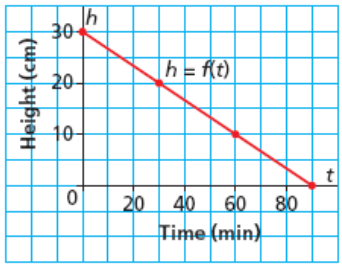
6.5 Slope-Point Form of the Equation for a Linear Function

LESSON FOCUS Relate the graph of a linear function to its equation in slope-point form.

Make Connections

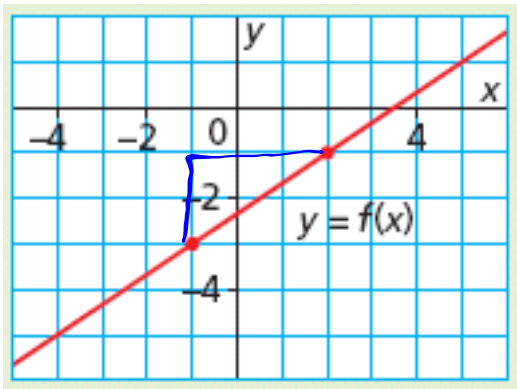
This graph shows the height of a candle as it burns.
How would you write an equation to describe this line?
Suppose you could not identify the h-intercept.
How could you write an equation for the line?



$y = mx + b$

$b = 30$ $m = \frac{\text{rise}}{\text{run}} = -\frac{2}{3}$ $y = -\frac{2}{3}x + 30$

How about this one using y = mx + b?

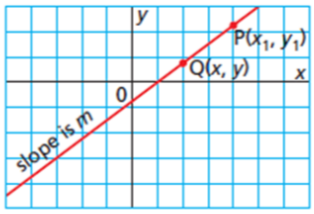


$m = \frac{2}{3}$

$b = ?$

We can use this strategy to develop a formula for the slope-point form for the equation of a line.

This line has slope m and passes through the point $P(x_1, y_1)$.
Another point on the line is $Q(x, y)$.



The slope, m, of the line is:

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

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

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

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

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

Slope-Point Form of the Equation of a Linear Function

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

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

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

Slope - Point Formula...

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

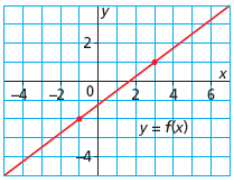
YOU NEED... 1) slope & 2) a point on the line

(x_1, y_1)

Example 2 Writing an Equation Using a Point on the Line and Its Slope

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

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



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

$= \frac{3}{4}$

$y - y_1 = m(x - x_1)$ (3,1)

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

$4y - 4 = 3x - 9$

$4y = 3x - 9 + 4$

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

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

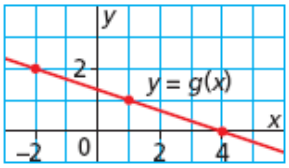
$b = -\frac{5}{4}$

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

YOUR TURN...

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

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



$m = -\frac{1}{3}$ (4,0)

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

$y - 0 = -\frac{1}{3}(x - 4)$ (a)

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

$b = \frac{4}{3}$

EXAMPLE #3:

Determine the equation of the line that passes through (-1, 4) & (3, -12).

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{4 - (-12)}{-1 - 3}$

$= \frac{16}{-4}$

$= -4$

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

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

$y - 4 = -4x - 4$

$4x + y - 4 + 4 = 0$

$4x + y = 0$

Example 4 Writing an Equation of a Line That Is Parallel or Perpendicular to a Given Line

Write an equation for the line that passes through R(1, −1) and is:

a) parallel to the line $y = \frac{2}{3}x - 5$

b) perpendicular to the line $y = \frac{2}{3}x - 5$

a) $m = \frac{2}{3}$

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

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

b) $m = \frac{2}{3}$ $\perp m = -\frac{3}{2}$

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

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

CHECK YOUR UNDERSTANDING

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

Practice problems...

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#5. a) $m=-5$ $P(-4,2)$

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

$y-2=-5(x+4)$