

Assignment 2

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

$$f(x) = e^{-0.5x} (4-x)^2$$

$$f'(x) = u = e^{-0.5x} = 4-x$$

$$f'(x) = \frac{dy}{dx} = u \frac{dy}{dx} + u \frac{dy}{dx}$$

$$f'(x) = (4-x) e^{-0.5x} + e^{-0.5x} (-1)$$

$$f'(x) = 0.5e^{-0.5x} (x-4) - e^{-0.5x}$$

$$x_{n+1} = x_n - \frac{e^{-0.5x} (4-x)^2}{0.5e^{-0.5x} (x-4) - e^{-0.5x}}$$

i)	x	E _n
0	0.5	0
1	0.838890606	40.89747299
2	0.8849559809	5.205386019
3	0.8857086071	0.08497447061
4	0.885708802	

$$x_{0+1} = \frac{0.5 - e^{-0.5(0.5)} (4-0.5)^2}{e^{-0.5(0.5)} (0.5-4) - e^{-0.5 \cdot 0.5}} \Rightarrow 0.838890606$$

$$E_0 \text{ to error} = \left| \frac{x_{n+1} - x_n}{x_{n+1}} \right| \times 100\%$$

$$= \left| \frac{0.838890606 - 0.5}{0.838890606} \right| \times 100 = 40.89747299$$

$$x_2 = 0.838890606 = \frac{e^{-0.5(0.838890606)} (4-0.838890606)^2}{0.5e^{-0.5(0.838890606)} (0.838890606-4) - e^{-0.5(0.838890606)}}$$

$$E_1 = \left| \frac{0.8849559809 - 0.838890606}{0.8849559809} \right| \times 100 \Rightarrow 5.205386019$$

$$x_3 = 0.8849559809 = \frac{e^{-0.5(0.8849559809)} (4-0.8849559809)^2}{0.5e^{-0.5(0.8849559809)} (0.8849559809-4) - e^{-0.5(0.8849559809)}}$$

$$E_2 = \left| \frac{0.8857086071 - 0.8849559809}{0.8857086071} \right| \times 100 \Rightarrow 0.08497447061$$

$$\begin{aligned}
 X_4 &= 0.8857086071 - e^{-0.5(0.8857086071)} (4 - 0.8857086071) - 2 \\
 &\quad 0.5e^{-0.5(0.8857086071)} (0.8857086071 - 4) - e^{0.5(0.8857086071)} \\
 &= 0.885708802 \\
 &= 2.200497495 \times 10^{-9}
 \end{aligned}$$

$$\begin{aligned}
 X_5 &= 0.88708802 - e^{-0.5(0.88708802)} (4 - 0.88708802) - 2 \\
 &\quad 0.5e^{-0.5(0.88708802)} (0.88708802 - 4) - e^{0.5(0.88708802)} \\
 &= 0.885708802
 \end{aligned}$$

$$\begin{aligned}
 E_a &= \left| \frac{0.885708802 - 0.885708802}{0.885708802} \right| \times 100 \\
 &= 0
 \end{aligned}$$