

Key Concepts

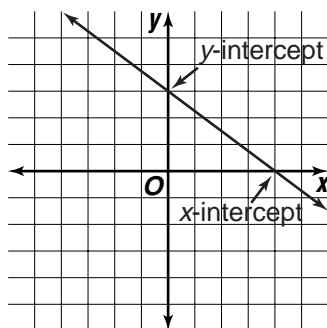


Intercepts

Objective Teach students to find the x - and y -intercepts of a line and to use these points to graph the equation of a line.

Finding the x - and y -Intercepts of a Line

First, tell students that the x - and y -intercepts of a line are the points where the line intersects the x - and y -axes, respectively. The diagram shown will help convey this idea.



For the line graphed, the x -intercept is 4, and y -intercept is 3.

Ask students, “How can you find the x - and y -intercepts of a line given by an equation?” Help students discover that if the equation is written in standard form or in point-slope form, you can find the x - and y -intercepts by solving the equation.

Consider the following examples.

Example 1 Find the x - and y -intercepts of $y = -2x - 8$.

Solution To find the x -intercept,
let $y = 0$.

$$y = -2x - 8$$

$$0 = -2x - 8$$

$$0 + 8 = -2x - 8 + 8$$

$$8 = -2x$$

$$\frac{8}{-2} = \frac{-2x}{-2}$$

$$-4 = x$$

The x -intercept is -4 .

The ordered pair is $(-4, 0)$

To find the y -intercept,
let $x = 0$.

$$y = -2x - 8$$

$$y = -2(0) - 8$$

$$y = 0 - 8$$

$$y = -8$$

The y -intercept is -8 .

The ordered pair is $(0, -8)$.

Example 2 Find the x - and y -intercepts of $2x + 3y = 12$.

Solution To find the x -intercept, let $y = 0$.

$$2x + 3y = 12$$

$$2x + 3(0) = 12$$

$$2x + 0 = 12$$

$$2x = 12$$

$$\frac{2x}{2} = \frac{12}{2}$$

$$x = 6$$

The x -intercept is 6.

The ordered pair is $(6, 0)$.

To find the y -intercept, let $x = 0$.

$$2x + 3y = 12$$

$$2(0) + 3y = 12$$

$$0 + 3y = 12$$

$$3y = 12$$

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

$$y = 4$$

The y -intercept is 4.

The ordered pair is $(0, 4)$.

Note to the Teacher *This is an excellent opportunity to work as a class to find the x - and y -intercepts of various equations written in standard form and in point-slope form. Here are a few classroom exercises.*

Exercises

State the x -intercept and the y -intercept for each line.

1. $2x + 5y = 20$

$(10, 0); (0, 4)$

2. $3x - 4y = 36$

$(12, 0); (0, -9)$

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

$(-6, 0); (0, 4)$

4. $7(y + 5) = 5(x - 14)$

$(21, 0); (0, -15)$

Graphing Using x - and y -Intercepts

Once we know both the x -intercept and the y -intercept, we can graph the equation.

Example 3 Graph $3x + 5y = 15$ using the x - and y -intercept.

Solution First, find the intercepts.

To find the y -intercept, let $x = 0$.

$$3 \cdot 0 + 5y = 15$$

$$5y = 15$$

$$y = 3$$

The y -intercept is 3.

The ordered pair is $(0, 3)$.

To find the x -intercept, let $y = 0$.

$$3x + 5 \cdot 0 = 15$$

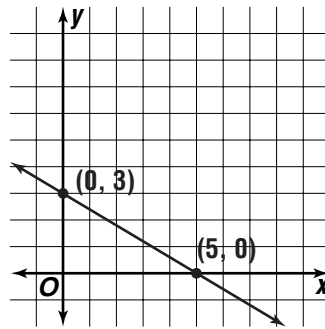
$$3x = 15$$

$$x = 5$$

The x -intercept is 5.

The ordered pair is $(5, 0)$.

We now graph these two points and draw the line that contains them.



Slope-Intercept Form

Note to the Teacher *The slope-intercept form is a special case of the point-slope form, where the given point of the line (x_0, y_0) lies on the y -axis, so $x_0 = 0$. This means that the equation is of the form $y - y_0 = mx$, or $y = mx + y_0$. So, the equation is given explicitly when we know both the intercept and the slope and it is simpler than the more general point-slope form. This is the most common form for the equation of a line. Write and label the equation on the chalkboard.*

$$y = mx + b$$

slope y-intercept

Key Idea	An equation for a line is said to be in slope-intercept form when it is of the form $y = mx + b,$ where m is the slope of the line and b is the y -coordinate of the y -intercept. Any line that is not vertical has an equation that can be written in slope-intercept form.
-----------------	--

Note to the Teacher *The equation of a vertical line cannot be written in slope-intercept form because the slope of a vertical line is undefined; that is, it has no slope.*

