

LESSON  
3.4**Study Guide**

For use with pages 171–179

**GOAL Find and compare slopes of lines.****Vocabulary**

The **slope** ( $m$ ) of a nonvertical line is the ratio of vertical change (*rise*) to horizontal change (*run*) between any two points on the line.

$$m = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$$

**Postulate 17 Slopes of Parallel Lines:** In a coordinate plane, two nonvertical lines are parallel if and only if they have the same slope. Any two vertical lines are parallel.

**Postulate 18 Slopes of Perpendicular Lines:** In a coordinate plane, two nonvertical lines are perpendicular if and only if the product of their slopes is  $-1$ . Horizontal lines are perpendicular to vertical lines.

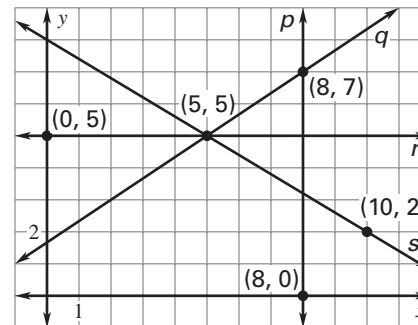
**EXAMPLE 1 Find slopes of lines in a coordinate plane**

Find the slope of line  $q$  and line  $r$ .

**Solution**

$$\text{Slope of line } q: m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7 - 5}{8 - 5} = \frac{2}{3}$$

$$\text{Slope of line } r: m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - 5}{5 - 0} = 0$$

**Exercise for Example 1**

- In Example 1, find the slope of line  $p$  and line  $s$ .

**EXAMPLE 2 Identify parallel lines**

Find the slope of each line. Is  $a \parallel b$ ?

**Solution**

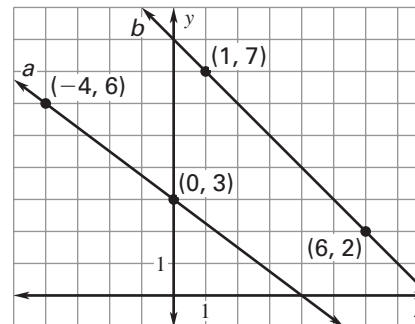
Find the slope of  $a$  through  $(-4, 6)$  and  $(0, 3)$ .

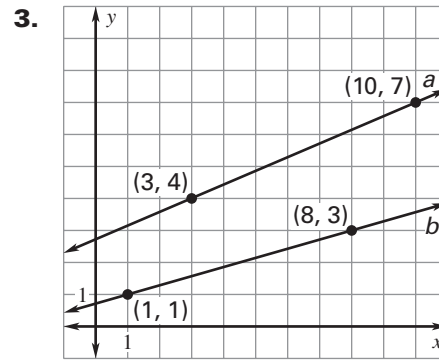
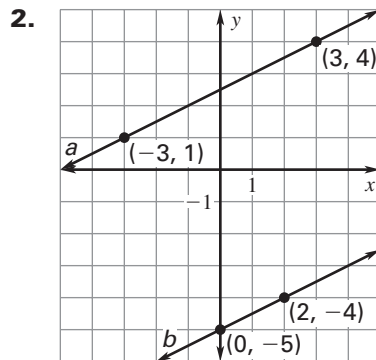
$$m_a = \frac{3 - 6}{0 - (-4)} = -\frac{3}{4}$$

Find the slope of  $b$  through  $(1, 7)$  and  $(6, 2)$ .

$$m_b = \frac{2 - 7}{6 - 1} = -1$$

Compare the slopes. Because  $a$  and  $b$  have different slope, they are not parallel.



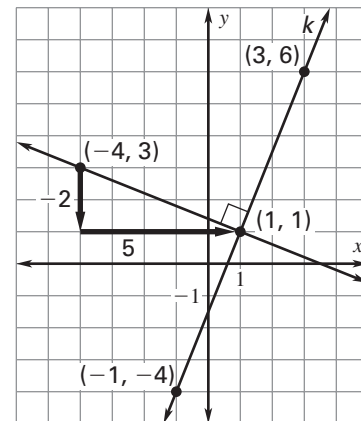
LESSON  
3.4**Study Guide** *continued*  
For use with pages 171–179**Exercises for Example 2**Find the slope of each line. Is  $a \parallel b$ ?**EXAMPLE 3** Draw a perpendicular lineLine  $k$  passes through  $(-1, -4)$  and  $(3, 6)$ . Graph the line perpendicular to  $k$  that passes through the point  $(-4, 3)$ .**Solution****STEP 1** Find the slope  $m_1$  of line  $k$  through  $(-1, -4)$  and  $(3, 6)$ .

$$m_1 = \frac{6 - (-4)}{3 - (-1)} = \frac{10}{4} = \frac{5}{2}$$

**STEP 2** Find the slope  $m_2$  of a line perpendicular to  $k$ . Use the fact that the product of the slopes of two perpendicular lines is  $-1$ .

$$\frac{5}{2} \cdot m_2 = -1$$

$$m_2 = -\frac{2}{5}$$

**STEP 3** Use the rise and run to graph the line.**Exercises for Example 3**

- Line  $j$  passes through  $(-4, 2)$  and  $(6, 0)$ . Graph the line perpendicular to  $j$  that passes through the point  $(0, -4)$ .
- Line  $n$  passes through  $(-2, 3)$  and  $(5, -1)$ . Graph the line perpendicular to  $n$  that passes through the point  $(-6, -1)$ .