

Step 1

	High temp. in °C x	Iced tea orders y	$(x - \bar{x})^2$	$(y - \bar{y})^2$	$(x - \bar{x})(y - \bar{y})$
22nd (Mon.)	29	77	0.16	4	-0.8
23rd (Tues.)	28	62	1.96	169	18.2
24th (Wed.)	34	93	21.16	324	82.8
25th (Thurs.)	31	84	2.56	81	14.4
26th (Fri.)	25	59	19.36	256	70.4

$$\bar{x} = 29.4$$

$$S_{xx} = 45.2$$

$$S_{yy} = 834$$

$$S_{xy} = 185$$

$$\bar{y} = 75$$

Step 2

	High temp. in °C x	Iced tea orders y	\hat{y}	$(y - \hat{y})^2$
22nd (Mon.)	29	77	$29a + b$	$77 - (29a + b)^2$
23rd (Tues.)	28	62	$28a + b$	$62 - (28a + b)^2$
24th (Wed.)	34	93	$34a + b$	$93 - (34a + b)^2$
25th (Thurs.)	31	84	$31a + b$	$84 - (31a + b)^2$
26th (Fri.)	25	59	$25a + b$	$59 - (25a + b)^2$

$$S_e = [77 - (29a + b)]^2 + [62 - (28a + b)]^2 + [93 - (34a + b)]^2 + [84 - (31a + b)]^2 + [59 - (25a + b)]^2$$

Step 3

$$\frac{dS_e}{da} = 2[77 - (29a + b)] \times (-29) + 2[62 - (28a + b)] \times (-28) + 2[93 - (34a + b)] \times (-34) + 2[84 - (31a + b)] \times (-31) + 2[59 - (25a + b)] \times (-25) = 0 \quad (1)$$

$$\frac{dS_e}{db} = 2[77 - (29a + b)] \times (-1) + 2[62 - (28a + b)] \times (-1) + 2[93 - (34a + b)] \times (-1) + 2[84 - (31a + b)] \times (-1) + 2[59 - (25a + b)] \times (-1) = 0 \quad (2)$$

Step 4

divide by 2

$$\frac{dse}{da} = \frac{[77 - (29a + b)] \times (-29) + [62 - (28a + b)] \times (-28) + [93 - (34a + b)] \times (-34) + [84 - (31a + b)] \times (-31) + [59 - (25a + b)] \times (-25)}{2}$$

Multiply -1

$$\frac{dse}{da} = \frac{29[(29a + b) - 77] + 28[(28a + b) - 62] + 34[(34a + b) - 93] + 31[(31a + b) - 84] + 25[(25a + b) - 59]}{2}$$

$$\frac{dse}{da} = \frac{(29 \times 29a + 29b - 29 \times 77) + (28 \times 28a + 28b - 28 \times 62) + (34 \times 34a + 34b - 34 \times 93) + (31 \times 31a + 31b - 31 \times 84) + (25 \times 25a + 25b - 25 \times 59)}{2}$$

Separate a and b

$$\frac{dse}{da} = (29^2 + 28^2 + 34^2 + 31^2 + 25^2)a + (29 + 28 + 34 + 31 + 25)b - \frac{(29 \times 77 + 28 \times 62 + 34 \times 93 + 31 \times 84 + 25 \times 59)}{2} = 0 \quad (3)$$

divide by 2

$$\frac{dse}{db} = \frac{[77 - (29a + b)] \times (-1) + [62 - (28a + b)] \times (-1) + [93 - (34a + b)] \times (-1) + [84 - (31a + b)] \times (-1) + [59 - (25a + b)] \times (-1)}{2} = 0$$

Multiply -1

$$\frac{dse}{db} = [(29a + b) - 77] + [(28a + b) - 62] + [(34a + b) - 93] + [(31a + b) - 84] + [(25a + b) - 59] = 0$$

$$\frac{dse}{db} = (29 + 28 + 34 + 31 + 25)a + 5b - (77 + 62 + 93 + 84 + 59) = 0$$

$$b = \frac{(77 + 62 + 93 + 84 + 59)}{5} - \frac{(29 + 28 + 34 + 31 + 25)}{5}a$$

$$b = \bar{y} - \bar{x}a \quad (4)$$

Step 5

$$b = ④$$

④

$$(29^2 + 28^2 + 34^2 + 31^2 + 25^2) \alpha + (29 + 28 + 34 + 31 + 25) \left[\frac{(77 + 62 + 93 + 84 + 59)}{5} - \frac{(29 + 28 + 34 + 31 + 25) \alpha}{5} \right] = 0$$

$$- (29 \times 77 + 28 \times 62 + 34 \times 93 + 31 \times 84 + 25 \times 59)$$

$$\left[(29^2 + 28^2 + 34^2 + 31^2 + 25^2) - \frac{(29 + 28 + 34 + 31 + 25)^2}{5} \right] \alpha + \frac{(29 + 28 + 34 + 31 + 25)(77 + 62 + 93 + 84 + 59)}{5} = 0$$

$$- (29 \times 77 + 28 \times 62 + 34 \times 93 + 31 \times 84 + 25 \times 59)$$

$$\left[(29^2 + 28^2 + 34^2 + 31^2 + 25^2) - \frac{(29 + 28 + 34 + 31 + 25)^2}{5} \right] \alpha = (29 \times 77 + 28 \times 62 + 34 \times 93 + 31 \times 84 + 25 \times 59) - \frac{(29 + 28 + 34 + 31 + 25)(77 + 62 + 93 + 84 + 59)}{5}$$

$$\left[(29^2 + 28^2 + 34^2 + 31^2 + 25^2) - \frac{(29 + 28 + 34 + 31 + 25)^2}{5} \right] \alpha$$

$$(29^2 + 28^2 + 34^2 + 31^2 + 25^2) - \frac{(29 + 28 + 34 + 31 + 25)^2}{5} - \frac{(29 + 28 + 34 + 31 + 25)^2}{5} + \frac{(29 + 28 + 34 + 31 + 25)^2}{5}$$

$$(29^2 + 28^2 + 34^2 + 31^2 + 25^2) - 2 \times \frac{(29 + 28 + 34 + 31 + 25)^2}{5} + \frac{(29 + 28 + 34 + 31 + 25)^2}{5}$$

$$(29^2 + 28^2 + 34^2 + 31^2 + 25^2) - 2 \times \frac{(29 + 28 + 34 + 31 + 25)^2}{5} + \frac{(29 + 28 + 34 + 31 + 25)^2}{5}$$

$$(29^2 + 28^2 + 34^2 + 31^2 + 25^2) - 2 \times \frac{(29 + 28 + 34 + 31 + 25) \times (29 + 28 + 34 + 31 + 25)}{5} + \left(\frac{(29 + 28 + 34 + 31 + 25)^2}{5} \times \frac{5}{5} \right)$$

$$(29^2 + 28^2 + 34^2 + 31^2 + 25^2) - 2 \times \frac{(29 + 28 + 34 + 31 + 25) \times (29 + 28 + 34 + 31 + 25)}{5} + \frac{(29 + 28 + 34 + 31 + 25)^2 \times 5}{5 \times 5}$$

$$(29^2 + 28^2 + 34^2 + 31^2 + 25^2) - 2 \times \frac{(29 + 28 + 34 + 31 + 25) \times (29 + 28 + 34 + 31 + 25)}{5} + \left(\frac{(29 + 28 + 34 + 31 + 25)}{5} \right)^2 \times 5$$

$$(29^2 + 28^2 + 34^2 + 31^2 + 25^2) - 2 \times (29 + 28 + 34 + 31 + 25) \times \bar{X} + (\bar{X})^2 \times 5$$

$$[(29^2 - 2 \times 29 \times \bar{X} + \bar{X}^2) + (28^2 - 2 \times 28 \times \bar{X} + \bar{X}^2) + (34^2 - 2 \times 34 \times \bar{X} + \bar{X}^2) + (31^2 - 2 \times 31 \times \bar{X} + \bar{X}^2) + (25^2 - 2 \times 25 \times \bar{X} + \bar{X}^2)]$$

$$[(29 - \bar{X})^2 + (28 - \bar{X})^2 + (34 - \bar{X})^2 + (31 - \bar{X})^2 + (25 - \bar{X})^2] = S_{xx}$$

$$(29 \times 77 + 28 \times 62 + 34 \times 93 + 31 \times 84 + 25 \times 59) - \frac{(29 + 28 + 34 + 31 + 25)(77 + 62 + 93 + 84 + 59)}{5}$$

$$(29 \times 77 + 28 \times 62 + 34 \times 93 + 31 \times 84 + 25 \times 59) - (29 + 28 + 34 + 31 + 25) \times \frac{5}{5} \times \frac{(77 + 62 + 93 + 84 + 59)}{5}$$

$$(29 \times 77 + 28 \times 62 + 34 \times 93 + 31 \times 84 + 25 \times 59) - \frac{(29 + 28 + 34 + 31 + 25)}{5} \times \frac{(77 + 62 + 93 + 84 + 59)}{5} \times 5$$

$$(29 \times 77 + 28 \times 62 + 34 \times 93 + 31 \times 84 + 25 \times 59) - \bar{x} \times \bar{y} \times 5$$

$$(29 \times 77 + 28 \times 62 + 34 \times 93 + 31 \times 84 + 25 \times 59) - \bar{x} \times \bar{y} \times 5 - \bar{x} \times \bar{y} \times 5 + \bar{x} \times \bar{y} \times 5$$

$$(29 \times 77 + 28 \times 62 + 34 \times 93 + 31 \times 84 + 25 \times 59) - \frac{(29 + 28 + 34 + 31 + 25)}{5} \times \bar{y} \times 5 - \bar{x} \times \frac{(77 + 62 + 93 + 84 + 59)}{5} \times 5 + \bar{x} \times \bar{y} \times 5$$

$$(29 \times 77 + 28 \times 62 + 34 \times 93 + 31 \times 84 + 25 \times 59) - (29 + 28 + 34 + 31 + 25) \bar{y} - (77 + 62 + 93 + 84 + 59) \bar{x} + \bar{x} \times \bar{y} \times 5$$

$$[(29 \times 77 - 29 \bar{y} - 77 \bar{x} + \bar{x} \bar{y}) + (28 \times 62 - 28 \bar{y} - 62 \bar{x} + \bar{x} \bar{y}) +$$

$$(34 \times 93 - 34 \bar{y} - 93 \bar{x} + \bar{x} \bar{y}) + (31 \times 84 - 31 \bar{y} - 84 \bar{x} + \bar{x} \bar{y}) + (25 \times 59 - 25 \bar{y} - 59 \bar{x} + \bar{x} \bar{y})]$$

$$[(29 - \bar{x})(77 - \bar{y}) + (28 - \bar{x})(62 - \bar{y}) + (34 - \bar{x})(93 - \bar{y}) + (31 - \bar{x})(84 - \bar{y}) + (25 - \bar{x})(59 - \bar{y})] = S_{xy}$$

$$\left[(29^2 + 28^2 + 34^2 + 31^2 + 25^2) - \frac{(29 + 28 + 34 + 31 + 25)^2}{5} \right] a = (29 \times 77 + 28 \times 62 + 34 \times 93 + 31 \times 84 + 25 \times 59) - \frac{(29 + 28 + 34 + 31 + 25)(77 + 62 + 93 + 84 + 59)}{5}$$

$$S_{xx} a = S_{xy}$$

$$a = \frac{S_{xy}}{S_{xx}}$$

$$a = \frac{185}{45.2} = 4.09 \quad \times$$

$$b = \bar{y} - \bar{x} a$$

$$b = 75 - (29.4 \times 4.09) = -45.24 \quad \times$$