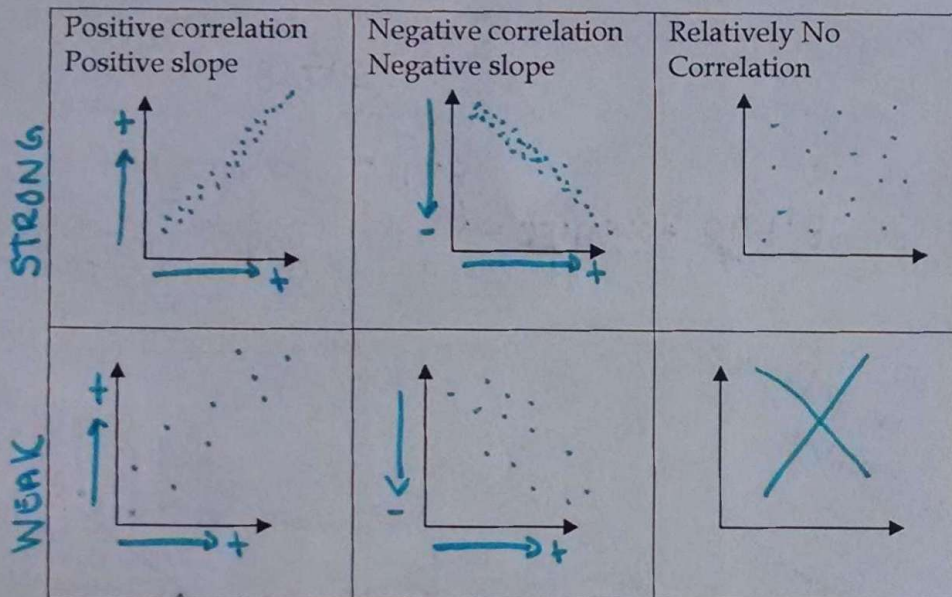
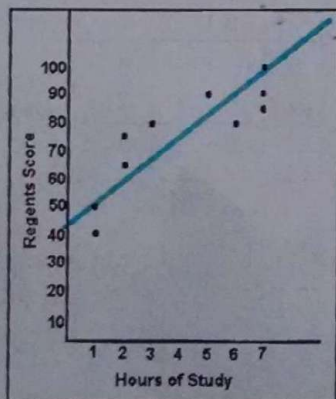


Notes: Lines of Best Fit and Linear Regression

A scatter plot is helpful in understanding form, direction and strength of a relationship between two variables.



LINES OF BEST FIT (a line that models a set of data)



Draw a line of best fit

Write an equation for the line.

$$(1, 50) + (7, 100)$$

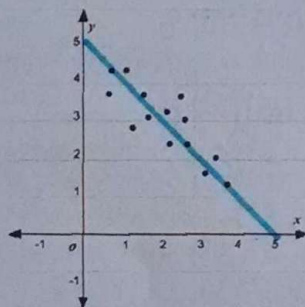
$$\frac{\Delta y}{\Delta x} = \frac{100 - 50}{7 - 1} = \frac{50}{6} = \frac{25}{3}$$

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

$$y - 50 = \frac{25}{3}(x - 1)$$

$$y = \frac{25}{3}x + \frac{125}{3}$$

$$y \approx 8.3x + 41.67$$



Draw a line of best fit

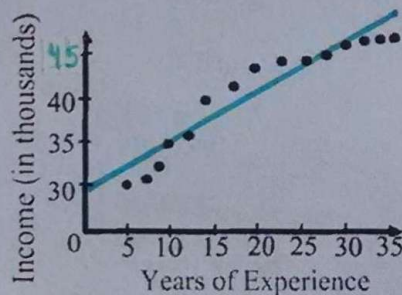
Write an equation for the line.

$$(4, 1) + (1, 4.3)$$

$$\frac{\Delta y}{\Delta x} = \frac{4.3 - 1}{1 - 4} = \frac{-3.3}{-3} = -1.1$$

$$y - 1 = -1.1(x - 4)$$

$$y = -1.1x + 5.4$$



Draw a line of best fit

Write an equation for the line.

$$(10, 35) + (28, 46)$$

$$\frac{\Delta y}{\Delta x} = \frac{46 - 35}{28 - 10} = \frac{11}{18} \approx 0.61$$

$$y - 35 = \frac{11}{18}(x - 10)$$

$$y = \frac{11}{18}x + \frac{260}{9}$$

$$y \approx 0.61x + 28.9$$

$$y = 0.61x + 28.77$$

$$r = 0.97$$

Properties of the Correlation Coefficient r

r is a value in the range $-1 \leq r \leq 1$ \rightarrow strong \oplus

strong \ominus

If $r = 1$, the data set forms a straight line with a \oplus slope.

If $r = 0$, the data set has no correlation.

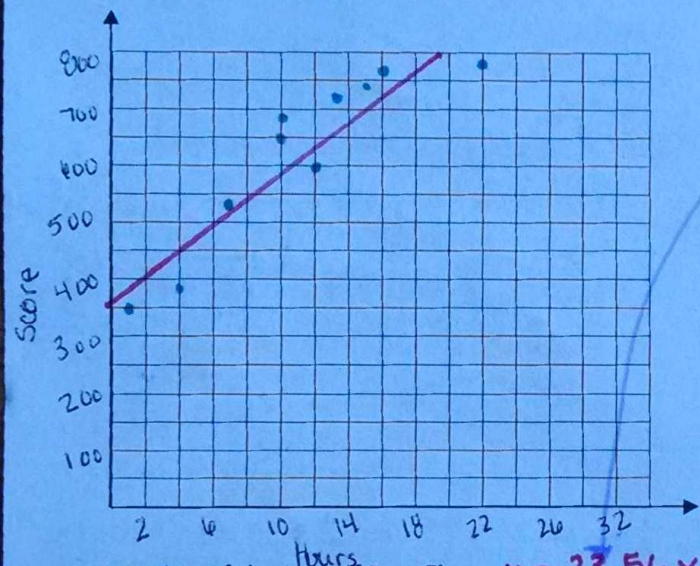
If $r = -1$, the data set forms a straight line with \ominus slope.

CAUTION! Don't confuse slope with the value of r . The r -value and the slope have the same **SIGN** but represent different concepts.

- 1) Is there a relationship between Math SAT scores and the number of hours spent studying for the test? A study was conducted involving 10 students as they prepared for and took the Math section of the SAT Examination.

Hours spent studying	4	10	7	12	22	1	16	13	10	15
Math SAT Score	390	650	530	600	790	350	770	730	690	740

Graph the data and be sure to label your axis.



Equation of the Line of Best Fit $y = 23.56x + 364.81$

Correlation Coefficient $.923$

Based on your graph, if you study for 19 hours, what should you score on the Math SAT? 812.5

Based on the graph, if you got a 450, approximately how many hours did you study? $\text{between } 3 + 4$

- 2) You are planning a road trip and want to determine the relationship between the miles driven and gasoline left in the tank.

Miles Travelled	0	50	160	270	305	395	475	510
Gasoline in Tank	16	15	12	8	7	4	1	0

What is the equation of the Line of Best Fit? $y = -.03x + 16.57$

Correlation Coefficient $-.99$

Based on your graph, if you drive for 350 miles, approximately how many gallons have you used? $\text{used } 11 \text{ gallons}$

Based on the graph, if used 13 gallons, approximately how many miles did you drive? $422 \text{ miles } (3 \text{ gal left in tank})$

- 3) Colleen is training for the NYC Marathon. She recorded the number of hours she practices and compares it to her mile time.

Hours Spent practicing	0	4	9	15	30	35	48	55
Mile Time (minutes)	12	11.5	10.5	9.5	7.5	7.25	6.75	6

What is the equation of the Line of Best Fit? $y = -.11x + 11.54$

Correlation Coefficient $-.976$

Based on your graph, if Colleen practiced for a total of 20 hours, what would her mile time be? 9.36 minutes

Based on the graph, if Colleen ran an 8 minute mile, how many hours did she practice? 32 hours

If Colleen continues to practice, what would her mile time be after 59 hours of practice? 5.12 minutes