

Lesson 3: Parallel and Perpendicular Lines

Are You Ready?

1. a. Two lines are parallel if **they never meet (or intersect)**.
b. Two lines are perpendicular if **they intersect at right angles**.
2. a. Line A is parallel to Line B. Line C is parallel to Line D.
b. Line A is perpendicular to Line C and Line D. Line B is perpendicular to Line C and Line D.
3. a. **Method 1:** Using general form. Slope is $-A/B$ and the y intercept is $-C/B$
Therefore, $m = -5/-2 = 5/2$ and y intercept is $-10/-2 = 5$

Method 2: Change to slope intercept form

$$5x - 2y + 10 = 0$$

$$2y = 5x + 10$$

$$\frac{2y}{2} = \frac{5x}{2} + \frac{10}{2}$$

$$y = \frac{5}{2}x + 5$$

The slope is $\frac{5}{2}$ and the y-intercept is (0, 5).

- b. **Method 1:** Using general form. Slope is $-A/B$ and the y intercept is $-C/B$
Therefore, $m = -3/4$ and y intercept is $-(-12)/4 = 12/4 = 3$

Method 2: Change to slope intercept form

$$3x + 4y - 12 = 0$$

$$4y = -3x + 12$$

$$\frac{4y}{4} = \frac{-3x}{4} + \frac{12}{4}$$

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

The slope is $-\frac{3}{4}$ and the y-intercept is (0, 3).

4. a. Again, there are several methods that could be used:

Method 1: Substitute the slope and point into slope point form and then solve for y so that the equation is in slope intercept form.

$$y - 1 = \frac{1}{2} x - 4$$

$$y - 1 = \frac{1}{2} x - 4$$

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

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

Method 2: Substitute the slope and point into the slope intercept form and solve for b(the y intercept) and then write the final answer.

$y = mx + b$, sub $\frac{1}{2}$ in for slope and the point (4, 1) in for x and y and solve for b

$$1 = \frac{1}{2}(4) + b$$

$$1 = 2 + b$$

$$1 - 2 = 2 - 2 + b$$

$$b = -1$$

Therefore, the equation of the line is

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

- b. Step 1: Find the slope using the slope formula:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{6 - 0}{-3 - 6}$$

$$m = \frac{6}{-9}$$

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

Now complete the question using one of the methods above:

Method 1: Substitute the slope and one of the points into slope point form and then solve for y so that the equation is in slope intercept form.

$$y - 0 = -\frac{2}{3} x - 6$$

$$y = -\frac{2}{3} x + \left(-\frac{2}{3}\right)\left(-\frac{6}{1}\right)$$

$$y = -\frac{2}{3} x + \frac{12}{3}$$

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

Method 2: Substitute the slope and one of the points into the slope intercept form and solve for b(the y intercept) and then write the final answer.

$y = mx + b$, sub $-\frac{2}{3}$ in for slope and the point $(6,0)$ in for x and y and solve for b

$$0 = -\frac{2}{3}(6) + b$$

$$0 = -\frac{12}{3} + b$$

$$0 = -4 + b$$

$$0 + 4 = -4 + 4 + b$$

$$b = 4$$

Therefore, the equation of the line is

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