NAME: Tamilayo Aluko

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MECHATRONICS ENGINEERING

Assignment 2

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

* Using Newton Rahpson Method

$x = g(x)$

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

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

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

* Initial guess value of 0.5 Hence; $x_i = 0.5$

(1)

$f(0.5) = e^{-0.5(0.5)}(4-0.5) - 2 = 0.725802707$

$f'(0.5) = (0.5-6)\,e^{-0.5(0.5)}/2 = -2.141702153$

$x_{i+1} = 0.5 - \frac{0.725802707}{-2.141702153} = 0.838870606$

(2)

$f(0.84) = e^{-0.5(0.84)}(4-0.84) - 2 = 0.078149297794$

$f'(0.84) = (0.84-6)\,e^{-0.5(0.84)}/2 = -1.696486032$

$(x_{i+1}) = 0.838870606 - \frac{0.078149297794}{-1.696486032} = 0.884956003$

(3)

$f(0.885) = e^{-0.5(0.885)}(4-0.885) - 2 = 0.001236575 19$

$f'(0.885) = (0.885-6)\,e^{-0.5(0.885)}/2 = -1.643060762$

$(x_{i+1}) = 0.884956003 - \frac{0.001236575 19}{-1.643060762} = 0.885708605$

(4)

$f(0.886) = e^{-0.5(0.886)}(4-0.886) - 2 = 0.000000032352 1408$

$f'(0.886) = (0.886-6)\,e^{-0.5(0.886)}/2 = -1.642200929$

$x_{i+1} = 0.885708605 - \frac{0.000000032352 1408}{-1.642200929} = 0.885708802$

MATLAB CODE FOR NEWTON-RHAPSON METHOD

```
Function [x1, err, relerr] = ass2 (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
```