Extension 4.2 Slopes of Parallel and Perpendicular Lines

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Common Core

Graphing Equations

In this extension, you will

- identify parallel and perpendicular lines.

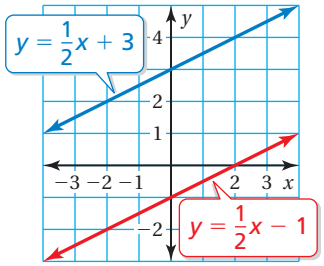
Applying Standard 8.EE.6

Key Idea

Parallel Lines and Slopes

Lines in the same plane that do not intersect are parallel lines. Nonvertical parallel lines have the same slope.

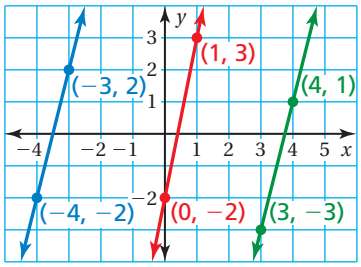
All vertical lines are parallel.



EXAMPLE 1 Identifying Parallel Lines

Which two lines are parallel? How do you know?

Find the slope of each line.



Blue Line

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

$$= \frac{-2 - 2}{-4 - (-3)}$$

$$= \frac{-4}{-1}, \text{ or } 4$$

Red Line

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

$$= \frac{-2 - 3}{0 - 1}$$

$$= \frac{-5}{-1}, \text{ or } 5$$

Green Line

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

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

$$= \frac{-4}{-1}, \text{ or } 4$$

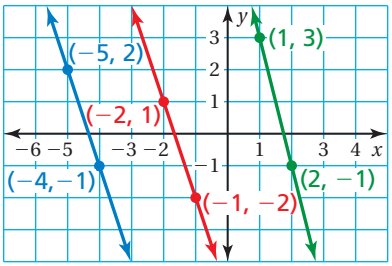
The slopes of the blue and green lines are 4. The slope of the red line is 5.

∴ The blue and green lines have the same slope, so they are parallel.

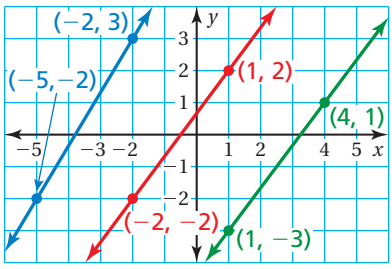
Practice

Which lines are parallel? How do you know?

1.



2.



Are the given lines parallel? Explain your reasoning.

3. $y = -5, y = 3$

4. $y = 0, x = 0$

5. $x = -4, x = 1$

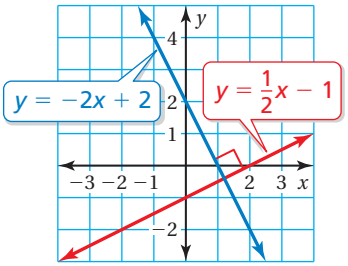
6. GEOMETRY The vertices of a quadrilateral are $A(-5, 3)$, $B(2, 2)$, $C(4, -3)$, and $D(-2, -2)$. How can you use slope to determine whether the quadrilateral is a parallelogram? Is it a parallelogram? Justify your answer.

Key Idea

Perpendicular Lines and Slope

Lines in the same plane that intersect at right angles are perpendicular lines. Two nonvertical lines are perpendicular when the product of their slopes is -1.

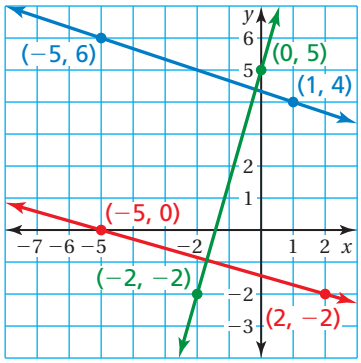
Vertical lines are perpendicular to horizontal lines.



EXAMPLE 2 Identifying Perpendicular Lines

Which two lines are perpendicular? How do you know?

Find the slope of each line.



Blue Line

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

$$= \frac{4 - 6}{1 - (-5)}$$

$$= \frac{-2}{6}, \text{ or } -\frac{1}{3}$$

Red Line

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

$$= \frac{-2 - 0}{2 - (-5)}$$

$$= -\frac{2}{7}$$

Green Line

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

$$= \frac{5 - (-2)}{0 - (-2)}$$

$$= \frac{7}{2}$$

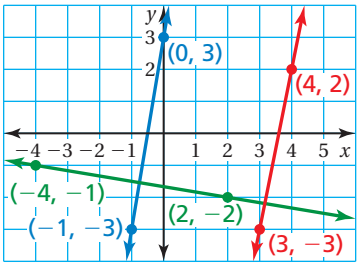
The slope of the red line is $-\frac{2}{7}$. The slope of the green line is $\frac{7}{2}$.

∴ Because $-\frac{2}{7} \cdot \frac{7}{2} = -1$, the red and green lines are perpendicular.

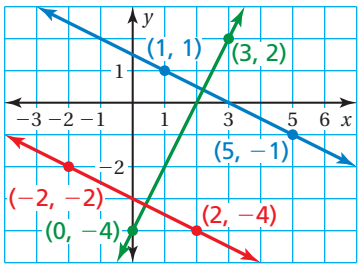
Practice

Which lines are perpendicular? How do you know?

7.



8.



Are the given lines perpendicular? Explain your reasoning.

9. $x = -2, y = 8$ **10.** $x = -8, x = 7$ **11.** $y = 0, x = 0$

12. **GEOMETRY** The vertices of a parallelogram are $J(-5, 0)$, $K(1, 4)$, $L(3, 1)$, and $M(-3, -3)$. How can you use slope to determine whether the parallelogram is a rectangle? Is it a rectangle? Justify your answer.