

Point-Slope Form of a Linear Equation

The line with slope m that contains the point (x_1, y_1) can be described by the equation $y - y_1 = m(x - x_1)$.

Example 1: Write the equation in slope intercept form that passes through the given points.

Step 1: Find the slope.

Step 2: Substitute the slope and one of the points into point-slope form.

Step 3: Write the equation in slope intercept form by solving for y .

a. x_1, y_1, x_2, y_2
 $(2, -3) (4, 1)$

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

$$= \frac{1 - (-3)}{4 - 2}$$

$$= \frac{4}{2}$$

$$= 2$$

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

$$y + 3 = 2(x - 2)$$

$$y + 3 = 2x - 4$$

$$y = 2x - 7$$

b. x_1, y_1, x_2, y_2
 $(3, 3) (3, 7)$

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

$$= \frac{7 - 3}{3 - 3}$$

$$= \frac{4}{0} = \text{undefined}$$

HOY VUX

$$x = 3$$

c. x_1, y_1, x_2, y_2
 $(7, 8) (-7, 6)$

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

$$= \frac{6 - 8}{-7 - 7}$$

$$= \frac{-2}{-14}$$

$$= \frac{1}{7}$$

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

$$y - 8 = \frac{1}{7}(x - 7)$$

$$y - 8 = \frac{1}{7}x - 1$$

$$y = \frac{1}{7}x + 7$$

d. x_1, y_1, x_2, y_2
 $(-4, 2) (6, 2)$

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

$$= \frac{2 - 2}{6 + 4}$$

$$= \frac{0}{10} = 0$$

HOY VUX

$$y = 2$$

Try it!

1. x_1, y_1, x_2, y_2
 $(1, -2) (3, 10)$

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

$$= \frac{10 - (-2)}{3 - 1}$$

$$= \frac{12}{2} = 6$$

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

$$y + 2 = 6(x - 1)$$

$$y + 2 = 6x - 6$$

$$y = 6x - 8$$

2. x_1, y_1, x_2, y_2
 $(3, -2) (5, -2)$

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

$$= \frac{-2 - (-2)}{5 - 3}$$

$$= \frac{0}{2} = 0$$

HOY

$$y = -2$$

3. x_1, y_1, x_2, y_2
 $(4, -6) (4, 0)$

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

$$= \frac{0 - (-6)}{4 - 4}$$

$$= \frac{6}{0} = \text{undefined}$$

VUX

$$x = 4$$

Example 2: Write the equation in slope intercept form that passes through the given intercepts.

* Change into ordered pairs

$(-2, 0)$ $(0, 4)$

a. x-intercept -2 and y-intercept 4

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

$$= \frac{4 - 0}{0 - (-2)}$$

$$= \frac{4}{2} = 2$$

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

$$y - 0 = 2(x + 2)$$

$$y = 2x + 4$$

Try it!

$(8, 0)$ $(0, 4)$

1. x-intercept 8 and y-intercept 4

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

$$= \frac{4 - 0}{0 - 8}$$

$$= \frac{4}{-8} = -\frac{1}{2}$$

$$b = 4$$

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

Problem Solving

Example 1: **Problem-Solving Application**

The cost to place an ad in a newspaper for one week is a linear function of the number of lines in the ad. The costs for 3, 5, and 10 lines are shown. Write an equation in slope-intercept form that represents the function. Then find the cost of an ad that is 18 lines long.

City Gazette			
Newspaper Ad Costs			
Lines	3	5	10
Cost (\$)	13.50	18.50	31

$(3, 13.50)$
 $(5, 18.50)$
 $(10, 31)$

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

$$= \frac{18.50 - 13.50}{5 - 3}$$

$$= \frac{5}{2} = 2.50 \rightarrow \text{cost per line}$$

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

$$y - 13.50 = 2.50(x - 3)$$

$$y - 13.50 = 2.50x - 7.50$$

$$y = 2.50x + 6$$

$$y = 2.50x + 6$$

$$y = 2.50(18) + 6$$

$$y = \$51$$

$$\$51 \text{ for an 18 line ad}$$

Example 2: **What if...?** At a different newspaper, the costs to place an ad for one week are shown. Write an equation in slope-intercept form that represents this linear function. Then find the cost of an ad that is 21 lines long.

Lines	Cost (\$)
3	12.75
5	17.25
10	28.50

$(3, 12.75)$
 $(5, 17.25)$

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

$$= \frac{17.25 - 12.75}{5 - 3}$$

$$= \frac{4.5}{2} = 2.25$$

$$y - 12.75 = 2.25(x - 3)$$

$$y - 12.75 = 2.25x - 6.75$$

$$y = 2.25x + 6$$

$$y = 2.25x + 6$$

$$y = 2.25(21) + 6$$

$$y = 53.25$$

\$53.25 for a 21 line ad