1. **Fit / Calculate / Estimate / Find / Compute the regression line taking X as an independent variable or Y on X.**

The estimated regression line Y on X is: $\hat{Y} = a + bX$

Data		**First Method**		**Second Method**	
$\boldsymbol{X}$	$\boldsymbol{Y}$	$\boldsymbol{XY}$	$\boldsymbol{X^2}$	$(\boldsymbol{X}-\bar{\boldsymbol{X}})(\boldsymbol{Y}-\bar{\boldsymbol{Y}})$	$(\boldsymbol{X}-\bar{\boldsymbol{X}})^2$
78	125	9750	6084	0	9
89	137	12193	7921	168	196
97	156	15132	9409	682	484
69	112	7728	4761	78	36
59	107	6313	3481	288	256
79	136	10744	6241	44	16
68	123	8364	4624	14	49
61	104	6344	3721	294	196
600	**1000**	**76568**	**46242**	**1568**	**1242**

$$b = b_{yx} = \frac{n\sum XY - \sum X \sum Y}{n\sum X^2 - (\sum X)^2}$$

$$b = b_{yx} = \frac{\sum(X-\bar{X})(Y-\bar{Y})}{\sum(X-\bar{X})^2}$$

$$a = a_{yx} = \bar{Y} - b_{yx} \times \bar{X}$$

2. **Compute the trend values $\widehat{Y}$ and verify that**

$$\sum e^2 = \sum\left(Y - \widehat{Y}\right)^2 = \sum Y^2 - a_{yx}\sum Y - b_{yx}\sum XY$$

X	Y	Y^2	$\widehat{Y} = a_{yx} + b_{yx}X$	$\left(Y - \widehat{Y}\right)^2$
78	125	15625	128.7874	14.34469883
89	137	18769	142.6747	32.20242661
97	156	24336	152.7746	10.40348148
69	112	12544	117.4251	29.4319354
59	107	11449	104.8003	4.838583034
79	136	18496	130.0499	35.40345814
68	123	15129	116.1626	46.74947944
61	104	10816	107.3253	11.05749907
600	**1000**	**127164**	**1000**	**184.431562**

3. **Fit / Calculate / Estimate / Find / Compute the regression line taking Y as an independent variable or X on Y.**

The estimated regression line X on Y is: $\hat{X} = a_{xy} + b_{xy}Y$

Data Set		**First Method**		**Second Method**	
$\boldsymbol{X}$	$\boldsymbol{Y}$	$\boldsymbol{XY}$	$\boldsymbol{Y^2}$	$(\boldsymbol{X-\bar{X}})(\boldsymbol{Y-\bar{Y}})$	$(\boldsymbol{Y-\bar{Y}})^{\boldsymbol{2}}$
78	125	9750	15625	0	0
89	137	12193	18769	168	144
97	156	15132	24336	682	961
69	112	7728	12544	78	169
59	107	6313	11449	288	324
79	136	10744	18496	44	121
68	123	8364	15129	14	4
61	104	6344	10816	294	441
600	**1000**	**76568**	**127164**	**1568**	**2164**

$$b = b_{xy} = \frac{n\sum XY - \sum X \sum Y}{n\sum Y^2 - (\sum Y)^2}$$

$$b = b_{xy} = \frac{\sum(X-\bar{X})(Y-\bar{Y})}{\sum(Y-\bar{Y})^2}$$

$$a = a_{xy} = \bar{X} - b_{xy} \times \bar{Y}$$

4. **Compute the trend values $\hat{X}$ and verify that**

$$\sum e^2 = \sum\left(X - \hat{X}\right)^2 = \sum X^2 - a_{xy}\sum X - b_{xy}\sum XY$$

X	Y	X^2	$\hat{X} = a_{xy} + b_{xy}Y$	$\left(X - \hat{X}\right)^2$
78	125	6084	75	9
89	137	7921	83.69501	28.14293
97	156	9409	97.46211	0.213543
69	112	4761	65.58041	11.69362
59	107	3481	61.95749	8.746724
79	136	6241	82.97043	15.76428
68	123	4624	73.55083	30.81173
61	104	3721	59.78373	1.479303
600	**1000**	**46242**	**600**	**105.8521**

5. **Compute / Calculate / Find the coefficient of correlation r and interpret the result.**

Data		**First Method**			**Second Method**		
$\boldsymbol{X}$	$\boldsymbol{Y}$	$\boldsymbol{XY}$	$\boldsymbol{X^2}$	$\boldsymbol{Y^2}$	$(\boldsymbol{X}-\bar{\boldsymbol{X}})(\boldsymbol{Y}-\bar{\boldsymbol{Y}})$	$(\boldsymbol{X}-\bar{\boldsymbol{X}})^2$	$(\boldsymbol{Y}-\bar{\boldsymbol{Y}})^2$
78	125	9750	6084	15625	0	9	0
89	137	12193	7921	18769	168	196	144
97	156	15132	9409	24336	682	484	961
69	112	7728	4761	12544	78	36	169
59	107	6313	3481	11449	288	256	324
79	136	10744	6241	18496	44	16	121
68	123	8364	4624	15129	14	49	4
61	104	6344	3721	10816	294	196	441
600	**1000**	**76568**	**46242**	**127164**	**1568**	**1242**	**2164**

$$r = \frac{n\sum XY - \sum X \sum Y}{\sqrt{[n\sum X^2 - (\sum X)^2][n\sum Y^2 - (\sum Y)^2]}}$$

$$r = \frac{\sum(X-\bar{X})(Y-\bar{Y})}{\sqrt{\sum(X-\bar{X})^2 \times \sum(Y-\bar{Y})^2}}$$

$$r = \pm\sqrt{b_{yx} \times b_{xy}}$$