

Chapter 3, Lesson 6 – Point-Slope Form Notes

Key Concept

Point-Slope Form of a Linear Equation

Work Zone

Slope

The point-slope form of a linear equation is tied directly to the definition of slope.

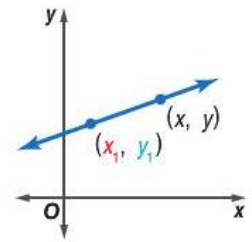
$$\frac{y - y_1}{x - x_1} = m(x - x_1)$$

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

Words The linear equation $y - y_1 = m(x - x_1)$ is written in point-slope form, where (x_1, y_1) is a given point on a nonvertical line and m is the slope of the line.

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

Graph



You can write an equation of a line in **slope-intercept form** when you know the slope and the **y-intercept**. You can write an equation of a line in **point-slope form** when you are given the slope and the coordinates of a point on the line that is not the **y-intercept**.

Examples



- Write an equation in point-slope form for the line that passes through $(-2, 3)$ with a slope of 4.

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

$$y - 3 = 4[x - (-2)] \quad (x_1, y_1) = (-2, 3), m = 4$$

$$y - 3 = 4(x + 2) \quad \text{Simplify.}$$

(opposite 2, opposite -3)

- Write the slope-intercept form of the equation from Example 1.

$$y - 3 = 4(x + 2) \quad \text{Write the equation.}$$

$$y - 3 = 4x + 8 \quad \text{Distributive Property}$$

$$\underline{+3} = \underline{+3} \quad \text{Addition Property of Equality}$$

$$y = 4x + 11 \quad \text{Simplify.}$$

(0, 11)

Check: Substitute the coordinates of the given point in the equation.

$$y = 4x + 11$$

$$3 \stackrel{?}{=} 4(-2) + 11$$

$$3 = 3 \quad \checkmark$$

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

Got It? Do this problem to find out.

- Write an equation in point-slope form and slope-intercept form for the line that passes through $(-1, 2)$ and has a slope of $-\frac{1}{2}$.

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

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

$$\begin{array}{r} +2 \\ y - 2 = -\frac{1}{2}x - \frac{1}{2} \\ \hline y = -\frac{1}{2}x + \frac{3}{2} \end{array}$$

Show your work.

Write a Linear Equation

- From Slope and a Point** • Substitute the slope m and the coordinates of the point in $y - y_1 = m(x - x_1)$.
- From Slope and y-intercept** • Substitute the slope m and y-intercept b in $y = mx + b$.
- From a Graph** • Find the y-intercept b and the slope m from the graph, then substitute the slope and y-intercept in $y = mx + b$.
- From Two Points** • Use the coordinates of the points to find the slope. Substitute the slope and coordinates of one of the points in $y - y_1 = m(x - x_1)$. $y = mx + b$
- From a Table** • Use the coordinates of the two points to find the slope, then substitute the slope and coordinates of one of the points in $y - y_1 = m(x - x_1)$.

The form you use to write a linear equation is based on the information you are given.

Example



3. Write an equation in point-slope form and slope-intercept form for the line that passes through $(8, 1)$ and $(-2, 9)$.

Step 1 Find the slope.

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

$$m = \frac{9 - 1}{-2 - 8} \quad (x_1, y_1) = (8, 1), (x_2, y_2) = (-2, 9)$$

$$m = -\frac{8}{10} \text{ or } -\frac{4}{5} \quad \text{Simplify.}$$

Step 2 Use the slope and the coordinates of either point to write the equation in point-slope form.

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

$$y - 1 = -\frac{4}{5}(x - 8) \quad (x_1, y_1) = (8, 1), m = -\frac{4}{5}$$

So, the point-slope form of the equation is $y - 1 = -\frac{4}{5}(x - 8)$.

In slope-intercept form, this is $y = -\frac{4}{5}x + \frac{37}{5}$.

$$y - 9 = -\frac{4}{5}(x + 2)$$

$$\textcircled{1} \frac{-3 - 0}{6 - 3} = \frac{-3}{3} = -1 = m$$

$$y + 0 = -1(x - 3)$$

Show your work

$$y = -1(x - 3)$$

$$y = -x + 3$$

$$\textcircled{2} \text{ c. } y - 2 = -2(x + 1)$$

$$y = -2x$$

$$\text{d. } y + 10 = -2(x - 5)$$

Got It? Do these problems to find out.

c. $(3, 0)$ and $(6, -3)$

$$y + 3 = -1(x - 6)$$

d. $(-1, 2)$ and $(5, -10)$

$$m = -2$$





Example



4. The cost of assistance dog training sessions is shown in the table. Write an equation in point-slope form to represent the cost y of attending x dog training sessions.

Number of Sessions	Cost (\$)
5	165
10	290

Find the slope of the line. Then use the slope and one of the points to write the equation of the line.

$$m = \frac{290 - 165}{10 - 5}$$

$$(x_2, y_2) = (10, 290), (x_1, y_1) = (5, 165)$$

$$m = \frac{125}{5} \text{ or } 25$$

Simplify.

$$y - 165 = 25(x - 5)$$

Replace (x_1, y_1) with $(5, 165)$ and m with 25 in the point-slope form equation.

So, the equation of the line is $y - 165 = 25(x - 5)$.

Show your work.

e. $y - 25 = \frac{1}{5}(x - 100)$
 OR
 $y - 35 = \frac{1}{5}(x - 150)$

Got It? Do this problem to find out.

e. The cost for making spirit buttons is shown in the table. Write an equation in point-slope form to represent the cost y of making x buttons.

Number of Buttons	Cost (\$)
100	25
150	35

$$\frac{35 - 25}{150 - 100} = \frac{10}{50} = \frac{1}{5}$$

$$m = \frac{1}{5}$$

Guided Practice



Write an equation in point-slope form and slope-intercept form for each line. (Examples 1–3)

1. passes through $(2, 5)$, slope = 4

$$y - 5 = 4(x - 2); y = 4x - 3$$

Show your work.

2. passes through $(-3, 1)$ and $(-2, -1)$

Sample answer: $y - 1 = -2(x + 3);$

$$y = -2x - 5$$

3. Janelle is planning a party. The cost for 20 people is \$290. The cost for 45 people is \$590. Write an equation in point-slope form to represent the cost y of having a party for x people. (Example 4)

Sample answer: $y - 290 = 12(x - 20)$

4. **Building on the Essential Question** How does using the point-slope form of a linear equation make it easier to write the equation of a line? **Sample answer: You**

can substitute the slope and a point into the equation.

You do not need to find the y -intercept of the line.

Rate Yourself!

How confident are you about writing linear equations? Check the box that applies.



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