Assignment 2

① $f(x) = e^{-0.5x}(4-x) - 2$ --- ①

Using Newton raphsons method

$F(x) = \left[U\frac{dv}{dx} + V\frac{du}{dx} \right]$

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

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

$V' = -1$

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

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

Here = 0, $x_1 = 0.5$

Recall

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

$$x_i + 1 = 0.5 - \frac{0.7258027407}{2.141702152}$$

$x_i + 1 = 0.8388906061$

$$\% \text{ error} = \left| \frac{0.8388906061 - 0.5}{0.8388906061} \right| \times 100\% = 0.40397473 \times 100$$

$= 40.397471\%$

For iter = 2

$x_i = 0.8388906061$

$$x_i + 1 = 0.8388906061 - \frac{e^{-0.5(0.8388906061)}(4 - 0.8388906061) - 2}{e^{-0.5(0.8388906061)} - 0.5e^{-0.5(0.838)}(4.0839)}$$

$x_i + 1 = 0.834956000$

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

% Error = 5.205388064 %

For iter = 3

$x_i = 0.884956000$

$$x_{i+1} = 0.884956000 - \frac{e^{0.5(0.884956000)}(4 - 0.884956000) - 2}{e^{0.5(0.884956000)} - 0.5e^{0.5(0.884956000)}(4 - 0.885)}$$

$x_{i+1} = 0.885708605$

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

% Error = 0.084771864 %

(2)

For iter = 4

$x_i = 0.885708605$

$$x_{i+1} = 0.885708605 - \frac{e^{0.5(0.885708605)}(4 - 0.885708605) - 2}{e^{0.5(0.885708605)} - 0.5e^{0.5(0.885708605)}(4 - 0.886)}$$

$x_{i+1} = 0.885708802$

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

% 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	0.8388706061	40.397473
2	0.884956000	3.205388064
3	0.885708605	0.084971964
4	0.885700802	$2.224267315 \times 10^{-7}$ %
5	0.855708802	0

(2) $f_0 = \frac{0.3v^2}{500 + (mv)^3} - 0.02v$

$f_0 = mg \qquad m = 3.5kg \; ; \; g = 9.8 m/s^2$

$f_0 = 9.8 \times 3.5 = f_0 = 34.3$ Equating both equation.

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

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

$f(v) = \frac{0.3v^2 \to u}{500 + (mv)^3 \to v}$ using quotient rule $u'v - v'u / v^2$

$u = 0.3v^2 ; \; u' = 0.6v ; \; v = 500 + (mv)^3 ; \; v' = 3(mv)^2 / v$

$= \frac{0.6v(300 + (mv)^3) - 0.3v^2(3(\frac{mv}{v}))}{(500 + (mv)^3)^2}$

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

$\Rightarrow x_i' - \frac{\frac{0.3v^2}{500 + (mv)^3} - 0.02v - 34.3}{\frac{300v + mv^3(0.6v) - 0.9v(mv)^2}{500^2 + mv^6}}$