Regression equation

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	High temp. in °C x	Iced tea orders y
22nd (Mon.)	29	77
23rd (Tues.)	28	62
24th (Wed.)	34	93
25th (Thurs.)	31	84
26th (Fri.)	25	59

Step 1

find The sum of squares of x, $S_{xx} : (x-\bar{x})^2$

The sum of squares of y, $S_{yy} : (y-\bar{y})^2$

The sum of products of x and y, $S_{(xy)} : (x-\bar{x})(y-\bar{y})$

	High temp. in °C x	Iced tea orders y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$	$(y-\bar{y})^2$	$(x-\bar{x})(y-\bar{y})$
22nd (Mon.)	29	77	-0.4	2	0.16	4	-0.8
23rd (Tues.)	28	62	-1.4	-13	1.96	169	18.2
24th (Wed.)	34	93	4.6	18	21.16	324	82.8
25th (Thurs.)	31	84	1.6	9	2.56	81	14.4
26th (Fri.)	25	59	-4.4	-16	19.36	256	70.4
Sum	147	375			45.2	834	185
Average	29.4	75			$\downarrow$	$\downarrow$	$\downarrow$
	$\bar{x}$	$\bar{y}$			S_{xx}	S_{yy}	S_{xy}

Step 2

Find the residual sum of squares, S_e

y is the observed value

$\hat{y}$ is the estimated value based on our regression equation

$y-\hat{y}$ is called the residual and is written as e.

	High temp. in °C x	Iced tea orders y	Prediction $\hat{y} = ax+b$	Residuals (e) $y-\hat{y}$	Squared residuals $(y-\hat{y})^2$
22nd (Mon.)	29	77	$a \times 29 + b$	$77-(a\times29+b)$	$[77-(a\times29+b)]^2$
23rd (Tues.)	28	62	$a \times 28 + b$	$62-(0\times28+b)$	$[62-(0\times28+b)]^2$
24th (Wed.)	34	93	$a \times 34 + b$	$93-(a\times34+b)$	$[93-(a\times34+b)]^2$
25th (Thurs.)	31	84	$a \times 31 + b$	$84-(a\times31+b)$	$[84-(a\times31+b)]^2$
26th (Fri.)	25	59	$a \times 25 + b$	$59-(a\times25+b)$	$[59-(a\times25+b)]^2$
Sum	147	375	$147a+5b$	$375-(147a+5b)$	S_e
Average	29.4	75	$29.4a+b$	$75-(29.4a+b)$	$=\frac{S_e}{5}$
	$\bar{x}$	$\bar{y}$	$=\bar{x}a+b$	$=\bar{y}-(\bar{x}a+b)$	

$S_e = [77-(a\times29+b)]^2 + [62-(0\times28+b)]^2 + [93-(a\times34+b)]^2 + [84-(a\times31+b)]^2 + [59-(a\times25+b)]^2$

Step 3

Differentiate S_e with respect to a and b, and set it equal to 0

differentiating $y = (ax+b)^n$ with respect x

$\dfrac{dy}{dx} = n(ax+b)^{n-1} \times a$

- Differentiate with respect to a

$\dfrac{dS_e}{d_a} = 2[77-(29a+b)]\times(-29) + 2[62-(a\,28+b)]\times(-28) + 2[93-(a\,34+b)]\times(-34) + 2[84-(a\,31+b)]\times(-31) + 2[59-(a\,25+b)]\times(-25)$

- Differentiate with respect to b

$\dfrac{dS_e}{d_b} = 2[77-(29a+b)]\times(-1) + 2[62-(a\,28+b)]\times(-1) + 2[93-(a\,34+b)]\times(-1) + 2[84-(a\,31+b)]\times(-1) + 2[59-(a\,25+b)]\times(-1)$

Step 6

$a = \dfrac{S_{xy}}{S_{xx}} = \dfrac{185}{45.2} \approx 4.09$

$b = \bar{y}-\bar{x}a = 75 - 29.4\times4.09 = -45.246 \approx 45.25$

$y = 4.09x - 45.246$ ※