

Given  $d = x^t$  — (1)

Comparing eqt (1) to  $y = mx + c$

$\log d = \log x + t \log \beta$

where;  $a_0 = \log x$

$a_1 = \log \beta$

$y = \log d$	$t = x$	$xy$	$d(m)$	$x^2$	$y^2$
0.301029996	0	0	0	0	0.09061905
0.698970004	1	0.698970004	1	1	0.488559067
1.278753601	2	2.557507202	2	4	1.635210772
1.698970004	3	5.096910013	3	9	2.986499076
2.178976447	4	8.715907789	4	16	4.747940537
2.672097858	5	13.36048929	5	25	7.140106962
3.1568519091	6	18.9411142	6	36	9.965713925
3.65436901	7	25.55059364	7	49	13.35441345
4.11800027	8	32.89440006	8	64	16.9068993
4.614163911	9	41.5269532	9	81	21.28997336
5.045405135	10	50.45405135	10	100	25.4611297

$\sum y = 29.41133046$

$\sum x = 55$

$\sum xy = 199.8268839$

$\sum x^2 = 385$

$\sum y^2 = 103.9620485$

$\sum y^2 = a_0 \cdot n + a_1 \cdot \sum x$

$29.41133046 = a_0(11) + a_1(55)$

$\sum xy = a_0 \sum x + a_1 \sum x^2$

$199.8268839 = a_0(55) + a_1(385) \dots (2)$

solving eqn (1) and eqn (2)

$$29.4113046 = 11a_0 + 55a_1$$

$$199.8268839 = 55a_0 + 385a_1$$

$$a_0 = \begin{vmatrix} 29.4113046 & 55 \\ 199.8268839 & 385 \end{vmatrix} \\ \begin{vmatrix} 11 & 55 \\ 55 & 385 \end{vmatrix}$$

$$= \frac{(29.4113046)(385) - (55)(199.8268839)}{(11 \times 385) - (55 \times 55)}$$

$$a_0 = 0.27511$$

$$a_1 = \begin{vmatrix} 11 & 29.4113046 \\ 55 & 199.8268839 \end{vmatrix} \\ \begin{vmatrix} 11 & 55 \\ 55 & 385 \end{vmatrix}$$

$$a_1 = \frac{(11 \times 199.8268839) - (29.4113046 \times 55)}{(11 \times 385) - (55 \times 55)}$$

$$a_1 = 0.47973$$

$$a_0 = \log \alpha$$

$$0.27511 = \log \alpha$$

$$\alpha = 1.8841$$

$$a_1 = \log \beta$$

$$0.47973 = \log \beta$$

$$\beta = 3.0181$$

$$\alpha = 1.8841$$

$$\beta = 3.0181$$

Correlation Co-efficient

$$R = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{N \sum X^2 - (\sum X)^2} \sqrt{N \sum Y^2 - (\sum Y)^2}}$$

$$R = \frac{(11 \times 199.8268839) - 55(29.4113046)}{\sqrt{(11 \times 385 - 55^2)} \times \sqrt{11 \times 103.9620485 - (29.4113046)^2}}$$

$$R = 0.9998448312$$

$$R_{\text{square}} = (0.9998448312)^2 \\ = 0.9996896864$$

For manual method

$$R = 0.9998448312$$

$$R^2 = 0.9996896864$$

For mat lab;

$$R = 0.9998$$

$$R^2 = 0.9997$$

For excel,

$$R = 0.99984483235763$$

$$R^2 = 0.999689688792257$$

(d) From observation for all the methods used to solve the correlation coefficient and its square, it can be seen that  $R^2 < R$  i.e. the value of the square of the correlation coefficient is lesser than the actual value of the correlation coefficient.

ln(t)	ln(t)	ln(t)	ln(t)	ln(t)	ln(t)
0	2	0.693147	0.693147	-5.523089	5.463407
1	5	1.609438	1.738003	-4.418471	4.547116
2	15	2.845049	2.842101	-3.313853	3.211115
3	50	3.912023	3.947318	-2.209235	2.246531
4	151	5.017203	5.016966	-1.104618	1.130374
5	470	6.152733	6.156554	0.000000	0.003821
6	1435	7.26892	7.261171	1.104618	1.112366
7	4511	8.414995	8.367389	2.209235	2.257942
8	12938	9.467769	9.470407	3.313853	3.311216
9	41225	10.62437	10.57062	4.418471	4.407828
10	111021	11.61747	11.67964	5.523089	5.460921
ln(mean)	ln(10)	sum	sum		
15611.45	6.156554	134.219829	134.261496		
	R	Required			
		0.9998483	0.9998969		

  

SUMMARY OUTPUT				
Regression Statistics				
Multiple R	0.9998483			
R Square	0.9998969			
Adjusted R Sq	0.9996521			
Standard Error	0.0002836			
Observations	11			

  

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	134.219829	134.219829	28994.1419	4.2229E-23
Residual	9	0.04166265	0.00462921		
Total	10	134.261496			

  

	Coefficient	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.63346515	0.0381970	16.5906196	6.8205E-08	0.54546337	0.702068	0.546646	0.702068
X Variable 1	1.10461772	0.00648719	170.276663	4.2259E-17	1.08984266	1.119293	1.089943	1.119293

