Using Intercepts

Objectives
Find *x*- and *y*-intercepts and interpret their meanings in real-world situations.

Use *x*- and *y*-intercepts to graph lines.

Vocabulary
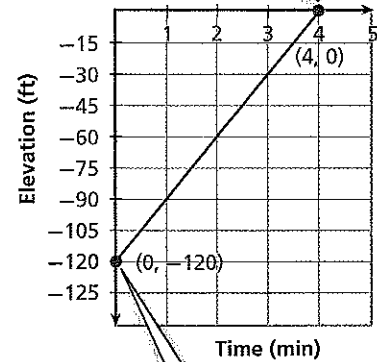*y*-intercept
x-intercept

Who uses this?
Divers can use intercepts to determine the time a safe ascent will take.

A diver explored the ocean floor 120 feet below the surface and then ascended at a rate of 30 feet per minute. The graph shows the diver's elevation below sea level during the ascent.

The **y-intercept** is the *y*-coordinate of the point where the graph intersects the *y*-axis. The *x*-coordinate of this point is always 0.

The **x-intercept** is the *x*-coordinate of the point where the graph intersects the *x*-axis. The *y*-coordinate of this point is always 0.
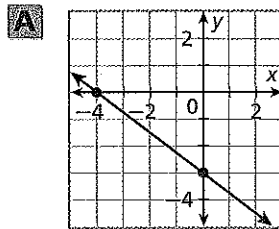

The y-intercept is −120. It represents the diver's elevation at the start of the ascent, when time = 0.

EXAMPLE 1 Finding Intercepts

Find the *x*- and *y*-intercepts.

A

The graph intersects the y-axis at (0, −3).
The *y*-intercept is −3.

The graph intersects the x-axis at (−4, 0).
The *x*-intercept is −4.

B $3x - 2y = 12$

To find the *x*-intercept, replace *y* with 0 and solve for *x*.

$$3x - 2y = 12$$
$$3x - 2(0) = 12$$
$$3x - 0 = 12$$
$$3x = 12$$
$$\frac{3x}{3} = \frac{12}{3}$$
$$x = 4$$
The *x*-intercept is 4.

To find the *y*-intercept, replace *x* with 0 and solve for *y*.

$$3x - 2y = 12$$
$$3(0) - 2y = 12$$
$$0 - 2y = 12$$
$$-2y = 12$$
$$\frac{-2y}{-2} = \frac{12}{-2}$$
$$y = -6$$
The *y*-intercept is −6.

CHECK IT OUT! Find the *x*- and *y*-intercepts.

1a.

1b. $-3x + 5y = 30$

1c. $4x + 2y = 16$

Finding Intercepts

I use the "cover-up" method to find intercepts. To use this method, make sure the equation is in standard form first.

If I have $4x - 3y = 12$:

First, I cover $4x$ with my finger and solve the equation I can still see.

$$(\text{✋}) - 3y = 12$$
$$y = -4$$

The y-intercept is −4.

Then I cover $-3y$ with my finger and do the same thing.

$$4x\ (\text{✋}) = 12$$
$$x = 3$$

The x-intercept is 3.
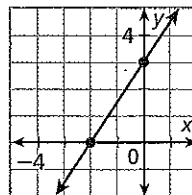
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EXAMPLE 2 **Travel Application**

The Sandia Peak Tramway in Albuquerque, New Mexico, travels a distance of about 4500 meters to the top of Sandia Peak. Its speed is 300 meters per minute. The function $f(x) = 4500 - 300x$ gives the tram's distance in meters from the top of the peak after x minutes. Graph this function and find the intercepts. What does each intercept represent?
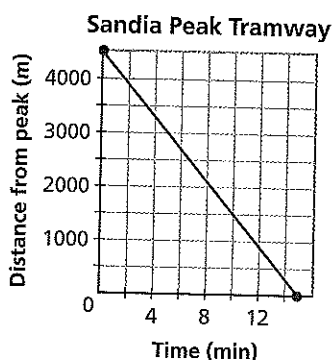
Neither time nor distance can be negative, so choose several nonnegative values for x. Use the function to generate ordered pairs.
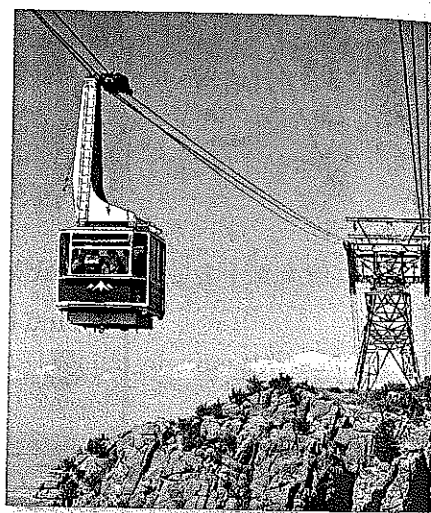
x	0	2	5	10	15
$f(x) = 4500 - 300x$	4500	3900	3000	1500	0

Graph the ordered pairs. Connect the points with a line.

Sandia Peak Tramway

- y-intercept: 4500. This is the starting distance from the top (time = 0).
- x-intercept: 15. This the time when the tram reaches the peak (distance = 0).

Caution!

The graph is not the path of the tram. Even though the line is descending, the graph describes the distance from the peak as the tram goes *up* the mountain.

CHECK IT OUT! 2. The school store sells pens for $2.00 and notebooks for $3.00. The equation $2x + 3y = 60$ describes the number of pens x and notebooks y that you can buy for $60.

a. Graph the function and find its intercepts.

b. What does each intercept represent?

Remember, to graph a linear function, you need to plot only two ordered pairs. It is often simplest to find the ordered pairs that contain the intercepts.

EXAMPLE 3 Graphing Linear Equations by Using Intercepts

Use intercepts to graph the line described by each equation.
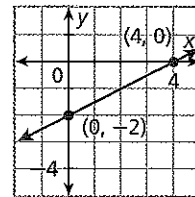
A $2x - 4y = 8$

Step 1 Find the intercepts.

x-intercept:	y-intercept:
$2x - 4y = 8$	$2x - 4y = 8$
$2x - 4(0) = 8$	$2(0) - 4y = 8$
$2x = 8$	$-4y = 8$
$\dfrac{2x}{2} = \dfrac{8}{2}$	$\dfrac{-4y}{-4} = \dfrac{8}{-4}$
$x = 4$	$y = -2$

Step 2 Graph the line.

Plot (4, 0) and (0, −2).
Connect with a straight line.

Helpful Hint

You can use a third point to check your line. Either choose a point from your graph and check it in the equation, or use the equation to generate a point and check that it is on your graph.

B $\dfrac{2}{3}y = 4 - \dfrac{1}{2}x$

Step 1 Write the equation in standard form.

$6\left(\dfrac{2}{3}y\right) = 6\left(4 - \dfrac{1}{2}x\right)$ *Multiply both sides by 6, the LCD of the fractions, to clear the fractions.*

$4y = 24 - 3x$

$3x + 4y = 24$ *Write the equation in standard form.*

Step 2 Find the intercepts.

x-intercept:	y-intercept:
$3x + 4y = 24$	$3x + 4y = 24$
$3x + 4(0) = 24$	$3(0) + 4y = 24$
$3x = 24$	$4y = 24$
$\dfrac{3x}{3} = \dfrac{24}{3}$	$\dfrac{4y}{4} = \dfrac{24}{4}$
$x = 8$	$y = 6$

Step 3 Graph the line.

Plot (8, 0) and (0, 6).
Connect with a straight line.
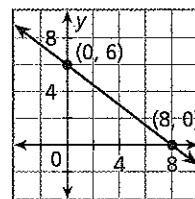
CHECK IT OUT! Use intercepts to graph the line described by each equation.

3a. $-3x + 4y = -12$ 3b. $y = \dfrac{1}{3}x - 2$

THINK AND DISCUSS

1. A function has x-intercept 4 and y-intercept 2. Name two points on the graph of this function.

2. What is the y-intercept of $2.304x + y = 4.318$? What is the x-intercept of $x - 92.4920y = -21.5489$?

3. **GET ORGANIZED** Copy and complete the graphic organizer.

Graphing $Ax + By = C$ Using Intercepts

1. Find the x-intercept by ___?___.	2. Find the y-intercept by ___?___.	3. Graph the line by ___?___.