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MATRIC NO: 15/ENG06/009

DEPT: MECH. ENG

COURSE: ENG 382

Assignment

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

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

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

$f'(x) = -2e^{-0.5x} + 0.5xe^{-0.5x} - e^{-0.5x}$

$f'(x) = 0.5xe^{-0.5x} - 3e^{-0.5x}$

doing Newton Raphson's method

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

% max Absolute error = 1E-9 = 1×10^{-9}

at $x_i = 0.5$

$$x_{0.5+1} = 0.5 - \frac{4e^{-0.5(0.5)} - 0.5e^{-0.5(0.5)} - 2}{0.5(0.5)e^{-0.5(0.5)} - 3e^{-0.5(0.5)}}$$

$$= 0.5 - \frac{0.7258027407}{-2.141702153} = 0.8388906061$$

at $x_i = 0.8388906061$

$$x_{i+1} = 0.8388906061 - \frac{4e^{-0.5(0.8388906061)} - (0.8388906061)e^{-0.5(0.8388906061)} - 2}{0.5(0.8388906061)e^{-0.5(0.8388906061)} - 3e^{-0.5(0.8388906061)}}$$

$$= 0.8388906061 - \frac{0.07814929779}{-1.696486032} = 0.8849560003$$

at $x_i = 0.8849560003$

$$x_{i+1} = 0.8849560003 - \frac{4e^{-0.5(0.8849560003)} - 0.8849560003e^{-0.5(0.8849560003)} - 2}{0.5(0.8849560003)e^{-0.5(0.8849560003)} - 3e^{-0.5(0.8849560003)}}$$

$$= 0.8849560003 - \frac{1.23657519 \times 10^{-3}}{-1.643060762} = 0.8857086605$$

at $x_i = 0.8857086605$

$$x_{i+1} = 0.8857086605 - \frac{4e^{-0.5(0.8857086605)} - 0.8857086605e^{-0.5(0.8857086605)} - 2}{0.5(0.8857086605)e^{-0.5(0.8857086605)} - 3e^{-0.5(0.8857086605)}}$$

$$x_{i+1} = 0.8857086605 - \frac{3.23521409 \times 10^{-7}}{-1.642203429} = 0.8857086602$$

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at $x_i = 0.885708802$

$$x_{i+1} = 0.885708802 - \frac{4e^{-0.5(0.885708802)} - (0.885708802)e^{-0.5(0.885708802)} - 2}{0.5(0.885708802)e^{-0.5(0.885708802)} - 3e^{-0.5(0.885708802)}}$$

$$= 0.885708802 - \frac{7.846\times10^{-12}}{-1.642200704}$$

$$= 0.885708802$$

$$\% \text{ error}_i = \left|\frac{\text{new value} - \text{initial value}}{\text{new value}}\right| \times 100$$

$$\text{error}_1 = \left|\frac{0.838890606 - 0.5}{0.838890606}\right| \times 100 = 40.397473$$

$$\text{error}_2 = \left|\frac{0.884956000 3 - 0.838890606 1}{0.884956000 3}\right| \times 100 = 5.205388085$$

$$\text{error}_3 = \left|\frac{0.885708605 - 0.884956000 3}{0.885708605}\right| \times 100 = 0.084972043 37$$

$$\text{error}_4 = \left|\frac{0.885708802 - 0.885708605}{0.885708802}\right| \times 100 = 2.240731 2\times10^{-5}$$

$$\text{error } 5 = \left|\frac{0.885708802 - 0.885708802}{0.885708802}\right| \times 100 = 0$$

Therefore;

S/N	ITERATIONS	x_i	% ABS ERROR
1	0	0.5	40.397473
2	1	0.838890606 1	5.205388085
3	2	0.884956000 3	0.084972043 37
4	3	0.885708605	$2.240731 2\times10^{-5}$
5	4	0.885708802	0
6	5	0.885708802	

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