# GRAPHING USING SLOPE-INTERCEPT FORM

## LESSON 3.1

Graph linear equations in slope-intercept form.

In **Lesson 2.5** you were introduced to linear functions. Slope-intercept form is the most common equation used to represent a linear function. It is called this because the slope and the $y$-intercept are easily identified.

**SLOPE-INTERCEPT FORM OF A LINEAR EQUATION**

$$y = mx + b$$

The slope of the line is represented by $m$.
The $y$-intercept is $b$.

- Slope ($m$) is also called the rate of change. The slope gives you the rise over the run of the line.
- The $y$-intercept is also called the start value. The $y$-intercept is the location where the line crosses the $y$-axis. The ordered pair for the $y$-intercept will be $(0, b)$.
- Equations in slope-intercept form may also be written $y = b + mx$.

Graphing an equation is a very important skill in mathematics because it is a visual representation of a mathematical equation. In this lesson you will learn how to graph an equation when it is presented in slope-intercept form.

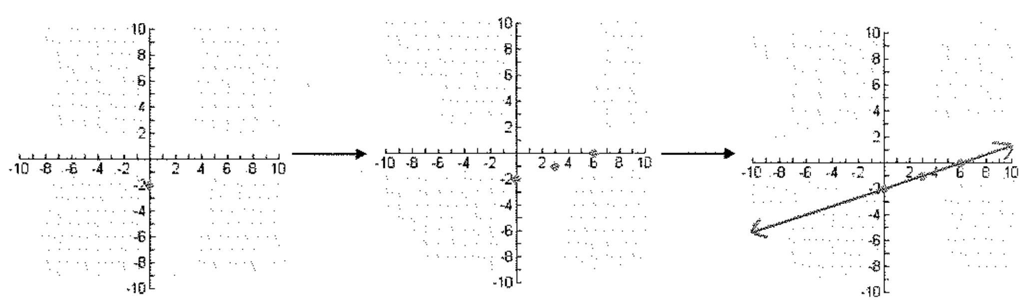
**EXAMPLE 1**

**Graph $y = \frac{1}{3}x - 2$. Clearly mark at least three points on the line.**

**SOLUTION**

First determine the slope and $y$-intercept. $y = \frac{1}{3}x - 2$ ← $y$-intercept, ↖ slope

$m = \frac{1}{3}$ and $b = -2$



Start by graphing the $y$-intercept on the coordinate plane.

Use the slope to find at least two more points. Remember rise over run.

Draw a straight line through the points. Put an arrow on each end.

EXAMPLE 2

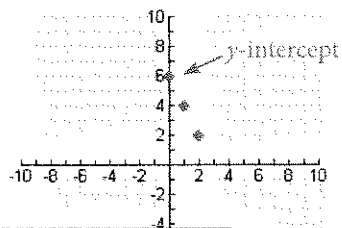
**Graph each linear equation. Clearly mark at least three points on each line.**

**a.** $y = 6 - 2x$ **b.** $y = -\frac{7}{2}x + 1$

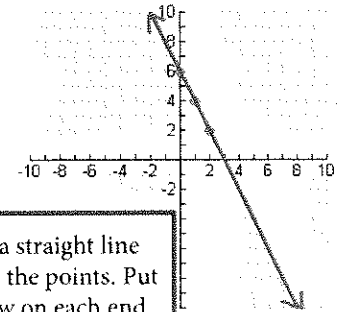
**SOLUTIONS**

**a.** $y = 6 - 2x \rightarrow m = -2$ and $b = 6$

The slope is the coefficient of $x$.

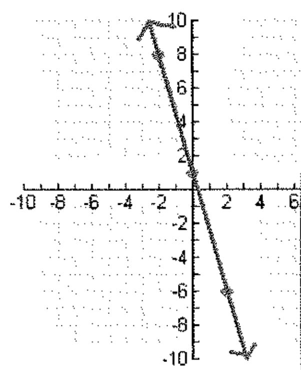



Graph the $y$-intercept of 6 and then graph 3 points using the slope fraction $-2 = \frac{-2}{1}$.



Draw a straight line through the points. Put an arrow on each end.

**b.** $y = -\frac{7}{2}x + 1 \rightarrow m = -\frac{7}{2}$ and $b = 1$



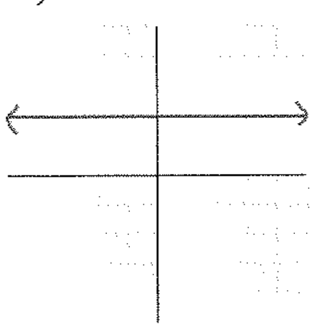
Sometimes you may have to use your slope in two directions. Go down 7 and right 2. In order to get another point on the coordinate plane, go up 7 and left 2.

$$\frac{-7}{2} = \frac{7}{-2}$$

As you learned in **Block 2**, there are lines that have a slope of zero and other lines that have an undefined slope. The equations of these lines are unique.

**Zero Slope**

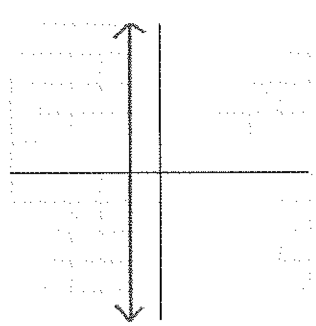
$y$ = constant



$y = 2$

**Undefined Slope**

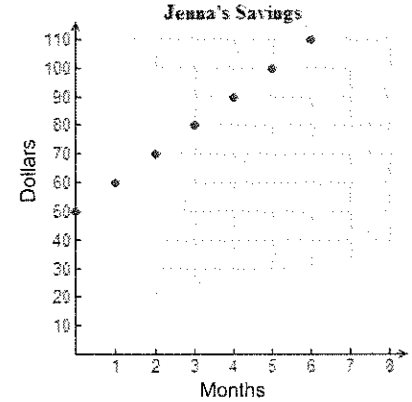
$x$ = constant



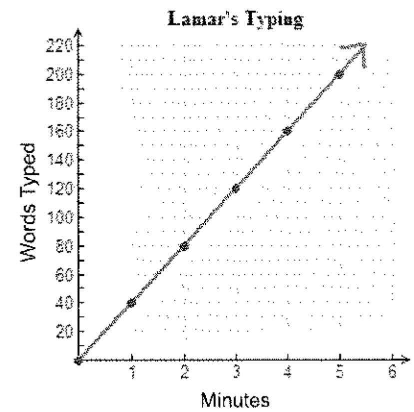
$x = -1$

When a graph can be drawn from beginning to end without lifting your pencil, it is continuous. Continuous graphs often represent real-world scenarios where something is happening continuously with no breaks. Some situations are modeled by linear equations but are not continuous. This could mean that it would not make sense to connect the points of the equation with a line.

For example, Jenna started with \$50 in her savings account. She adds \$10 each month. The linear equation that represents the balance in her savings account is $y = 50 + 10x$. Since she only puts money in her account once a month, a line should not be drawn through the points on the graph. Only the whole numbers and 0 can be used as $x$-values. This graph is called discrete because it is represented by a unique set of points rather than a continuous line.




A graph can be continuous but limited to a certain quadrant or section of the graph. For example, Lamar types 40 words per minute. It would not make sense to graph points out of the first quadrant because he cannot type for a negative number of minutes or type a negative number of words. This graph is continuous because it can be drawn without lifting your pencil.




## EXERCISES

**Draw a coordinate plane for each problem. Graph the given equation. Clearly mark three points on the line.**

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

**2.** $y = 1 - 3x$

**3.** $y = -\frac{2}{5}x + 6$

**4.** $y = x + 2$

**5.** $y = 4$

**6.** $y = -5 + \frac{4}{3}x$

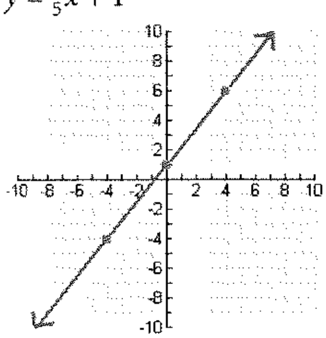
**7.** $x = -2$

**8.** $y = 5x$

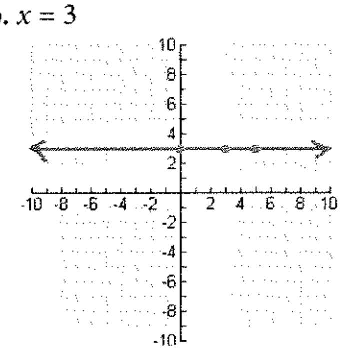
**9.** $y = -\frac{3}{2}x + 4$

**10.** Taylor's graphs of two different linear equations are seen below. His teacher told him both graphs were incorrect. Explain to Taylor why each of his graphs is not correct.

**a.** $y = \frac{4}{5}x + 1$



**b.** $x = 3$



**11.** Daryl was given the linear equation $y = 1.5x + 2$. He was not sure how to graph this equation because its slope was a decimal. Follow the process Daryl decided to use.

| $x$ | $y$ |
|---|---|
| −2 | |
| 0 | |
| 2 | |
| 4 | |

**a.** Copy the table and use the equation to fill in the output values.

**b.** Graph your ordered pairs $(x, y)$ from the table on a coordinate plane. Draw a line through the points.

**c.** Daryl was quite happy with the graph of the linear equation and was sure he had found the easiest way to deal with a linear equation which has a decimal slope value. Do you agree with him? Explain your reasoning.

**12.** Graph the three linear equations below on the same coordinate plane. Describe the similarities and differences of the three lines.

$y = \frac{3}{4}x$ $\qquad$ $y = \frac{3}{4}x - 5$ $\qquad$ $y = \frac{3}{4}x + 2$

**13.** Create a linear equation that satisfies each condition. Graph your equations on a coordinate plane.

**a.** Slope = $\frac{1}{3}$ and a negative $y$-intercept

**b.** Slope = 0 and a $y$-intercept of 4

**c.** A positive slope and a positive $y$-intercept

**d.** A negative slope and a $y$-intercept of 0

**14.** Mrs. Samuels warned her class that the linear equations shown below were the most-often missed problems on the linear equations test she gave to her class last year. Explain why you think each problem might have been missed and then graph each equation.

**a.** $y = x - 3$

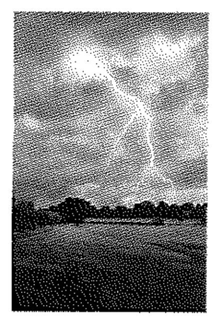
**b.** $y = 4$

**c.** $x = -4$

**d.** $y = 6 - x$

**15.** Falls City experienced a massive rainstorm from December 26th to December 30th in 1936. On the first day of the storm it rained 5.5 inches. It continued to rain 2.5 inches each day for the next four days.

| $x$ | $y$ |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |



**a.** Fill in the table with the TOTAL rain that had fallen during the storm as each day passed.

**b.** In this situation, which number represents the slope (or rate of change)?

**c.** Determine the $y$-intercept. Show all work necessary to justify your answer.

**d.** Write a linear equation that represents the total rainfall in Falls City based on the number of days the storm had lasted.

**e.** If the storm had continued at the same rate for 10 days, what would have been the total rainfall?

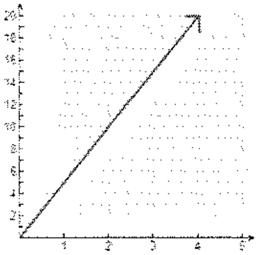
**16.** Dave was able to do 3 pull-ups before attending PE class. Each week of PE, the number of pull-ups he was able to do increased by 2.

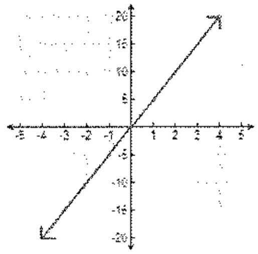
**a.** Write a linear equation representing the number of pull-ups, $y$, Dave was able to do in a given week, $x$.

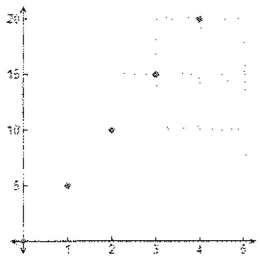
**b.** Would this graph be a continuous line? Why or why not?

**c.** Graph the equation in the way that best models the situation.

**Choose which of the following graphs is the best model for each situation. Explain your reasoning.**

A. 

B. 

C. 

**17.** Ima started collecting coins. She adds 5 coins to her collection each week.

**18.** Todd runs at a rate of 5 miles per hour.

**19.** A continuous relationship where $y$ is 5 times $x$.

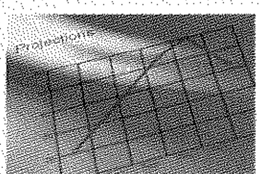
## REVIEW

**Find the slope of the line that passes through the given points.**

**20.** (2, 9) and (6, 11) **21.** (1, 2) and (1, 6) **22.** (3, −1) and (5, 0)

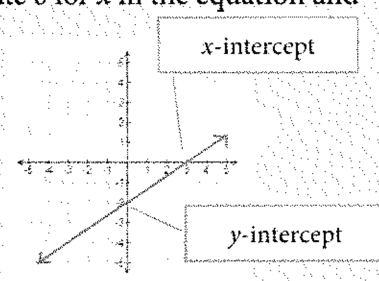
**23.** (−2, 6) and (1, 9) **24.** (4, 5) and (0, 5) **25.** (1, 2) and (4, −3)

## Tic-Tac-Toe ~ x- and y-Intercepts



When linear equations are written in standard form ($Ax + By = C$), they can be graphed by finding the $x$- and $y$-intercepts and then drawing a line through those two points.

- In order to find the $x$-intercept, you must substitute 0 for $y$ in the equation and then solve for $x$.
- In order to find the $y$-intercept, you must substitute 0 for $x$ in the equation and then solve for $y$.




*For example:* Graph $2x - 3y = 6$ using the intercept method:

| x-intercept | y-intercept |
|---|---|
| $2x - 3(0) = 6$ | $2(0) - 3y = 6$ |
| $2x = 6$ | $-3y = 6$ |
| $x = 3$ | $y = -2$ |

**Graph each of the following using the intercept method.**

**1.** $5x + 4y = 20$ **2.** $-3x + y = 6$ **3.** $2x - 3y = 9$
**4.** $-3x + 5y = 15$ **5.** $4x - y = -8$ **6.** $4x + 7y = 14$
**7.** Convert each of the equations in **#1-6** into slope-intercept form using the method shown in **Lesson 3.4**. Use the slope-intercept equation to verify that each graph has the correct $y$-intercept and slope.