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Question 1

t(hr)	d(m)
0	2
1	5
2	19
3	50
4	151
5	470
6	1435
7	4512
8	12936
9	41125
10	111021

$d = \alpha\beta t$

$\log d = \log\alpha + \log\beta t$ (taking the log of both sides)

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

Where

$Y = a_0 + a_1 x$

$a_1 = \log\beta$, $x = t$, $a_0 = \log\alpha$, $Y = \log d$

$Yx = a_0 x + a x^2$

$\Sigma Y = Na_0 + a_1 \Sigma x$ ——①

$\Sigma Yx = a_0 \Sigma x + a_1 \Sigma x^2$ ——②

where $N = 11$

From the table

$\Sigma Y = 29.4113$

$\Sigma x = 55$

$\Sigma Yx = 199.8269$

$\Sigma x^2 = 385$

$\Sigma y^2 = 103.962$

x	d	$\log d(y)$	$y(x)$	x^2	y^2
0	2	0.30103	0	0	6.096619
1	5	0.69899	0.69897	1	0.488559
2	19	1.278754	2.557507	4	1.635211
3	50	1.69897	5.09691	9	2.886499
4	151	2.178977	8.715908	16	4.747941
5	470	2.672048	13.36049	25	7.140107
6	1435	3.156852	18.94111	36	9.965714
7	4512	3.654369	25.58058	89	13.13441
8	12936	4.1118	32.894	64	16.9096
9	41125	4.614126	41.52692	81	21.28997
10	111021	5.045404	50.45405	100	25.46511
55	171726	29.41135	199.8269	385	103.962

$29.41133 = 11a_0 + 55a_1$ —— (i)

$199.8269 = 55a_0 + 385a_1$ —— (ii)

$29.41133 - 5a_1 = 11a_0$

$a_0 = \frac{29.41133 - 55a_1}{11}$ —— (iii)

putting (iii) into (ii)

$199.8269 = 85\left(\frac{29.41133 - 55a_1}{11}\right) + 385a_1$

$199.82692 = 5(29.41133 - 55a_1) + 385a_1$

$199.8269 = 142.05665 - 275a_1 + 385a_1$

$199.8269 - 147.05665 = 385a_1 - 275a_1$

$52.77025 = 110a_1$

$$a_1 = \frac{52.77025}{110}$$

$$a_1 = 0.4797$$

$$a_0 = \frac{29.41133 - 55 \times 0.4797}{11}$$

$$a_0 = \frac{29.41133 - 26.3835}{11} = 0.2752$$

$$a_0 = \log \alpha$$

$$\alpha = \log^{-1} 0.2752 = 1.8845$$

$$a_1 = \log \beta$$

$$\beta = \log^{-1} 4797 = 3.0179$$

Correlation coefficient (R)

$$R = \frac{N \Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{(N \Sigma x^2 - (\Sigma x)^2)(N \Sigma y^2 - (\Sigma y)^2)}}$$

$$R = \frac{(11 \times 199.8209) - (55 \times 29.41133)}{\sqrt{(11 \times 385) - 55^2)(11 \times 103.962 - (29.41133)^2)}}$$

$$R = 0.999846088$$

$$R^2 = (0.999846088)^2$$

$$R^2 = 0.999692201$$

$$R = 0.9998$$

This indicates that $R^2 < R$ because the value of the square of the correlation coefficient is lesser than the actual value of the correlation coefficient