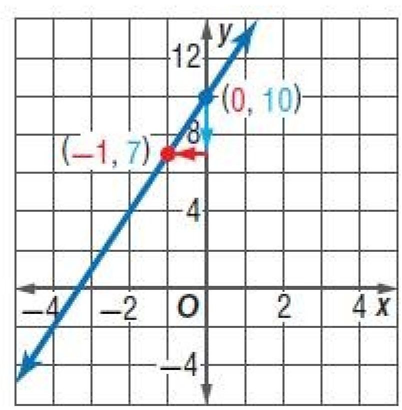
18. slope: 3, y-intercept: 10

SOLUTION:

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

$y = mx + b$ Slope-intercept form
$y = 3x + 10$ Replace m with 3 and b with 10.

Plot the y-intercept (0, 10). The slope is $\frac{\text{rise}}{\text{run}} = \frac{3}{1}$. From (0, 10), move up 3 units and right 1 unit. Plot the point. Draw a line through the two points.



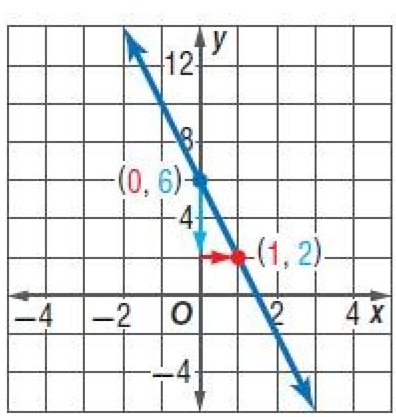
19. slope: −4, y-intercept: 6

SOLUTION:

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

$y = mx + b$ Slope-intercept form
$y = -4x + 6$ Replace m with -4 and b with 6.

Plot the y-intercept (0, 6). The slope is $\frac{\text{rise}}{\text{run}} = \frac{-4}{1}$. From (0, 6), move down 4 units and right 1 unit. Plot the point. Draw a line through the two points.



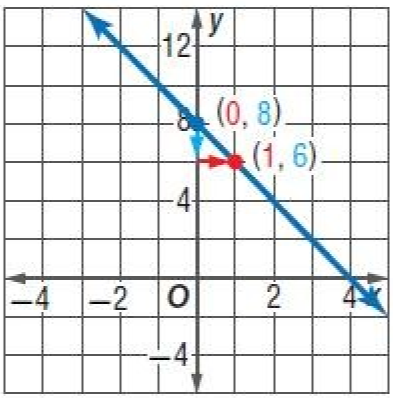
20. slope: −2, y-intercept: 8

SOLUTION:

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

$y = mx + b$ Slope-intercept form
$y = -2x + 8$ Replace m with −2 and b with 8.

Plot the y-intercept (0, 8). The slope is $\frac{\text{rise}}{\text{run}} = \frac{-2}{1}$. From (0, 8), move down 2 units and right 1 unit. Plot the point. Draw a line through the two points.



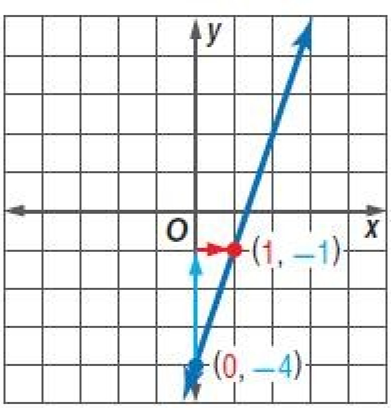
21. slope: 3, y-intercept: −4

SOLUTION:

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

$y = mx + b$ Slope-intercept form
$y = 3x - 4$ Replace m with 3 and b with −4.

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



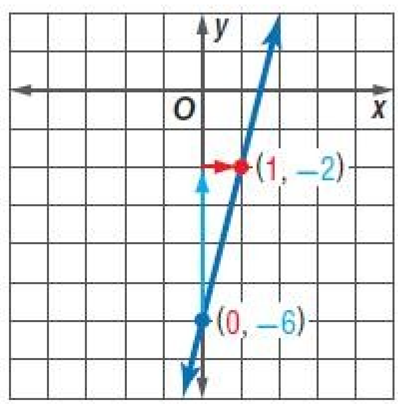
22. slope: 4, y-intercept: −6

SOLUTION:

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

$y = mx + b$ Slope-intercept form
$y = 4x - 6$ Replace m with 4 and b with −6.

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



Graph each equation.

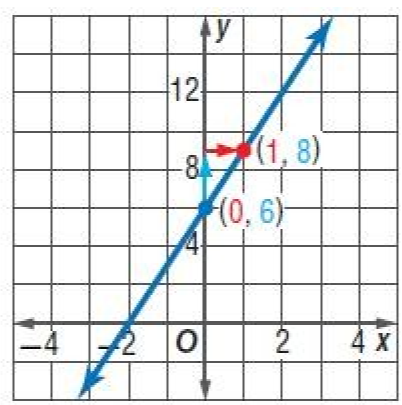
23. $-3x + y = 6$

SOLUTION:

Rewrite the equation in slope-intercept form.

$$\begin{aligned} -3x + y &= 6 && \text{Original equation} \\ -3x + 3x + y &= 6 + 3x && \text{Add } x \text{ to each side.} \\ y &= 3x + 6 && \text{Simplify.} \end{aligned}$$

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



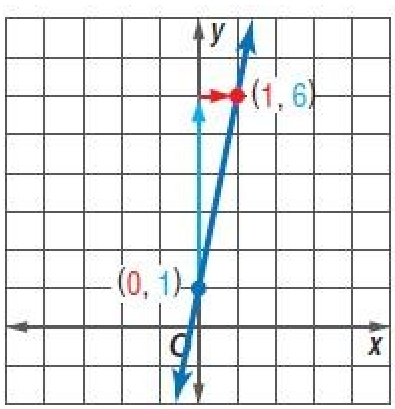
24. $-5x + y = 1$

SOLUTION:

Rewrite the equation in slope-intercept form.

$$\begin{aligned} -5x + y &= 1 && \text{Original equation} \\ -5x + 5x + y &= 1 + 5x && \text{Add } 5x \text{ to each side.} \\ y &= 5x + 1 && \text{Simplify.} \end{aligned}$$

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



4-1 Graphing Equations in Slope-Intercept Form

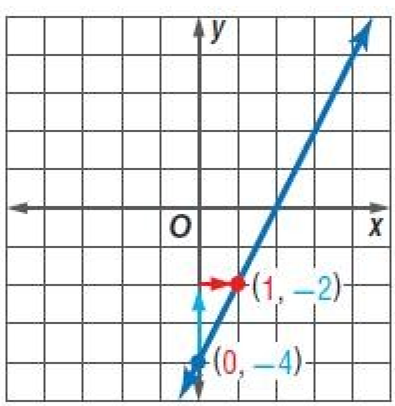
25. $-2x + y = -4$

SOLUTION:

Rewrite the equation in slope-intercept form.

$$\begin{aligned} -2x + y &= -4 && \text{Original equation} \\ -2x + 2x + y &= -4 + 2x && \text{Add } 2x \text{ to each side.} \\ y &= 2x - 4 && \text{Simplify.} \end{aligned}$$

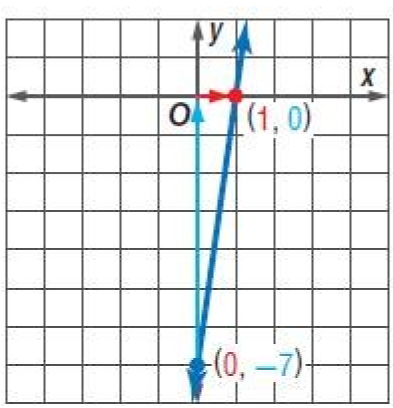
The slope is 2, and the y-intercept is −4. Plot the y-intercept (0, −4). The slope is $\frac{\text{rise}}{\text{run}} = \frac{2}{1}$. From (0, −4), move up 2 units and right 1 unit. Plot the point. Draw a line through the two points.



26. $y = 7x - 7$

SOLUTION:

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



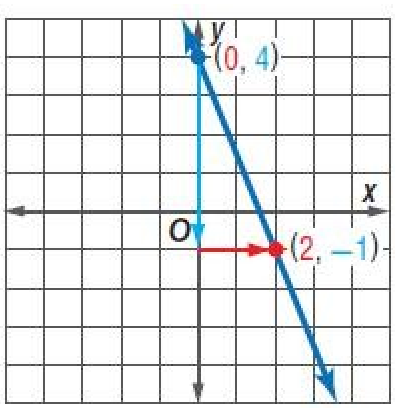
27. $5x + 2y = 8$

SOLUTION:

Rewrite the equation in slope-intercept form.

$$\begin{aligned} 5x + 2y &= 8 && \text{Original equation} \\ 5x - 5x + 2y &= 8 - 5x && \text{Subtract } 5x \text{ from each side.} \\ 2y &= -5x + 8 && \text{Simplify.} \\ \frac{2y}{2} &= \frac{-5x+8}{2} && \text{Divide each side by 2.} \\ y &= -\frac{5}{2}x + 4 && \text{Simplify.} \end{aligned}$$

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



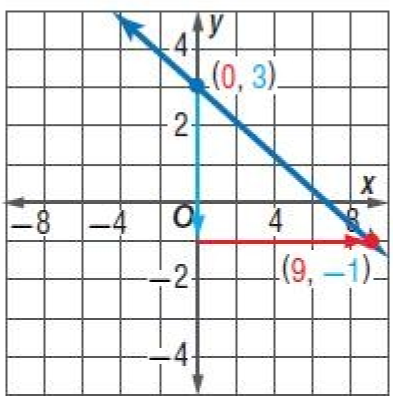
28. $4x + 9y = 27$

SOLUTION:

Rewrite the equation in slope-intercept form.

$$\begin{aligned} 4x + 9y &= 27 && \text{Original equation} \\ 4x - 4x + 9y &= 27 - 4x && \text{Subtract } 4x \text{ from each side.} \\ 9y &= -4x + 27 && \text{Simplify.} \\ \frac{9y}{9} &= \frac{-4x+27}{9} && \text{Divide each side by 9.} \\ y &= -\frac{4}{9}x + 3 && \text{Simplify.} \end{aligned}$$

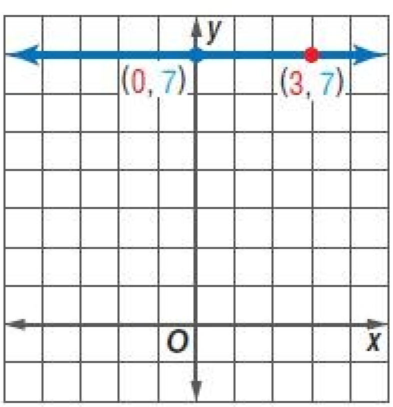
The slope is $-\frac{4}{9}$, and the y-intercept is 3. Plot the y-intercept (0, 3). The slope is $\frac{\text{rise}}{\text{run}} = -\frac{4}{9}$. From (0, 3), move down 4 units and right 9 units. Plot the point. Draw a line through the two points.



29. $y = 7$

SOLUTION:

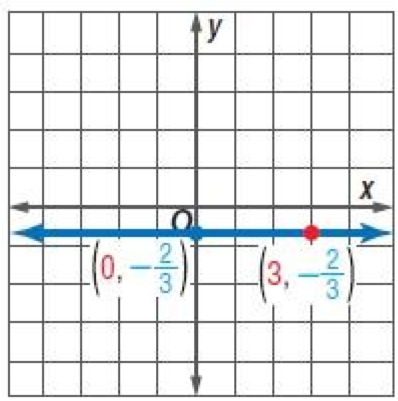
Plot the y-intercept (0, 7). The slope is 0. Draw a line through the points with y-coordinate 7.



30. $y = -\frac{2}{3}$

SOLUTION:

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

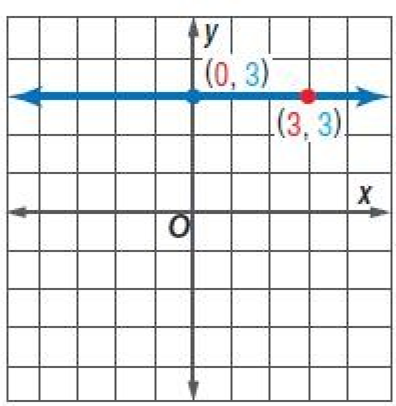


31. $21 = 7y$

SOLUTION:

$$21 = 7y$$
$$\frac{21}{7} = \frac{7y}{7}$$
$$3 = y$$

Plot the y-intercept (0, 3). The slope is 0. Draw a line through the points with y-coordinate 3.



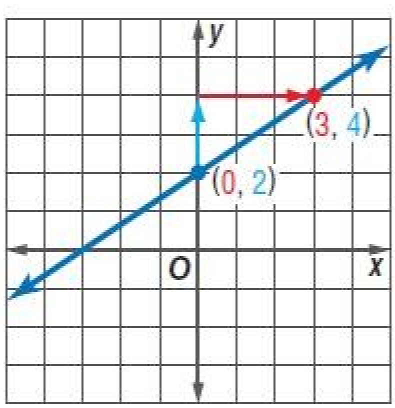
32. $3y - 6 = 2x$

SOLUTION:

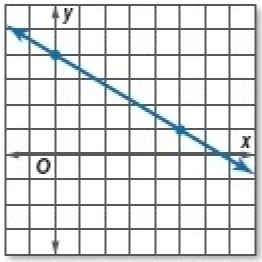
Rewrite the equation in slope-intercept form.

$$\begin{aligned} 3y - 6 &= 2x && \text{Original equation} \\ 3y - 6 + 6 &= 2x + 6 && \text{Add 6 to each side.} \\ 3y &= 2x + 6 && \text{Simplify.} \\ \frac{3y}{3} &= \frac{2x+6}{3} && \text{Divide each side by 3.} \\ y &= \frac{2}{3}x + 2 && \text{Simplify.} \end{aligned}$$

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



Write an equation in slope-intercept form for each graph shown.

33. 

SOLUTION:

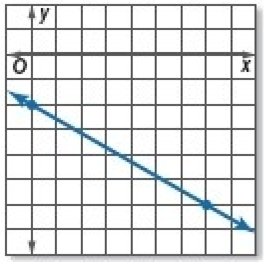
Use the two points (0, 4) and (5, 1).
Find the slope of the line containing the given points.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{4 - (1)}{0 - 5}$$
$$= -\frac{3}{5}$$

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

Write the equation in slope-intercept form.

$$y = mx + b$$
$$y = -\frac{3}{5}x + 4$$

34. 

SOLUTION:

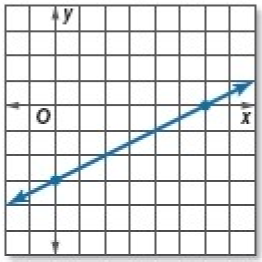
Use the two points (0, –2) and (7, –6).
Find the slope of the line containing the given points.

$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{-2-(-6)}{0-7} \\ &= -\frac{4}{7} \end{aligned}$$

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

Write the equation in slope-intercept form.

$$\begin{aligned} y &= mx + b \\ y &= -\frac{4}{7}x - 2 \end{aligned}$$

35. 

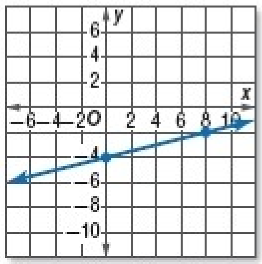
SOLUTION:

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

$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{-3 - 0}{0 - 6} \\ &= \frac{-3}{-6} \\ &= \frac{1}{2} \end{aligned}$$

The line crosses the y-axis at (0, –3), so the y-intercept is –3.
Write the equation in slope-intercept form.

$$\begin{aligned} y &= mx + b \\ y &= \frac{1}{2}x - 3 \end{aligned}$$

36. 

SOLUTION:

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

$$
\begin{aligned}
m &= \frac{y_2 - y_1}{x_2 - x_1} \\
&= \frac{-4-(-2)}{0-8} \\
&= \frac{-2}{-8} \\
&= \frac{1}{4}
\end{aligned}
$$

The line crosses the y-axis at (0, –4), so the y-intercept is –4.
Write the equation in slope-intercept form.

$$
\begin{aligned}
y &= mx + b \\
y &= \frac{1}{4}x - 4
\end{aligned}
$$

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

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

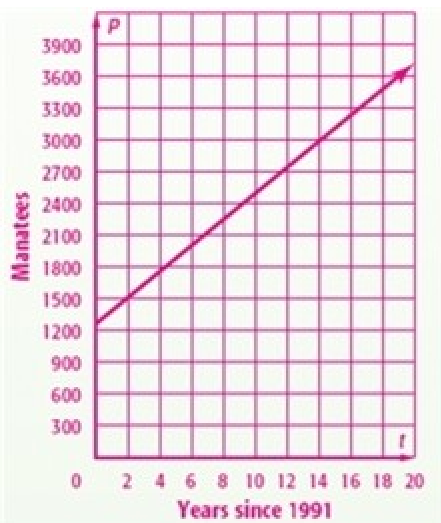
b. Graph this equation.

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

SOLUTION:

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

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



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

$$P = 1267 + 123t$$
$$P = 1267 + 123(15)$$
$$P = 1267 + 1845$$
$$P = 3112$$

So, the manatee population in 2006 was 3112.

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

38. slope: $\frac{1}{2}$, y-intercept: −3

SOLUTION:

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

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

39. slope: $\frac{2}{3}$, y-intercept: −5

SOLUTION:

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

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

40. slope: $-\frac{5}{6}$, y-intercept: 5

SOLUTION:

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

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

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

SOLUTION:

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

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

42. slope: 1, y-intercept: 4

SOLUTION:

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

$$y = mx + b$$
$$y = 1x + 4$$

43. slope: 0, y-intercept: 5

SOLUTION:

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

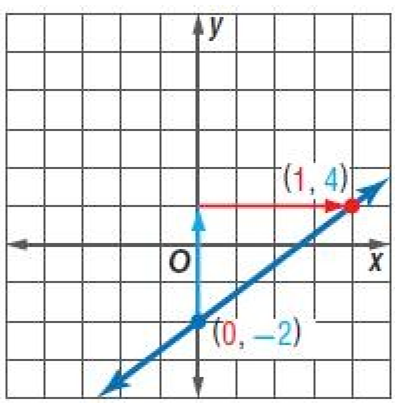
$$y = mx + b$$
$$y = 0x + 5$$
$$y = 5$$

Graph each equation.

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

SOLUTION:

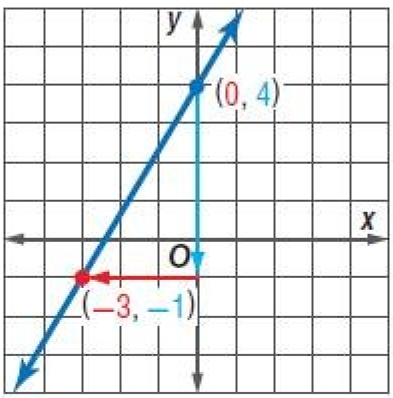
The slope is $\frac{3}{4}$, and the y-intercept is –2. Plot the y-intercept (0, –2). The slope is $\frac{\text{rise}}{\text{run}} = \frac{3}{4}$. From (0, –2), move up 3 units and right 4 units. Plot the point. Draw a line through the two points.



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

SOLUTION:

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



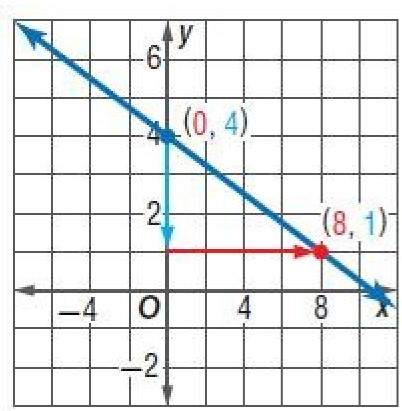
46. $3x + 8y = 32$

SOLUTION:

Rewrite the equation in slope-intercept form.

$$\begin{aligned} 3x + 8y &= 32 && \text{Original equation} \\ 3x - 3x + 8y &= 32 - 3x && \text{Subtract } 3x \text{ from each side.} \\ 8y &= -3x + 32 && \text{Simplify.} \\ \frac{8y}{8} &= \frac{-3x+32}{8} && \text{Divide each side by 8.} \\ y &= -\frac{3}{8}x + 4 && \text{Simplify.} \end{aligned}$$

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



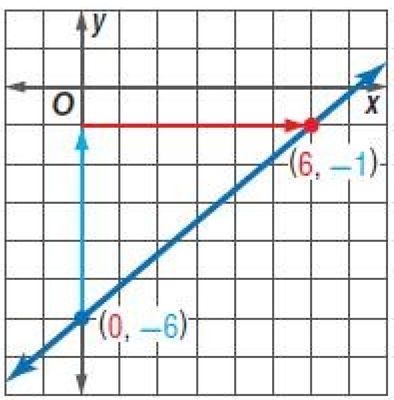
47. $5x - 6y = 36$

SOLUTION:

Rewrite the equation in slope-intercept form.

$$
\begin{aligned}
5x - 6y &= 36 && \text{Original equation}\\
5x - 5x - 6y &= 36 - 5x && \text{Subtract } 5x \text{ from each side.}\\
-6y &= -5x + 36 && \text{Simplify.}\\
\frac{-6y}{-6} &= \frac{-5x+36}{-6} && \text{Divide each side by } -6.\\
y &= \frac{5}{6}x - 6 && \text{Simplify.}
\end{aligned}
$$

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



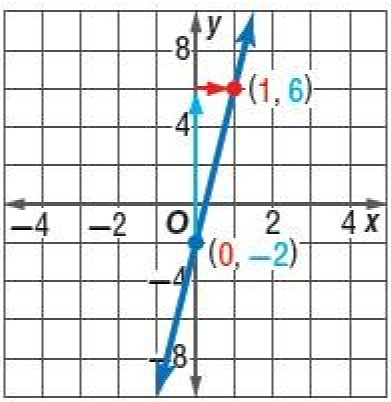
48. $-4x + \frac{1}{2}y = -1$

SOLUTION:

Rewrite the equation in slope-intercept form.

$$
\begin{aligned}
-4x + \tfrac{1}{2}y &= -1 && \text{Original equation} \\
-4x + 4x + \tfrac{1}{2}y &= -1 + 4x && \text{Add } 4x \text{ to each side.} \\
\tfrac{1}{2}y &= 4x - 1 && \text{Simplify.} \\
2\left(\tfrac{1}{2}y\right) &= 2(4x - 1) && \text{Multiply each side by 2.} \\
y &= 8x - 2 && \text{Simplify.}
\end{aligned}
$$

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



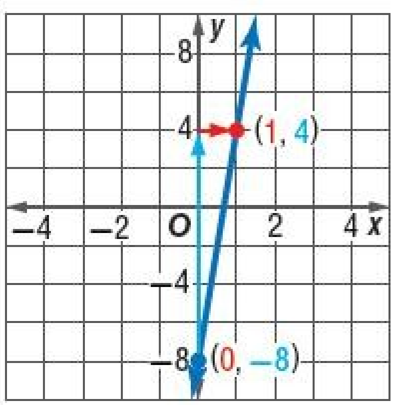
49. $3x - \frac{1}{4}y = 2$

SOLUTION:

Rewrite the equation in slope-intercept form.

$$
\begin{aligned}
3x - \tfrac{1}{4}y &= 2 && \text{Original equation} \\
3x - 3x - \tfrac{1}{4}y &= 2 - 3x && \text{Subtract } 3x \text{ from each side.} \\
-\tfrac{1}{4}y &= -3x + 2 && \text{Simplify.} \\
-4\left(-\tfrac{1}{4}y\right) &= -4(-3x + 2) && \text{Multiply each side by } -4. \\
y &= 12x - 8 && \text{Simplify.}
\end{aligned}
$$

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



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

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

b. Graph the equation.

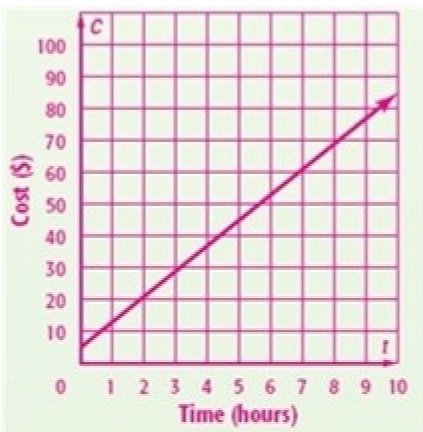
c. What would the cost be for two helmets and 2 bicycles for 8 hours?

SOLUTION:

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

.

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



c.

$$C = 8t + 5$$
$$C = 8(8) + 5$$
$$C = 64 + 5$$
$$C = 69$$

The cost for one bike and one helmet for 8 hours is \$69. So, the cost for two bikes and two helmets for 8 hours is \$138.

51. **CCSS REASONING** For Illinois residents, the average tuition at Chicago State University is \$157 per credit hour. Fees cost \$218 per year.

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

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

SOLUTION:

a. The independent variable in this case is c, the number of credit hours, and the dependent variable is the tuition costs T. Tuition costs increase by \$157 for each credit hour, and there is a flat fee of \$218, so the slope is \$157 and the T-intercept is \$218.

$T = 157c + 218$

b. For a student taking 32 credit hours, the cost of tuition is $T = 157(32) + 218 = \$5242$

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

52. slope: −1, y-intercept: 0

SOLUTION:

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

$$y = mx + b$$
$$y = -1x + 0$$
$$y = -x$$

53. slope: 0.5, y-intercept: 7.5

SOLUTION:

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

$$y = mx + b$$
$$y = 0.5x + 7.5$$

54. slope: 0, y-intercept: 7

SOLUTION:

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

$$y = mx + b$$
$$y = 0x + 7$$
$$y = 7$$

55. slope: −1.5, y-intercept: −0.25

SOLUTION:

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

$$y = mx + b$$
$$y = -1.5x + (-0.25)$$
$$y = -1.5x - 0.25$$

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

SOLUTION:

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

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

SOLUTION:

$$y = mx + b$$
$$0 = 3(0) + b$$
$$0 = 0 + b$$
$$0 = b$$

So, the equation of the line would be $y = 3x$.

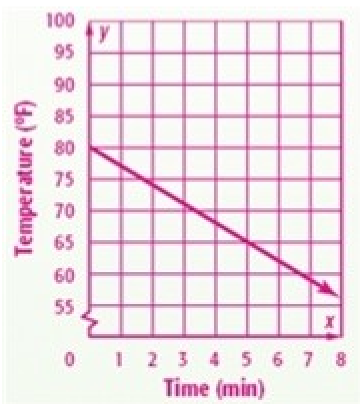
58. **TEMPERATURE** The temperature dropped rapidly overnight. Starting at 80°F, the temperature dropped 3° per minute.

a. Draw a graph that represents this drop from 0 to 8 minutes.

b. Write an equation that describes this situation. Describe the meaning of each variable as well as the slope and y-intercept.

SOLUTION:

a. To graph the equation, plot the y-intercept (0, 80). Then move down 3 units and right 1 unit. Plot the point. Draw a line through the two points.



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

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

a. Write an equation that represents the cost C of a membership for m months.

b. What does the slope represent?

c. What does the C-intercept represent?

d. What is the cost of a two-year membership?

SOLUTION:

a. The rate of $45 per month represents the rate or slope. The amount of $145 startup fee is constant, no matter how many months you have a membership. So, the total cost for m months can be written as $C = 45m + 145$.

b. The slope represents the cost per month to maintain the membership.

c. The C-intercept represents the start-up fee.

d. There are 24 months in 2 years, solve substitute 24 for m and solve for C.

$$\begin{aligned} C &= 45m + 145 \\ C &= 45(24) + 145 \\ C &= 1080 + 145 \\ C &= 1225 \end{aligned}$$

The cost for a two-year member ship is $1225.

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

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

b. What does the slope represent?

c. What does the c-intercept represent?

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

SOLUTION:

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

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

c. The c-intercept represents the circulation in the first year.

d.

$$\begin{aligned} c &= 33,388t + 500,000 \\ 3,000,000 &= 33,388t + 500,000 \\ 3,000,000 - 500,000 &= 33,388t + 500,000 - 500,000 \\ 2,500,000 &= 33,388t \\ \frac{2,500,000}{33,388} &= \frac{33,388t}{33,388} \\ 74.88 &= t \end{aligned}$$

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

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

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

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

SOLUTION:

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

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

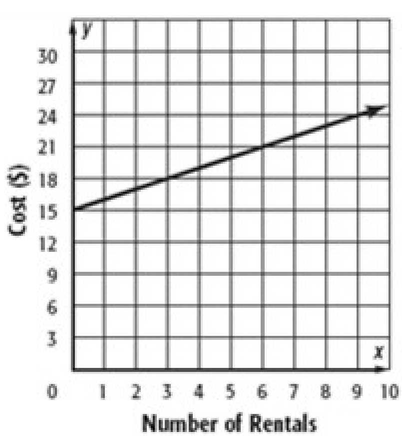
$$\begin{aligned} P &= 9125t + 3305 && \text{Original equation} \\ 100,000 &= 9125t + 3305 && \text{Replace } P \text{ with } 100,000. \\ 100,000 - 3305 &= 9125t + 3305 - 3305 && \text{Subtract 3305 from each side.} \\ 96,695 &= 9125t && \text{Simplify.} \\ \frac{96,695}{9125} &= \frac{9125t}{9125} && \text{Divide each side by 9125.} \\ 10.6 &\approx t && \text{Simplify.} \end{aligned}$$

12 yr

62. **OPEN ENDED** Draw a graph representing a real-world linear function and write an equation for the graph. Describe what the graph represents.

SOLUTION:

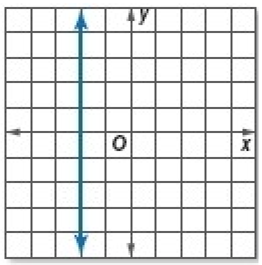
Students' answers will vary.
Sample answer: $y = x + 15$; The initial cost of joining a movie club is \$15. Then each movie costs \$1 for a 1-night rental.



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

SOLUTION:

A vertical line can not be written in slope-intercept form. Consider the following example.



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

$$m = \frac{y_2 - y_1}{x_2 - x_1} \quad \text{Slope formula.}$$
$$= \frac{4-(-3)}{-2-(-2)} \quad \text{Let}(-2, -3) = (x_1, y_1) \text{ and } (-2, 4) = (x_2, y_2).$$
$$= \frac{7}{0} \quad \text{Simplify.}$$

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

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

SOLUTION:

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

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

SOLUTION:

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

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

$$\begin{aligned} 2x + 4y &= 12 && \text{Original equation} \\ 2x - 2x + 4y &= -2x + 12 && \text{Subtract } 2x \text{ from each side.} \\ 4y &= 2x + 12 && \text{Simplify.} \\ \frac{4y}{4} &= \frac{2x+12}{4} && \text{Divide each side by 4.} \\ y &= \frac{1}{2}x + 3 && \text{Simplify.} \end{aligned}$$

The slope is $\frac{1}{2}$.

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

SOLUTION:

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

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

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

A $350 + 3y - x$

B $x - 350 + 3y$

C $x + 350 + 3y$

D $3y - 350 - x$

SOLUTION:

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

The correct choice is B.

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

Extracurricular Activity	Students
art club	24
band	134
choir	37
drama club	46
mock trial	19
school paper	26
sports	314

F $\frac{3}{8}$

G $\frac{4}{9}$

H $\frac{3}{5}$

J $\frac{2}{3}$

SOLUTION:

To find the probability, you need to first find the number of favorable results, which is sports or drama club. This total is 314 + 46 = 360. Next, find the total number of outcomes 24 + 134 + 37 + 46 + 19 + 26 + 314 = 600. So, the probability is favorable outcomes over the total outcomes. $\frac{360}{600}=\frac{3}{5}$. So, the correct choice is H.

69. A recipe for fruit punch calls for 2 ounces of orange juice for every 8 ounces of lemonade. If Jennifer uses 64 ounces of lemonade, which proportion can she use to find x, the number of ounces of orange juice needed?

A $\frac{2}{x} = \frac{64}{6}$

B $\frac{8}{x} = \frac{64}{2}$

C $\frac{2}{8} = \frac{x}{64}$

D $\frac{6}{2} = \frac{x}{64}$

SOLUTION:

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

So, the correct choice is C.

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

Grade	Cans
9	340
10	x
11	280
12	y

SOLUTION:

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

10th = x, 12th = $x + 55$

$$\begin{aligned} x + x + 55 &= 605 \\ 2x + 55 &= 605 \\ 2x + 55 - 55 &= 605 - 55 \\ 2x &= 550 \\ x &= 275 \end{aligned}$$

10th = 275; 12th = 275 + 55 = 330

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

71. 3, 7, 11, …

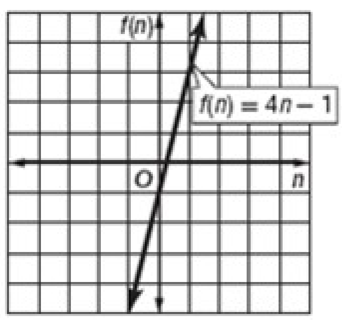
SOLUTION:

7 – 3 = 4
11 – 7 = 4

The common difference is 4. Substitute the first term and the difference into the formula for the *n*th term is $a_n = a_1 + (n-1)d$.

$$a_n = 3 + (n-1)(4)$$
$$a_n = 3 + 4n - 4$$
$$a_n = 4n - 1$$

Graph the equation.



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

72. 8, 6, 4, …

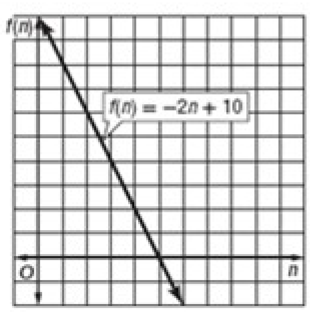
SOLUTION:

6 – 8 = –2
4 – 6 = –2

The common difference is –2. Substitute the first term and the difference into the formula for the *n*th term is $a_n = a_1 + (n-1)d$.

$$a_n = 8 + (n-1)(-2)$$
$$a_n = 8 - 2n + 2$$
$$a_n = -2n + 10$$

Graph the equation.



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

73. 0, 3, 6, …

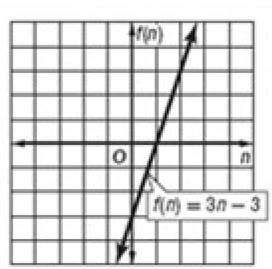
SOLUTION:

3 – 0 = 3
6 – 3 = 3

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

$$a_n = 0 + (n-1)(3)$$
$$a_n = 3n - 3$$

Graph the equation.



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

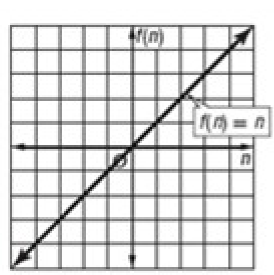
74. 1, 2, 3, …

SOLUTION:

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

$$a_n = 1 + (n-1)(1)$$
$$a_n = 1 + n - 1$$
$$a_n = n$$

Graph the equation.



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

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

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

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

SOLUTION:

a. Let q represent the number of questions.

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

$$\begin{aligned}3000 + 2500(q - 1) &= 3000 + 2500(10 - 1)\\ &= 3000 + 2500(9)\\ &= 3000 + 22,500\\ &= 25,500\end{aligned}$$

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

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

$$\begin{aligned}&3000 + 5500 + 8000 + 10,500 +\\ &13,000 + 15,500 + 18,000 +\\ &20,500 + 23,000 + 25,500\\ &= 142,500\end{aligned}$$

So, the contestant will win $142,500.

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

76. If $y = 10$ when $x = 5$, find y when $x = 6$.

SOLUTION:

$$\begin{aligned} y &= kx \\ 10 &= k(5) \\ \frac{10}{5} &= \frac{k(5)}{5} \\ 2 &= k \end{aligned}$$

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

$$\begin{aligned} y &= 2x \\ y &= 2(6) \\ y &= 12 \end{aligned}$$

So, $y = 12$ when $x = 6$.

77. If $y = -16$ when $x = 4$, find x when $y = 20$.

SOLUTION:

$$\begin{aligned} y &= kx \\ -16 &= k(4) \\ \frac{-16}{4} &= \frac{k(4)}{4} \\ -4 &= k \end{aligned}$$

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

$$\begin{aligned} y &= -4x \\ 20 &= -4x \\ \frac{20}{-4} &= \frac{-4x}{-4} \\ -5 &= x \end{aligned}$$

So, $x = -5$ when $y = 20$.

78. If $y = 6$ when $x = 18$, find y when $x = -12$.

SOLUTION:

$$\begin{aligned} y &= kx \\ 6 &= k(18) \\ \frac{6}{18} &= \frac{k(18)}{18} \\ \frac{1}{3} &= k \end{aligned}$$

So, the direct variation equation is $y = \frac{1}{3}x$. Substitute –12 for x and find y.

$$\begin{aligned} y &= \frac{1}{3}x \\ y &= \frac{1}{3}(-12) \\ y &= -4 \end{aligned}$$

So, $y = -4$ when $x = -12$.

79. If $y = 12$ when $x = 15$, find x when $y = -6$.

SOLUTION:

$$\begin{aligned} y &= kx \\ 12 &= k(15) \\ \frac{12}{15} &= \frac{k(15)}{15} \\ \frac{4}{5} &= k \end{aligned}$$

So, the direct variation equation is $y = \frac{4}{5}x$. Substitute –6 for y and find x.

$$\begin{aligned} y &= \frac{4}{5}x \\ -6 &= \frac{4}{5}x \\ \frac{5}{4}(-6) &= \frac{5}{4}\left(\frac{4}{5}x\right) \\ \frac{-15}{2} &= x \\ -7.5 &= x \end{aligned}$$

So, $x = -7.5$ when $y = -6$.

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

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

SOLUTION:

$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{7-3}{9-2} \\ &= \frac{4}{7} \end{aligned}$$

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

81. (−3, 6), (2, 4)

SOLUTION:

$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{6-4}{-3-2} \\ &= \frac{2}{-5} \\ &= -\frac{2}{5} \end{aligned}$$

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

82. (2, 6), (−1, 3)

SOLUTION:

$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{6-3}{2-(-1)} \\ &= \frac{3}{3} \\ &= 1 \end{aligned}$$

So, the slope is 1.

83. (−3, 3), (1, 3)

SOLUTION:

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

So, the slope is 0.