

Ens 382

Engineering Mathematics IV

17/Enso6/101 Mechanical Engineering

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Assignment 2

Given $f(x) = e^{-0.5x} (4-x) - 2$, using newton raphson iteration method we have:

$$f'(x) = \frac{d}{dx} f(x)$$

$$\text{where } f(x) = 4e^{-0.5x} - xe^{-0.5x} - 2$$

$$\therefore f'(x) = -2e^{-0.5x} - [x \cdot 0.5e^{-0.5x} + e^{-0.5x} \cdot 1]$$
$$\rightarrow -2e^{-0.5x} + 0.5xe^{-0.5x} - e^{-0.5x}$$

Applying the newton raphson equation

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

where $x_0 = 0.5$

Iterating we have:

$$x_1 = x_0 - \frac{f(x_0)}{f'(x_0)}$$

$$x_1 = 0.5 - \frac{e^{-0.5(0.5)} (4-0.5) - 2}{-2e^{-0.5(0.5)} + 0.5(0.5)e^{-0.5(0.5)} - e^{-0.5(0.5)}}$$

$$x_1 = 0.5 - \frac{e^{-0.5(0.5)} (4-0.5) - 2}{-2e^{-0.5(0.5)} + 0.5(0.5)e^{-0.5(0.5)} - e^{-0.5(0.5)}}$$

$$\rightarrow 0.838890606$$

To find x_2

$$x_2 = x_1 - \frac{f(x_1)}{f'(x_1)}$$

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

$$\rightarrow 0.8849560003$$

To find x_3

$$x_3 = x_2 - \frac{f(x_2)}{f'(x_2)}$$

$$x_3 = 0.8849560003 - \frac{e^{-0.5(0.8849560003)}(4 - 0.8849560003) - 2}{-2e^{-0.5(0.8849560003)} + 0.5(0.5)e^{-0.5(0.8849560003)} - 0.5(0.8849560003)}$$

$$\rightarrow 0.885708605$$

To find x_4

$$x_4 = x_3 - \frac{f(x_3)}{f'(x_3)}$$

$$x_4 = 0.885708605 - \frac{e^{-0.5(0.885708605)}(4 - 0.885708605) - 2}{-2e^{-0.5(0.885708605)} + 0.5(0.885708605)e^{-0.5(0.885708605)} - 0.5(0.885708605)}$$

$$\rightarrow 0.885708802$$

To find x_5

$$x_5 = 0.885708802 - \frac{e^{-0.5(0.885708802)}(4 - 0.885708802) - 2}{-2e^{-0.5(0.885708802)} + 0.5(0.885708802)e^{-0.5(0.885708802)} - 0.5(0.885708802)}$$

$$\rightarrow 0.885708802$$

Hence, the solution for x is 0.885708802