**6.5 – Slope-Point Form of the Equation for a Linear Function**

We have shown you how to write the equation of the line when we know its slope and y-intercept. We can also write the equation of a line when we know its slope and the coordinates of a point on the line.



We can find the slope of the line above as follows:

$$m= \frac{y-y1}{x-x1}$$

By multiplying each side by $(x-x1)$, we can change the equation so that it is in slope-point form.

In general:

The equation of a line that passes through ***P(x1, y1)*** and has slope ***m***is:

$$y-y1=m(x-x1)$$

**Example 1: Graphing a Line Given Its Equation in Slope-Point Form**

a) Write the slope and the coordinates of a point on the line $y+3= -\frac{3}{4}\left(x-2\right)$

Rewrite the equation: $y-(-3)= -\frac{3}{4}\left(x-2\right)$

From this we can find the point on the line **(2, -3)** and the slope **(**$-\frac{3}{4} )$

**Careful: A common mistake would be to say that the coordinates are (-2, 3) instead of (2, -3).**

 **Watch your signs!!**

We could also graph the point and use the slope of the line to verify our solution.

**Example 2: Writing an Equation in Slope-Point Form**

Write an equation for this line in slope-point form and slope-intercept form.



Pick another coordinate (such as (-2, 0)), then calculate the slope of the line.

$$m= \frac{0-7}{-2-(-4)} = \frac{-7}{2} = - \frac{7}{2}$$

Now, substitute the given point into the slope-point form of the equation:

$$y-7= -\frac{7}{2}\left(x+4\right)$$

Notice that we could have substituted our second point (-2,0) as well:

$$y= -\frac{7}{2}\left(x+2\right)$$

A line can be represented by many slope-point equations, but only one slope-intercept equation!

**Example 3: Writing an Equation of a Line That is Parallel or Perpendicular to a Given Line**

Write an equation for a line that passes through B(-1, 3) and is:

a) parallel to the line $y= -\frac{7}{3}x-3$

Any line parallel to the given line must have a slope that is exactly the same. So, our line has a slope of $-\frac{7}{3} $and passes through the point B(-1, 3). We can then use slope-point form and create our equation.

**Answer:**
$$y-3= -\frac{7}{3}\left(x+1\right)$$

b) perpendicular to the line $y= -\frac{7}{3}x-3$

Any line perpendicular to the given line must have a slope that is the negative reciprocal of the original slope. So, our line has a slope of $\frac{3}{7} $and passes through the point B(-1, 3). We can then use slope-point form and create our equation.

**Answer:**
$$y-3= \frac{3}{7}\left(x+1\right)$$

**Example 4: Writing an Equation of a Linear Function Given Two Points**

Distance travelled, *d*, is a function of time, *t*. After 75-min., a bus travelled 50-km. After 165-min., the bus had travelled 110-km. Write an equation to represent this function.

Our two points would be: A( 75, 50) and B(165, 110)

Find the slope of the line passing through these two points:

$$m= \frac{110-50}{165-75} = \frac{60}{90} = \frac{2}{3}$$

Use the slope and point A or B, and substitute the values into point-slope form.

**Answer:**
$$d-50= \frac{2}{3}\left(t-75\right)$$