

Parallel and Perpendicular Lines

Parallel lines are coplanar lines that do not intersect. Nonvertical parallel lines have the same slope. Two lines that intersect to form a right angle are **perpendicular lines**. Two nonvertical lines are perpendicular if and only if the product of their slopes is -1 .

Example 1 Determine which of the lines are parallel and which are perpendicular.

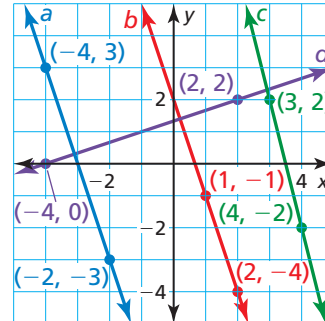
Find the slope of each line.

Line *a*: $m = \frac{3 - (-3)}{-4 - (-2)} = -3$

Line *b*: $m = \frac{-1 - (-4)}{1 - 2} = -3$

Line *c*: $m = \frac{2 - (-2)}{3 - 4} = -4$

Line *d*: $m = \frac{2 - 0}{2 - (-4)} = \frac{1}{3}$

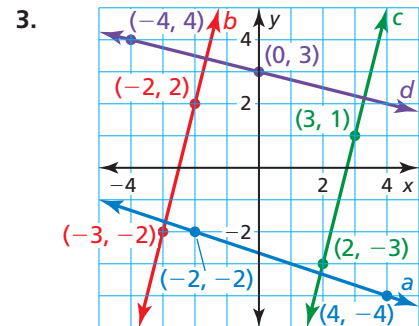
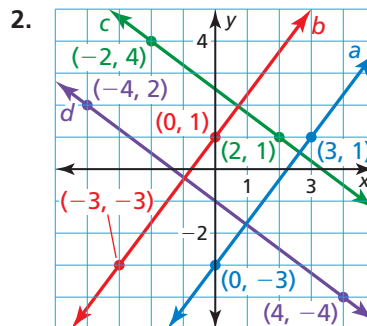
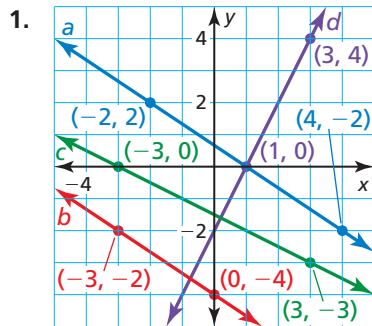


▶ Because lines *a* and *b* have the same slope, lines *a* and *b* are parallel. Because $\frac{1}{3}(-3) = -1$, lines *a* and *d* are perpendicular and lines *b* and *d* are perpendicular.

Practice

Check your answers at BigIdeasMath.com.

Determine which of the lines are parallel and which are perpendicular.



4. **GEOMETRY** The vertices of a quadrilateral are $A(-5, 3)$, $B(2, 2)$, $C(4, -3)$, and $D(-2, -2)$. Is the quadrilateral a parallelogram? Explain your reasoning.

5. **GEOMETRY** The vertices of a parallelogram are $J(-5, 0)$, $K(1, 4)$, $L(3, 1)$, and $M(-3, -3)$. Is the parallelogram a rectangle? Explain your reasoning.