8.2 teacher notes

Objectives

- Write the equation of a line using slope-intercept form when given a graph.
- Write the equation of a line using slope-intercept form when given the slope and *y*-intercept.
- Write the equations of vertical and horizontal lines.
- Write the equations of lines parallel and perpendicular to given lines.

Vocabulary

Slope (Lesson 7-2)
y-intercept (Lesson 7-2)
Parallel lines (Lesson 8-1)
Perpendicular lines (Lesson 8-1)

Prerequisites

Graphing lines using the slope-intercept method

Graphing vertical and horizontal lines

Finding the slopes of parallel and perpendicular lines

Get Started

- What is the equation you would use to graph a line using the slope-intercept method? $y = mx + b$
- Which letter represents the slope in this equation? m
- Which letter represents the *y*-intercept in this equation? b

Section 1

Expand Their Horizons

In Module 7, students graphed lines using the slope-intercept method. In this section students will be asked to find the slope-intercept form of the equation of a line that is already graphed. To do this, they will replace the letters, m and b, in the equation $y = mx + b$ with the slope and y-intercept of the line.

Every line you can graph has an equation. The set of points that makes the equation true form the line. Even though lines that are parallel have the same slope, they have a different y-intercept.

In the first example, there is a graph of the line $y = \frac{3}{4}x + 3$. Have students count the slope along with the characters on the video. Remind them to first count the rise and then the run. Ask, "Why are the 3 and the 4 both positive values?" Three is positive because, on the y-axis, up is positive and down is negative. Four is positive because, on the x-axis, right is positive and left is negative. Have them replace the m in the equation with $\frac{3}{4}$. Next, have the class identify the y-intercept along with the characters and replace the b in the equation with 3. The equation of the line is $y = \frac{3}{4}x + 3$.

In the second example, the graph of the line $y = -2x - 2$, is very similar to the first. However, this line has both a negative slope and a negative y-intercept. Have students count the slope with the characters. To count the rise they will count up two units making the 2 a positive value. Then they must count left one unit to find the next point. This will make 1 have a negative value, or –1. The equation is $y = -2x - 2$.

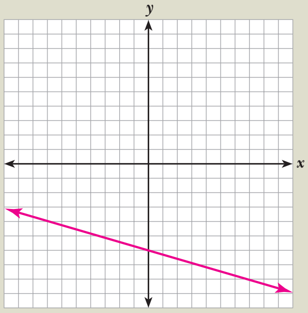
1 The y-intercept of this line is –4. Another point on the line is up one unit and right two units. Therefore, the equation is $y = \frac{1}{2}x - 4$.

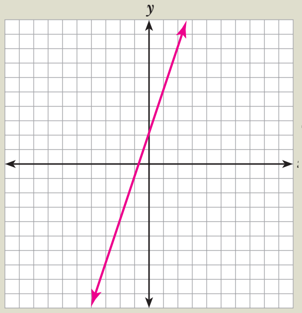
2 This line rises to the left. It will have a negative slope. The slope can be found by counting from the point (0, 0). Going up 4 units and left 5 units or going down 4 units and right 5 units will give another point on the line.

Additional Examples

1. Find the equation of the line in slope-intercept form.

The y-intercept of this line is –6. The slope is $-\frac{2}{7}$. Count up two units and left 7 units to find another point on the line. The equation in slope-intercept form is $y = -\frac{2}{7}x - 6$.





2. Find the equation of the line in slope-intercept form.

The y-intercept of this line is 2. The slope is 3. Count up 3 units and right 1 unit to find another point on the line. The equation in slope-intercept form is $y = 3x + 2$.

Section 2

Expand Their Horizons

In Section 2, students will write the slope-intercept form of the linear equation given the slope and the y-intercept. The line will no longer be shown. Students will replace the m in the equation $y = mx + b$ with the slope and replace the b in the equation with the y-intercept.

In the example, with a slope equal to 5 and a y-intercept equal to –2, the equation is $y = 5x - 2$. Remind students that adding a negative two is the same as subtracting a positive two.

Students also will be writing equations of horizontal and vertical lines. A horizontal line is of the form $y = b$, where b is the coordinate of all y values on the line. A horizontal line has a slope of zero. A vertical line is of the form $x = a$, where a is the coordinate of all x values on the line. A vertical line has an undefined slope.

In the example with a slope of zero and a y-intercept of –6, help students determine if the line is vertical or horizontal. Because the slope is zero, the line must be horizontal with the equation $y = -6$. If students are still experiencing difficulty, have them graph the line. Begin at the point (0, –6) and count using $\frac{0}{1}$ as the slope.

The next example has an undefined slope. Lines with an undefined slope are vertical. The equation is $x = -1$.

3 Help students correctly substitute values into the equation, $y = mx + b$. Watch to be sure that they write the slope as m and the y-intercept as b.

4 An equation with an undefined slope is always a vertical line through the x-coordinate of the point given. The equation is $x = -2$.

5 An equation with a slope of zero is always a horizontal line through the y-coordinate of the point given. The equation is $y = -9$.

Common Error Alert

Many times students will confuse vertical and horizontal lines. They will write the equation of a horizontal line as $x = a$ and the equation of a vertical line as $y = b$ because x is the horizontal axis and y is the vertical axis. To help students eliminate this mistake, show them a vertical line, and plot several coordinates on it showing that the x-coordinate is the one that does not change. Then, do the same for a horizontal line.

Additional Examples

1. Find the equation of the line in slope-intercept form.

slope: $\frac{5}{4}$
y-intercept: –2

Substitute the slope and y-intercept into the equation $y = mx + b$ to find the equation, $y = \frac{5}{4}x - 2$.

2. Find the equation of the line.

slope: 0
passes through (0, 0)

This is a horizontal line. The equation of this line is $y = 0$.

Section 3

Expand Their Horizons

In Section 3, students are introduced to equations of parallel and perpendicular lines. Help students remember that parallel lines always have the same slope. Perpendicular lines have slopes that are negative reciprocals. You may want them to practice finding slopes of parallel and perpendicular lines before you continue the video.

For example, find the slope of a line that is parallel to a line having a slope of:

a) $\frac{1}{2}$ $\left(\frac{1}{2}\right)$ b) –3 (–3) c) $-\frac{5}{3}$ $\left(-\frac{5}{3}\right)$

Find the slope of a line that is perpendicular to a line having a slope of:

a) $\frac{1}{2}$ (–2) b) –3 $\left(\frac{1}{3}\right)$ c) $-\frac{5}{3}$ $\left(\frac{3}{5}\right)$

Connections

Air traffic controllers must be familiar with the concept of linear equations and parallel lines. They should be able to determine from the linear path that two airplanes are traveling whether or not their paths are parallel. Thus, they can help the aircrafts avoid collision.

Find the equation of the line that is parallel to $y = -2x - 2$ and has a y-intercept of 5. Because the lines are parallel, they have the same slope. The given line has a slope of –2. Therefore, a line parallel to the given line will have a slope of –2. The equation is $y = -2x + 5$.

Find the equation of the line that is perpendicular to $y = 2x + 6$ and has a y-intercept of 3. The negative reciprocal of 2 is $-\frac{1}{2}$. The equation is $y = -\frac{1}{2}x + 3$.

6 Some students may feel more comfortable writing this equation as $y = -\frac{4}{7}x + (-3)$. This answer is also acceptable.

7 Remind students that the opposite of a negative is a positive. Therefore, the negative reciprocal of $\frac{-3}{4}$ is $\frac{4}{3}$.

Look Beyond

In later topics students will be finding the equation of a line of best fit. Data is collected and plotted as points on a scatterplot. Then the line that best fits this data is drawn, and its equation is found using the slope and y-intercept of the line. These lines are then used to make predictions about data that has yet to be collected.

Additional Examples

1. Write the equation of the line that is parallel to $y = -4x + 6$ and has a y-intercept of 9.

Because the lines are parallel, they have the same slope, –4. The equation of this line is $y = -4x + 9$.

2. Write the equation of the line that is perpendicular to the line $y = \frac{1}{3}x - 2$ and has a y-intercept of $-\frac{2}{3}$.

Because the lines are perpendicular, they have slopes that are negative reciprocals. The slope of the given line is $\frac{1}{3}$. The slope of a perpendicular line is –3. The equation is $y = -3x - \frac{2}{3}$.