General Newton-Raphson's formula

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

$f(x_0) = f(0.5) = 0.725802740 7$

$f'(x_0) = f'(0.5) = -2.141702153$

root 1 $\Rightarrow$ $x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 0.8388906061$ //

$f(x_1) = 0.078149297 79$

$f'(x_1) = -1.696486032$

root 2 $\Rightarrow$ $x_2 = x_1 - \frac{f(x_1)}{f'(x_1)} = 0.8849560003$ //

$f(x_2) = 1.236575203 \times 10^{-3}$

$f'(x_2) = -1.643060762$

root 3 $\Rightarrow$ $x_3 = x_2 - \frac{f(x_2)}{f'(x_2)} = 0.885708605$ //

$f(x_3) = 3.23583557 \times 10^{-7}$

$f'(x_3) = -1.642200929$

root 4 $\Rightarrow$ $x_4 = x_3 - \frac{f(x_3)}{f'(x_3)} = 0.88570880 2$ //

$f(x_4) = 7.845 \times 10^{-12}$

$f'(x_4) = -1.642200704$

$x_5 = x_4 - \frac{f(x_4)}{f'(x_4)} = 0.88570880 2$ //

$\therefore$ 0.88570880 2 is the root of eqn (1.1)

b. MATLAB PROGRAM CODE

```
function [x1, err, relerr] = assign2(x0, max1, tol, iter,
                                     f, fprime)
x0 = 0.5;
max1 = 100;
tol = 0.0000000001;
iter = 1;
f = @(x) ((exp(-0.5*x))*(4-x))-2;
fprime = @(x) (-exp(-0.5*x))+((-0.5*exp(-0.5*x))
                              *(4-x));
for i = 1 : max1
    x1 = x0 - feval(f,x0)/feval(fprime, x0);
    err = abs(x1-x0); relerr = abs(x1-x0)/x1
    fprintf('%2.0f %10.10f %10.10f %10.10f %10.10f
        \n', iter, x0, x1, err, relerr)
    x0 = x1, iter = 1+iter;
    if err <= tol, break, end
end
```

ASSIGMENT II

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Mechanical Engineering

MARCH, 19

ENG382: Engineering Mathematics IV

Question

If the maximum percentage absolute error is desired to be $1\epsilon-9$, using the Newton-Raphson interation method and initial guess value of 0.5, Find the root of the function given in Equation (1.1)

a. manually and
b. With the aid of MATLAB

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

NB: For the manual solution, use all the values given by the Calculator

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

$f'(x) \Rightarrow$

Let $u = e^{-0.5x}$; $v = (4-x)$

$du = -0.5e^{-0.5x}$; $dv = -1$

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

$x_0 = 0.5$ {Initial guess}