

Q.17

Eqn of Regression Line:  $Y = a + bX$

To get reg. line, we use 2 eq<sup>n</sup>

$\sum y = na + b \sum x$  total data points / observations

$\sum ny = a \sum n + b \sum n^2$

# NOTE: Price is taken as  $X$  & Demand is taken as  $Y$  because demand depends on price, but vice-versa is not true Independent variable

X	Y	xy	X <sup>2</sup>
100	20	2000	10000
150	18	2700	22500
200	15	3000	40000
300	12	3600	90000
400	9	3600	160000
500	5	2500	250000
600	2	1200	360000
$\sum 2250$	81	18600	932500

n=7

So, eq<sup>n</sup> becomes

$81 = 7a + b2250$

$18600 = 2250a + 932500b$

Using Cramer's Rule

$$D = \begin{vmatrix} 7 & 2250 \\ 2250 & 932500 \end{vmatrix}$$

$$= 6527500 - 5062500$$

$$= 1,465,000$$

$$a = \begin{vmatrix} 81 & 2250 \\ 18600 & 932500 \end{vmatrix}$$

D

$$b = \begin{vmatrix} 33,682,500 & 22.991 \\ 1,465,000 & 81 \end{vmatrix}$$

D

$$= \frac{-52,050}{1,465,000} = -0.0355$$



Regression line

$$Y = 22.991 + (-0.0355)X$$

Q2] Income is independent, but consumption depends on Income. So Income is X.

$(Y - \bar{Y})$

X	Y	XY	X <sup>2</sup>	$\hat{Y}$	$\hat{Y} - \bar{Y}$	$(Y - \bar{Y})^2$
260	150	39000	67600	158.01	2444.3	1716.4
80	70	5600	6400	64.41	1450.1	1487.6
240	155	37200	57600	147.61	1524.12	2155.7
100	65	6500	10000	74.81	1139.73	1898.3
160	110	17600	25600	106.01	6.55	2.04
180	115	20700	32400	116.41	61.46	41.34
140	95	13300	19600	95.61	167.96	184.14
$\Sigma = 1160$	760	139900	219200		7294.22	8085.52

$$\bar{Y} = \frac{760}{7} = 108.57$$

eqn to calc. regression line ( $Y = 22.81 + 0.52X$ )

$$\Sigma Y = na + b \Sigma X \rightarrow 760 = 7a + 1160b$$

$$\Sigma XY = a \Sigma X + b \Sigma X^2 \rightarrow 139900 = 1160a + 219200$$

$$D = \begin{vmatrix} 7 & 1160 \\ 1160 & 219200 \end{vmatrix} = 188,800$$

$$a = \frac{\begin{vmatrix} 760 & 1160 \\ 139900 & 219200 \end{vmatrix}}{D} = \frac{4,308,000}{188,800} = 22.817$$

$$b = \frac{\begin{vmatrix} 7 & 760 \\ 1160 & 139900 \end{vmatrix}}{D} = \frac{97700}{188,800} = 0.517$$



repression time

$$Y = 22.81 + 0.52X$$

Coefficient of Determination =  $R^2 = \frac{\sum (\hat{y} - \bar{y})^2}{\sum (y - \bar{y})^2}$

$$= \frac{7294.22}{8085.52} = 0.9021$$

$\bar{Y} - Y$	$\bar{Y} - F$	$\bar{Y} - F$	$\bar{Y} - F$	$\bar{Y} - F$	$\bar{Y} - F$	$\bar{Y} - F$
10.821	10.821	10.821	10.821	10.821	10.821	10.821
11.181	11.181	11.181	11.181	11.181	11.181	11.181
12.216	12.216	12.216	12.216	12.216	12.216	12.216
13.371	13.371	13.371	13.371	13.371	13.371	13.371
14.581	14.581	14.581	14.581	14.581	14.581	14.581
15.821	15.821	15.821	15.821	15.821	15.821	15.821
17.081	17.081	17.081	17.081	17.081	17.081	17.081
18.371	18.371	18.371	18.371	18.371	18.371	18.371
19.681	19.681	19.681	19.681	19.681	19.681	19.681
20.981	20.981	20.981	20.981	20.981	20.981	20.981
22.281	22.281	22.281	22.281	22.281	22.281	22.281
23.581	23.581	23.581	23.581	23.581	23.581	23.581
24.881	24.881	24.881	24.881	24.881	24.881	24.881
26.181	26.181	26.181	26.181	26.181	26.181	26.181
27.481	27.481	27.481	27.481	27.481	27.481	27.481
28.781	28.781	28.781	28.781	28.781	28.781	28.781
30.081	30.081	30.081	30.081	30.081	30.081	30.081
31.381	31.381	31.381	31.381	31.381	31.381	31.381
32.681	32.681	32.681	32.681	32.681	32.681	32.681
33.981	33.981	33.981	33.981	33.981	33.981	33.981
35.281	35.281	35.281	35.281	35.281	35.281	35.281
36.581	36.581	36.581	36.581	36.581	36.581	36.581
37.881	37.881	37.881	37.881	37.881	37.881	37.881
39.181	39.181	39.181	39.181	39.181	39.181	39.181
40.481	40.481	40.481	40.481	40.481	40.481	40.481
41.781	41.781	41.781	41.781	41.781	41.781	41.781
43.081	43.081	43.081	43.081	43.081	43.081	43.081
44.381	44.381	44.381	44.381	44.381	44.381	44.381
45.681	45.681	45.681	45.681	45.681	45.681	45.681
46.981	46.981	46.981	46.981	46.981	46.981	46.981
48.281	48.281	48.281	48.281	48.281	48.281	48.281
49.581	49.581	49.581	49.581	49.581	49.581	49.581
50.881	50.881	50.881	50.881	50.881	50.881	50.881
52.181	52.181	52.181	52.181	52.181	52.181	52.181
53.481	53.481	53.481	53.481	53.481	53.481	53.481
54.781	54.781	54.781	54.781	54.781	54.781	54.781
56.081	56.081	56.081	56.081	56.081	56.081	56.081
57.381	57.381	57.381	57.381	57.381	57.381	57.381
58.681	58.681	58.681	58.681	58.681	58.681	58.681
59.981	59.981	59.981	59.981	59.981	59.981	59.981
61.281	61.281	61.281	61.281	61.281	61.281	61.281
62.581	62.581	62.581	62.581	62.581	62.581	62.581
63.881	63.881	63.881	63.881	63.881	63.881	63.881
65.181	65.181	65.181	65.181	65.181	65.181	65.181

$\Sigma Y = 7294.22$   
 $\Sigma Y^2 = 8085.52$   
 $V = 0.9021$

Regression line eq<sup>n</sup>'s  
 $\Sigma y = na + b \Sigma x \rightarrow 70 = 10a + 130b$   
 $\Sigma ny = a \Sigma n + b \Sigma x^2 \rightarrow 949 = 130a + 1818b$

$$D = \begin{vmatrix} 10 & 126 \\ 130 & 1818 \end{vmatrix} = 1280$$

$$a = \frac{70 + 130}{949 + 1818} \div D = \frac{3890}{1280} = 3.039 \approx 3.04$$

$$b = \frac{10 \times 70}{130 + 949} \div D = 390 \div 1280 = 0.304$$

$$\text{eqn } Y = 3.04 + 0.304 X$$

$$S_b = \sqrt{\frac{\sum (y - \hat{y})^2}{(n-k-1) \sum (x - \bar{x})^2}}$$

$$= \sqrt{\frac{27.34}{(10-1-1) 128}} = \underline{\underline{0.16339}}$$

$$t = \frac{b}{S_b} = \frac{0.304}{0.163} = \underline{\underline{1.8650}}$$

$$t_{cal} 1.865 < t_{table} 2.306 \quad \} \text{ So, relation is not significant}$$

→ Confidence interval

$$b \pm 2.306 (S_b)$$

$$0.304 \pm 2.306 (0.163)$$

$$0.304 \pm 0.375$$

$$[-0.071 \text{ --- } 0.679]$$

As zero lies b/w the interval  
there is no significant relation  
b/w  $x$  &  $y$ .