

5-3

Slope-Intercept Form



Each point of the graph gives you information about the bamboo plant.



Getting Ready!

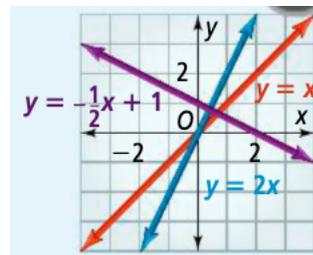
Bamboo can grow very quickly. The graph models the growth of a bamboo plant. Find the point where the line crosses the vertical axis. What does this point tell you about the bamboo plant? Find the slope of the line. What does the slope tell you about the bamboo plant? How do you know?



It started 20 ft high.
 $m = \frac{+10 \text{ ft}}{+10 \text{ days}} = +1 \text{ ft/day}$
 The height is increasing 1-ft/day.



The function in the Solve It is a linear function. A family of functions is a group of functions with common characteristics. A **parent function** is the simplest function with these characteristics. The **linear parent function** is $y = x$ or $f(x) = x$. The graphs of three linear functions are shown at the right.



A **linear equation** is an equation that models a linear function. In a linear equation, the variables cannot be raised to a power other than 1. So $y = 2x$ is a linear function, but $y = x^2$ and $y = 2^x$ are not. The graph of a linear equation contains all the ordered pairs that are solutions of the equations.

Graphs of linear functions may cross the y-axis at any point. A **y-intercept** of a graph is the y-coordinate of a point where the graph crosses the y-axis. You can use the slope and y-intercept of a line to write and graph an equation of the line.

KEY CONCEPT: SLOPE-INTERCEPT FORM OF A LINEAR EQUATION

The **slope-intercept form** of a linear equation of a nonvertical line is:

$$y = mx + b$$

Annotations: 'y must be isolated' points to the left side; 'slope' points to 'm'; 'y-intercept' points to 'b'.

PROBLEM 1: IDENTIFYING SLOPE AND Y-INTERCEPT

Find the slope and y-intercept of each equation.

a) $y = 5x - 2$

$m = 5$
 $y\text{-int} = -2$
 $(0, -2)$

b) $y = -x + 4$

$m = -1$
 $y\text{-int} = 4$
 $(0, 4)$

c) $y = 7x$

$m = 7$
 $y\text{-int} = 0$
 $(0, 0)$

d) $y = 4$

$m = 0$
 $y\text{-int} = 4$
 $(0, 4)$

e) $y = \frac{1}{2}x + \frac{2}{3}$

$m = \frac{1}{2}$
 $y\text{-int} = \frac{2}{3}$
 $(0, \frac{2}{3})$

f) $y = -3x + 2$

$m = -3$
 $y\text{-int} = 2$
 $(0, 2)$

g) $3x + 4y = 12$

$4y = -\frac{3x}{4} + \frac{12}{4}$
 $y = -\frac{3}{4}x + 3$
 $m = -\frac{3}{4}$

h) $x = 2$

m is undefined
 no y-intercept

$y = 0x + 4$

$$y = mx + b$$

$$y\text{-int} = +3 \\ (0, 3)$$

PROBLEM 2: WRITING AN EQUATION IN SLOPE-INTERCEPT FORM

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

a) $m = -\frac{4}{5}, b = 7$

$$y = -\frac{4}{5}x + 7$$

b) $m = 4, b = -2$

$$y = 4x - 2$$

c) $m = -2, b = 5$

$$y = -2x + 5$$

d) $m = \frac{1}{2}, b = -\frac{1}{2}$

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

e) $m = \frac{7}{10}, b = 3$

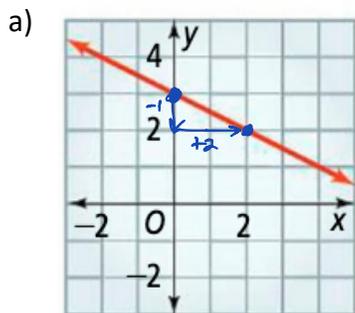
$$y = \frac{7}{10}x + 3$$

f) $m = -2, b = \frac{8}{5}$

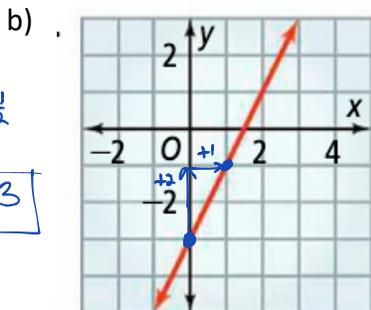
$$y = -2x + \frac{8}{5}$$

PROBLEM 3: WRITING AN EQUATION FROM A GRAPH

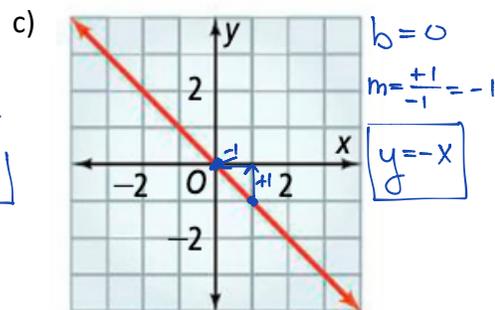
Write an equation in slope-intercept form of each line.



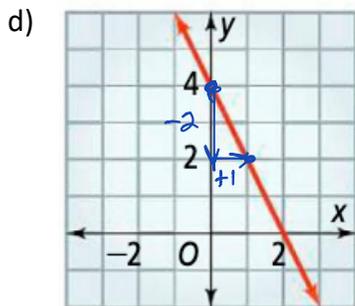
$b = 3$
 $m = \frac{-1}{+2} = -\frac{1}{2}$
 $y = -\frac{1}{2}x + 3$



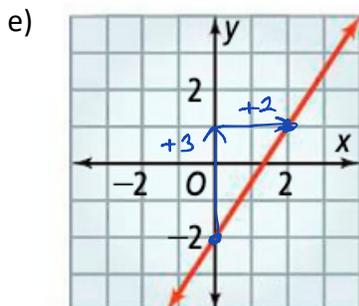
$b = -3$
 $m = \frac{+3}{+1} = 3$
 $y = 3x - 3$



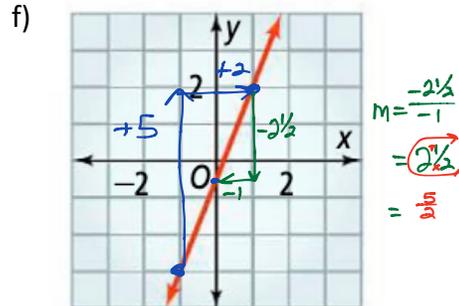
$b = 0$
 $m = \frac{+1}{-1} = -1$
 $y = -x$



$b = 4, m = \frac{-2}{+1} = -2$
 $y = -2x + 4$



$b = -2, m = \frac{+3}{+2} = \frac{3}{2}$
 $y = \frac{3}{2}x - 2$



$b = -\frac{1}{2}, m = \frac{+5}{+2} = \frac{5}{2}$
 $y = \frac{5}{2}x - \frac{1}{2}$

$$y = mx + b$$

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

PROBLEM 4: WRITING AN EQUATION FROM TWO POINTS

Write an equation in slope-intercept form of the line that passes through the given points.

a) $(2, 1)$ and $(5, -8)$
 $x_1 \ y_1 \quad x_2 \ y_2$

b) $(0, 3)$ and $(2, 5)$
 $x_1 \ y_1 \quad x_2 \ y_2$

c) $(-2, 4)$ and $(3, -1)$
 $x_1 \ y_1 \quad x_2 \ y_2$

1. Find slope
 $m = \frac{-8 - 1}{5 - 2} = \frac{-9}{3} = -3$

2. Substitute m, x_1 & y_1 and solve for b .
 $y = -3x + b$
 $1 = -3(2) + b$
 $1 = -6 + b$
 $+6 \quad +6$
 $7 = b$

$y = -3x + 7$

$m = \frac{5 - 3}{2 - 0} = \frac{2}{2} = 1$

$y = x + b$
 $5 = 2 + b$
 $-2 \quad -2$
 $3 = b$

$y = x + 3$

$m = \frac{-1 - 4}{3 - (-2)} = \frac{-5}{5} = -1$

$y = -x + b$
 $-1 = -3 + b$
 $+3 \quad +3$
 $2 = b$

$y = -x + 2$

d) $(3, -2)$ and $(1, -3)$
 $x_1 \ y_1 \quad x_2 \ y_2$

e) $(3, -3)$ and $(1, 2)$
 $x_1 \ y_1 \quad x_2 \ y_2$

f) $(-2, -4)$ and $(0, 5)$
 $x_1 \ y_1 \quad x_2 \ y_2$

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

$m = \frac{2 - (-3)}{1 - 3} = \frac{5}{-2} = -\frac{5}{2}$

$m = \frac{5 - (-4)}{0 - (-2)} = \frac{9}{2}$

$y = \frac{1}{2}x + b$
 $-2 = \frac{1}{2}(3) + b$
 $-2 = 1.5 + b$
 $-1.5 \quad -1.5$
 $-3.5 = b$

$y = -\frac{5}{2}x + b$
 $2 = -\frac{5}{2}(1) + b$
 $2 = -\frac{5}{2} + b$
 $+\frac{5}{2} \quad +\frac{5}{2}$
 $\frac{9}{2} = b$

$y = \frac{9}{2}x + b$
 $-4 = \frac{9}{2}(-2) + b$
 $-4 = -9 + b$
 $+9 \quad +9$
 $5 = b$

$y = \frac{1}{2}x - 3.5$
 $y = \frac{1}{2}x - 3\frac{1}{2}$

$y = -\frac{5}{2}x + \frac{9}{2}$ or $y = -\frac{5}{2}x + 4\frac{1}{2}$

$y = \frac{9}{2}x + 5$

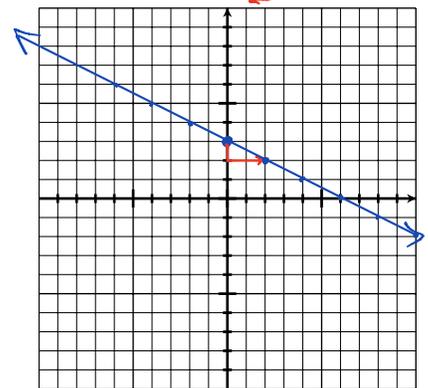
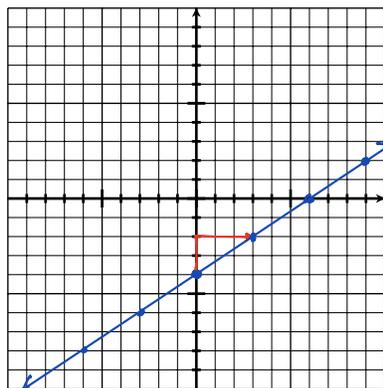
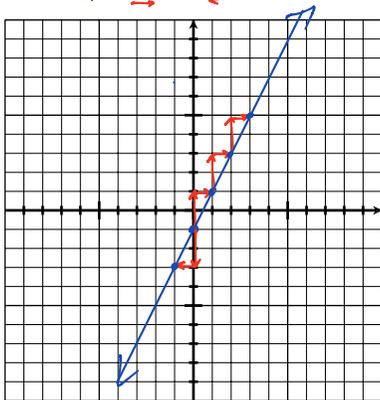
PROBLEM 5: GRAPHING A LINEAR EQUATION

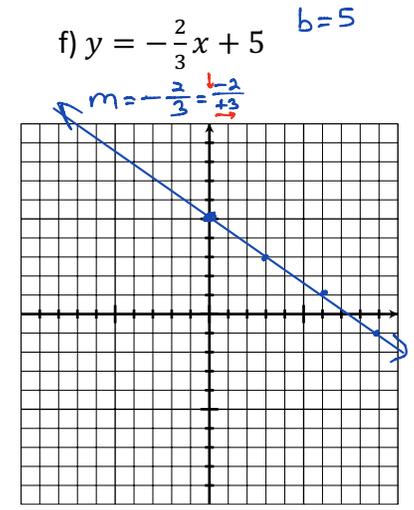
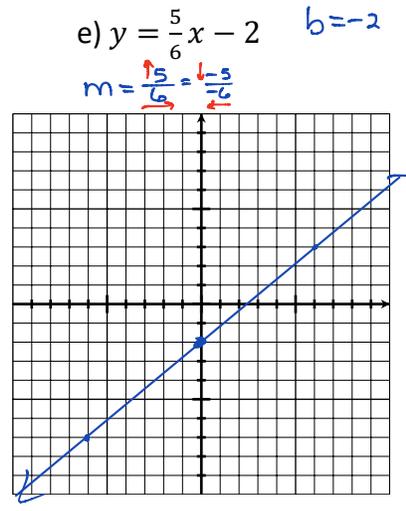
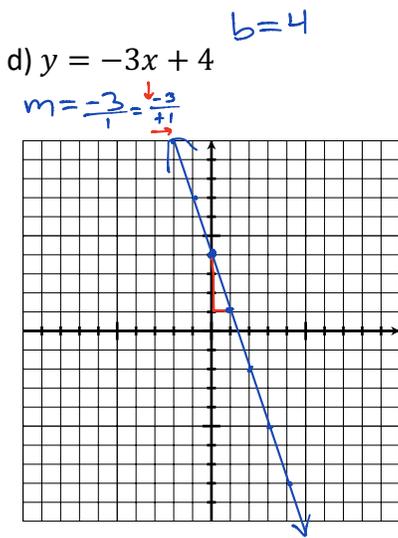
Graph each equation.

a) $y = 2x - 1$ $b = -1$
 $m = \frac{2}{1} = \frac{+2}{+1} = \frac{-1}{-1}$

b) $y = \frac{2}{3}x - 4$ $b = -4$
 $m = \frac{2}{3} = \frac{+2}{+3} = \frac{-4}{-3}$

c) $y = -\frac{1}{2}x + 3$ $b = 3$
 $m = -\frac{1}{2} = \frac{-1}{+2} = \frac{+3}{-2}$





PROBLEM 6: MODELING A FUNCTION

a) Water pressure can be measured in atmospheres (*atm*). At the surface of the water, the pressure is 1 *atm*. As the depth increases, the pressure increases by 0.1 *atm*/m. Write an equation that models the pressure y at a depth of x meters. Graph the function.

$$y = 0.1x + 1$$

when slope (rate of change) is positive:

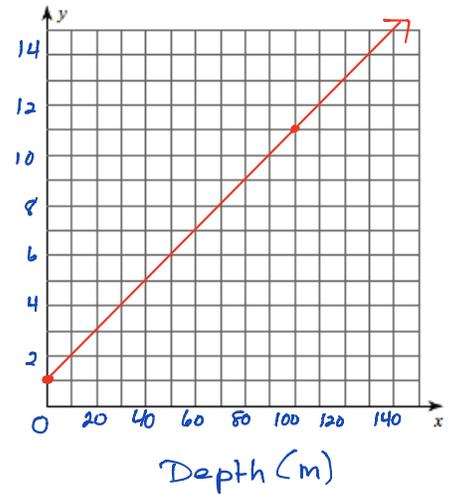
* Multiply x -axis scale by slope to determine y -axis scale

$$10(.1) = 1$$

$$m = \frac{0.1}{1} \times \frac{100}{100} = \frac{10}{100}$$

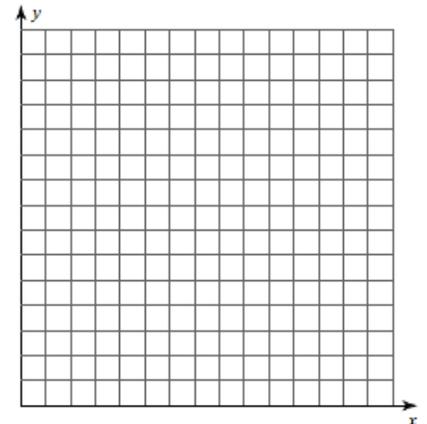
rate

Water Pressure (*atm*)



Initial

b) A plumber charges a \$65 fee for a repair plus \$35 per hour. Write an equation to model the total cost y of a repair that takes x hours. Graph the function that models the total cost.



5-3 Practice Worksheet

Identify the slope and y-intercept for each equation.

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

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

3. $2y - 6x = 10$

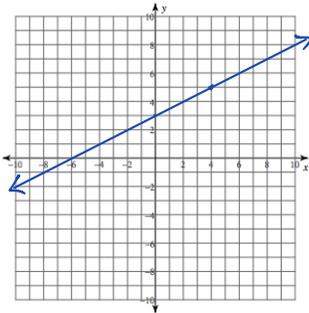
Write an equation for the line with the given slope and y-intercept.

4. $m = \frac{2}{5}, b = 5$

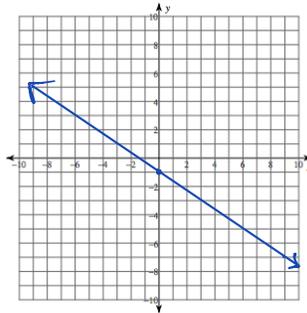
5. $m = 0.3, b = -1.5$

Write an equation for the lines shown on each graph.

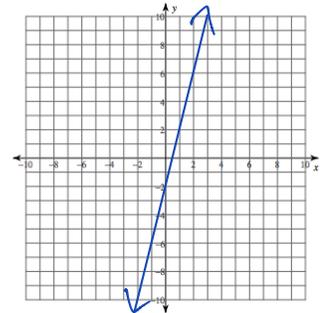
6.



7.



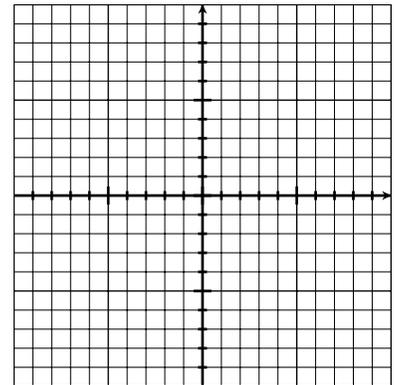
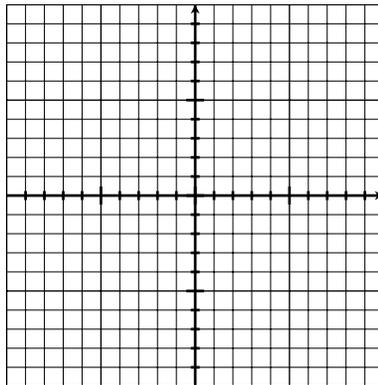
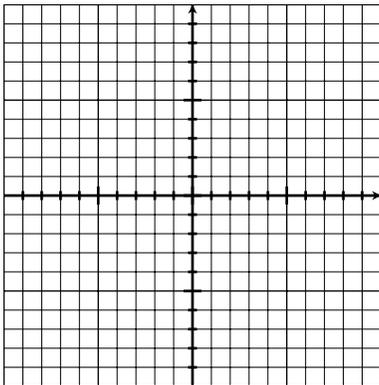
8.

**Graph each equation.**

9. $y = 2x - 3$

10. $y = -\frac{2}{5}x + 4$

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

**Is the ordered pair on the graph of the given equation?**

12. $(-3, 4); y = -2x + 1$

13. $(-6, 5); y = -\frac{1}{2}x + 2$

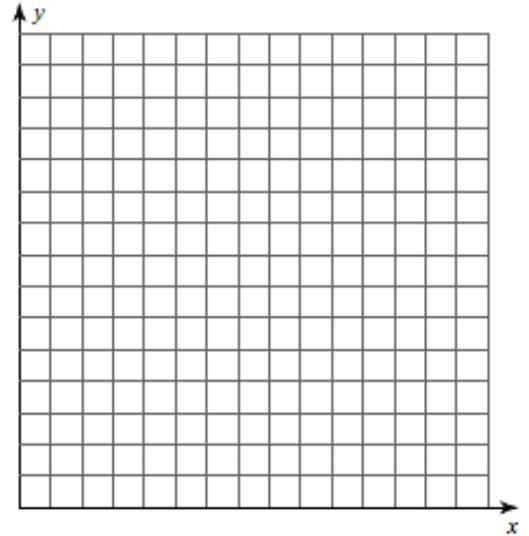
Find the value of a so that the graph of the given equation has the given slope.

14. $y = 2ax + 4, \text{slope} = -1$

15. $y = \frac{2}{3}ax + 3, \text{slope} = 6$

16. When the Bryants leave town for a vacation, they put their dog Tyco in a kennel. The kennel charges \$15 for an immediate flea bath and \$5 per day.

- a.) Write an equation in slope-intercept form to represent the situation.
- b.) Graph the equation.
- c.) Explain why only Quadrant I is needed to graph this situation.



17. Which equation has the same y-intercept as $y = 4x - 3$?

- a) $y - 3 = x$
- b) $y = 8x + 3$
- c) $3 - y = 4x$
- d) $y = -3 + 8x$

18. Which of the following is the equation of the line that has the same slope as $y = -\frac{3}{2}x + 2$ and the same y-intercept as $y = 3x - 2$?

- a) $y - 2 = -\frac{3}{2}x$
- b) $-\frac{3}{2}x = y + 2$
- c) $y + 2 = -\frac{3}{2}$
- d) $-\frac{3}{2}x = y + 3$

19. A software company started with 2 employees. In 6 months, the company had 7 employees. The number of employees increased at a steady rate. Which equation models the relationship between the number of employees n and the number of months m since the company started?

- a) $n = \frac{5}{6}m + 2$
- b) $m = 2n + \frac{5}{6}$
- c) $n = \frac{6}{5}m + 2$
- d) $m = \frac{5}{6}n + 2$

20. A line passes through the points (0,3) and (1,5). Graph this line and find an equation for the line in slope-intercept form.

