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ENG382 Assignment 2 Computer Engineering

Solution:

(1) $f(x) = e^{-0.5x}(4-x) - 2$ — (1)

Applying newton raphson method:

Applying product rule to diff eqn (1)

$$f'(x) = \left[u\frac{dv}{dx} + v\frac{du}{dx} \right]$$

$u = e^{-0.5x}$, $V = (4-x)$

$u' = -0.5e^{-0.5x}$

$V' = -1$

$$f'(x) = -1e^{-0.5x} + (4-x) - 0.5e^{-0.5x} - 0$$

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

iter = 0, $x_i = 0.5$

Recall:

$$x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)} \text{ — (*)}$$

Initial value $x_0 = 0.5 \Rightarrow$ iter = 0

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

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

$$x_{i+1} = 0.5 - \frac{0.725802774 07}{-2.141702153}$$

$x_{i+1} =$ [illegible]

$x_{i+1} = 0.838890606$

% error $= \left|\frac{0.838890606 - 0.5}{0.838890606}\right| \times 100 = 0.40397473 \times 100$

$= 40.397473\%$

for iter = 2

$x_i = 0.838890606$

$x_{i+1} = 0.838890606 - \frac{e^{-0.5(0.838890606)}(4-0.838890606)-2}{-e^{-0.5(0.838890606)} - 0.5e^{-0.5(0.8389)}(4-0.8389)}$

$x_{i+1} = 0.884956000$

% error $= \left|\frac{0.884956000 - 0.838890606}{0.884956000}\right| \times 100\%$

% error $= 5.205388064\%$

for iter = 3

$x_i = 0.884956000$

$x_{i+1} = 0.884956000 - \frac{e^{-0.5(0.884956000)}(4-0.884956000)-2}{-e^{-0.5(0.884956000)} - 0.5e^{-0.5(0.884956000)}(4-0.884956)}$

$x_{i+1} = 0.885708605$

% error $= \left|\frac{0.885708605 - 0.884956000}{0.885708605}\right|$

% error $= 0.084971984\%$

for iter = 4

$x_i = 0.885708605$

$$x_{i+1} = 0.885708605 - \frac{e^{-0.5(0.885708605)}(4 - 0.885708605) - 2}{-e^{-0.5(0.885708605)} - 0.5e^{-0.5(0.885708605)}(4 - 0.885708605)}$$

$x_{i+1} = 0.885708802$

$$\% \text{ error} = \left| \frac{0.885708802 - 0.885708605}{0.885708802} \right| \times 100\%$$

$\%$ error $= 2.224267317 \times 10^{-7}\%$

for iter = 5

$x_i = 0.885708802$

$$x_{i+1} = 0.885708802 - \frac{e^{-0.5(0.885708802)}(4 - 0.885708802) - 2}{-e^{-0.5(0.885708802)} - 0.5e^{-0.5(0.885708802)}(4 - 0.885708802)}$$

$x_{i+1} = 0.885708802$

$$\% \text{ error} = \left| \frac{0.885708802 - 0.885708802}{0.885708802} \right| \times 100\%$$

$= 0$

Table of Values

i	x_i	% error
0	0.5	
1	0.838890606	40.397473
2	0.884956000	5.205388064
3	0.885708605	0.084971964
4	0.885708802	$2.224267319 \times 10^{-7}$ %
5	0.885708802	0

(2) MATLAB Code

```
Command window
clear
cle
close all

iter = 0;
V = 18;

for i = (1 : inf)

iter(i+1) = i;
fV = ((0.3*V(i))12)/(500+(log(V(i))13)))-0.02*V(i);
fV2 = (3*(V(i)))/5*(log(V(i))13+500))-(9*V(i)*log(V(i))12)/
      V(0.1*log(V(i))13+500)12 - 1/50;
V(i+1) = V(i) - (ft/ft2);

ea = abs(V(i+1) - V(i))*100;
if ea(i+1) > 1e-15
  break
end
end
table = [iter' V' ea'];
```