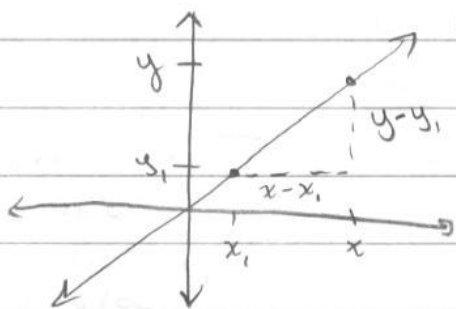


### Lesson 11: Equation of a line: Point-slope form

Recall  $m = \frac{y_2 - y_1}{x_2 - x_1}$  gives all the information needed to plot a line. It is convenient to have a formula from which we can determine points on the line without having to draw the graph and follow the slope. (ie, we want to express  $y$  as a function of  $x$  so that we can make a table of values, or just find a specific  $y$  corresponding to some specific  $x$ )

So: If we know one point on the line and the slope, we can re-arrange our formula to get the equation of a line. Let  $(x_1, y_1)$  represent the point we know and  $(x, y)$ , no subscripts, represent any point on the line



Then  $m = \frac{y - y_1}{x - x_1}$ . Multiply by the denominator on both sides, and you get

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

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

(29)

Or, more commonly seen as

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

we know the number values of  $m$ ,  $x_1$ , and  $y_1$ , so our only variables are  $x$  and  $y$  without the subscripts. Thus, we have a linear equation in 2 variables.

ex. Give the equation of the line with

slope 3 which passes through  $(1, -2)$

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

$$y - (-2) = 3(x - 1)$$

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

$$\underline{-2} \qquad \underline{-2}$$

$$y = 3x - 5$$

← this is the equation of our line in slope intercept form (i.e. solved for  $y$ )

can also

represent as

$$y + 5 = 3x$$

or  $y - 3x = -5$  or any other arrangement,

but  $y = 3x - 5$  is standard slope intercept form.

★ Thus, to use this formula, we need a point  $(x_1, y_1)$  and a slope  $(m)$ .

Hence it is called the point

slope formula (11)

what if the slope isn't given?

- To give an equation of a line you need:

a) a point and a slope

OR

b) two points (from which you can get the slope and then have a slope and any of the two points).

ex. Give the equation of the line that goes through  $(1, -2)$  and  $(-3, -1)$

\* we need to use  $y - y_1 = m(x - x_1)$  but that requires slope and point. We have a point (in fact we have 2) but we need a slope. Thus:

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-1 - (-2)}{-3 - 1} = \frac{-1 + 2}{-3 - 1} = \frac{1}{-4}$$

now, we have a point (ie  $(1, -2)$ ) and a slope  $m = -\frac{1}{4}$ , so we can use formula.

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

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

$$\underline{-2} \qquad \underline{-2}$$

$$y = -\frac{1}{4}x + \frac{1}{4} - 2 \left(\frac{4}{4}\right)$$

$$y = -\frac{1}{4}x + \frac{1}{4} - \frac{8}{4}$$

$$y = -\frac{1}{4}x - \frac{7}{4}$$