Interactive Classroom

Glencoe

ALGEBRA 1

LESSON 4–4 Parallel and Perpendicular Lines

Lesson Menu

5-Minute Check

Over Lesson 4–3

CheckPoint

1 What is the point-slope form of an equation for a line that passes through the point (5, –5) with the slope $m = 2$?

A. $y = 2x + 5$

B. $y = 2x - 5$

C. $y + 5 = 2(x - 5)$

D. $y = 2(x - 5)$

5-Minute Check Over Lesson 4–3

CheckPoint

New Vocabulary

- Slope-Intercept Form

$$y = mx + b$$

- Standard Form

$$Ax + By = C$$

- Point-slope Form

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

5-Minute Check

Over Lesson 4–3

CheckPoint

2 What is the point-slope form of an equation for a line that passes through the point $(-1, 5)$ with the slope $m = -\frac{7}{16}$?

A. $y = -\frac{7}{16}(x + 1)$

B. $y - 1 = -\frac{7}{16}x$

C. $y + 5 = \frac{7}{16}(x + 1)$

D. $y - 5 = -\frac{7}{16}(x + 1)$

5-Minute Check

Over Lesson 4–3

CheckPoint

3 What is $y - 3 = \frac{8}{9}(x + 18)$ in slope-intercept form?

A. $y = \frac{8}{9}x + 15$

B. $y = \frac{8}{9}x + 19$

C. $y = \frac{8}{3}x + 15$

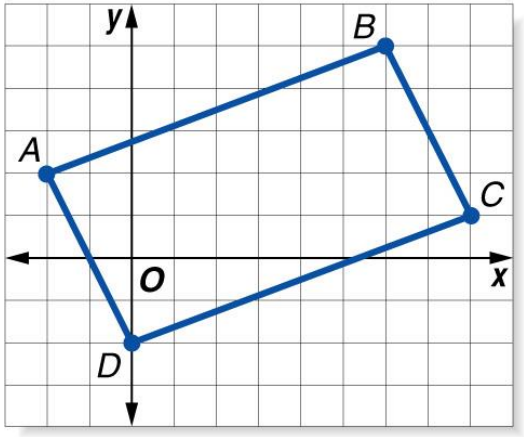
D. $y = \frac{8}{3}x + 19$

5-Minute Check

Over Lesson 4–3

CheckPoint

4 **A. What is the standard form of the equation of the diagonal $\overline{AC}$?**



A. $x + 10y = 18$

B. $x + 5y = 9$

C. $10x + y = 18$

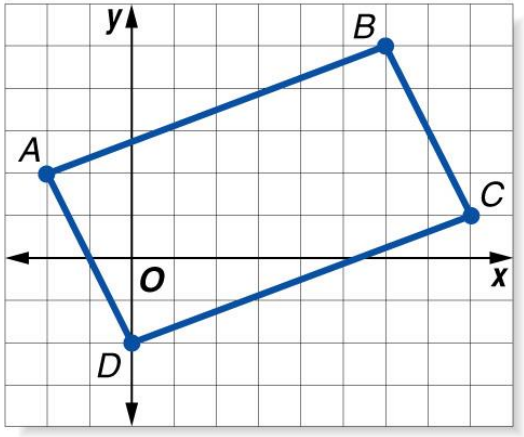
D. $x - 10y = 9$

5-Minute Check

Over Lesson 4–3

CheckPoint

4 B. What is the slope-intercept form of the equation of the diagonal $\overline{AC}$?



A. $10y = 18 - x$

B. $y = -\frac{1}{10}x + \frac{9}{5}$

C. $y = -\frac{1}{10}x + 9$

D. $y = 18 - x$

5-Minute Check

Over Lesson 4–3

CheckPoint

Standardized Test Practice

5 Which equation has a graph that passes through the points at (3, 4) and (–1, –4)?

A. $y - 3 = 2(x - 4)$

B. $y + 1 = 2(x + 4)$

C. $y + 4 = 2(x - 1)$

D. $y - 4 = 2(x - 3)$

Content Standards

F.LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

S.ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

Mathematical Practices

5 Use appropriate tools strategically.

Then

You wrote equations in point-slope form.

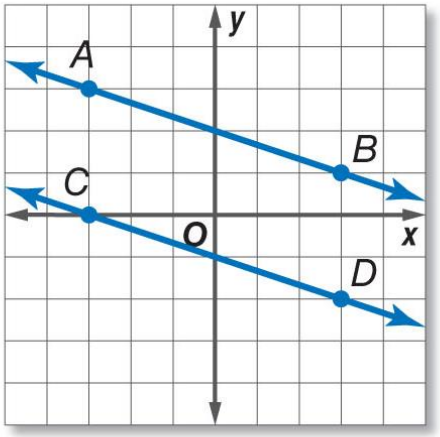
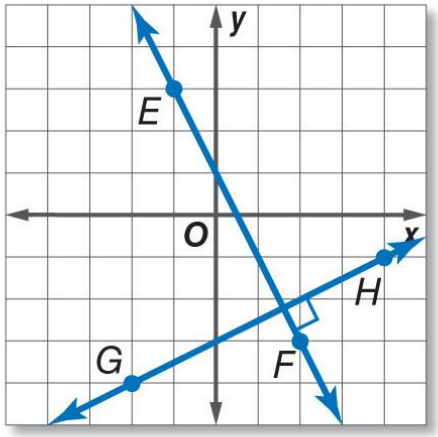
Now

- Write an equation of the line that passes through a given point, parallel to a given line.
- Write an equation of the line that passes through a given point, perpendicular to a given line.

New Vocabulary

- parallel lines
- perpendicular lines

ConceptSummary Parallel and Perpendicular Lines

	Parallel Lines	Perpendicular Lines
Words	Two nonvertical lines are parallel if they have the same slope.	Two nonvertical lines are perpendicular if the product of their slopes is −1.
Symbols	$\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$	$\overleftrightarrow{EF} \perp \overleftrightarrow{GH}$
Models		

EXAMPLE 1 Parallel Line Through a Given Point

Write the slope-intercept form of an equation for the line that passes through (4, –2) and is parallel to the graph of $y = \frac{1}{2}x - 7$.

The line parallel to $y = \frac{1}{2}x - 7$ has the same slope, $\frac{1}{2}$.

Replace m with $\frac{1}{2}$, and (x_1, y_1) with $(4, -2)$ in the point-slope form.

EXAMPLE 1 Parallel Line Through a Given Point

$y - y_1 = m(x - x_1)$ Point-slope form

$y - (-2) = \frac{1}{2}(x - 4)$ Replace m with $\frac{1}{2}$, y_1 with –2, and x_1 with 4.

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

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

$y + 2 - 2 = \frac{1}{2}x - 2 - 2$ Subtract 2 from each side.

EXAMPLE 1 Parallel Line Through a Given Point

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

Write the equation in slope-intercept form.

Answer: The equation is $y = \frac{1}{2}x - 4$.

EXAMPLE 1 Check Your Progress

CheckPoint

Write the slope-intercept form of an equation for the line that passes through (2, 3) and is parallel to the graph of $y = \frac{1}{2}x - 1$.

A. $y = -2x + 3$

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

C. $y = \frac{1}{2}x + 2$

D. $y = -2x - 1$

EXAMPLE 4 Perpendicular Line Through a Given Point

Write an equation in slope-intercept form for the line that passes through (4, –1) and is perpendicular to the graph of $7x - 2y = 3$.

Step 1 Find the slope of the given line by solving the equation for y.

$7x - 2y = 3$ Original equation

$7x - 7x - 2y = -7x + 3$ Subtract $7x$ from each side.

$-2y = -7x + 3$ Simplify.

$\frac{-2y}{-2} = \frac{-7x + 3}{-2}$ Divide each side by –2.

$y = \frac{7}{2}x + \frac{3}{2}$ Simplify.

EXAMPLE 4 Perpendicualar Line Through a Given Point

The slope is $\frac{7}{2}$.

Step 2 The slope of the perpendicular line is the opposite reciprocal of $\frac{7}{2}$ or $-\frac{2}{7}$. Find the equation of the perpendicular line.

$y - y_1 = m(x - x_1)$ Point-slope form

$y - (-1) = -\frac{2}{7}(x - 4)$ $(x_1, y_1) = (4, -1)$ and $m = -\frac{2}{7}$

$y + 1 = -\frac{2}{7}(x - 4)$ Simplify.

EXAMPLE 4 Perpendicualar Line Through a Given Point

$$y + 1 = -\frac{2}{7}x + \frac{8}{7}$$ Distributive Property

$$y + 1 - 1 = -\frac{2}{7}x + \frac{8}{7} - 1$$ Subtract 1 from each side.

$$y = -\frac{2}{7}x + \frac{1}{7}$$ Simplify.

Answer: $y = -\frac{2}{7}x + \frac{1}{7}$

EXAMPLE 4 Check Your Progress

CheckPoint

Write an equation in slope-intercept form for the line that passes through (–3, –2) and is perpendicular to the graph of $x + 4y = 12$.

A. $y = \frac{1}{4}x + 10$

B. $y = 4x + 10$

C. $y = -4x + 10$

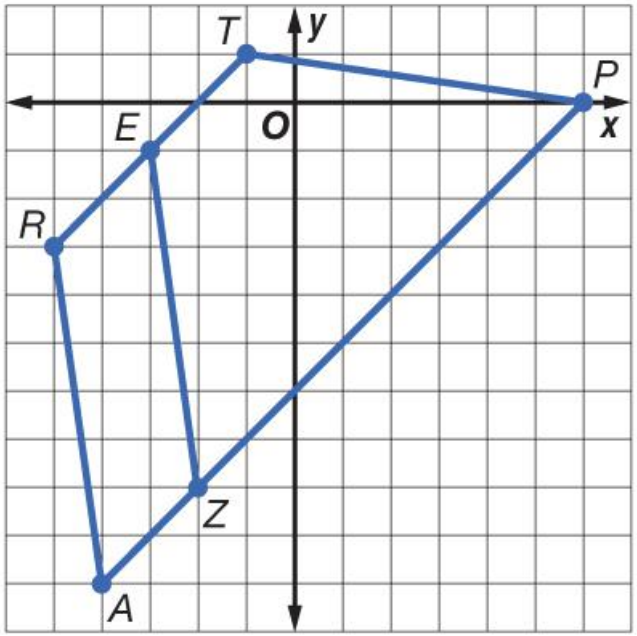
D. $y = -\frac{1}{4}x + 10$

Homework:

Pg 243 #11-15 odd,
23-27 odd

Real-World Example 2 Slopes of Perpendicular Lines

A. GEOMETRY The height of a trapezoid is the length of a segment that is perpendicular to both bases. In trapezoid *ARTP*, $\overline{RT}$ and $\overline{AP}$ are bases. Can $\overline{EZ}$ be used to measure the height of the trapezoid? Explain.



Real-World Example 2 Slopes of Perpendicular Lines

Find the slope of each segment.

Slope of $\overline{RT}$: $m = \frac{1-(-3)}{-1-(-5)}$ or 1

Slope of $\overline{AP}$: $m = \frac{0-(-10)}{6-(-4)}$ or 1

Slope of $\overline{EZ}$: $m = \frac{-8-(-1)}{-2-(-3)}$ or -7

Answer: The slope of $\overline{RT}$ and $\overline{AP}$ is 1 and the slope of $\overline{EZ}$ is –7. Since $1(-7) \neq -1$, $\overline{EZ}$ is not perpendicular to $\overline{RT}$ and $\overline{AP}$. So, it cannot be used to measure the height of $ARTP$.

Real-World Example 2 Slopes of Perpendicular Lines

B. GEOMETRY **The height of a trapezoid is the length of a segment that is perpendicular to both bases. In trapezoid *ARTP*, $\overline{RT}$ and $\overline{AP}$ are bases. Are the bases parallel?**

Slope of $\overline{RT}$: $m = \dfrac{1-(-3)}{-1-(-5)}$ or 1

Slope of $\overline{AP}$: $m = \dfrac{0-(-10)}{6-(-4)}$ or 1

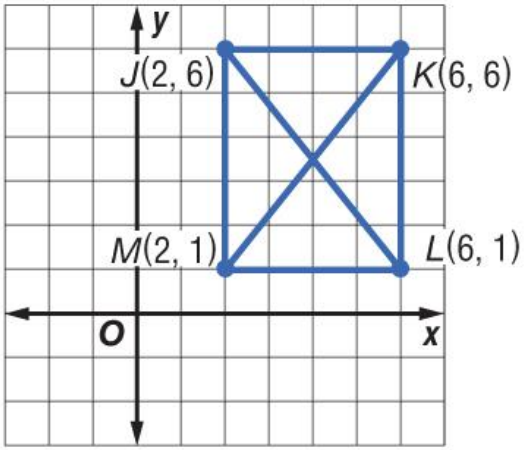
Answer: Yes, both $\overline{RT}$ and $\overline{AP}$ have a slope of 1.

Real-World Example 2

Check Your Progress

CheckPoint

The graph shows the diagonals of a rectangle. Determine whether $\overline{JL}$ is perpendicular to $\overline{KM}$.



A. $\overline{JL}$ is not perpendicular to $\overline{KM}$.

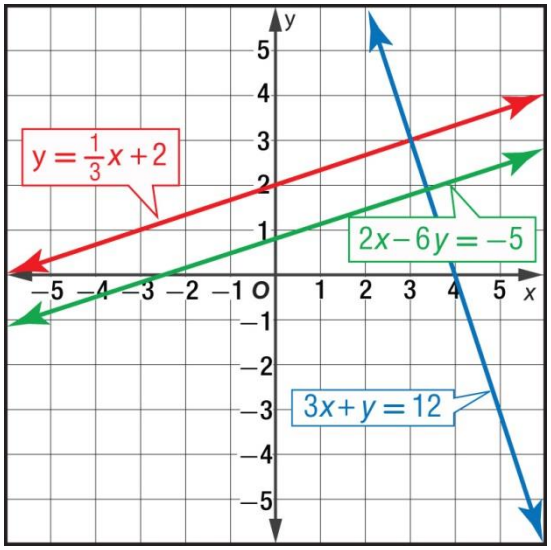
B. $\overline{JL}$ is perpendicular to $\overline{KM}$.

C. cannot be determined

EXAMPLE 3 Parallel or Perpendicular Lines

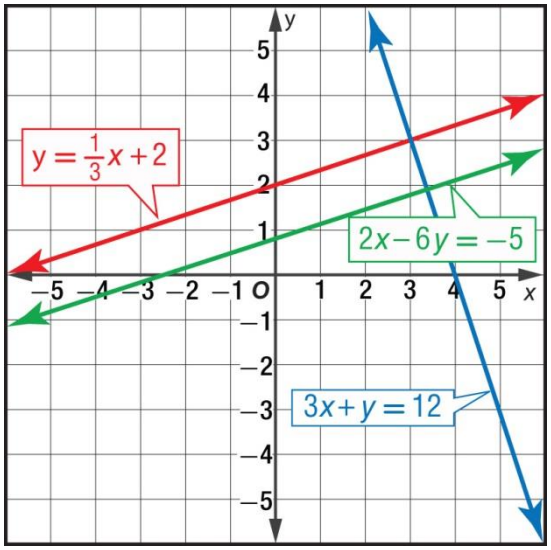
Determine whether the graphs of $3x + y = 12$, $y = \frac{1}{3}x + 2$, and $2x - 6y = -5$ are *parallel* or *perpendicular*. Explain.

Graph each line on a coordinate plane.



EXAMPLE 3 Parallel or Perpendicular Lines

Answer: From the graph, you can see that $y = \frac{1}{3}x + 2$ is parallel to $2x - 6y = -5$. They are parallel because they have equal slopes. $3x + y = 12$ is perpendicular to them both because the product of their slopes, $\frac{1}{3}$ and –3, is –1.



EXAMPLE 3 Check Your Progress

CheckPoint

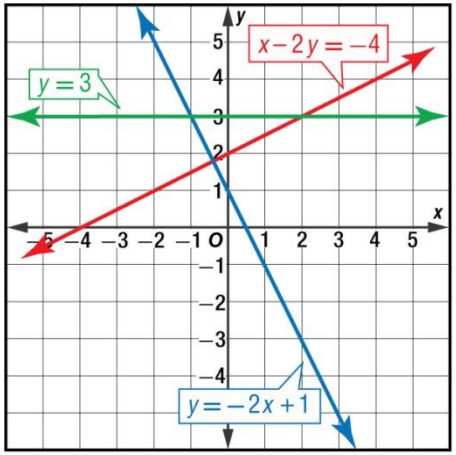
Determine whether the graphs of $y = -2x + 1$, $x - 2y = -4$, and $y = 3$ are *parallel* or *perpendicular*.

A. $y = -2x + 1$ and $x - 2y = -4$ are perpendicular. None of the lines are parallel.

B. $y = -2x + 1$ and $y = 3$ are perpendicular. None of the lines are parallel.

C. $y = -2x + 1$ and $x - 2y = -4$ are parallel. None of the lines are perpendicular.

D. None of the lines are parallel or perpendicular.



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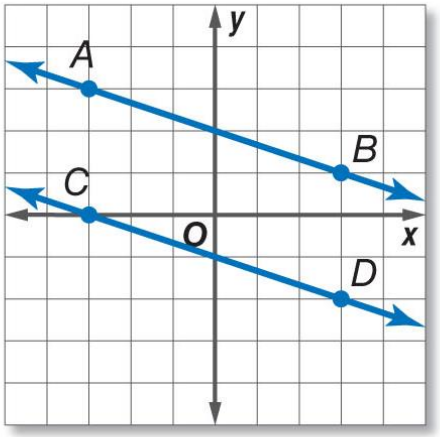
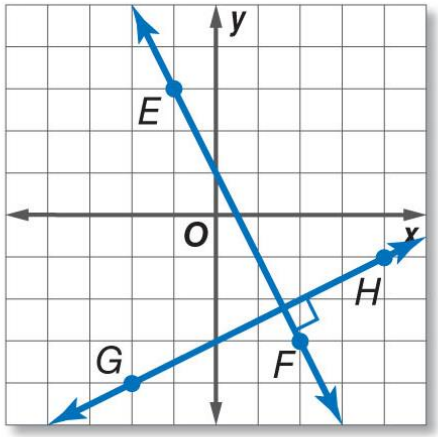
Models		

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ALGEBRA 1

Click the mouse button to return to the lesson menu.

Mc Graw Hill