Name: Joshua N. Bok
Dept: Mechatronics Engr.
Mat No: 16/ENG05/016
Course: ENG 382 - Eng. Maths. IV

If the maximum percentage absolute error is desired to be $1E-9$, using the Newton - Raphson iteration method and initial guess value of 0.5, find the root of the function given in eqn (1.1).

$$f(x) = e^{-0.5x}(4-x) - 2 \quad \ldots (1.1)$$

Soln

$$f(x) = e^{-0.5x}(4-x) - 2$$
$$= 4e^{-0.5x} - xe^{-0.5x} - 2$$
$$f'(x) = -2e^{-0.5x} - e^{-0.5x} + 0.5xe^{-0.5x}$$
$$= (-2 - 1 + 0.5x)e^{-0.5x}$$
$$= (-3 + 0.5x)e^{-0.5x}$$

$$x_{(i+1)} = x_i - \frac{f(x_i)}{f'(x_i)}$$
$$= x_i - \frac{e^{-0.5x_i}(4-x_i) - 2}{(-3+0.5x)e^{-0.5x}}$$

using initial guess value of 0.5

$$x_{(i+1)} = 0.5 - \frac{e^{-0.5(0.5)}(4-0.5) - 2}{(-3+0.5(0.5))e^{-0.5(0.5)}}$$
$$= 0.83889$$

when $x_i = 0.83889$

$$x_{(i+1)} = 0.83889 - \frac{e^{-0.5(0.83889)}(4-0.83889) - 2}{(-3+0.5(0.83889))e^{-0.5(0.83889)}}$$
$$= 0.88496$$

when $x_i = 0.88496$

$$x_{(i+1)} = 0.88496 - \frac{e^{-0.5(0.88496)}(4-0.88496) - 2}{(-3+0.5(0.88496))e^{-0.5(0.88496)}}$$

≈ 0.885709

i	x_{i+1}	ε_q
0	0.5	0
1	0.83889	40.39747299
2	0.884496	5.205388089
3	0.885708671	0.084972014
4	0.885708802	2.22468558
5	0.885708802	1.52925215