

Q5. Given  $y = a x e^{bx}$

$$\Rightarrow \log y = \log a + \log x + bx$$

$$\Rightarrow \log \left( \frac{y}{x} \right) = \log a + bx$$

$$\Rightarrow Y = A_0 + A_1 X$$

where  $Y = \log \left( \frac{y}{x} \right)$   $X = x$ .

Given data :-

$x$	0.1	0.2	0.4	0.6	0.9	1.3	1.5	1.7	1.8
$y$	0.75	1.25	1.45	1.25	0.85	0.55	0.35	0.28	0.18

The set of linear eq<sup>n</sup> can be written as:

$$\begin{bmatrix} 1 & x_1 \\ 1 & x_2 \\ 1 & x_3 \\ 1 & x_4 \\ 1 & x_5 \\ 1 & x_6 \\ 1 & x_7 \\ 1 & x_8 \\ 1 & x_9 \end{bmatrix} \begin{bmatrix} A_0 \\ A_1 \end{bmatrix} = \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \\ y_6 \\ y_7 \\ y_8 \\ y_9 \end{bmatrix}$$

$$\Rightarrow X A = Y$$

where  $X = \begin{bmatrix} 1 & 0.1 \\ 1 & 0.2 \\ 1 & 0.4 \\ 1 & 0.6 \\ 1 & 0.9 \\ 1 & 1.3 \\ 1 & 1.5 \\ 1 & 1.7 \\ 1 & 1.8 \end{bmatrix}$   $Y = \log\left(\frac{Y}{X}\right) = \begin{bmatrix} 2.6149 \\ 1.8326 \\ 1.2879 \\ 0.7340 \\ -0.0572 \\ -0.8602 \\ -1.4553 \\ -1.8036 \\ -2.3026 \end{bmatrix}$

$$\Rightarrow XA = Y$$

$$X^T X A = X^T Y$$

$$A = (X^T X)^{-1} X^T Y.$$

where  $(X^T X)^{-1} = \begin{bmatrix} 0.3718 & -0.2760 \\ -0.2760 & 0.2922 \end{bmatrix}$

$$\Rightarrow \text{This gives } a_0 = 2.2682 \quad a_1 = -2.4733$$

$$\text{Now, } a_0 = \ln a \Rightarrow a = e^{a_0} = 9.6618$$

$$b = a_1 = -2.4733$$