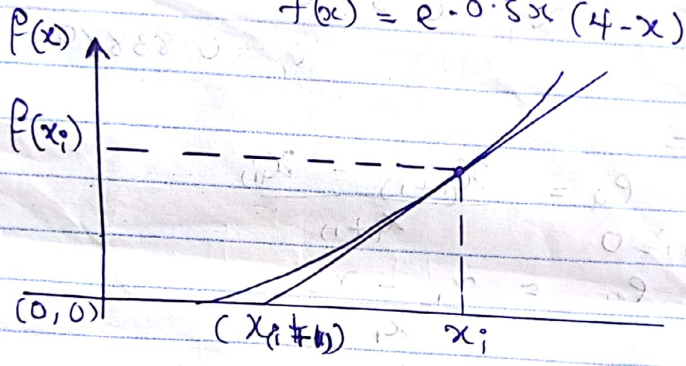
NAME: OYEFUSI OLUWAJOBA ELISACOME
MATRIC NO: 16/ENG04/049
DEPT: ELECT/ELECT

If the maximum percentage absolute error desired is to be, 9E-9, using Newton-Raphsons iteration method, and initial guess value of 0.5, find the root of the function, given in equation (9.9)

(a) manually
(b) with MATLAB

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



$$f'(x_i) = \frac{(f(x_i) - 0)}{x_i - (x_{(i+1)})}$$

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

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

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

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

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

$$F(x) = 4e^{-0.5x} - (x \cdot e^{-0.5x}) - 2$$

$$f'(x) = -0.5 \times 4(e^{-0.5x}) - (x * (-0.5e^{-0.5x}) + e^{-0.5x} \cdot 1) - 0$$

$$f'(x) = -0.5 \times 4e^{-0.5x} - (-x0.5e^{-0.5x} + e^{-0.5x}) - 0$$

$$= -2e^{-0.5x} + x0.5e^{-0.5x} - e^{-0.5x}$$

Therefore if $x_0 = 0.5$ as given

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

when $i = 0$

$$x_{(0+1)} = x_0 - \frac{f(x_0)}{f'(x_0)}$$

16|ENG04|049

$x_0 = 0.5$

$$x_1 = 0.5 - \left(\frac{e^{-0.5(0.5)}(4 - 0.5)_{i=2}}{(-2e^{-(-05*0.8)} + 0.5(0.5e^{-0.5\times0.5}) - e^{-0.5(0.5)}} \right)$$

$$x_1 = 0.5 - \left(\frac{0.725803}{-2.1417022} \right)$$

$$x_1 = 0.5 - (-0.338890)$$

$$x_1 = 0.83889$$

error =

$$e_a = \frac{x_{(i+1)} - x_{(i)}}{x_{(i+1)}}$$

when $i = 0$

$$e_a = \frac{x_1 - x_0}{x_1}$$

$$e_a = \frac{0.83889 - 0.5}{0.83889}$$

$$= 0.40397 \times 100 = 40.397\%$$

when $i = 1$

$$x_2 = x_1 - \frac{f(x_1)}{f'(x_1)}$$

$$x_2 = 0.83889 - \left(\frac{e^{-(0.83889\times0.5)}(4 - (0.83889)^{-2}}{-2e^{-(-0.5*0.83889)} + (0.83889\times0.5\times e^{(-0.5\times0.83889)}) - e^{-(0.5*0.83889)}} \right)$$

$$x_2 = 0.83889 - \left(\frac{0.078150}{-1.6640} \right)$$

$$0.83889 - (-0.046965)$$

$$= 0.8858$$

when $i = 1$

$$\text{error} = \frac{x_2 - x_1}{x_2}$$

$$= \frac{0.8858 - 0.83889}{0.8858}$$

$$= 0.05295 \times 100$$

$$= 5.295\%$$

16/ENG04/049.

When $i = 2$

$$x_3 = x_2 - \frac{f(x_2)}{f'(x_2)}$$

$$x_3 = 0.8858 - \frac{(e^{-0.8858 \times 0.5}(4 - 0.8858) - 2)}{-2e^{-(-0.5 * 0.8858)} + (0.8858 \times 0.5 \times e^{(-0.5 \times 0.8858)} - (e^{-(0.5 \times 0.8858)})}$$

$$x_3 = 0.8858 - \left(\frac{-0.0001496}{-1.6426}\right)$$

$$0.8858 + 0.000091075$$

$$= 0.885891075$$

error

$$= \frac{x_3 - x_2}{x_3}$$

$$= \frac{0.88589 - 0.8858}{0.88589}$$

$$= 0.0001015 = 1.015 \times 10^{-4}$$

$$= 0.01\%$$

when $i = 3$

$$x_4 = x_3 - \frac{f(x_3)}{f'(x_3)}$$

$$x_4 = 0.88589 - \frac{(e^{-0.88589 \times 0.5} \times (4 - 0.88589) - 2)}{-2e^{-(-0.5 * 0.88589)} + (0.8859 \times 0.5 \times e^{(-0.5 \times 0.88589)} - e^{-(0.5 \times 0.88589)}}$$

$$x_4 = 0.88589$$

$$\text{error} = \frac{0.88589 - 0.88589}{0.88589}$$

$$= 0\%$$