

LESSON
4.5**Problem Solving Workshop:**
Worked Out Example*For use with the lesson "Write Equations of Parallel and Perpendicular Lines"*

PROBLEM Streets A map of a city shows streets as lines on a coordinate grid. Main Street is modeled by the equation $y = -\frac{1}{4}x + 4$. Mill Road intersects Main Street at the point $(8, 2)$ and is perpendicular to Main Street. Find the equation that models Mill Road.

STEP 1 Read and Understand*What do you know?*

You know the equation that models Main Street and that Mill Road is perpendicular to Main Street at the point $(8, 2)$.

What do you want to find out?

The equation that models Mill Road.

STEP 2 Make a Plan Use what you know to find the slope of Mill Road. Then find the equation for Mill Road.

STEP 3 Solve the Problem Because Main Street and Mill Road are perpendicular, the slopes of the lines are negative reciprocals. So, the slope of the line through $(8, 2)$ that is perpendicular to Main Street is 4. Use the slope to write an equation in point-slope form.

$$y - y_1 = 4(x - x_1) \quad \text{Write point-slope form.}$$

$$y - 2 = 4(x - 8) \quad \text{Substitute 2 for } y_1 \text{ and 8 for } x_1.$$

$$y - 2 = 4x - 32 \quad \text{Simplify.}$$

$$y = 4x - 30 \quad \text{Solve for } y.$$

The equation that models Mill Road is $y = 4x - 30$.

STEP 4 Look Back Substitute 8 for x to see if $y = 2$.

$$y = 4(8) - 30 \quad \text{Substitute 8 for } x.$$

$$y = 2 \quad \text{Simplify.}$$

The answer is correct.

PRACTICE 1. Streets A map of a city shows streets as lines on a coordinate grid. Cherry Street is modeled by the equation $y = -2x - 3$. June Road intersects Cherry Street at the point $(-4, 5)$ and is perpendicular to Cherry Street. Find the equation that models June Road.

2. What If? In Exercise 1, Blossom Street is perpendicular to June Road at the point $(4, 9)$. Find the equation that models Blossom Street.

3. Error Analysis Describe and correct the error made in solving Exercise 1.

The slope of June Road is $-\frac{1}{2}$.

$$y - 5 = -\frac{1}{2}(x + 4)$$

$$y = -\frac{1}{2}x + 3$$
