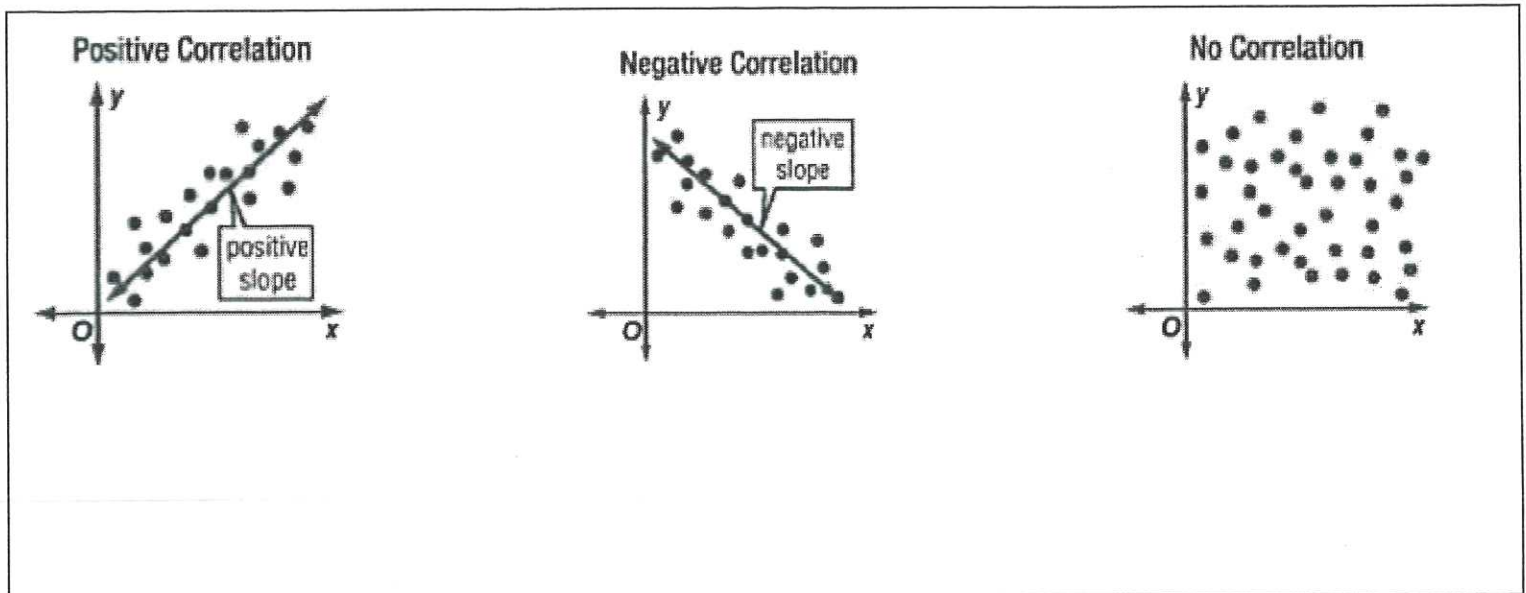


LINE OF BEST FIT- LINEAR REGRESSION

SWBAT: make a scatter plot and write equations

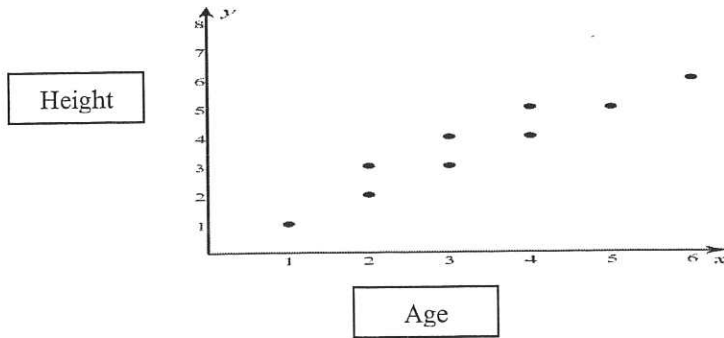
<u>Word</u>	<u>Definition</u>
Scatter plot	A graph of ordered pairs used to determine whether there is a relationship between paired data.
line of best fit	Also called "trend line" is a straight line that best represents the data on a scatter plot  *** The line of best fit may pass through some of the points, none of the points, or all of the points.

## Types of Relationships:



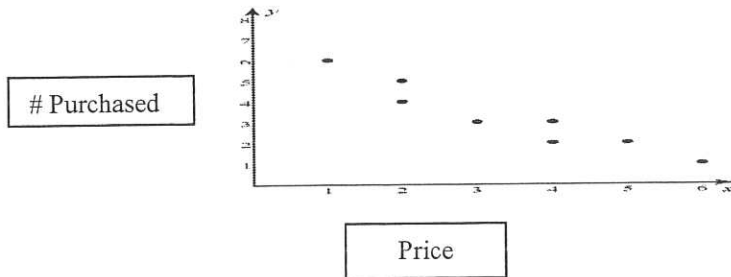
Correlation: the degree to which two variables are associated

The graph below shows the relationship between height and age.



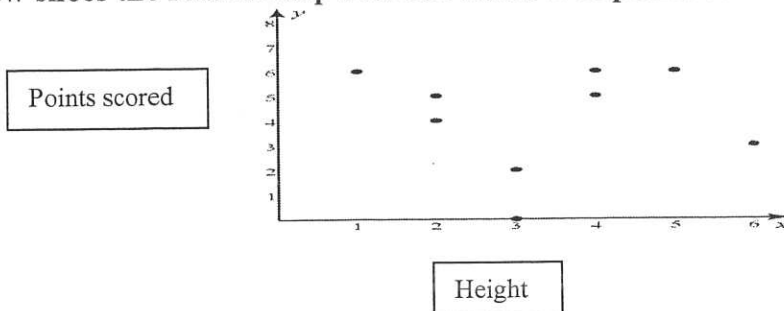
Although it isn't linear, *positive correlation* between age and height. This means that as age increases, height increases.

The graph below shows the relationship between price of an object and the number purchased by customers.



This illustrates a *negative correlation*. This means as price of an object increases, the number purchased decreases. In other words, if the price of an object goes up, fewer people will buy that object.

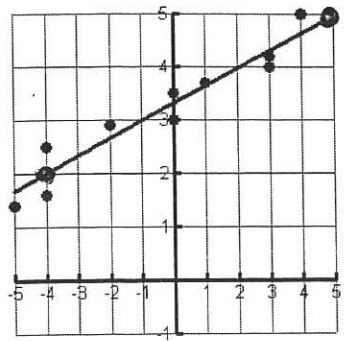
The graph below shows the relationship between number of points scored on a test and height.



There is *no correlation* between height and points scored because there is no definable pattern. Therefore, height and number of points scored on a test have no relationship.

EX 1: Find an equation for the line of best fit for the plot to the right. The data and line are already drawn.

- Pick two points on the line and find the slope between them.



Slope:  $\frac{y_2 - y_1}{x_2 - x_1}$   $(-4, 2)$   $(5, 5)$  ★

Try to pick ordered pairs at the extremes of the line.

$$m = \frac{5 - 2}{5 - (-4)} = \frac{3}{9} = \frac{1}{3} \approx .3$$

- Using  $y = mx + b$ , solve to find  $b$ .

Pick one of the ordered pair

$$\begin{aligned} 5 &= .3(5) + b \\ 5 &= 1.5 + b \\ -1.5 & \quad -1.5 \\ \hline 3.5 &= b \end{aligned}$$

- Write out your line of best fit.

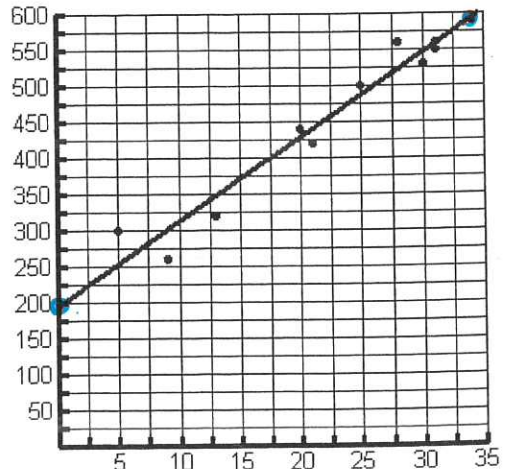
$$y = .3x + 3.5$$

EX 2: Find the line of best fit for the relationship between the total fat and total calories for various sandwiches. Use the graph to the right.

- Pick two points on the line and find the slope between them.

Slope:  $\frac{y_2 - y_1}{x_2 - x_1}$  ★  $(0, 200)$   $(34, 585)$

$$m = \frac{585 - 200}{34 - 0} = \frac{385}{34} \approx 11.32$$



- Using  $y = mx + b$ , solve to find  $b$ .

$$\begin{aligned} 200 &= 11.32(0) + b \\ 200 &= b \end{aligned}$$

- Find the equation for the line of best fit.

$$y = 11.32x + 200$$

\*4. Now let's use the calculator to determine the actual line of best fit equation as well as the value of  $r$ .

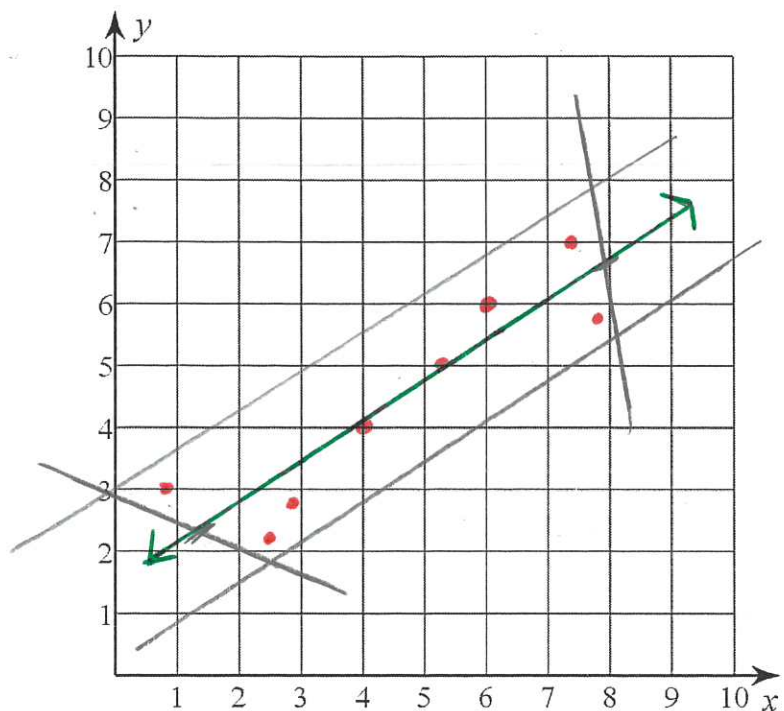
5	9	13	20	21	25	28	30	31	34
300	260	320	440	420	500	560	530	550	585

How to get the line of best fit by hand (estimation):

- 1.) Plot the data
- 2.) Find the line of best fit: should run in the direction of the points and run through as many points as possible.
- 3.) Find two points on the line.
- 4.) Find the equation of a line from 2 points.

Ex.) Draw the line of best fit and find the equation of the line.

x	y
.9	3
2.5	2.2
2.9	2.8
4	4
5.1	5
6	6
7.2	7
7.9	5.9



$(4, 4)$   $(5.1, 5)$

$$m = \frac{5 - 4}{5.1 - 4} = \frac{1}{1.1} \approx .9 = m$$

$$y = .9x + .4$$

$$y = mx + b$$

$$4 = .9(4) + b$$

$$4 = 3.6 + b$$

$$-3.6 \quad -3.6$$

$$.4 = b$$

Ex) Draw the line of best fit by hand

X	1	1	3	4	5	6	9
Y	10	12	33	46	59	70	102

★  $(1, 10)$   $(6, 70)$

$$m = \frac{70 - 10}{6 - 1} = \frac{60}{5} = 12$$

$$y = mx + b$$

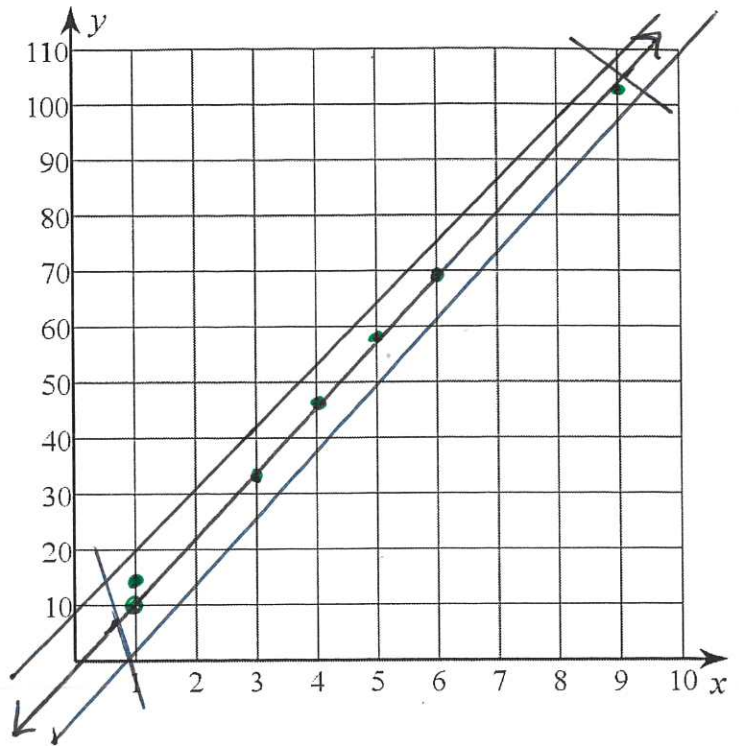
$$10 = 12(1) + b$$

$$10 = 12 + b$$

$$\begin{array}{r} -12 \quad -12 \\ \hline \end{array}$$

$$-2 = b$$

$$y = 12x - 2$$



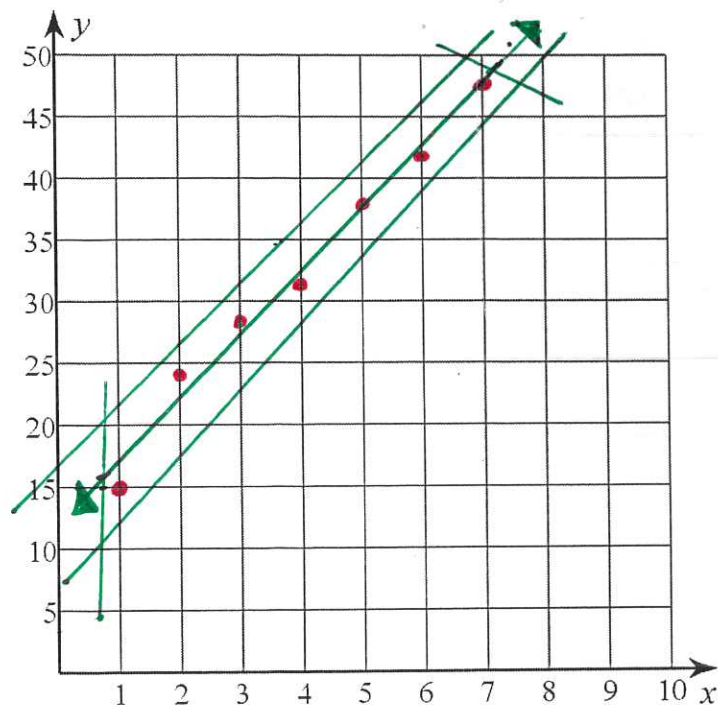
## Example

Dogs age differently than humans do. You may have heard someone say that a dog ages 1 year for every 7 human years. However, that is not the case. The table below shows the relationship between dog years and human years.

Dog Years	Human Years
1	15
2	24
3	28
4	32
5	37
6	42
7	47

a. Draw a scatter plot to model the data and determine what relationship, if any, exists in the data.

$(6, 42)$   $(1, 15)$



$(7, 47)$   $(5, 37)$

$$m = \frac{37 - 47}{5 - 7} = 5$$

3

b. Draw a best-fit line for the scatter plot.

c. Find an equation for the best-fit line.

$$y = mx + b$$

$$47 = 5(7) + b$$

$$47 = 35 + b$$

$$\begin{array}{r} -35 \\ -35 \\ \hline \end{array}$$

$$12 = b$$

$$y = 5x + 12$$