

Equations of Perpendicular Lines

You can use the slope-intercept form or the point-slope form to write equations of perpendicular lines.

Example 1 Write an equation of the line passing through $(-3, 8)$ that is perpendicular to the line $y = -3x + 4$.

Step 1 Find the slope of the perpendicular line. The graph of the given equation has a slope of -3 . Because the slopes of perpendicular lines are negative reciprocals, the slope of the perpendicular line passing through $(-3, 8)$ is $\frac{1}{3}$.

Step 2 Use the slope $m = \frac{1}{3}$ and the slope-intercept form to write an equation of the perpendicular line passing through $(-3, 8)$.

$$y = mx + b$$

Write the slope-intercept form.

$$8 = \frac{1}{3}(-3) + b$$

Substitute $\frac{1}{3}$ for m , -3 for x , and 8 for y .

$$9 = b$$

Solve for b .

► So, an equation of the perpendicular line is $y = \frac{1}{3}x + 9$.

Example 2 Write an equation of the line passing through $(1, -2)$ that is perpendicular to the line $2x - 3y = -9$.

Step 1 Find the slope of the perpendicular line.

$$2x - 3y = -9$$

Write original equation.

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

Solve for y .

The graph of the given equation has a slope of $\frac{2}{3}$. Because the slopes of perpendicular lines are negative reciprocals, the slope of the perpendicular line passing through $(1, -2)$ is $-\frac{3}{2}$.

Step 2 Find the slope $m = -\frac{3}{2}$ and the point-slope form to write an equation of the perpendicular line passing through $(1, -2)$.

$$y - y_1 = m(x - x_1)$$

Write the point-slope form.

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

Substitute $-\frac{3}{2}$ for m , 1 for x_1 , and -2 for y_1 .

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

Simplify.

► So, an equation of the perpendicular line is $y + 2 = -\frac{3}{2}(x - 1)$.

Practice

Check your answers at BigIdeasMath.com.

Write an equation of the line passing through point P that is perpendicular to the line.

1. $P(-4, 5); y = -4x + 2$

$$y - 5 = \frac{1}{4}(x + 4) \text{ or } y = \frac{1}{4}x + 6$$

3. $P(-3, 7); 2x + y = -5$

$$y - 7 = \frac{1}{2}(x + 3) \text{ or } y = \frac{1}{2}x + \frac{17}{2}$$

5. $P(1, 0); y = 8 \quad x = 1$

2. $P(6, 2); y = -\frac{1}{3}x + 1$

$$y - 2 = 3(x - 6) \text{ or } y = 3x - 16$$

4. $P(4, -5); y + 2 = \frac{4}{3}(x - 5)$

$$y + 5 = -\frac{3}{4}(x - 4) \text{ or } y = -\frac{3}{4}x - 2$$

6. $P(-6, -1); x = 3 \quad y = -1$