DERRI COLUMBUS BOMAFE
15/ENG02/019
COMPUTER ENGINEERING

ENG882 [ENGINEERING MATHEMATICS III]

ASSIGNMENT TWO

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

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

Recall $x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)} = x_i - \left(\frac{e^{-0.5x}(4-x) - 2}{-0.5e^{-0.5x}(4-x) - e^{-0.5x}}\right)$

for $i = 0$, $x = 0.5$

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

$= 0.8389$

for $i = 1$, $x = 0.8389$

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

$= 0.8850$

for $i = 2$, $x = 0.8850$

$x_{i+1} = 0.8850 - \left(\frac{e^{-0.5(0.8850)}(4-0.8850) - 2}{-0.5e^{-0.5(0.8850)}(4-0.8850) - e^{-0.5(0.8850)}}\right)$

$= 0.8857$

for $i = 3$, $x = 0.8857$

$x_{i+1} = 0.8857 - \left(\frac{e^{-0.5(0.8857)}(4-0.8857) - 2}{-0.5e^{-0.5(0.8857)}(4-0.8857) - e^{-0.5(0.8857)}}\right)$

$= 0.8857$

for $i = 4$, $x = 0.8857$

for $i = 5$, $x = 0.8857$

% error tolerance $= \left|\frac{x_{i+1} - x_i}{x_{i+1}}\right| \times 100$

for $i=0$, $x=0.5$ & $\varepsilon_r = 100\%$

for $i=1$, $x=0.8389$ $= \left|\frac{0.8389-0.5}{0.8389}\right| \times 100 = 40.37\%$

for $i=2$, $x=0.8850$ $= \left|\frac{0.8850-0.8389}{0.8850}\right| \times 100 = 5.28\%$

for $i=3$, $x=0.8857$ $= \left|\frac{0.8857-0.8850}{0.8857}\right| \times 100 = 0.079\%$

for $i=4$, $x=0.8857$ $= \left|\frac{0.8857-0.8857}{0.8857}\right| \times 100 = 0\%$

for $i=5$, $x=0.8857$ $= \left|\frac{0.8857-0.8857}{0.8857}\right| \times 100 = 0\%$

i	x_i	% Error
0	0.5	100
1	0.8389	40.37
2	0.8857	5.28
3	0.8857	0.077
4	0.8857	0
5	0.8857	0

QUESTION TWO

2. $F_D = \frac{0.3v^2}{500+(\ln v)^3} - 0.02v$

$F_B = mg$

$m = 3.5kg$

$g = 9.8m/s$

$F_B = 9.8 \times 3.5 = F_D = 34.3$

$$34.3 = \frac{0.3v^2}{500+(\ln v)^3} - 0.02v$$

$$0 = \frac{0.3v^2}{500+(\ln v)^3} - 0.02v - 34.3$$

$$f(v) = \frac{0.3v^2}{500+(\ln v)^3} - 0.02v - 34.3$$

$$f'(v) = ;$$

$$\frac{0.3v^2}{500+(\ln v)^3} \quad \begin{matrix} \cdots u \\ \cdots v \end{matrix}$$

using quotient rule $\frac{uv - vu}{v^2}$

$$u = 0.3v^2 \qquad u' = 0.6v$$

$$v = 500 + (\ln v)^3, \qquad v' = \frac{3(\ln v)^2}{v}$$

$$= \frac{0.6v\,(500+(\ln v)^3) - 0.3v^2\,(3(\frac{(\ln v)}{v})^2)}{(500+(\ln v)^3)^2}$$

$$= \frac{300v + (\ln v)^3\,0.6v - 0.9v\,(\ln v)^2}{500^2 + \ln v^6}$$

$$f'(v) = \frac{300v + \ln v^3\,(0.6v) - 0.9v\,(\ln v)^2 - 0.02}{500^2 + \ln v^6}$$

$$v_{i+1} = v_i - \frac{f(v)}{f'(v)}$$

$$= v_i - \frac{\frac{0.3v^2}{500+(\ln v)^3} - 0.02v - 34.3}{\frac{300v + \ln v^3\,(0.6v) - 0.9v(\ln v)^2 - 0.02}{500^2 + \ln v^6}}$$