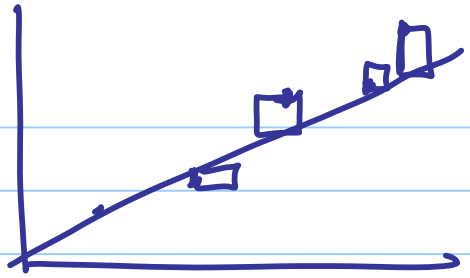
$y = a + bx$



let N = # of points

let A = area = $\sum_{i=1}^{N} \left[y_i - (a + b x_i) \right]^2$

$$\left(\frac{dA}{b}\right)_a = 0 = \sum 2 \left[y_i - a - b x_i \right] (-x_i)$$

$$0 = -2 \sum y_i x_i + 2a \sum x_i + 2b \sum x_i^2 \quad (1)$$

$$\left(\frac{dA}{da}\right)_b = 0 = \sum 2 \left[y_i - a - b x_i \right] (-1)$$

$$0 = -2 \sum y_i + \underbrace{2 \sum a}_{2Na} + 2b \sum x_i \quad (2)$$

Eq. 1 $\Rightarrow$ $a = \dfrac{\sum x_i y_i - b \sum x_i^2}{\sum x_i}$

Eq. 2 $\Rightarrow$ $\boxed{a = \dfrac{\sum y_i - b \sum x_i}{N}}$

equate

$$\frac{\sum x_i y_i}{\sum x_i} - \frac{b \sum x_i^2}{\sum x_i} = \frac{\sum y_i}{N} - b \frac{\sum x_i}{N}$$

$$\frac{\sum x_i y_i}{\sum x_i} - \frac{\sum y_i}{N} = b\left[\frac{\sum x_i^2}{\sum x_i} - \frac{\sum x_i}{N}\right]$$

$$b = \frac{\dfrac{\sum x_i y_i}{\sum x_i} - \dfrac{\sum y_i}{N}}{\dfrac{\sum x_i^2}{\sum x_i} - \dfrac{\sum x_i}{N}} = \frac{N\sum x_i y_i - \sum x_i \sum y_i}{N\sum x_i^2 - \left(\sum x_i\right)^2}$$

or... $$\boxed{b = \frac{N\sum x_i y_i - \sum x_i \sum y_i}{N\sum x_i^2 - \left(\sum x_i\right)^2}}$$

Use this result in Eq. 2 to get a.

test data $\begin{matrix} x = 0, 1, 2, 3 \\ y = 1, 2, 3, 4 \end{matrix}$

$\Sigma x = 6 \qquad \Sigma y = 10$

So $N = 4$

$$b = \frac{4(0\cdot 1 + 1\cdot 2 + 2\cdot 3 + 3\cdot 4) - 6\cdot 10}{4(0^2 + 1^2 + 2^2 + 3^2) - 36}$$

$$= \frac{4\cdot 20 - 60}{4\cdot 14 - 36} = \frac{20}{20} = 1$$

✓ OK

Then $a = \dfrac{\Sigma y_i - b\Sigma x_i}{N} = \dfrac{10 - 1\cdot(6)}{4}$

$$= \frac{4}{4} = 1$$

✓ OK, too

Now, we wanted you to do it manually in Excel. This is going to look like this:

Xdata	Ydata		
0	1		
1	2	Below we show the actual Excel equations used in column B	
2	3	Terms like N, SumX are named using the name variable feature.	
3	4	Note the helpful COUNT and SUMPRODUCT functions!	
N	4	"=COUNT(A3:A6)"	
SumX	6	"=SUM(A3:A6)"	
SumY	10	"=SUM(B3:B6)"	
SumXY	20	"=SUMPRODUCT(A3:A6,B3:B6)"	
SumX^2	14	"=SUMPRODUCT(A3:A6*A3:A6)"	
b	1	"=(N*SumXY-SumX*SumY)/(N*SumX2-(SumX)^2)"	
a	1	"=(SumY-B*SumX)/N"	