

Math Assignment KRIS

[Signature]

Assignment 2

17/ENG04/087

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

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

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

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

$$\rightarrow -2e^{-0.5x} + 0.5xe^{-0.5x} - e^{-0.5x}$$

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

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

$$x_1 = x_0 - \frac{e^{-0.5x_0} (4 - x_0) - 2}{-2e^{-0.5x_0} + 0.5x_0 e^{-0.5x_0} - e^{-0.5x_0}}$$

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

$$\rightarrow 0.838890606$$

To find x_2

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

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

$$\rightarrow 0.8849660003$$

To find x_3

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

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

$$\longrightarrow 0.885708605$$

To find x_4

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

$$\longrightarrow 0.885708802$$

To find x_5

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

$$\longrightarrow 0.885708802$$

Hence, the solution for x is 0.885708802.

Matlab program

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- $f = \exp(-0.5 * x) * (4 - x) - 2$

- $f_2 = \text{diff}(f)$

- $x = 0.5$

for i = 1:10

iter(i+1) = 1

$x_f(i) = x$

$x = \text{double}(\text{subs}(x - (f/f_2)))$;

$x_f(i+1) = x$

$ea(i+1) = \text{abs}((x_f(i+1) - x_f(i)) / x_f(i+1))$

if $ea > 1e-9$

break

end

end

- Table = [iter' x_f 'ea']