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15/ENG06/052.

Mechanical Engr.

Mat 382

Problem Statement one (solution)

$$\textcircled{1} \quad f(x) = e^{-0.5x} (4-x) - 2$$

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

$$x_{i+1} = x_i - \frac{e^{-0.5x_i} (4-x_i) - 2}{-2e^{-0.5x_i} + 0.5e^{-0.5x_i}}$$

$$\begin{aligned} x_1 &= 0.5 - \frac{e^{-0.5(0.5)} (4-0.5) - 2}{-2e^{-0.5(0.5)} + 0.5e^{-0.5(0.5)}} \\ &= 0.838890606 \end{aligned}$$

$$\text{Error}_1 = \left| \frac{0.838890606 - 0.5}{0.838890606} \right| \times 100 = 40.39745865\%$$

$$\begin{aligned} x_2 &= 0.838890606 - \frac{e^{-0.5(0.838890606)} (4-0.838890606) - 2}{-2e^{-0.5(0.838890606)} + 0.5e^{-0.5(0.838890606)}} \\ &= 0.8849559424 \end{aligned}$$

$$\text{Error}_2 = \left| \frac{0.8849559424 - 0.838890606}{0.8849559424} \right| \times 100 = 5.205381897\%$$

$$\begin{aligned} x_3 &= 0.8849559424 - \frac{e^{-0.5(0.8849559424)} (4-0.8849559424) - 2}{-2e^{-0.5(0.8849559424)} + 0.5e^{-0.5(0.8849559424)}} \\ &= 0.8857083129 \end{aligned}$$

$$\text{Error}_3 = \left| \frac{0.8857083129 - 0.8849559424}{0.8857083129} \right| \times 100$$

$$= 0.0849456286\%$$

$$\begin{aligned} x_4 &= 0.8857083129 - \frac{e^{-0.5(0.8857083129)} (4-0.8857083129) - 2}{-2e^{-0.5(0.8857083129)} + 0.5e^{-0.5(0.8857083129)}} \\ &= 0.885708802 \end{aligned}$$



$$\text{Error}_4 = \left| \frac{-0.885708802 - 0.8867083129}{0.885708802} \right| \times 100$$

$$= 5.522130963 \times 10^{-5}$$

$$X_5 = 0.885708802 - \frac{e^{-0.5(0.885708802)} (4 - 0.885708802) - 2}{-3e^{-0.5(0.885708802)} + 0.5e^{-0.5(0.885708802)} (0.885708802)}$$

$$= 0.885708802 //$$

$$\text{Error}_5 = \left| \frac{0.885708802 - 0.885708802}{0.885708802} \right| \times 100$$

$$= 5.394210816 \times 10^{-10}$$

due to maximum Percentage error given as  $10^{-9}$  we will stop at the 5th iteration.

C	x	Error
0	0.3	
1	0.838890608	40.39448855
2	0.8849559424	5.205351897
3	0.8857083129	0.08499862866
4	0.885708802	5.522130963 $\times 10^{-5}$
5	0.885708802	5.394210816 $\times 10^{-10}$