Using Slopes and Intercepts

Warm Up

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

1. (3, 6) and (–1, 4) $\frac{1}{2}$

2. (1, 2) and (6, 1) $-\frac{1}{5}$

3. (4, 6) and (2, –1) $\frac{7}{2}$

4. (–3, 0) and (–1, 1) $\frac{1}{2}$

Using Slopes and Intercepts

Module 9

Essential ?

How can you show the linear relationship between two quantities?

Standard

MCC8.F.4: Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the funcion

Using Slopes and Intercepts

You can graph a linear equation easily by finding the ***x*-intercept** and the ***y*-intercept**. The ***x*-intercept** of a line is the value of x where the line crosses the x-axis (where $y = 0$). The ***y*-intercept** of a line is the value of y where the line crosses the y-axis (where $x = 0$).

Algebra 1 Graphing with the Slope Intercept Form NOTES Name_____

Using slope intercept form is one of the quickest and easiest ways to graph a linear equation.

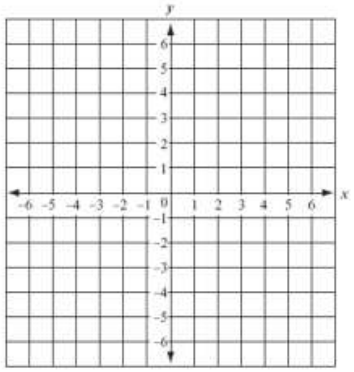
We need to define:

x intercept is the point (,) where your line crosses_____.

y intercept is the point (,) where your line crosses _____.

We are only going to focus on the **y intercept** in this lesson, but you'll need to know x intercept later.

Examples:



Recall: Slope Intercept Form- _____

___ and ____ are your variables.

_____ = slope.

_____ = y-coordinate of the y-intercept.

In this form only (y = mx +b) the _____of x is the slope and the _____ is the y intercept.

$y = 2x + 3$

slope _____

y intercept _____

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

slope _____

y intercept _____

$8x + 3y = -9$

slope _____

$4x - 5y = 0$

slope _____

Using Slopes and Intercepts

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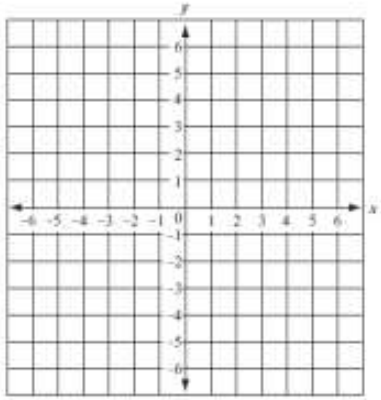
flagarts.com/faculty-staff/documents/slopeinterceptgraphingstudentNOTES.pdf

Graph the equation $y = 2x + 4$

Step 1

Step 2

Step 3

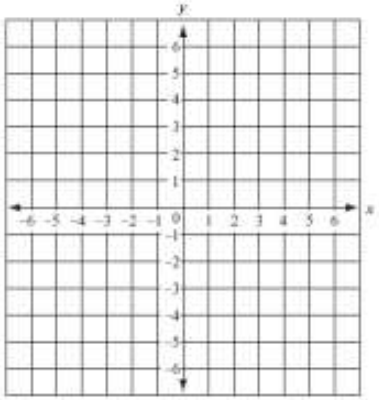


Graph the equation $y = -\frac{1}{3}x$

Step 1

Step 2

Step 3

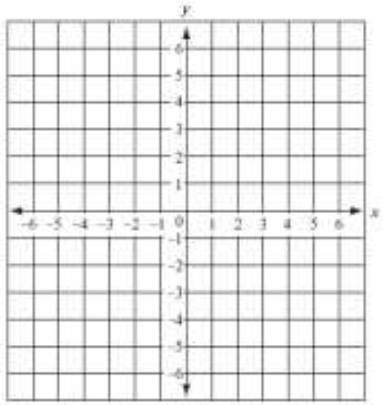


Graph the equation $y = -\frac{1}{3}x$

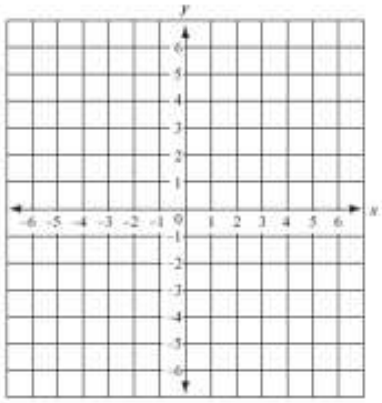
Step 1

Step 2

Step 3

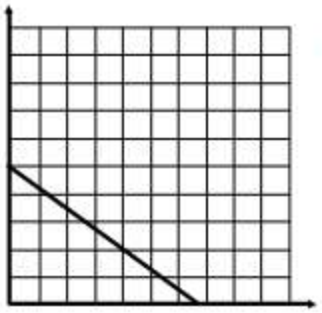


Graph the equation $4x - 3y = 9$

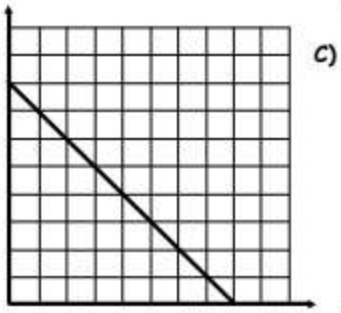


1) Example: A bottle of water is being emptied. In each of the graphs below, determine how much water was in the bottle before it started to empty.

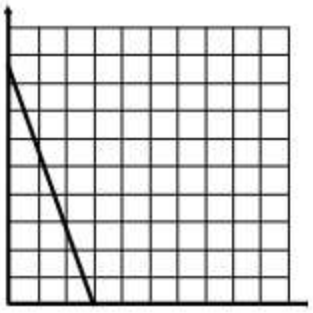
A)



B)

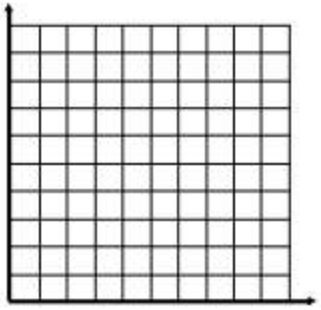


C)



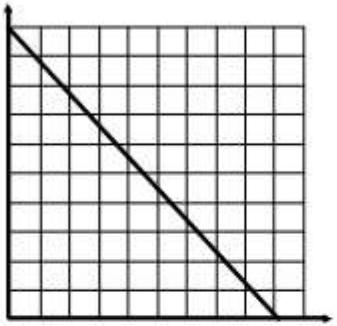
2) Which letter above represents the bottle that is empting the fastest?

3) On the graph below, draw any graph of a bottle of water that starts with 6 liters of water and is emptying.

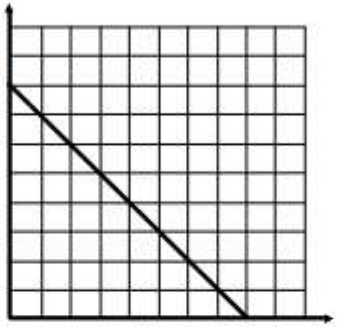


4) Pick which graph below represents a bottle of water being emptied $\frac{3}{4}$ of a liter at a tim started with 8 liters

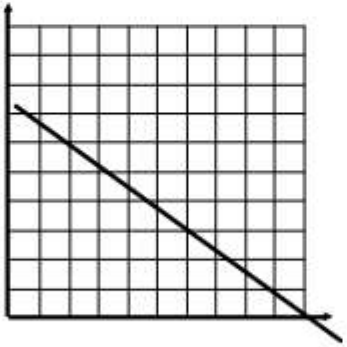
A)



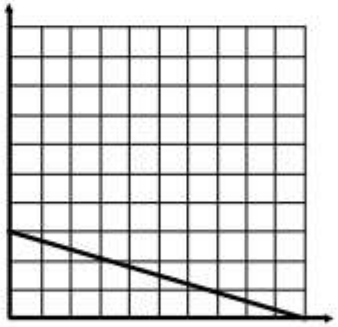
B)



C)



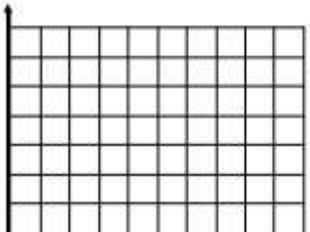
D)



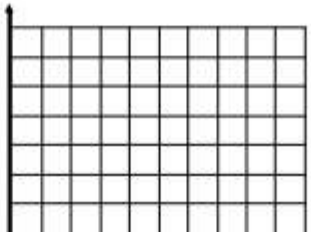
5) In graph A) draw a line of a bottle of water that is being filled.

In graph B) draw aline of a bottle of water that is being emptied.

A)



B)



Additional Example 1: Finding *x*-intercepts and *y*-intercepts to Graph Linear Equations

Find the *x*-intercept and *y*-intercept of the line $4x - 3y = 12$. Use the intercepts to graph the equation.

Find the *x*-intercept ($y = 0$).

$$4x - 3y = 12$$

$$4x - 3(0) = 12$$

$$4x = 12$$

$$\frac{4x}{4} = \frac{12}{4}$$

$$x = 3$$

The *x*-intercept is 3.

Additional Example 1 Continued

Find the y-intercept ($x = 0$).

$$4x - 3y = 12$$

$$4(0) - 3y = 12$$

$$-3y = 12$$

$$\frac{-3y}{-3} = \frac{12}{-3}$$

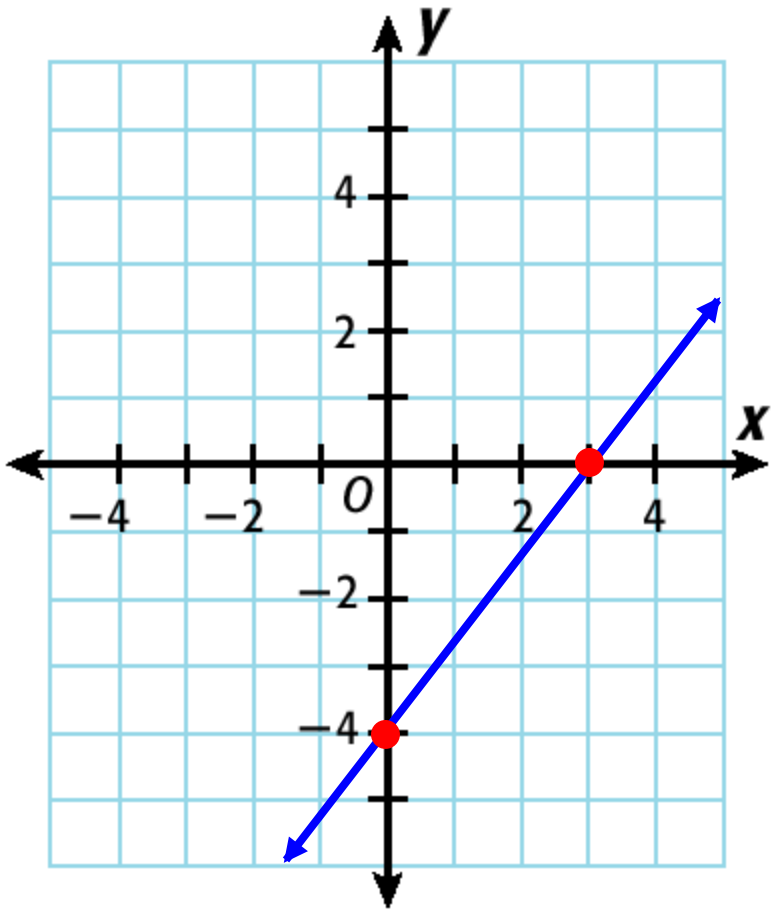
$$y = -4$$

The y-intercept is -4.

Using Slopes and Intercepts

Additional Example 1 Continued

The graph of $4x - 3y = 12$ is the line that crosses the x-axis at the point (3, 0) and the y-axis at the point (0, –4).



The equation $y = mx + b$ is called the **slope-intercept form** of the equation of a line. In this form, it is easy to see the slope and the y-intercept. When the equation of a line is in slope-intercept form, you can quickly graph the line.

MCC8.F.3

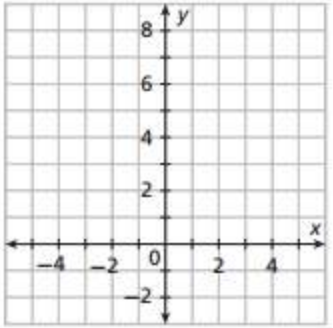
2 EXAMPLE Using Slope-Intercept Form to Graph a Line

Graph $y = -2x + 5$.

Step 1 Identify the slope and the y-intercept.

slope: $m =$ ____ $= \frac{\text{____}}{1}$

y-intercept: $b =$ ____



Step 2 The point that contains the y-intercept is $(0,$ ____$)$. Plot this point.

Step 3 Use the slope to find a second point on the line. Count down _____ unit(s) and right _____ unit(s). Plot this point.

Step 4 Draw a line connecting the two points.

TRY THIS!

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

2a. slope: -4; y-intercept: 6

_____

2b. slope: $\frac{5}{2}$; y-intercept: -3

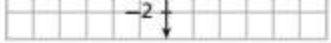
_____

Graph each equation.

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

2d. $y = -3x + 4$

is $(0, \quad)$. Plot this point.



Step 3 Use the slope to find a second point on the line. Count down _____ unit(s) and right _____ unit(s). Plot this point.

Step 4 Draw a line connecting the two points.

TRY THIS!

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

2a. slope: -4; y-intercept: 6

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_____

Graph each equation.

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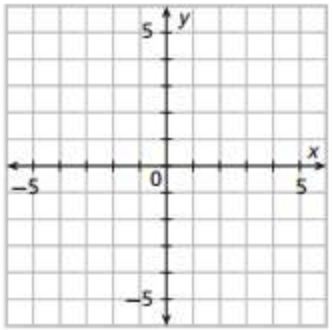
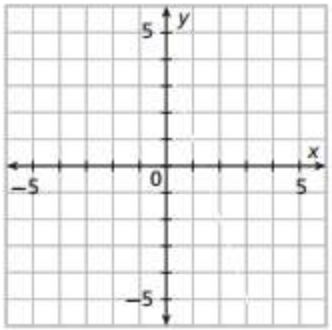


2d. $y = -3x + 4$



Elizabeth can choose from several monthly cell phone plans. The cost of each plan is a linear function of the number of minutes that are included in the plan. Write an equation in slope-intercept form that represents the function.

Minutes Included, x	100	200	300	400	500
Cost of Plan ($), y	18	28	38	48	58

A Choose any two ordered pairs from the table to find the slope.

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

B Use the equation $y = mx + b$ and any point from the table. Substitute values for y, m, and x into the equation and solve for b.

$y = mx + b$

$\square = \square \cdot \square + b$ *Substitute for y, m, and x.*

$\square = \square + b$ *Simplify on the right side.*

$-\square \quad -\square$ *Subtract the number that is added to b from both sides.*

$\square = b$

C Use the slope and y-intercept values to write an equation in slope-intercept form.

$y = \square x + \square$

REFLECT

3a. Use the equation to predict the cost of a cell phone plan that includes 175 minutes.

3b. What is the base price for any cell phone plan, regardless of how many minutes are included?

TRY THIS!

3c. **What If?** Elizabeth's cell phone company changed the prices for each of their plans. Write an equation in slope-intercept form that represents the function.

Minutes Included, x	100	200	300	400	500
Cost of Plan ($), y	30	35	40	45	50

Using Slopes and Intercepts

Write an equation in slope-intercept form that represents the function.

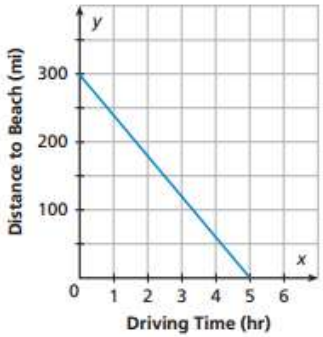
A Choose two points on the graph to find the slope.

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

B Read the y-intercept from the graph.

$b = \square$

C Use your slope and y-intercept values to write an equation in slope-intercept form.



REFLECT

4a. What does the value of the slope represent in this context?

4b. Is the slope positive or negative? What does the sign of the slope mean in this context?

4c. Describe the meaning of the y-intercept.

TRY THIS!

The graph shows the distance Norma skateboarded over a period of time.

4d. Write an equation in slope-intercept form that represents the function.

4b. Is the slope positive or negative? What does the sign of the slope mean in this context?

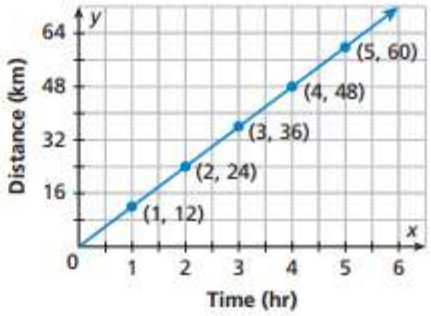
4c. Describe the meaning of the y-intercept.

TRY THIS!

The graph shows the distance Norma skateboarded over a period of time.

4d. Write an equation in slope-intercept form that represents the function.

4e. Describe the meaning of the y-intercept.



MCC8.F.4

5 EXPLORE Writing an Equation for a Function from a Description

The rate at which crickets chirp is a linear function of temperature. At 59 °F, they chirp 76 times per minute, and at 65 °F, they chirp 100 times per minute. Write an equation in slope-intercept form that represents the function.

A Identify the input and output variables in this relationship.

Input variable: _____ Output variable: _____

B Write the information given in the problem as ordered pairs.

At 59 °F, crickets chirp 76 times per minute: (,)

At 65 °F, crickets chirp 100 times per minute: (,)

C Find the slope.

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

D Use the equation $y = mx + b$ and one of the ordered pairs. Substitute values for y, m, and x into the equation and solve for b.

$y = mx + b$

$\square = \square \cdot \square + b$ *Substitute for y, m, and x.*

$\square = \square + b$ *Simplify on the right side.*

$-\square \quad -\square$ *Subtract the number that is added to b from both sides.*

$\square = \quad b$

E Write an equation in slope-intercept form.

_____

REFLECT

$x_2 - x_1$ _____ – _____ _____ _____

D Use the equation $y = mx + b$ and one of the ordered pairs. Substitute values for y, m, and x into the equation and solve for b.

$y = mx + b$

_____ = _____ · _____ + b *Substitute for y, m, and x.*

_____ = _____ + b *Simplify on the right side.*

– _____ – _____ *Subtract the number that is added to b from both sides.*

_____ = b

E Write an equation in slope-intercept form.

_____

REFLECT

5a. Predict the number of chirps per minute when the temperature is 72 °F.

_____

5b. Without graphing, tell whether the graph of this function rises or falls from left to right. What does the sign of the slope mean in this context?

_____

_____

Using Slopes and Intercepts

Helpful Hint

The form $Ax + By = C$, where A, B, C are real numbers, is called the Standard Form of a Linear Equation.

Using Slopes and Intercepts

Check It Out: Example 1

Find the *x*-intercept and *y*-intercept of the line $8x - 6y = 24$. Use the intercepts to graph the equation.

Find the *x*-intercept ($y = 0$).

$$8x - 6y = 24$$

$$8x - 6(0) = 24$$

$$8x = 24$$

$$\frac{8x}{8} = \frac{24}{8}$$

$$x = 3$$

The *x*-intercept is 3.

Check It Out: Example 1 Continued

Find the y-intercept ($x = 0$).

$$8x - 6y = 24$$

$$8(0) - 6y = 24$$

$$-6y = 24$$

$$\frac{-6y}{-6} = \frac{24}{-6}$$

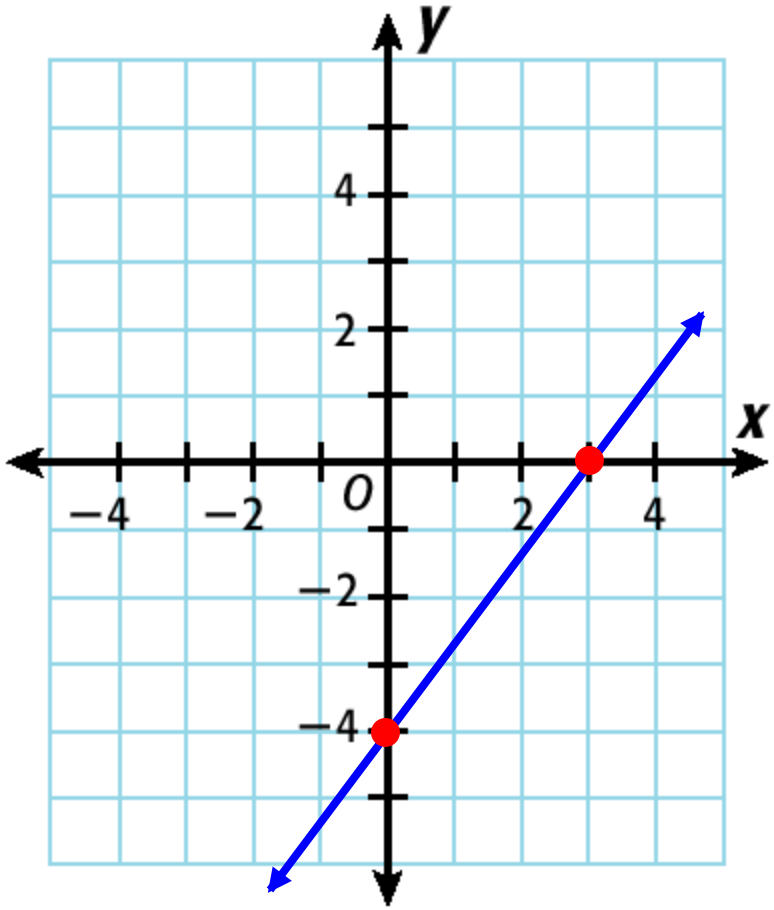
$$y = -4$$

The y-intercept is -4.

Using Slopes and Intercepts

Check It Out: Example 1 Continued

The graph of $8x - 6y = 24$ is the line that crosses the x-axis at the point (3, 0) and the y-axis at the point (0, –4).



Using Slopes and Intercepts

In an equation written in **slope-intercept form**, $y = mx + b$, m is the slope and b is the y-intercept.

$$y = mx + b$$

Slope y-intercept

Using Slopes and Intercepts

Additional Example 2A: Using Slope-Intercept Form to Find Slopes and *y*-intercepts

Write each equation in slope-intercept form, and then find the slope and *y*-intercept.

$2x + y = 3$

$2x + y = 3$

$-2x \qquad -2x$ *Subtract 2x from both sides.*

$y = 3 - 2x$

Rewrite to match slope-intercept form.

$y = -2x + 3$ *The equation is in slope-intercept form.*

$m = -2$ $b = 3$

The slope of the line $2x + y = 3$ is -2, and the *y*-intercept is 3.

Using Slopes and Intercepts

Additional Example 2B: Using Slope-Intercept Form to Find Slopes and *y*-intercepts

$5y = 3x$

$5y = 3x$

$\frac{5y}{5} = \frac{3}{5}x$ *Divide both sides by 5 to solve for y.*

$y = \frac{3}{5}x + 0$ *The equation is in slope-intercept form.*

$m = \frac{3}{5}$ $b = 0$

The slope of the line $5y = 3x$ is $\frac{3}{5}$, and the *y*-intercept is 0.

Using Slopes and Intercepts

Additional Example 2C: Using Slope-Intercept Form to Find Slopes and y-intercepts

$4x + 3y = 9$

$4x + 3y = 9$

$-4x \qquad -4x$ *Subtract 4x from both sides.*

$3y = 9 - 4x$

Rewrite to match slope-intercept form.

$3y = -4x + 9$

$\frac{3y}{3} = \frac{-4x}{3} + \frac{9}{3}$ *Divide both sides by 3.*

$y = -\frac{4}{3}x + 3$ *The equation is in slope-intercept form.*

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

The slope of the line $4x + 3y = 9$ is $-\frac{4}{3}$, and the y-intercept is 3.

Check It Out: Example 2A

Write each equation in slope-intercept form, and then find the slope and y-intercept.

$4x + y = 4$

$-4x \qquad -4x$ *Subtract 4x from both sides.*

$y = 4 - 4x$

Rewrite to match slope-intercept form.

$y = -4x + 4$ *The equation is in slope-intercept form.*

$m = -4 \quad b = 4$

The slope of the line $4x + y = 4$ is -4, and the y-intercept is 4.

Using Slopes and Intercepts

Check It Out: Example 2B

$7y = 2x$

$7y = 2x$

$\frac{7y}{7} = \frac{2}{7}x$ *Divide both sides by 7 to solve for y.*

$y = \frac{2}{7}x + 0$ *The equation is in slope-intercept form.*

$m = \frac{2}{7}$ $b = 0$

The slope of the line $7y = 2x$ is $\frac{2}{7}$, and the y-intercept is 0.

Using Slopes and Intercepts

Check It Out: Example 2C

$5x + 4y = 8$

$5x + 4y = 8$

$-5x \qquad -5x$ *Subtract 5x from both sides.*

$4y = 8 - 5x$

Rewrite to match slope-intercept form.

$4y = 8 - 5x$

$\frac{4y}{4} = \frac{-5x}{4} + \frac{8}{4}$ *Divide both sides by 4.*

$y = -\frac{5}{4}x + 2$ *The equation is in slope-intercept form.*

$m = -\frac{5}{4}$ $b = 2$

The slope of the line $5x + 4y = 8$ is $-\frac{5}{4}$, and the y-intercept is 2.

Using Slopes and Intercepts

Additional Example 3: *Entertainment Application*

A video club charges $8 to join, and $1.25 for each DVD that is rented. The linear equation $y = 1.25x + 8$ represents the amount of money y spent after renting x DVDs. Graph the equation by first identifying the slope and y-intercept.

$y = 1.25x + 8$

The equation is in slope-intercept form.

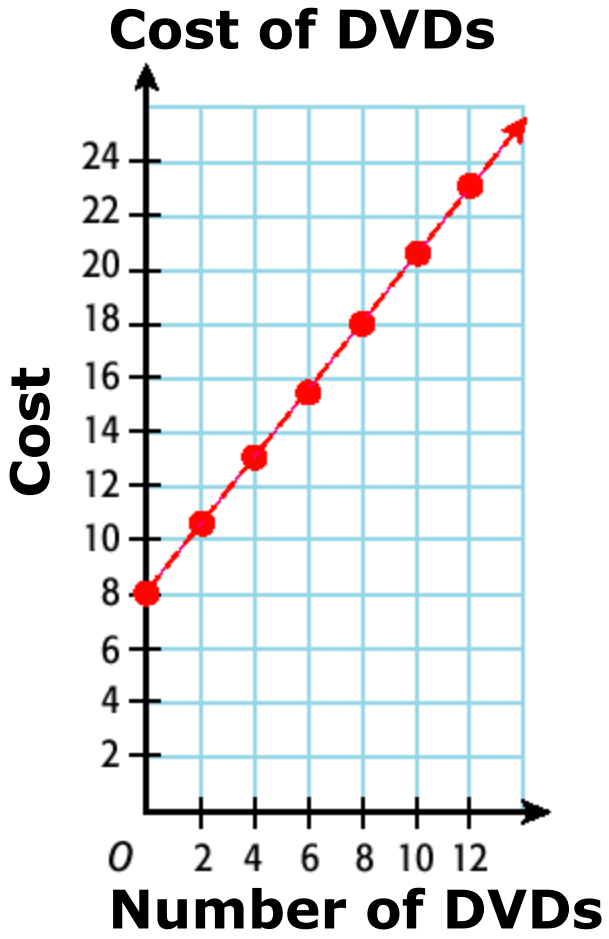
$m = 1.25$

$b = 8$

Using Slopes and Intercepts

Additional Example 3 Continued

The slope of the line is 1.25, and the *y*-intercept is 8. The line crosses the *y*-axis at the point (0, 8) and moves up 1.25 units for every 1 unit it moves to the right.



Using Slopes and Intercepts

Check It Out: Example 3

A salesperson receives a weekly salary of $500 plus a commission of 5% for each sale. Total weekly pay is given by the equation $y = 0.05x + 500$. Graph the equation using the slope and y-intercept.

$y = 0.05x + 500$

The equation is in slope-intercept form.

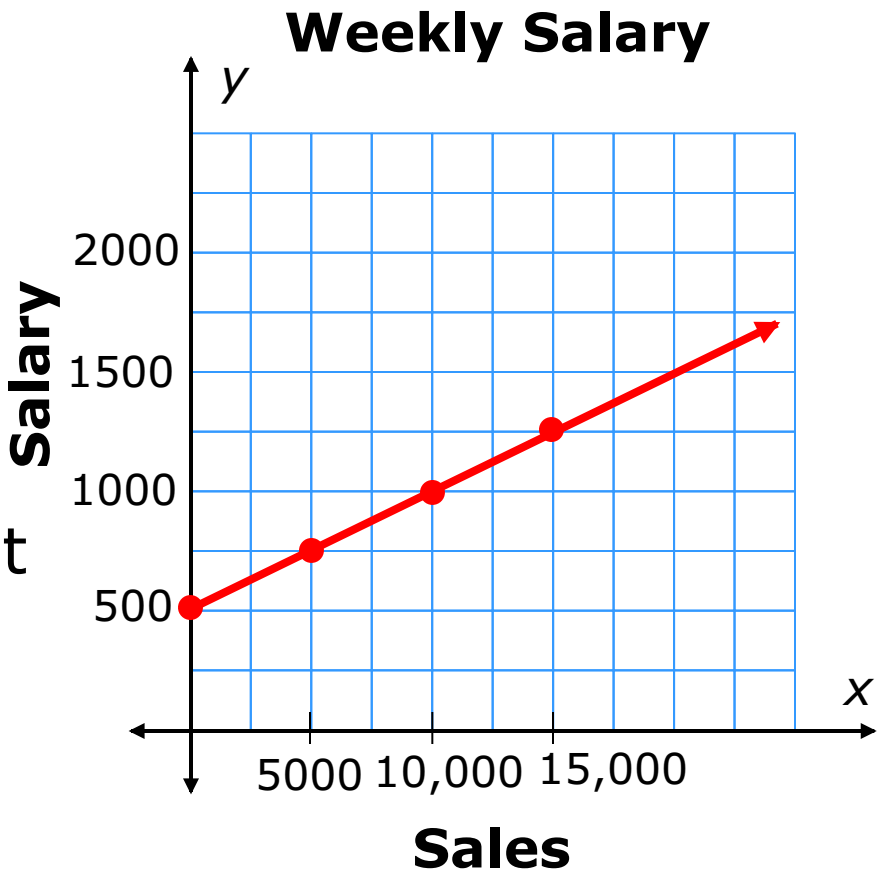
$m = 0.05$

$b = 500$

Using Slopes and Intercepts

Check It Out: Example 3 Continued

The slope of the line is 0.05, and the *y*-intercept is 500. The line crosses the *y*-axis at the point (0, 500) and moves up 0.05 units for every 1 unit it moves to the right.



Using Slopes and Intercepts

Additional Example 4: Writing Slope-Intercept Form

Write the equation of the line that passes through (3, –4) and (–1, 4) in slope-intercept form.

Find the slope.

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - (-4)}{-1 - 3} = \frac{8}{-4} = -2$$

The slope is –2.

Substitute either point and the slope into the slope-intercept form.

$y = mx + b$

$4 = -2(-1) + b$ *Substitute –1 for x, 4 for y, and –2 for m.*

$4 = 2 + b$ *Simplify.*

Additional Example 4 Continued

Solve for b.

$4 = 2 + b$

$-2 \quad -2$ *Subtract 2 from both sides.*

$2 = b$

Write the equation of the line, using -2 for m and 2 for b.

$y = -2x + 2$

Check It Out: Example 4

Write the equation of the line that passes through (1, 2) and (2, 6) in slope-intercept form.

Find the slope.

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - 2}{2 - 1} = \frac{4}{1} = 4$$

The slope is 4.

Substitute either point and the slope into the slope-intercept form.

$y = mx + b$

$2 = 4(1) + b$ *Substitute 1 for x, 2 for y, and 4 for m.*

$2 = 4 + b$ *Simplify.*

Check It Out: Example 4 Continued

Solve for b.

$2 = 4 + b$

$-4 \quad -4$ *Subtract 4 from both sides.*

$-2 = b$

Write the equation of the line, using 4 for m and -2 for b.

$y = 4x - 2$

Lesson Quizzes

Standard Lesson Quiz

Lesson Quiz for Student Response Systems

Using Slopes and Intercepts

Lesson Quiz

Write each equation in slope-intercept form, and then find the slope and y-intercept.

1. $2y - 6x = -10$ $y = 3x - 5$; $m = 3$; $b = -5$

2. $-5y - 15x = 30$ $y = -3x - 6$; $m = -3$; $b = -6$

Write the equation of the line that passes through each pair of points in slope-intercept form.

3. (0, 2) and (4, −1) $y = -\frac{3}{4}x + 2$

4. (−2, 2) and (4, −4) $y = -x$

Using Slopes and Intercepts

Lesson Quiz for Student Response Systems

1. Identify the slope-intercept form of the equation $3y - 9x = -12$, and then find the slope and y-intercept.

A. $y = 3x + 4$; $m = 3$, $b = -4$

B. $y = 3x + 4$; $m = 3$, $b = 4$

C. $y = 3x - 4$; $m = 3$, $b = -4$

D. $y = 3x - 4$; $m = 3$, $b = 4$

Lesson Quiz for Student Response Systems

2. Identify the slope-intercept form of the equation $-3y - 15x = 45$, and then find the slope and y-intercept.

A. $y = -5x - 15$; $m = -5$, $b = -15$

B. $y = 5x - 15$; $m = 5$, $b = -15$

C. $y = -5x - 15$; $m = -5$, $b = 15$

D. $y = 5x - 15$; $m = -5$, $b = 15$

Lesson Quiz for Student Response Systems

3. Identify the equation of the line that passes through the pair of points (–1, 4) and (2, –8) in slope-intercept form.

A. $y = 4x$

B. $y = -4x$

C. $y = 4x + 2$

D. $y = -4x + 2$