PARALLEL AND PERPENDICULAR LINES Recall that two lines in a plane are **parallel** if they do not intersect. Two lines in a plane are **perpendicular** if they intersect to form a right angle.

Slope can be used to determine whether two different nonvertical lines are parallel or perpendicular.

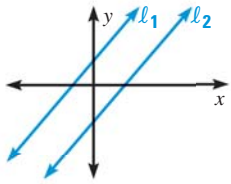
KEY CONCEPT *For Your Notebook*

Slopes of Parallel and Perpendicular Lines

Consider two different nonvertical lines ℓ_1 and ℓ_2 with slopes m_1 and m_2.

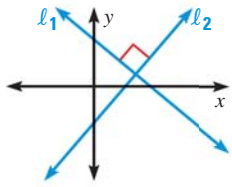
Parallel Lines The lines are parallel if and only if they have the same slope.

$$m_1 = m_2$$



Perpendicular Lines The lines are perpendicular if and only if their slopes are negative reciprocals of each other.

$$m_1 = -\frac{1}{m_2}, \text{ or } m_1 m_2 = -1$$



EXAMPLE 4 Classify parallel and perpendicular lines

Tell whether the lines are *parallel*, *perpendicular*, or *neither*.

a. Line 1: through (−2, 2) and (0, −1)
Line 2: through (−4, −1) and (2, 3)

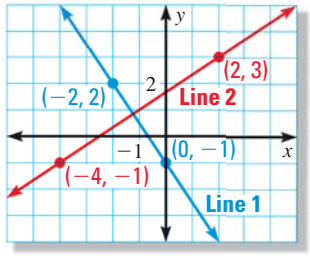
b. Line 1: through (1, 2) and (4, −3)
Line 2: through (−4, 3) and (−1, −2)

Solution

a. Find the slopes of the two lines.

$$m_1 = \frac{-1-2}{0-(-2)} = \frac{-3}{2} = -\frac{3}{2}$$

$$m_2 = \frac{3-(-1)}{2-(-4)} = \frac{4}{6} = \frac{2}{3}$$

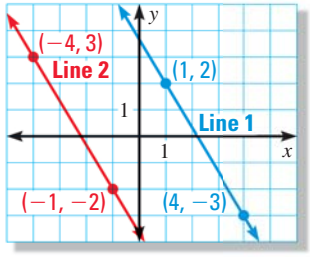


▶ Because $m_1 m_2 = -\frac{3}{2} \cdot \frac{2}{3} = -1$, m_1 and m_2 are negative reciprocals of each other. So, the lines are perpendicular.

b. Find the slopes of the two lines.

$$m_1 = \frac{-3-2}{4-1} = \frac{-5}{3} = -\frac{5}{3}$$

$$m_2 = \frac{-2-3}{-1-(-4)} = \frac{-5}{3} = -\frac{5}{3}$$



▶ Because $m_1 = m_2$ (and the lines are different), you can conclude that the lines are parallel.