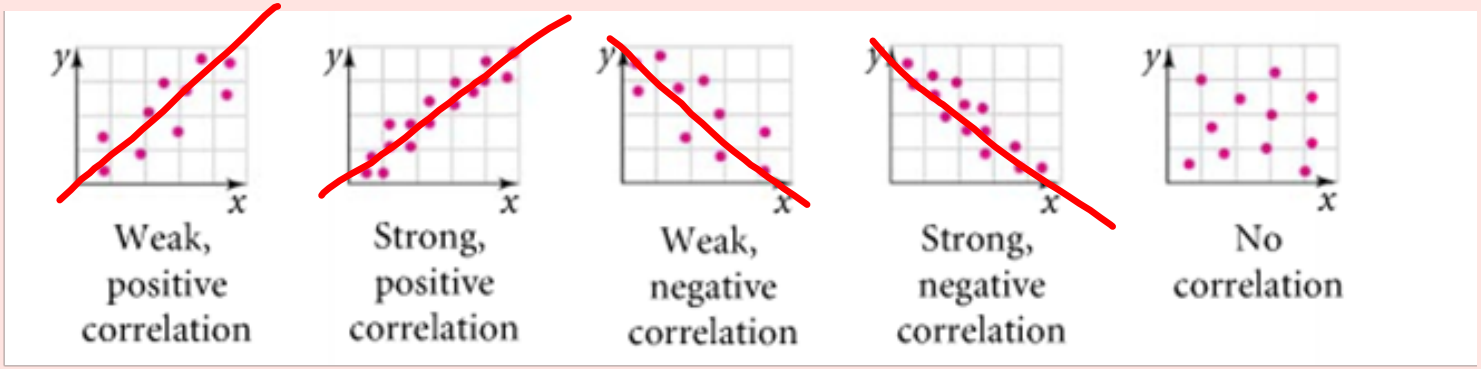
Algebra 2

2.4 Using Linear Models

A **scatter plot** is a graph that relates two different sets of data by plotting the data as ordered pairs. Use a scatter plot to determine a relationship between the data sets.



A **trend line** is a line that approximates the relationship between the data sets of scatter points. You can use the trend line to make predictions.

Suppose an airplane descends at a rate of 300 ft/min from an elevation of 8000 ft. Write and graph an equation to model the plane's elevation as a function of the time it has been descending. Interpret the intercept at which the graph intersects the vertical axis.

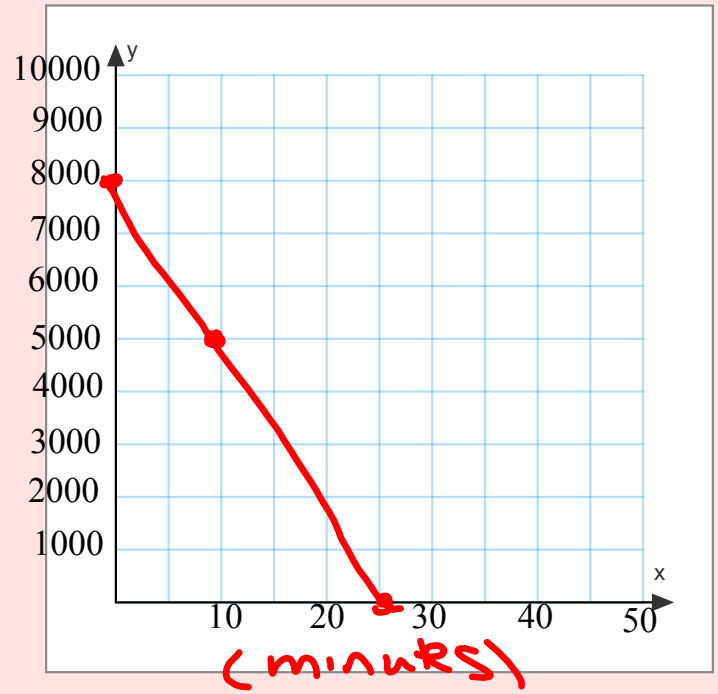
$m = -300$ $(0, 8000)$

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

$y - 8000 = -300(x - 0)$

$y - 8000 = -300x$

$\boxed{y = -300x + 8000}$



x-int: $(26\frac{2}{3}, 0)$

$0 = -300x + 8000$

$-8000 = -300x$

$x = \frac{-8000}{-300} = 26\frac{2}{3}$

x-int: $(26\frac{2}{3}, 0)$ plane took $26\frac{2}{3}$ mins to land

y-int: $(0, 8000)$ height at which plane to descend

A spring has a length of 8 cm when a 20-g mass is hanging at the bottom end. Each additional gram stretches the spring another 0.15 cm. Write an equation for the length y of the spring as a function of the mass x of the attached weight.

(mass, length)

(20, 8) (21, 8.15)

$$m = \frac{8.15 - 8}{21 - 20} = \frac{.15}{1} = .15$$

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

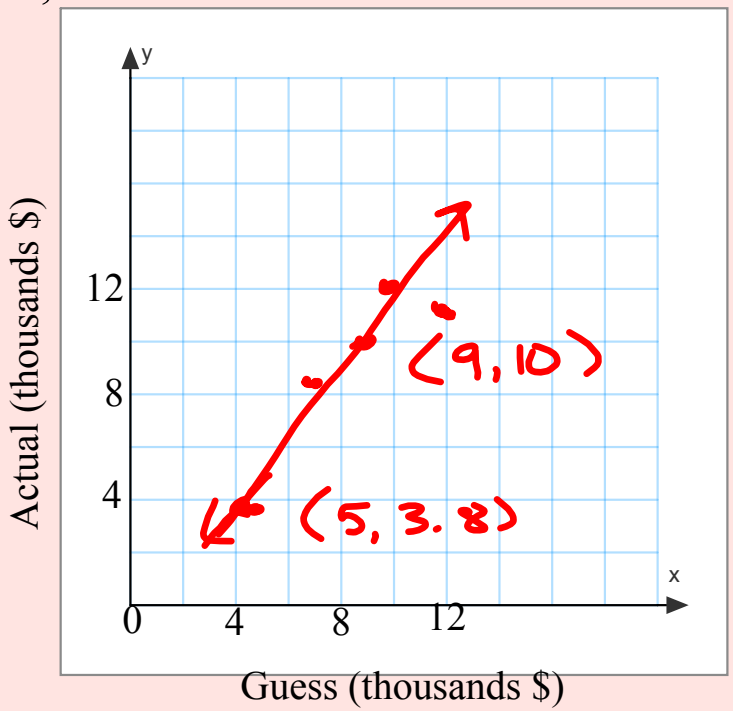
$$y - 8 = .15(x - 20)$$

$$y - 8 = .15x - 3$$

$$y = .15x + 5$$

An art expert guessed the selling prices of five paintings. Then, she checked the actual prices. The data points (guess, actual) show the results, where each number is in thousands of dollars. Graph the data points. Decide whether a linear model is reasonable. If so, draw a trend line and write its equation.

$\{(12,11),(7,8.5),(10,12),(5,3.8),(9,10)\}$



(9, 10) (5, 3.8)

$m = \frac{3.8-10}{5-9} = \frac{-6.2}{-4} = 1.55$

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

$y - 10 = 1.55(x - 9)$

$y - 10 = 1.55x - 13.95$

$y = 1.55x - 3.95$

Suppose a balloon begins descending at a rate of 20 ft/min from an elevation of 1350 ft. Write an equation to model the balloon's elevation as a function of time. What is true about the slope of this line? Graph the equation and interpret the h-intercept.

$m = -20 \quad (0, 1350)$

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

$y - 1350 = -20(x - 0)$

$y - 1350 = -20x$

$\boxed{y = -20x + 1350}$

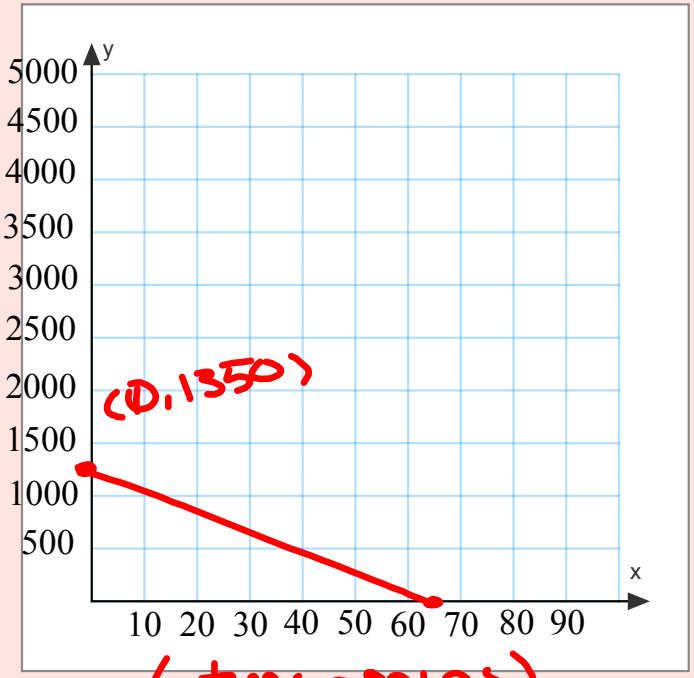
x-int: $(67.5, 0)$

$0 = -20x + 1350$

$-1350 = -20x$

$x = \frac{-1350}{-20}$

$x = 67.5$



x-int: (67.5, 0) → after 67.5 mins balloon will land

y-int: (0, 1350) → at 1350 ft balloon start to descend

A candle is 7 in. tall after burning for 1 h, and 5 in tall after burning for 2 h.
A Write a linear equation to model the height of the candle. B If the candle burns for 3.5 hours, what would the height of the candle be? C How long would it take for the candle to burn out completely?

(time, height)

A (1, 7) (2, 5)

$m = \frac{5-7}{2-1} = \frac{-2}{1} = -2$

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

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

$y - 5 = -2x + 4$

$+5 \qquad +5$

$y = -2x + 9$

B $x = 3.5$ hours

$y = -2x + 9$

$y = -2(3.5) + 9 = -7 + 9 = 2$

height = 2 in

C $y = -2x + 9$

$0 = -2x + 9$

$-9 = -2x$

$x = \frac{9}{2}$

For candle to burn completely out it would 4.5 hours