

Assignment

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Submitted To,

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Sums

1. Examine the curve of the form $y=ax+bx^2$ that fit the given data.

x	1	2	3	4	5	6
y	14	27	41	56	68	76

Solution:

$$a \sum x + nb = \sum y$$

$$a \sum x^2 + b \sum x = \sum xy$$

x	y	X ²	XY
1	14	1	14
2	27	4	54
3	41	9	123
4	56	16	224
5	68	25	340
6	76	36	456
$\sum x=21$	$\sum y=282$	$\sum x^2=91$	$\sum xy=1121$

$$a21 + 6b = 282 \quad 1 \text{ equation}$$

$$a91 + 21b = 4211 \quad 2 \text{ equation.}$$

$$1911a + 546b = 25662$$

$$1911a + 441b = 4211$$

$$-105b = -231$$

$$b = -231/-105$$

$$b = 2.2$$

$$a21 + 6(2.2) = 282$$

$$21a = 282 - 13.2$$

$$a = 268.8/21$$

$$y = 12.8x + 2.2$$

2. Examine the curve of the form $y=ax+bx^2$ that fit the given data.

x	1	2	3	4	5
y	1.8	2.1	8.9	14.1	19.8

Solution :

$$Y = ax + bx^2$$

Dividing by x,

$$y/x = ax/x + bx^2/x$$

$$y/x = a + bx$$

Therefore, $Y = y/x$, $A = a$, $b = B$, $X = x$.

x	y	Y=y/x	X ²	XY
1	1.8	1.8	1	1.8
2	5.1	2.55	4	5.1
3	8.9	2.967	9	8.901
4	14.1	3.525	16	14.1
5	19.8	3.96	25	19.8
$\Sigma x = 15$		$\Sigma y = 14.802$	$\Sigma x^2 = 55$	$\Sigma xy = 49.701$

$$5a + 15b = 14.802 \quad - 1 \text{ equation}$$

$$15a + 55b = 49.701 \quad - 2 \text{ equation}$$

Multiply 3 into 1 equation,

$$15a + 45b = 44.409$$

$$15a + 55b = 49.701$$

$$-10b = -5.275$$

$$b = -5.275/10$$

$$b = 0.53$$

substitute $b = 0.53$ into 1 equation

$$5a + 15(0.53) = 14.802$$

$$5a + 7.93 = 14.802$$

$$5a = 6.872$$

$$a = 6.872/5$$

$$a = 1.37$$

Hence,

$$Y = 1.37 + 0.53x$$

$$y/x = 1.37 + 0.53x$$

$$y = 1.37 + 0.53x^2$$

when $x = 2$

$$y = 1.37 + 0.53x(2^2)$$

$$\text{hence, } y = 1.37 + 2.12x$$

3. Examine the curve of the form $y = ax^b$ that by least squares.

x	25	35	50	75	150	200	250
y	1.09	2.21	5.72	9.60	44.3	76.0	156.0

Solution :

$$Y = ax^b$$

$$\text{Log } y = \text{log } ax^b$$

$$= \text{log } a + \text{log } x^b$$

$$= \text{log } a + b \text{ log } x$$

$$Y = A + BX$$

x	y	Log x	Log y	X ²	XY
25	1.09	1.3979	0.0374	0.0014	0.0523
35	2.21	1.5441	0.3444	2.3842	0.5318
50	5.72	1.6990	0.7574	2.8866	1.2868
75	9.60	1.8751	0.9823	3.5160	1.8419
150	44.3	2.1761	1.6464	4.7354	3.5827
200	76.0	2.3010	1.8808	5.2946	4.3277
250	156.0	2.3979	2.1931	5.7499	5.2588
		= 13.3911	= 7.8418	= 24.5681	= 16.8820

$$Na + b \sum y = \sum y$$

$$a \sum x + b \sum x^2 = \sum xy$$

$$7a + 13.3911b = 7.8418 \quad \text{1 equation}$$

$$13.3911a + 24.5681b = 16.8620 \quad \text{2 equation.}$$

$$1 * 13.3911 = 93.7377a + 179.3216b = 105.0103$$

$$2 * 7 = 93.7377a + 171.9767b = 118.1740$$

$$- 7.3449b = 13.1637$$

$$b = 13.1637 / -7.3449$$

$$b = -1.7922$$

$$7a + 13.3911(-1.7922) = 7.8418$$

$$7a - 23.9995 = 7.8418$$

$$7a = 7.8418 + 23.9995$$

$$a = 31.8413 / 7$$

$$a = 4.5488$$

$$y = 4.5488x^{-1.7922}$$

4. Examine the curve of the form $y = ae^{bx} + c$ by the method of group averages.

x	1	2	6	8	11
y	12.71	12.46	11.65	11.34	10.99

Solution:

$$c = \frac{y_1 y_3 - y_2^2}{y_1 + y_3 - 2 y_2}$$

$$= \frac{12.71 * 10.99 - (11.65)^2}{12.71 + 10.99 - 2(11.65)}$$

$$= \frac{139.6829 - 135.7225}{23.7 - 23.3}$$

$$= \frac{3.904}{0.4} = 9.901$$

Group 1,

x	y	X=x	Y=log(y-c)
1	12.71	1	0.4486
2	12.46	2	0.4081
		$\Sigma x=3$	$\Sigma y=0.8567$

Group 2,

x	y	X=x	Y=log(y-c)
6	11.65	6	0.2428
8	11.34	8	0.1581
11	10.99	11	0.0370
		$\Sigma x=25$	$\Sigma y=0.4379$

$$\Sigma y_1 / 2 = A + B \Sigma x_1 / 2$$

$$0.8567 / 2 = A + B 3 / 2$$

$$0.4284 = A + B 1.5$$

$$A + 1.5 B = 0.4284$$

$$\Sigma y_2 / 3 = A + B \Sigma x_2 / 3$$

$$0.4379 / 3 = A + B 25 / 3$$

$$0.1460 = A + B 8.3333$$

$$A + 8.3333 B = 0.1460$$

$$A + 1.5 B = 0.4284 \quad - \text{1 equation}$$

$$A + 8.3333 B = 0.1460 \quad - \text{2 equation}$$

$$-6.8333B = 0.2824$$

$$B = 0.2824 / -6.8333$$

$$B = -0.0413$$

Substitute $B = -0.0413$ in 2 equation

$$A + 1.5 (-0.0413) = 0.4284$$

$$A + -0.0619 = 0.4284$$

$$A = 0.4284 / -0.0619$$

$$A = 0.4907$$

$$A = \log_{10} a \Rightarrow a = \text{antilog } A$$

$$a = \text{antilog}(0.4907)$$

$$a = 3.0953$$

$$B = b \log_e \Rightarrow B / \log_{10} e = -0.0413 / \log_{10} e$$

$$= -0.0413 / 0.4342$$

$$= -0.0951$$

$$\text{Hence, } y = 3.0953e^{-0.0951x} + 9.901$$

5. Examine the curve of the form $y=ab^x$ that fit the given data.

x	2	4	6	8	10	12
y	24	41	69	126.5	219	404

Solution:

$$\Sigma y = an + b \Sigma x$$

$$\sum xy = a \sum x + b \sum x^2$$

x	y	x^2	$x \cdot y$
2	24	4	48
4	41	16	164
6	69	36	414
8	126.5	64	1012
10	219	100	2190
12	404	144	4848
$\sum x = 42$	$\sum y = 883.5$	$\sum x^2 = 364$	$\sum x \cdot y = 8676$

$$6a + 42b = 883.5$$

$$42a + 364b = 8676$$

$$6a + 42b = 883.5$$

$$\text{and } 42a + 364b = 8676$$

$$2(21a + 182b) = 2 \cdot 4338$$

$$21a + 182b = 4338$$

$$6a + 42b = 883.5 \rightarrow (1)$$

$$21a + 182b = 4338 \rightarrow (2)$$

$$\text{equation}(1) \times 7 \Rightarrow 42a + 294b = 6184.5$$

$$\text{equation}(2) \times 2 \Rightarrow 42a + 364b = 8676$$

$$-70b = -2491.5$$

$$70b = 2491.5$$

$$b = 2491.570$$

$$b = 35.5929$$

$b=35.5929$ in equation (1)

$$6a+42(35.5929)=883.5$$

$$6a=883.5-1494.9$$

$$6a=-611.4$$

$$a=-611.46/6$$

$$a=-101.9$$

$$y = -101.9+35.5929x$$