

Perpendicular Lines: lines in the same plane that intersect at right angles \perp p.157

PERPENDICULAR LINES HAVE SLOPES WHOSE PRODUCTS ARE -1 (which means they are opposite reciprocals of each other)

ex: $5/7$ and $-7/5$; any vertical line is perpendicular to any horizontal line

Which two lines are perpendicular? How do you know?

Find the slope of each line.

Blue Line

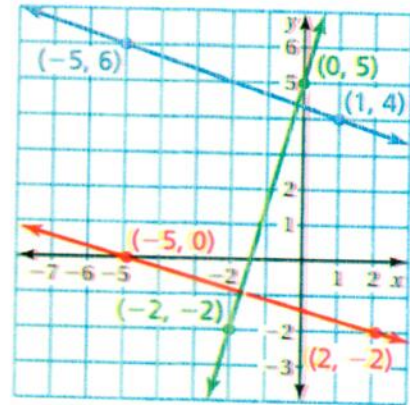
$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 6}{1 - (-5)} = \frac{-2}{6}, \text{ or } -\frac{1}{3}$$

Red Line

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - 0}{2 - (-5)} = \frac{-2}{7}$$

Green Line

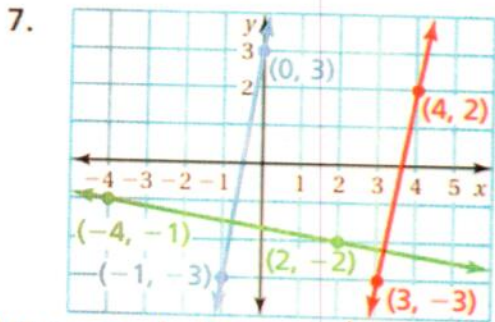
$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - (-2)}{0 - (-2)} = \frac{7}{2}$$



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

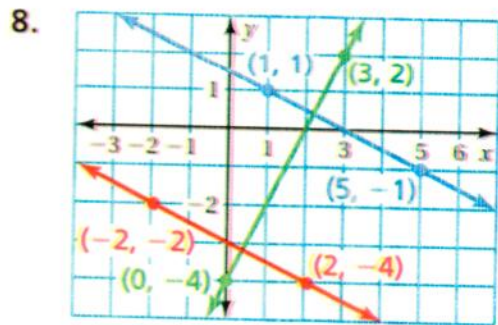
Because $-\frac{2}{7} \cdot \frac{7}{2} = -1$, the red and green lines are perpendicular.

Which lines are perpendicular? How do you know?



blue and green; blue slope is 6, green slope is $-\frac{1}{6}$

Are the given lines perpendicular? Explain your reasoning.



blue $-\frac{1}{2}$
green 2
AND
red $-\frac{1}{2}$
green 2

9. $x = -2, y = 8$ **yes**
vertical horizontal

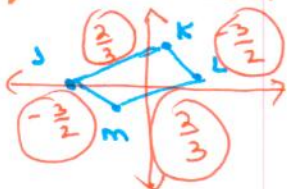
10. $x = -8, x = 7$ **no**
both vertical (parallel)

11. $y = 0, x = 0$ **yes**
horizontal vertical

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.

- quick sketch; find slope of each side

yes



$$\begin{aligned} \overline{JK} &= \frac{2}{3} & \overline{ML} &= \frac{2}{3} \\ \overline{KL} &= -\frac{2}{3} & \overline{JM} &= -\frac{2}{3} \end{aligned}$$

4.2 Extension Slopes of Parallel and Perpendicular Lines p.156

Parallel Lines: lines in the same plane that do not intersect and are always the same distance apart //

PARALLEL LINES HAVE THE SAME SLOPE (if both lines are vertical, they are still parallel, but they have an undefined slope)

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

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

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

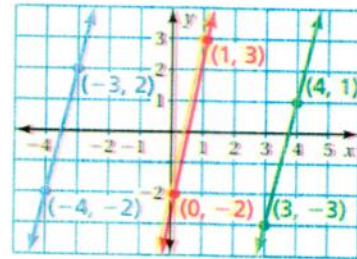
$$= \frac{-5}{-1}, \text{ or } 5$$

Green Line

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

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

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

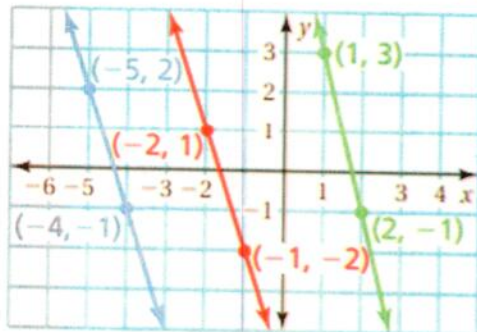


The slopes of the blue and green lines are 4. The slope of the red line is 5.

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

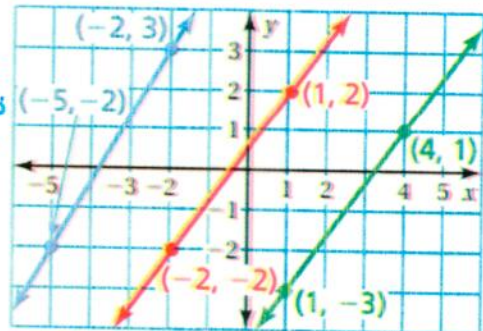
Which lines are parallel? How do you know?

1.



blue + red;
slope is -3

2.

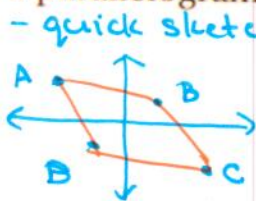


red + green;
slope is 4/3

Are the given lines parallel? **Explain** your reasoning.

3. $y = -5, y = 3$ **yes; both are horizontal lines w/ slope of 0** 4. $y = 0, x = 0$ **no; they have diff. slopes → 0 slope → undefined slope** 5. $x = -4, x = 1$ **yes**

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.



- quick sketch; find the slope of each side to see if they are the same to determine if they are //.

$$\overline{AB} = -\frac{1}{7} \quad \overline{BC} = -\frac{5}{2}$$

$$\overline{CD} = -\frac{1}{6} \quad \overline{DA} = -\frac{5}{6}$$

NO

both are vertical lines w/ an undefined slope