Q.1.

Years of Experience	1	3	5	7	9
Annual Salary	40	52	61	74	87

Step 1.

data is given.

Year of Experience	Annual Salary
1	40
3	52
5	61
7	74
9	87

Step 2. Compute means.

$$n = 5$$

$$\bar{x} = \frac{1+3+5+7+9}{5} = 5$$

$$\bar{y} = \frac{40+52+61+74+87}{5} = 62.8$$

Step 3. Compute Slope b_1

by using the Formula.,

$$b_1 = \frac{\Sigma(x_i - \bar{x})(y_i - \bar{y})}{\Sigma(x_i - \bar{x})^2}$$

x_i	y_i	$(x_i - \bar{x})$	$(y_i - \bar{y})$	$[(x_i - \bar{x})(y_i - \bar{y})]$	$(x_i -$
1	40	-4	-22.8	91.2	16
3	52	-2	-10.8	21.6	4
5	61	0	-1.8	0	0
7	74	2	11.2	22.4	4
9	87	4	24.2	96.8	16

$$\Sigma (x_i - \bar{x})(y_i - \bar{y}) = 232$$
$$\Sigma (x_i - \bar{x})^2 = 40$$
$$\therefore \ b_1 = 232/40 = 5.8$$

Step 4. Compute Intercept b_0

$$b_0 = \bar{y} - b\bar{x}$$
$$b_0 = 62.8 - (5.8)(5)$$
$$= 33.8$$

Step 5. Regression Equation
$$\therefore \ \hat{y} = 33.8 + 5.8x$$

Step 6. Predict Salary for $x = 5$ yrs.
$$\hat{y} = 33.8 + 5.8(5)$$
$$= 62.8$$

$\therefore$ Slope = 5.8

Intercept = 33.8

Pred. salary for 5yr = 62.8 thousand dollars.

Step 1.

As per the given data :-

Car	Mileage (x_i)	Age (x_2)	Price (y)
Honda	54.3	4	13.5
Mercedes	98.7	4	12.2
Toyota	158.2	5	11.9
Chevorlet	97.5	7	10.5
Volkswagen	123.1	6	16.2

- So, we want, multiple regression model.

$$\hat{y} = b_0 + b_1 x_1 + b_2 x_2$$

Step 2. Compute means

$$n = 5$$

$$\bar{x}_1 = \frac{54.3 + 98.7 + 158.2 + 97.5 + 123.1}{5}$$

$$= 106.36 \,,$$

$$\bar{x}_2 = \frac{4 + 4 + 5 + 7 + 6}{5} = 5.2 \,,$$

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$$\bar{y} = \frac{13.5 + 12.2 + 11.9 + 10.5 + 16.2}{5} = 12.86 \,.$$

Step 3.

Set up sums for normal equations :-

y	x_1	x_2	$x_1 - \bar{x}_1$	$x_2 - \bar{x}_2$	$y - \bar{y}$
13.5	54.3	4	-52.06	-1.2	0.64
12.2	98.7	4	-7.66	-1.2	-0.66
11.9	158.2	5	51.84	-0.2	-0.96
10.5	97.5	7	-8.86	1.8	-2.36
16.2	123.1	6	16.74	0.8	3.36

$\therefore \Sigma(x_1 - \bar{x}_1)^2 = (-52.06)^2 + (-7.66)^2 + (51.84)^2 + (-8.86)^2$
$$+ (16.74)^2$$
$$= 5814.632 \underline{\hspace{2cm}} (S_{11})$$

$\therefore \Sigma(x_2 - \bar{x}_2)^2 = (-1.2)^2 + (-1.2)^2 + (-0.2)^2 + (1.8)^2 + (0.8)^2$
$$= 6.8 \underline{\hspace{2cm}} (S_{22})$$

$\therefore \Sigma(x_1 - \bar{x}_1)(x_2 - \bar{x}_2) = 58.74 \underline{\hspace{1cm}} (S_{12})$

$\therefore \Sigma(x_1 - \bar{x}_1)(y - \bar{y}) = -1.208 \underline{\hspace{1cm}} (S_{1y})$

$\therefore \Sigma(x_2 - \bar{x}_2)(y - \bar{y}) = -1.36 \longleftarrow (S_{2y})$

Step 4.

Solve normal equations.
$$S_{11} b_1 + S_{12} b_2 = S_{1y}$$
$$S_{21} b_1 + S_{22} b_2 = S_{2y}$$

Now.

$$(5814.632) b_1 + (58.74) b_2 = -1.208$$
$$(58.74) b_1 + (6.8) b_2 = -1.36$$

$\therefore \quad b_1 = 0.001985$

$\quad b_2 = -0.2171$

Now $b_0 = \bar{y} - b_1 \bar{x}_1 - b_2 \bar{x}_2$

$\therefore \quad b_0 = 12.86 - (0.001985)(106.36) - (-0.2171)(5.2)$

$\therefore \quad b_0 = 13.7778 \,$ //

Step 5.

Regression Equation.

$$\hat{y} = b_0 + b_1 x_1 \, \cancel{\#} - b_2 x_2$$

$\therefore \quad \hat{y} = 13.778 + 0.001985 x_1 - 0.2171 x_2$

Now,

Step 6.

prediction for $x_1 = 82.0$ and $x_2 = 5$

$$\hat{y} = 13.7778 + (0.001985)(82.0) - (0.2171)(5)$$

$$= 12.85507 \,$$ //

- Intercept $b_0 = 13.78$
- Mileage coefficient $b_1 = 0.00199$
- Age Coefficient $b_2 = -0.2171$
- Predicted price for 82k miles, 5yrs old.

$\qquad = 12.88$ thousand dollars.