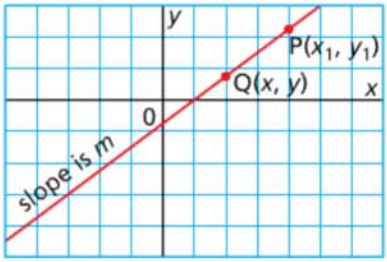
6.5 Slope-Point Form of the Equation for a Linear Function (Part 1)

Develop a formula for the **slope-point form** for the equation of a line.

Consider a line that has slope m and passes through the point $P(x_2, y_2)$. Another point on the line is $Q(x, y)$.



$$m = \frac{\text{rise}}{\text{run}}$$

$$m = \frac{y - y_1}{x - x_1}$$ ← rise, ↖ run

eliminate the denominator by multiplying it on both sides

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

denominator cancels out

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

now rewrite this equation with the $y - y_1$ on the left.

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

Slope-Point Form of the Equation of a Linear Function

The equation of a line that passes through a point $P(x_1, y_1)$ and has slope m is:

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

variables

slope

coordinates of a point on the line

So, to determine the equation of a straight line we need a point (x_1, y_1) and the slope m.

Example 1: A line passes through the point P (-2, 5) and has a slope of -3.

a) Write the equation in **slope-point form**.

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

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

$y - 5 = -3(x + 2)$

b) Write the equation in **slope-intercept form**.

start w/ point-slope form

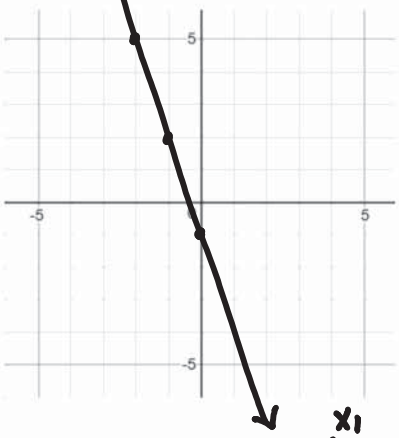
$y - 5 = -3(x + 2)$

$y - 5 = -3x - 6$

$+5 \qquad +5$

$y = -3x - 1$

c) Graph



To graph, either use point (-2,5) and slope or y-int (0,-1) and slope.

Example 2: A line passes through the point P (3, -2) and has a slope of $\frac{1}{3}$.

a) Write the equation in **slope-point form**.

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

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

$y + 2 = \frac{1}{3}(x - 3)$

b) Write the equation in **slope-intercept form**.

$y + 2 = \frac{1}{3}(x - 3)$

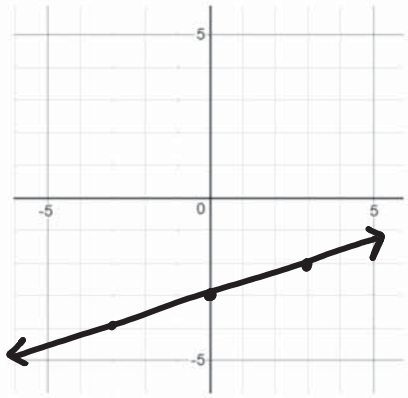
$y + 2 = \frac{1}{3}x - \frac{3}{1}(\frac{1}{3})$

$y + 2 = \frac{1}{3}x - 1$

$-2 \qquad -2$

$y = \frac{1}{3}x - 3$

c) Graph



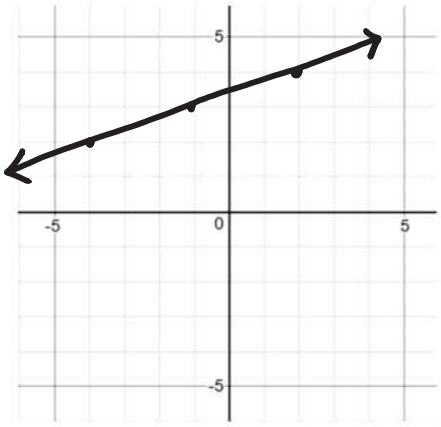
$y - y_1 = m(x - x_1)$

Example 3: Describe the graph of the linear function with this equation and then graph it.

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

To match the slope-point form, rewrite the given equation so that the operations are subtractions.

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



So, $m = \frac{1}{3}$

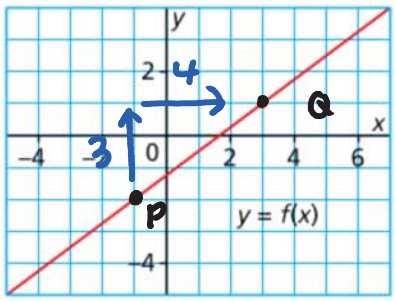
$x_1 = -4$

$y_1 = 2$

So, the graph has a slope of $\frac{1}{3}$ and passes through the point $(-4, 2)$.

Example 4: Writing an equation using a point and slope

a) Write an equation in **slope-point form** for this line.



$\text{slope} = m = \frac{\text{rise}}{\text{run}} = \frac{3}{4}$

pick a point

(i) $P(-1, -2)$ or (ii) $Q(3, 1)$

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

$y + 2 = \frac{3}{4}(x + 1)$

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

more than one possible answer.

b) Write the equation in part (a) in **slope-intercept form**. What is the *y*-intercept of this line?

(i) $y + 2 = \frac{3}{4}(x + 1)$

$y + 2 = \frac{3}{4}x + \frac{3}{4}$

$-2 \quad -2$

$y = \frac{3}{4}x + \frac{3}{4} - \frac{2}{1}$ (×4)

$y = \frac{3}{4}x - \frac{5}{4}$

or (ii) $y - 1 = \frac{3}{4}(x - 3)$

$y - 1 = \frac{3}{4}x - \frac{9}{4}$

$+1 \quad +1$

$y = \frac{3}{4}x - \frac{9}{4} + \frac{1}{1}$ (×4)

$y = \frac{3}{4}x - \frac{5}{4}$

y-int. $(0, -\frac{5}{4})$

Practice: p.372 #4 – 7, 9, 11, 12

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