

Warm Up

Lesson Presentation

Lesson Quiz

Holt McDougal Algebra 2

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Warm Up

Write each function in slope-intercept form.

1. $4x + y = 8$ 2. $-y = 3x$ 3. $2y = 10 - 6x$
 $y = -4x + 8$ $y = -3x$ $y = -3x + 5$

Determine whether each line is vertical or horizontal.

4. $x = \frac{3}{4}$ 5. $y = 0$
vertical horizontal

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Objectives

Use slope-intercept form and point-slope form to write linear functions.

Write linear functions to solve problems.

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Vocabulary

Point-slope form

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Recall from Lesson 2-3 that the slope-intercept form of a linear equation is $y = mx + b$, where m is the slope of the line and b is its y -intercept.

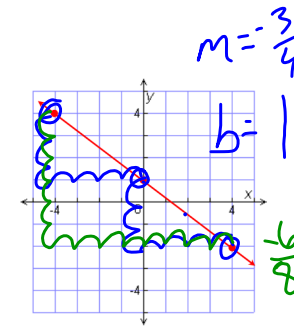
In Lesson 2-3, you graphed lines when you were given the slope and y -intercept. In this lesson you will write linear functions when you are given graphs of lines or problems that can be modeled with a linear function.

Example 1: Writing the Slope-Intercept Form of the Equation of a Line

Write the equation of the graphed line in slope-intercept form.

$$y = mx + b$$

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



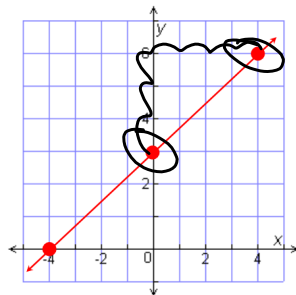
Check It Out! Example 1

$m =$ $b =$

Write the equation of the graphed line in slope-intercept form.

$$y = mx + b$$

$$y = \frac{3}{4}x + 3$$



Example 2A: Finding the Slope of a Line Given Two or More Points

Find the slope of the line through $(-1, 1)$ and $(2, -5)$.

Let (x_1, y_1) be $(-1, 1)$ and (x_2, y_2) be $(2, -5)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - 1}{2 - (-1)} = \frac{-6}{3} = -\frac{6}{3} = -2$$

Use the slope formula.

The slope of the line is -2 .

Example 2B: Finding the Slope of a Line Given Two or More Points

Find the slope of the line.

x	4	8	12	16
y	2	5	8	11

$$\frac{\Delta y}{\Delta x} = \frac{3}{4}$$

Let (x_1, y_1) be $(4, 2)$ and (x_2, y_2) be $(8, 5)$. *Choose any two points.*

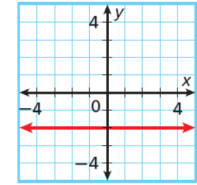
$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - 2}{8 - 4} = \frac{3}{4} \quad \text{Use the slope formula.}$$

The slope of the line is $\frac{3}{4}$.

Example 2C: Finding the Slope of a Line Given Two or More Points

Find the slope of the line shown.

Let (x_1, y_1) be $(0, -2)$ and (x_2, y_2) be $(1, -2)$.



$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - (-2)}{1 - 0} = \frac{0}{1} = 0$$

The slope of the line is 0.

Check It Out! Example 2A

Find the slope of the line.

x	-6	-4	-2
y	-3	-1	1

Let (x_1, y_1) be $(-4, -1)$ and (x_2, y_2) be $(-2, 1)$. *Choose any two points.*

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - (-1)}{-2 - (-4)} = \frac{2}{2} = 1 \quad \text{Use the slope formula.}$$

The slope of the line is 1.

Check It Out! Example 2BFind the slope of the line through $(2, -5)$ and $(-3, -5)$.

Let (x_1, y_1) be $(2, -5)$ and (x_2, y_2) be $(-3, -5)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - (-5)}{-3 - 2} = \frac{0}{-5} = 0 \quad \text{Use the slope formula.}$$

The slope of the line is 0.

Because the slope of line is constant, it is possible to use any point on a line and the slope of the line to write an equation of the line in **point-slope form**.

Point-Slope Form

The equation of a line with a slope of m and the point (x_1, y_1) is

$$y - y_1 = m(x - x_1)$$

Example 3: Writing Equations of Lines

In slope-intercept form, write the equation of the line that contains the points in the table.

x	-8	-4	4	8
y	-5	-3.5	-0.5	1

Handwritten work for Example 3:

- Graph of the line passing through the points in the table.
- Handwritten slope calculation: $m = \frac{3}{8}$
- Handwritten equations: $y + 5 = \frac{3}{8}(x + 8)$, $y + 5 = \frac{3}{8}x + 3$, $y = \frac{3}{8}x - 2$
- Handwritten slope-intercept form: $y = \frac{3}{8}x - 2$
- Handwritten slope calculation: $m = \frac{6}{16} = \frac{3}{8}$

Example 3 Continued

Method A Point-Slope Form
Using (8, 1):

Rewrite in slope-intercept form.

$$y - y_1 = m(x - x_1)$$

$$y - (1) = \frac{3}{8}(x - 8) \text{ Substitute.}$$

$$y - 1 = \frac{3}{8}x - 3 \text{ Distribute.}$$

$$y - 1 = \frac{3}{8}(x - 8) \text{ Simplify.}$$

$$y = \frac{3}{8}x - 2 \text{ Solve for } y.$$

Example 3 Continued

Method B Slope-intercept Form

Using (8, 1), solve for b .

Rewrite the equation using m and b .

$$y = mx + b$$

$$1 = \frac{3}{8}(8) + b \text{ Substitute.}$$

$$y = \frac{3}{8}x - 2 \text{ } y = mx + b$$

$$1 = 3 + b \text{ Simplify.}$$

$$b = -2 \text{ Solve for } b.$$

The equation of the line is $y = \frac{3}{8}x - 2$.

Check It Out! Example 3a

Write the equation of the line in slope-intercept form with slope -5 through $(1, 3)$.

$$\begin{aligned} y - y_1 &= m(x - x_1) \\ y - 3 &= -5(x - 1) \end{aligned}$$

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Check It Out! Example 3b

Write the equation of the line in slope-intercept form through $(-2, -3)$ and $(2, 5)$.

o Slope $\frac{5 - (-3)}{2 - (-2)} = \frac{8}{4} = 2$

$$\begin{aligned} y - (-3) &= 2(x - (-2)) \\ y + 3 &= 2(x + 2) \\ y + 3 &= 2x + 4 \\ y &= 2x + 1 \end{aligned}$$

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Example 4A: Entertainment Application

The table shows the rents and selling prices of properties from a game.

Express the rent as a function of the selling price.

Let x = selling price and y = rent

Selling Price (\$)	Rent (\$)
75	9
90	12
160	26
250	44

Find the slope by choosing two points. Let (x_1, y_1) be $(75, 9)$ and (x_2, y_2) be $(90, 12)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{12 - 9}{90 - 75} = \frac{3}{15} = \frac{1}{5}$$

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Example 4A Continued

To find the equation for the rent function, use point-slope form.

$$y - y_1 = m(x - x_1)$$

$$y - 9 = \frac{1}{5}(x - 75) \quad \text{Use the data in the first row of the table.}$$

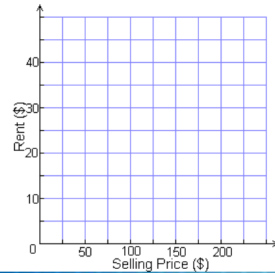
$$y = \frac{1}{5}x - 6 \quad \text{Simplify.}$$

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Example 4B: Entertainment Application

Graph the relationship between the selling price and the rent. How much is the rent for a property with a selling price of \$230?



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Check It Out! Example 4a

Express the cost as a linear function of the number of items.

Items	Cost (\$)
4	14.00
7	21.50
18	

Let x = items and y = cost.

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By comparing slopes, you can determine if the lines are parallel or perpendicular. You can also write equations of lines that meet certain criteria.

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Parallel and Perpendicular Lines

WORDS	GRAPH	ALGEBRA
<p>Parallel Lines If both slopes are defined, the slopes of parallel lines are equal. The slopes of parallel vertical lines are undefined.</p>		<p>$y_1 = 2x + 1$, so $m_1 = 2$ $y_2 = 2x - 3$ so $m_2 = 2$ $m_1 = m_2$ $2 = 2$</p>
<p>Perpendicular Lines If both slopes are defined, the slopes of perpendicular lines are opposite reciprocals. Their product is -1. A vertical line and a horizontal line are perpendicular.</p>		<p>$y_1 = -\frac{3}{2}x + 4$, so $m_1 = -\frac{3}{2}$ $y_2 = \frac{2}{3}x - 3$, so $m_2 = \frac{2}{3}$ $(m_1)(m_2) = -1$ $(-\frac{3}{2})(\frac{2}{3}) = -1$</p>

Handwritten notes in blue ink: $\frac{0}{1}$ next to the parallel section, and $\frac{2}{3} \cdot -\frac{3}{2} = -1$ next to the perpendicular section.

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Example 5B: Writing Equations of Parallel and Perpendicular Lines

Write the equation of the line in slope-intercept form.

~~perpendicular to $y = \frac{3}{2}x - 1$~~ and through $(9, -2)$

$m = \frac{2}{3}$

$y + 2 = \frac{2}{3}(x - 9)$

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

$y = \frac{2}{3}x - 8$

Check It Out! Example 5a

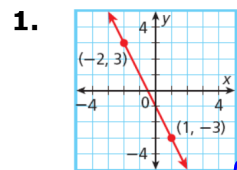
Write the equation of the line in slope-intercept form.

parallel to $y = 5x - 3$ and through $(1, 4)$

$m = 5$

Lesson Quiz: Part I

Write the equation of each line in slope-intercept form.



2. parallel to $y = 0.5x + 2$ and through $(6, 1)$

3. perpendicular to $y = \frac{2}{3}x + 1$ and through $(4, 4)$

$m = \frac{3}{2}$

Lesson Quiz: Part II

4. Express the catering cost as a function of the number of people. Find the cost of catering a meal for 24 people.

Number in Group	Cost (\$)
4	98
7	134
15	230

$$\begin{array}{l} \text{Kevin} = x \\ \text{Keith} = x - 5 \\ \text{Kara} = x + 3 \end{array}$$

$x =$

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