Using Slope-Intercept Form

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6.6 **Using Slope-Intercept Form**

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[Figure 1]

Alyssa, a grade eight student, was looking through the school newsletter when she saw an ad placed by a local farmer looking for students to pick strawberries. The farmer has offered to pay the students a daily rate of $15.00 plus $3.00 for each quart basket of strawberries they pick.

Alyssa is interested in applying for a job but she would like to model the information with some type of a linear equation so she can figure out how much money she could make picking strawberries in one day. Alyssa is confident she can pick 50 quarts of berries in one day.

How can Alyssa figure this out?

In this concept, you will learn to use slope-intercept form.

Slope Intercept Form

A linear equation can be expressed in **standard form** as $Ax + By = C$ such that $A \neq 0$ and $B \neq 0$. When the equation is written in this form the x- and y-intercepts are easily found using the formulas:

The $x\text{-intercept} = \frac{C}{A}$ and $y\text{-intercept} = \frac{C}{B}$. To find the slope of the line using the equation written in standard form requires using algebra to solve the equation for the variable 'y'.

Linear equations can also be expressed in slope-intercept form as $y = mx + b$ such that 'm' is the slope of the line and 'b' is the y- intercept of the line.

Let's look at an example:

Graph the linear equation $y = 3x + 2$.
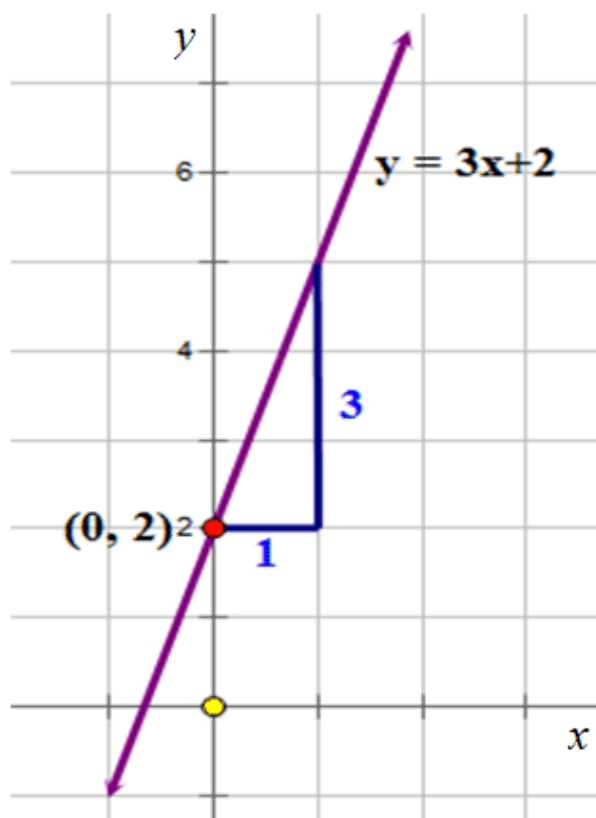
The graph of the line crosses the y-axis at the point $(0, 2)$. The slope of the line is one unit to the right (change in x) and up three units (change in y). The value of 'm' is $\dfrac{3}{1}$.

A linear equation written in standard form can be changed to slope-intercept form using algebra.

Given the equation $3x + 2y = 12$ written in standard form, rewrite it in slope-intercept form.

$$3x + 2y = 12$$

First, subtract $3x$ from both sides of the equation to isolate the 'y' term.

$$
\begin{aligned}
3x + 2y &= 12 \\
3x - 3x + 2y &= 12 - 3x
\end{aligned}
$$

Next, simplify both sides of the equation.

$$3x - 3x + 2y = 12 - 3x$$
$$2y = 12 - 3x$$

Next, rewrite the right side of the equation to correspond to $y = mx + b$.

$$2y = 12 - 3x$$
$$2y = -3x + 12$$

Then, divide both sides of the equation by '2' to solve for the variable 'y'.

$$2y = -3x + 12$$
$$\frac{\overset{1}{\cancel{2}}y}{\cancel{2}} = \frac{-3x}{2} + \frac{\overset{6}{\cancel{12}}}{\cancel{2}}$$
$$y = -\frac{3}{2}x + 6$$

The answer is $y = -\dfrac{3}{2}x + 6$.

For the following equation, identify the slope and the y-intercept of the line:

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

The equation is in the form

$$y = mx + b$$

The value of the slope (m) is $-\dfrac{3}{2}$ and the y-intercept (b) is $(0, 6)$.

Examples

Example 1

Earlier, you were given a problem about Alyssa and the strawberries. She needs to figure out how much money she can make picking 50 quarts of strawberries in one day. How can she do this?

Alyssa can write an equation in slope intercept form to represent the information she knows.

First, write down the information given in the ad.

$3.00 for each quart of berries picked plus $15.00 per day.

Next, write down the slope-intercept form of an equation.

$$y = mx + b$$

Next, for the given information, what do the letters represent?

y = amount of money earned

m = amount paid for each quart of berries picked

x = number of quarts of berries picked

b = amount paid for each day worked

Next, fill in the known values into the equation.

$$\begin{aligned} y &= mx + b \\ y &= 3x + 15 \end{aligned}$$

Then, using the equation fill in 50 for 'x' and simplify to calculate the total amount of money.

$$\begin{aligned} y &= 3x + 15 \\ y &= 3(50) + 15 \\ y &= 150 + 15 \\ y &= 165 \end{aligned}$$

The answer is 165.

Alyssa can earn $165.00 in one day picking strawberries.

Example 2

Write the following equation in slope-intercept form and state the slope and the y-intercept of the line.

$$-18x + 6y = 12$$

First, add $18x$ to both sides of the equation and simplify.

$$
\begin{aligned}
-18x + 6y &= 12 \\
-18x + 18x + 6y &= 12 + 18x \\
6y &= 12 + 18x
\end{aligned}
$$

Next, divide both sides of the equation by '6' to solve for 'y'.

$$
\begin{aligned}
6y &= 12 + 18x \\
\frac{\overset{1}{\cancel{6}}y}{\cancel{6}} &= \frac{\overset{2}{\cancel{12}}}{\cancel{6}} + \frac{\overset{3}{\cancel{18}}x}{\cancel{6}} \\
y &= 2 + 3x
\end{aligned}
$$

Then, express the equation in slope-intercept form.

$$
\begin{aligned}
y &= \textcolor{blue}{m}x + \textcolor{red}{b} \\
y &= \textcolor{blue}{3}x + \textcolor{red}{2}
\end{aligned}
$$

The slope of the line is '3' and the y-intercept is 2.

Example 3

For the following equation written in slope-intercept form, what is the slope and the y-intercept of the line?

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

First, match the given equation with the general form of an equation written in slope-intercept form.

$$y = mx + b$$
$$y = -\frac{3}{4}x - 1$$

The slope of the line is represented by 'm' and has a value of $-\dfrac{3}{4}$. The y-intercept of the line is represented by 'b' and has a value of -1.

Example 4

Write the following equation in slope-intercept form and state the slope and the y-intercept of the line.

$$7x - 3y = 21$$

First, subtract $7x$ from both sides of the equation and simplify.

$$
\begin{aligned}
7x - 3y &= 21 \\
7x - 7x - 3y &= 21 - 7x \\
-3y &= 21 - 7x
\end{aligned}
$$

Next, divide both sides of the equation by '-3' to solve for 'y'.

$$
\begin{aligned}
-3y &= 21 - 7x \\
\frac{\cancel{-3}\,y}{\cancel{-3}} &= \frac{\cancel{21}}{\cancel{-3}} - \frac{7}{-3}x \\
y &= -7 + \frac{7}{3}x
\end{aligned}
$$

Then, express the equation in slope-intercept form.

$$
\begin{aligned}
y &= mx + b \\
y &= \frac{7}{3}x - 7
\end{aligned}
$$

The slope of the line is $\dfrac{7}{3}$ and the y-intercept is -7.

Example 5

Write the following equation in slope-intercept form and state the slope and the y-intercept of the line.

$$5x + y = -10$$

First, subtract $5x$ from both sides of the equation and simplify.

$$
\begin{aligned}
5x + y &= -10 \\
5x - 5x + y &= -10 - 5x \\
y &= -10 - 5x
\end{aligned}
$$

Then, express the equation in slope-intercept form.

$$
\begin{aligned}
y &= \textcolor{blue}{mx} + \textcolor{red}{b} \\
y &= \textcolor{blue}{-5x} - \textcolor{red}{10}
\end{aligned}
$$

The slope of the line is -5 and the y-intercept is -10.

Review

Look at each equation and identify the slope and the y-intercept by looking at each equation. There are two answers for each problem.

1. $y = 2x + 4$

2. $y = 3x - 2$

3. $y = 4x + 3$

4. $y = 5x - 1$

5. $y = \dfrac{1}{2}x + 2$

6. $y = -2x + 4$

7. $y = -3x - 1$

8. $y = \dfrac{-1}{3}x + 5$

Use what you have learned to write each in slope-intercept form and then answer each question.

9. What form is the following equation in: $2x + 4y = 12$

10. Write this equation in slope-intercept form.

11. What is the slope?

12. What is the y-intercept?

13. What form is the following equation in: $6x + 3y = 24$

14. Write this equation in slope-intercept form.

15. What is the slope?

16. What is the y-intercept?

17. What form is the following equation in: $5x + 5y = 15$

18. Write this equation in slope-intercept form.

19. What is the slope?

20. What is the y-intercept?

Review (Answers)

To see the review answers, return to the Table of Contents and select 'Other Versions' or 'Resources'.

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