

ENG 382

Engineering Mathematics IV

EN506/101 Mechanical Engineering

Ogbomida Philip Ofeoshi

Assignment 5

Given: $d = \alpha \beta^t$

Multiply through by \ln

$$\ln d = \ln \alpha \beta^t$$

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

$$\downarrow \quad \downarrow \quad \downarrow$$

$$y = a_0 + a_1 x$$

where $y \rightarrow \ln d$

$a_0 \rightarrow \ln \alpha$

$a_1 \rightarrow \ln \beta$

$x \rightarrow t$

$$\sum y = a_0 N + a_1 \sum x$$

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

y	x	x^2	xy
0.69315	0	0	0
1.60940	1	1	1.6094
2.94440	2	4	5.8888
3.91200	3	9	11.7360
5.01730	4	16	20.0692
6.15270	5	25	30.7635
7.26890	6	36	43.6134
8.41450	7	49	58.9015
9.46780	8	64	75.7424
10.62440	9	81	95.6196
11.61750	10	100	116.1750
$\sum y = 67.7221$	$\sum x = 55$	$\sum x^2 = 385$	$\sum xy = 460.1189$

$N = \text{number of terms} \rightarrow 11$

Therefore:

$$67.7221 = 11a_0 + 55a_1$$

$$460.1189 = 55a_0 + 385a_1$$

From eqn (1):

$$a_1 = \frac{67.7221 - 11a_0}{55}$$

Substituting into (2)

$$460.1189 = 55a_0 + 385 \left[\frac{67.7221 - 11a_0}{55} \right]$$

$$25306.5395 = 3025a_0 + 26073.0085 - 4235a_0$$

$$-766.469 = -1210a_0$$

$$a_0 = 0.6335$$

Hence:

$$a_1 = \frac{67.7221 - 11(0.6335)}{55}$$

$$a_1 = 1.1047$$

Recall:

$$a_1 \rightarrow \ln \beta$$

$$a_0 \rightarrow \ln \alpha$$

$$0.6335 = \ln \alpha$$

$$\alpha = e^{0.6335}$$

$$\rightarrow 1.8842$$

$$\beta = e^{1.1047}$$

$$\rightarrow 3.0183$$