

Lesson 2-4

Example 1 Write an Equation Given Slope and a Point

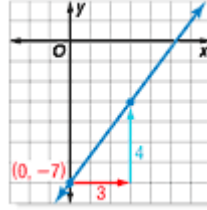
Write an equation in slope-intercept form for the line that has a slope of $\frac{4}{3}$ and passes through $(0, -7)$.

Substitute for m , x , and y in the slope-intercept form.

$$y = mx + b \quad \text{Slope-intercept form}$$

$$-7 = \frac{4}{3}(0) + b \quad (x, y) = (0, -7), m = \frac{4}{3}$$

$$-7 = b \quad \text{Simplify.}$$



The y -intercept is -7 . So, the equation in slope-intercept form is $y = \frac{4}{3}x - 7$.

Example 2 Write an Equation Given Two Points

Multiple-Choice Test Item

What is an equation of the line through $(2, 0)$ and $(-5, 8)$?

- A. $y = -\frac{8}{7}x + 2$ B. $y = -\frac{7}{8}x + \frac{16}{7}$ C. $y = -\frac{8}{7}x + \frac{16}{7}$ D. $y = -\frac{7}{8}x + 2$

Read the Test Item

You are given the coordinates of two points on the line. Notice that the answer choices are in slope-intercept form.

Solve the Test Item

- First, find the slope of the line.

$$m = \frac{y_2 - y_1}{x_2 - x_1} \quad \text{Slope formula}$$

$$= \frac{8 - 0}{-5 - 2} \quad (x_1, y_1) = (2, 0), (x_2, y_2) = (-5, 8)$$

$$= \frac{8}{-7} \text{ or } -\frac{8}{7} \quad \text{Simplify.}$$

The slope is $-\frac{8}{7}$. That eliminates choices B and D.

- Then use the point-slope form to find an equation.

$$y - y_1 = m(x - x_1) \quad \text{Point-slope form}$$

$$y - 0 = -\frac{8}{7}(x - 2) \quad m = -\frac{8}{7}; \text{ you can use either point for } (x_1, y_1).$$

$$y = -\frac{8}{7}x + \frac{16}{7} \quad \text{Distributive Property}$$

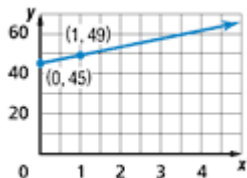
The answer is C.

Example 3 Write an Equation for a Real-World Situation

WILDLIFE In a region of northeastern Montana, it is determined that there were 45 coyotes in 2000. It is estimated that the population will increase by 4 each year thereafter.

- a. Write a linear equation to model this situation.

Let x be any number of years after the year 2000 and let y be the number of coyotes. A point on the line is $(0, 45)$. Since the population will increase by 4 for each 1 year, the slope of the line is 4. Use the point and the slope to make a graph to represent the situation.



$$\begin{aligned}y - y_1 &= m(x - x_1) && \text{Point-slope form} \\y - 45 &= 4(x - 0) && m = 4; (x_1, y_1) = (0, 45) \\y - 45 &= 4x - 0 && \text{Distributive Property} \\y &= 4x + 45 && \text{Add 45 to each side.}\end{aligned}$$

The slope-intercept form of the equation is $y = 4x + 45$.

- b. What do the slope and y-intercept of the graph represent?

The slope, 4, represents the increase per year in the number of coyotes. The y-intercept is the number of coyotes, 45, present in 2000, which is the 0 year.

- c. If the prediction is accurate for future coyote populations, how many coyotes will there be in 2010?

Find the value of y when $x = 10$, since 2010 is 10 years after 2000.

$$\begin{aligned}y &= 4x + 45 && \text{Use the equation you found in part a.} \\&= 4(10) + 45 && \text{Replace } x \text{ with 10.} \\&= 40 + 45 \text{ or } 85 && \text{Simplify.}\end{aligned}$$

There would be 85 coyotes in the year 2010.

Example 4 Write an Equation of a Perpendicular Line

Write an equation for the line that passes through $(-2, -1)$ and is perpendicular to the line whose equation is $y = -\frac{5}{3}x + 2$.

The slope of the given line is $-\frac{5}{3}$. Since the slopes of perpendicular lines are opposite reciprocals, the slope of the perpendicular line is $\frac{3}{5}$.

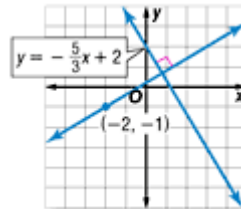
Use the point-slope form and the ordered pair $(-2, -1)$ to write the equation.

$$y - y_1 = m(x - x_1) \quad \text{Point-slope form}$$

$$y - (-1) = \frac{3}{5} [x - (-2)] \quad (x_1, y_1) = (-2, -1); m = \frac{3}{5}$$

$$y + 1 = \frac{3}{5}x + \frac{6}{5} \quad \text{Distributive Property}$$

$$y = \frac{3}{5}x + \frac{1}{5} \quad \text{Subtract 1 from each side.}$$



An equation of the line is $y = \frac{3}{5}x + \frac{1}{5}$.