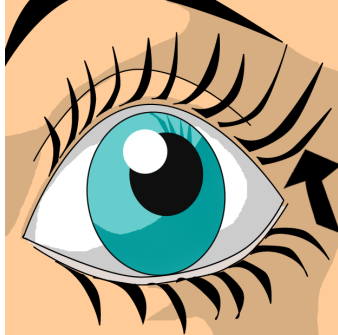
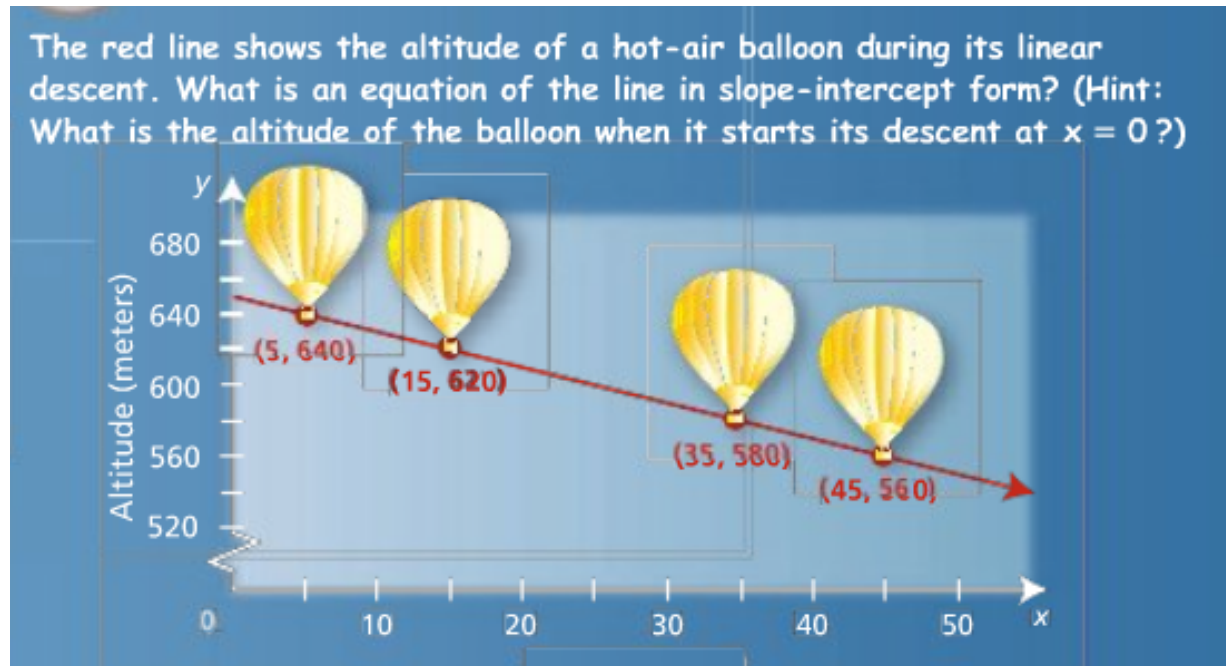


# 5-4: Linear Equation Point-Slope Form



## Eye Opener



**Essential Understanding** You can use the slope of a line and any point on the line to write and graph an equation of the line. Any two equations for the same line are equivalent.



### Definition

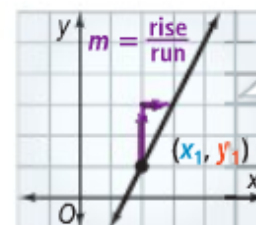
The **point-slope form** of an equation of a nonvertical line with slope  $m$  and through point  $(x_1, y_1)$  is  $y - y_1 = m(x - x_1)$ .

### Symbols

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

↑        ↑        ↑  
**y-coordinate**   **slope**   **x-coordinate**

### Graph



When you use  $y - y_1 = m(x - x_1)$ ,  $(x_1, y_1)$  represents a *specific* point and  $(x, y)$  represents *any* point.

**Here's Why It Works** Given a point  $(x_1, y_1)$  on a line and the line's slope  $m$ , you can use the definition of slope to derive point-slope form.

$$\frac{y_2 - y_1}{x_2 - x_1} = m \quad \text{Use the definition of slope.}$$

$$\frac{y - y_1}{x - x_1} = m \quad \text{Let } (x, y) \text{ be any point on the line. Substitute } (x, y) \text{ for } (x_2, y_2).$$

$$\frac{y - y_1}{x - x_1} \cdot (x - x_1) = m(x - x_1) \quad \text{Multiply each side by } (x - x_1).$$

$$y - y_1 = m(x - x_1) \quad \text{Simplify the left side of the equation.}$$

The point-slope form of a line is:

$$y - y_1 = m(x - x_1) \quad \text{where } m = \text{slope of the line}$$

$(x_1, y_1)$  = any ordered pair on the line  
 $x$  &  $y$  are the variables

**What can you use the point-slope form for?**

You can use it to **graph a line** using the slope ( $m$ ) and point  $(x_1, y_1)$

**OR**

You can use it to **write the equation of a line for which you have a graph**

**OR**

You can **write the equation of a line given two points**

Point-Slope:  $y - y_1 = m(x - x_1)$

Using point-slope to **graph a line:**

- graph the point  $(x_1, y_1)$
- use the slope " $m$ " to count off the rise and run to a second point, and graph
- draw a line through the two graphed points

Point-Slope:  $y - y_1 = m(x - x_1)$

Using point-slope to write the equation of a line for which you have a graph:

- identifying any one point on the graph  $(x_1, y_1)$
- count off the slope, " $m$ ", between that point and any second point
- plug both values into the formula:  $y - y_1 = m(x - x_1)$

Since you can pick any point you want on the line, there are infinite linear equations that can be written, BUT they will all be equivalent.

Point-Slope:  $y - y_1 = m(x - x_1)$

Writing the equation of a line given two points by:

- calculate the slope, " $m$ ", using the two points given and the slope formula:

$$m = (y_2 - y_1) / (x_2 - x_1)$$

- use one of the two points for  $(x_1, y_1)$  in the equation
- substitute both into the  $y - y_1 = m(x - x_1)$  form

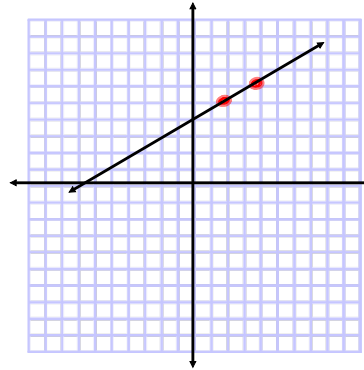
$$y - y_1 = m(x - x_1)$$

Graph the equation:

$$y - 5 = \frac{1}{2}(x - 2)$$

Line has a slope of  $\frac{1}{2}$

Line passes through the point  $(2, 5)$

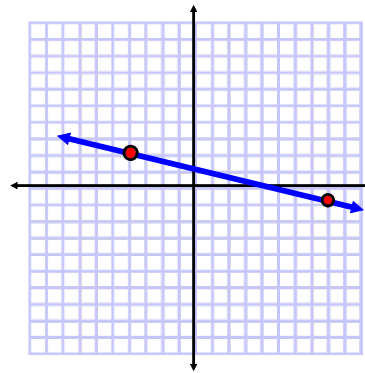


Write the equation of the line in point-slope form that is graphed below.

$m =$  \_\_\_\_\_

$(x_1, y_1) =$  \_\_\_\_\_

Equation of line = \_\_\_\_\_



Find the equation of the line, in point slope form, that passes through  $(-3, 7)$  and  $(5, -9)$

$m =$  \_\_\_\_\_

$(x_1, y_1) =$  \_\_\_\_\_

Equation of line = \_\_\_\_\_

Write the equation of the line, in slope-point form, that:

- has a slope of -3 and passes through (-1,7)  $y - y_1 = m(x - x_1)$

$$y - 7 = -3(x + 1)$$

- Has a slope of  $2/5$  and passes through (10,-8)

$$y + 8 = \frac{2}{5}(x - 10)$$

- passes through (-1,-5) and (2,3)

$$y - 3 = \frac{8}{3}(x - 2)$$

$$(y + 5) = \frac{8}{3}(x + 1)$$

- passes through (4,-2) and (9,-8)

$$\rightarrow \begin{matrix} 4 & -2 \\ 9 & -8 \end{matrix} \quad \frac{-6}{5}$$

$$y + 8 = \frac{6}{5}(x - 9)$$

$$y + 2 = \frac{6}{5}(x - 4)$$

$$y + 2 = -\frac{6}{5}x + \frac{6}{5}(-4) - 2$$

Graph the following linear equations:

$$y - 6 = -1/3(x + 5)$$

$$y + 3 = -3(x - 5)$$

$$m = \underline{-1/3}$$

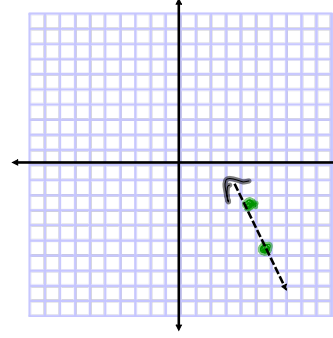
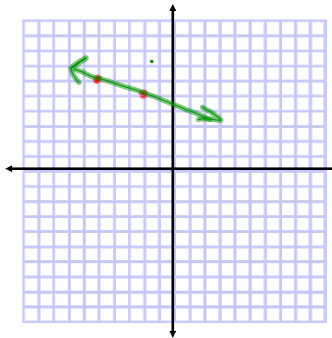
$$m = \underline{-3/1}$$

$$(x,y) = \underline{(-5, 6)}$$

$$(x,y) = \underline{x=5 \quad y=-3}$$

Graph:

Graph:



Name the line graphed below in point-slope form

$$m = \underline{9/8}$$

$$m = \underline{\quad} = \underline{-5}$$

$$(x,y) = \underline{-5, -2}$$

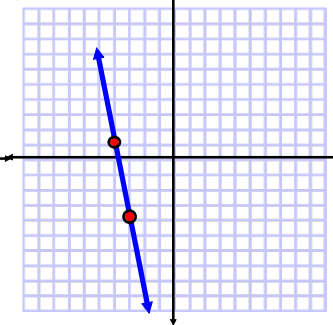
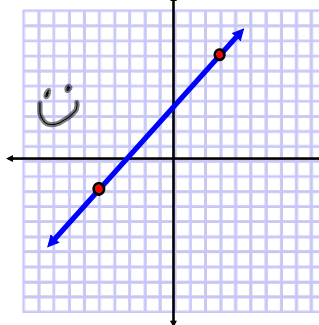
$$(x,y) = \underline{4, 1}$$

Equation of line:

Equation of line:

$$y + 2 = \frac{9}{8}(x + 5)$$

$$y - 1 = -5(x + 4)$$



$$y - y_1 = m(x - x_1)$$
$$y + 8 = \frac{2}{3}(x + 4)$$

$\uparrow m = 2/3$

$$(x, y) = (-4, -8)$$