LESSON 3.7

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Practice with Examples

For use with pages 172–178

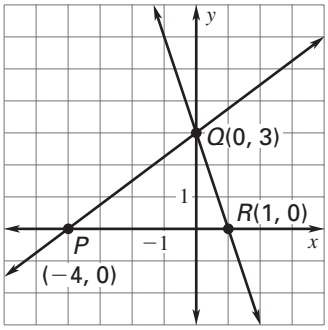
GOAL **Use slope to identify perpendicular lines in a coordinate plane and write equations of perpendicular lines**

VOCABULARY

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.

EXAMPLE 1 Deciding Whether Lines are Perpendicular

a. Decide whether $\overleftrightarrow{PQ}$ and $\overleftrightarrow{QR}$ are perpendicular.



b. Decide whether the lines are perpendicular.

Line ℓ: $2x - 3y = -4$ Line k: $3x + 2y = 3$

SOLUTION

a. Find each slope.

Slope of $\overleftrightarrow{PQ} = \dfrac{3 - 0}{0 - (-4)} = \dfrac{3}{4}$

Slope of $\overleftrightarrow{QR} = \dfrac{0 - 3}{1 - 0} = \dfrac{-3}{1} = -3$

Multiply slopes to see if the lines are perpendicular.

$\dfrac{3}{4} \cdot (-3) = -\dfrac{9}{4}$

The product of the slopes is not -1. So, $\overleftrightarrow{PQ}$ and $\overleftrightarrow{QR}$ are not perpendicular.

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b. Rewrite each equation in slope-intercept form to find the slope.

Line ℓ:

$y = \frac{2}{3}x + \frac{4}{3}$

slope $= \frac{2}{3}$

Line k:

$y = -\frac{3}{2}x + \frac{3}{2}$

slope $= -\frac{3}{2}$

Multiply the slopes to see if the lines are perpendicular.

$\left(\frac{2}{3}\right) \cdot \left(-\frac{3}{2}\right) = -1$, so the lines are perpendicular.

Exercises for Example 1

Decide whether lines *k* and ℓ are perpendicular.

1. k passes through $(3, 2)$ and $(-1, 5)$

ℓ passes through $(0, 2)$ and $(3, 6)$

2. k has the equation $2x - 4y = -3$

ℓ has the equation $x + 2y = -6$

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EXAMPLE 2 Writing the Equation of a Perpendicular Line

Line k has equation $y = \frac{2}{3}x - \frac{4}{3}$. Find an equation of line ℓ that passes through $P(3, -1)$ and is perpendicular to k.

SOLUTION

First determine the slope of ℓ. For k and ℓ to be perpendicular, the product of their slopes must equal -1.

$$m_k \cdot m_\ell = -1$$

$$\frac{2}{3} \cdot m_\ell = -1$$

$$m_\ell = -\frac{3}{2}$$

Then use $m = -\frac{3}{2}$ and $(x, y) = (3, -1)$ to find b.

$$y = mx + b$$

$$-1 = -\frac{3}{2} \cdot (3) + b$$

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

So, an equation of ℓ is $y = -\frac{3}{2}x + \frac{7}{2}$

Exercises for Example 2

Line j is perpendicular to the line with the given equation and line j passes through P. Write an equation of line j.

3. $4x + 7y = 13, P(-2, 6)$ **4.** $5x - 2y = 3, P\left(0, -\frac{3}{2}\right)$ **5.** $x + 5y = 6, P(-1, 2)$