Assignment 8

[illegible]

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[illegible]

MA 252

07/03/2018

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

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

using N-R $x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$

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

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

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

for $i=1$, $x = 0.9389$

$$x_{i+1} = 0.9389 - \left(\frac{e^{-0.5(0.9389)}(4-0.9389)-2}{-0.5e^{-0.5(0.9389)}(4-0.9389)-e^{-0.5(0.9389)}}\right)$$

$= 0.9850$

for $i=2$, $x = 0.9850$

$$x_{i+1} = 0.9850 - \left[\frac{e^{-0.5(0.9850)}(4-0.9850)-2}{-0.5e^{-0.5(0.9850)}(4-0.9850)-e^{-0.5(0.9850)}}\right]$$

$= 0.9857$

for $i=3$, $x = 0.9857$

$$x_{i+1} = 0.9857 - \left[\frac{e^{-0.5(0.9857)}(4-0.9857)-2}{-0.5e^{-0.5(0.9857)}(4-0.9857)-e^{-0.5(0.9857)}}\right]$$

$= 0.9857$

for $i=4$, $x = 0.9857$

for $i=5$, $x = 0.9857$

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$$\% \text{ error} = \left[\frac{x_{i+1} - x_i}{x_{i+1}}\right] \times 100$$

For $i = 0$, $x = 0.5$, $\% \text{ error} = 100\%$

for $i = 1$, $x = 0.5833$ $= \left[\frac{0.5833 - 0.5}{0.5833}\right] \times 100$

$= 46.39$

for $i = 2$, $x = 0.7500$ $= \left[\frac{0.7500 - 0.5833}{0.7500}\right] \times 100$

$= 22.22\%$

for $i = 3$, $x = 0.8333$ $= \left[\frac{0.8333 - 0.7500}{0.8333}\right] \times 100$

$= 10\%$

for $i = 4$, $x = 0.8667$ $= \left[\frac{0.8667 - 0.8333}{0.8667}\right] \times 100$

$= 4\%$

| i | x | % error |
|---|---|---|
| 0 | 0.5 | 100 |
| 1 | 0.5833 | 46.39 |
| 2 | 0.7500 | 22.22 |
| 3 | 0.8333 | 10 |
| 4 | 0.8667 | 4 |
| 5 | 0.8667 | 0 |

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$$\frac{0.5 \times 0.5 \times v^2}{500 \times (1-v)^2} = 0.02v$$

$k = mg$

$m = 5(10)$, $g = 9.8\,m/s$

$f(v) = 9.8 \times 5 \times 0.5 = 24.5$

$$24.5 = \frac{0.5v^2}{500 \times (1-v)^2} - 0.02v$$

$$0 = \frac{0.5v^2}{500 \times (1-v)^2} - 0.02v - 24.5$$

$f(v) = 0$

$$\frac{0.5v^2}{500 \times (1-v)^2}$$

Using product rule $\rightarrow \frac{uv' - vu'}{v^2}$

$u = 0.5v^2$, $u' = 0.5v$

$v = 500 \times (1-v)^2$, $v' = \frac{5(1-v)^2}{v}$

$$= \frac{0.5v\left(500 \times (1-v)^2\right) - 0.5v^2\left(5\left(\frac{1-v}{v}\right)^2\right)}{\left(500 \times (1-v)^2\right)^2}$$

$$= \frac{250v \times (1-v)^2 0.5v - 0.5v^2(1-v)^2}{500v^2 \times 1-v^4}$$

$$f'(v) = \frac{250v \times 1-v^2(0.5v) - 0.5v(1-v)^2 - 0.02}{500v^2 \times 1-v^4}$$

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

$$= x_n - \frac{\frac{0.5v^2}{500 \times (1-v)^2} - 0.02v - 24.5}{\frac{250v \times 1-v^2(0.5v) - 0.5v(1-v)^2 - 0.02}{500v^2 \times 1-v^4}}$$

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