Multiple Linear Regression.

TV Ad x_1	Newspaper Ad x_2	y (Sales)
60	22	140
62	25	155
67	24	159
70	20	179
71	15	192
72	14	200
75	14	212
78	11	215

Step 1:. Calculate x_1^2, x_2^2, $x_1 y$, $x_2 y$ and $x_1 x_2$.

y	x_1	x_2	x_1^2	x_2^2	$x_1 y$	$x_2 y$	$x_1 \cdot x_2$
140	60	22	3600	484	8400	3080	1320
155	62	25	3844	625	9610	3875	1550
159	67	24	4489	576	10653	3816	1608
179	70	20	4900	400	12530	3580	1400
192	71	15	5041	225	13632	2880	1065
200	72	14	5184	196	14400	2800	1008
212	75	14	5625	196	15900	2968	1050
215	78.	11	6084	121	16770	2365	858
Sum 1452	555	145	38767	2823	101895	25364	9859
mean 181.5	69.375	18.125				Regression Sum	

step² Regression sum:

$$\sum x_1^2 = \sum x_1^2 - (\sum x_1)^2 / n$$

$$= \frac{38767 - (555)^2}{8} = 263.875$$

$$\sum x_2^2 = \frac{\sum x_2^2 - (\sum x_2)^2}{n}$$

$$= \frac{2823 - (145)^2}{8} = 194.875$$

$$\sum x_1 y = \frac{\sum x_1 y - \sum x_1 \cdot \sum y}{n}$$

$$= \frac{101895 - 555 \times 1452}{8}$$

$$= 1162.5$$

$$\sum x_2 y = \frac{\sum x_2 y - \sum x_2 \sum y}{n}$$

$$= \frac{25364 - 145 \times 1452}{8}$$

$$= -953.5$$

$$\sum x_1 x_2 = \frac{\sum x_1 x_2 - \sum x_1 \cdot \sum x_2}{n}$$

$$= \frac{9859 - 555 \times 145}{8} \quad . = -200.375$$

x_1^2	x_2^2	$x_1 y$	$x_2 y$	$x_1 x_2$
Reg sem 263.875	194.875	1162.5	-953.5	-200.375

Step 3:

Calculate b_0, b_1, b_2

$$b_1 : \frac{[(\Sigma x_2^2)(\Sigma x_1 y) - (\Sigma x_1 x_2)(\Sigma x_2 y)]}{[(\Sigma x_1^2)(\Sigma x_2^2) - (\Sigma x_1 x_2)^2]}$$

$$= \frac{(194.875) \times (1162.5) - (-200.375) \times (-953.5)}{[(263.875)(194.875) - (-200.375)^2]}$$

$$\boxed{b_1 = 3.148}$$

$$b_2 : \frac{[(263.875)(-953.5) - (-200.375)(1152.5)]}{[(263.875)(194.875) - (-200.375)^2]}$$

$$\boxed{b_2 = -1.656}$$

$$b_0 : \bar{Y} - b_1 \bar{x_1} - b_2 \bar{x_2}$$

$$= 181.5 - (3.148 \times 69.375)$$
$$- (-1.656)(18.125)$$

$$\boxed{b_0 = -6.867}$$

$\therefore \boxed{\hat{y} = -6.867 + 3.148 x_1 - 1.656 x_2}$

$\bar{Y} = \text{mean } Y$.

$\therefore \quad \bar{x_1}, \bar{x_2}$

$\bar{Y} = \Sigma Y. \text{ mean } x$

$\bar{x_1} = \Sigma x_1. \text{ mean } y$

$\bar{x_2} = \Sigma x_2$