

Write an equation in point-slope form of the line that passes through the given point and has the given slope.

1. $(-5, -7); m = -3$

2. $(9, -3); m = \frac{8}{3}$

$y + 7 = -3(x + 5)$

$y + 3 = \frac{8}{3}(x - 9)$

3. $(0, -1); m = 3$

4. $(2, 0); m = -1$

$y + 1 = 3(x - 0)$

$y - 0 = -1(x - 2)$

5. $(-4, 2); m = -\frac{4}{7}$

6. $(-5, -3); m = \frac{1}{2}$

$y - 2 = -\frac{4}{7}(x + 4)$

$y + 3 = \frac{1}{2}(x + 5)$

Warm Up

Write the sentence as an inequality. Graph the inequality.

1. A number q is greater than 7 or less than 1.

2. A number p is greater than or equal to -6 and less than 11.

3. A number n is less than $-6\frac{1}{4}$ and at least -11 .

4. A number s is no more than -0.4 or greater than 10.4.

Review: Students need to write in point-slope form:

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

• Remind students to simplify after substituting a negative - don't want two operation symbols side by side

• Simplify after subbing a zero \rightarrow for example

$$\begin{aligned} 3.) \quad y + 1 &= 3(x - 0) \\ y + 1 &= 3x \end{aligned}$$

• Review of writing Inequalities

• Review of graphing

• Compound Inequalities
• Conjunctions
• Disjunctions

• Open circle
• Closed circle

Essential Question

How can you recognize lines that are parallel or perpendicular?

parallel lines: never intersect

perpendicular lines: intersect as a right angle.

Essential Question

• Student explanation
 • can use desmos to see the relation of each of the lines.

• Work in small groups

Work with a partner. Write each linear equation in slope-intercept form. Then use a graphing calculator to graph the three equations in the same square viewing window. (The graph of the first equation is shown.) Which two lines appear parallel? How can you tell?

a. $3x + 4y = 6$

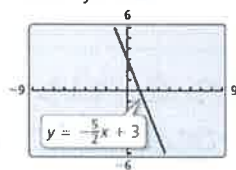
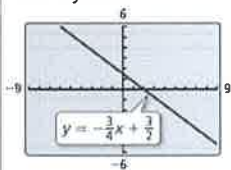
$3x + 4y = 12$

$4x + 3y = 12$

b. $5x + 2y = 6$

$2x + y = 3$

$2.5x + y = 5$



Continued Student
explanation

Work with a partner. Write each linear equation in slope-intercept form. Then use a graphing calculator to graph the three equations in the same square viewing window. (The graph of the first equation is shown.) Which two lines appear perpendicular? How can you tell?

a. $3x + 4y = 6$

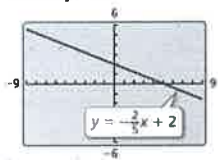
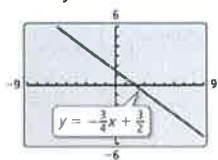
$3x - 4y = 12$

$4x - 3y = 12$

b. $2x + 5y = 10$

$-2x + y = 3$

$2.5x - y = 5$



Exploration 2

parallel lines \rightarrow if they
have the same slope
the lines are parallel.

Core Concept

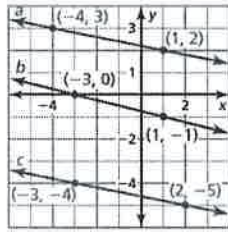
Parallel Lines and Slopes

Two lines in the same plane that never intersect are **parallel lines**. Nonvertical lines are parallel if and only if they have the same slope.

All vertical lines are parallel.

Determine which of the lines are parallel.

Lines a and c
are parallel



Two ways to approach

1.) Count between points
to determine slope

* pay attention to
positive and negative

2.) Calculate each slope
using slope formula

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Example 1

Write an equation of the line that passes through (5, -4) and is parallel to the line $y = 2x + 3$.

$$\begin{aligned} y - y_1 &= m(x - x_1) \\ y - (-4) &= 2(x - 5) \\ y + 4 &= 2(x - 5) \\ y + 4 &= 2x - 10 \\ -4 & \quad -4 \\ y &= 2x - 14 \end{aligned}$$

given a line
 $y = 2x + 3$

define slope : 2

parallel \rightarrow same slope

use new point to
write new equation
(5, -4)

Example 2

* Student practice

1. Line a passes through $(-5, 3)$ and $(-6, -1)$. Line b passes through $(3, -2)$ and $(2, -7)$. Are the lines parallel? Explain.

$$m = \frac{-1-3}{-6-5} = \frac{-4}{-1} = 4 \quad \text{slopes are not the same}$$

$$m = \frac{-7+2}{2-3} = \frac{-5}{-1} = 5 \quad \text{not parallel}$$

2. Write an equation of the line that passes through $(-4, 2)$ and is parallel to the line $y = \frac{1}{4}x + 1$. $m = \frac{1}{4}$

$$y - 2 = \frac{1}{4}(x + 4)$$

$$y - 2 = \frac{1}{4}x + 1$$

$$+ 2 \quad + 2$$

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

Monitoring Progress 1-2

perpendicular lines:
 • Slopes are opposite reciprocals

example:

$$m = 2 \quad \text{perp} \quad m = -\frac{1}{2}$$

$$m = -\frac{3}{4} \quad \text{perp} \quad m = \frac{4}{3}$$

$$m = -4 \quad \text{perp} \quad m = \frac{1}{4}$$

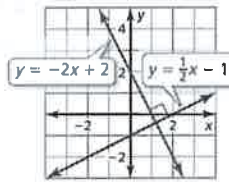
• all whole numbers can be written as fractions as long as you write it over 1.

Core Concept

Perpendicular Lines and Slopes

Two lines in the same plane that intersect to form right angles are **perpendicular lines**. Nonvertical lines are perpendicular if and only if their slopes are negative reciprocals.

Vertical lines are perpendicular to horizontal lines.



Determine which of the lines, if any, are parallel or perpendicular.

Line a: $y = 4x + 2$

Line b: $x + 4y = 3$

Line c: $-8y - 2x = 16$

$$m = 4$$

$$4y = -x + 3$$

$$-8y = 2x + 16$$

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

$$y = -\frac{1}{4}x - 2$$

$$m = -\frac{1}{4}$$

$$m = -\frac{1}{4}$$

Example 3

Write an equation of the line that passes through $(-3, 1)$ and is perpendicular to the line $y = \frac{1}{2}x + 3$.

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

$$y - 1 = -2(x + 3)$$

$$y - 1 = -2x - 6$$

$$y = -2x - 5$$

Example 4

Write each line in the form of

$$y = mx + b$$

review slopes (m)

Line a perpendicular to lines b and c

Line b and c are parallel

use given equation to define slope

$$y = \frac{1}{2}x + 3$$

$$m = \frac{1}{2}$$

$$\text{new slope } m = -2$$

3. Determine which of the lines, if any, are parallel or perpendicular. Explain.

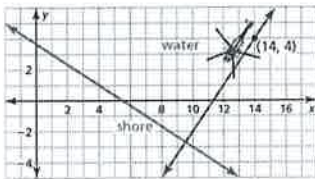
Line a: $2x + 6y = -3$ Line b: $y = 3x - 8$ Line c: $-6y + 18x = 9$

4. Write an equation of the line that passes through $(-3, 5)$ and is perpendicular to the line $y = -3x - 1$.

* Student practice

Monitoring Progress 3-4

The position of a helicopter search and rescue crew is shown in the graph. The shortest flight path to the shoreline is one that is perpendicular to the shoreline. Write an equation that represents this path.



Word problem for Slope.

Use Shore graph, find the Slope → Count

Use slope to write equation of line for water

Continuation of word
problems

5. In Example 5, a boat is traveling parallel to the shoreline and passes through (9, 3). Write an equation that represents the path of the boat.

Monitoring Progress 5

Writing Prompt: To write an equation of the line that passes through (-2, 4) and is parallel to $y = -3x + 4$, ...