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16/ENG07/007
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Assignment II

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 in the given equation
i) Manually
ii) With the aid of MATLAB

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

NB For the manual Solution, use all the values given by the calculator

Solution

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

$f'(x) =$

Let $u = e^{-0.5x}$, $V = (4-x)$

$du = 0.5e^{0.5x}$ $dV = 1$

$f'(x) = Udv + Vde$

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

$x_0 = 0.5$ (initial guess)

General Newton-Raphson's Formular

$$X_n+1 = X_n - \frac{f(X_n)}{f'(X_n)}$$

$f(X_0) = f(0.5) = 0.7258027AC7$

$f'(x_0) = f'(0.5) = -2.147C2153$

$X_1 = X_0 - \frac{f(x_0)}{f'(x_0)} = 0.8388906061$ (Root 1)

$f(x_1) = 0.0781492977 9$

$f'(x_1) = -1.6964860 3 2$

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

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

$f'(x_2) = 1.64306076 2$

$x_2 = x = \frac{f(x_2)}{f'(x_2)} = 0.885708605$ (root 3)

$f(x_3) = 3.235835 57 \times 10^{-3}$

$f'(x_3) = -1.642200929$

$x_4 = x_3 - \frac{f_2(x_3)}{f'(x_3)} = 0.885708802$ (root 4)

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

$f'(x_4) = -1.642200704$

$x_5 = x_4 = \frac{f(x_4)}{f'(x_4)} = 0.885708802$ (root 5)

$\therefore$ 0.885708802 is the root of eqn (1.1

MATLAB

$\boxed{E}$ function [x1, 200, relerr] = assign2 (x₀ max1, tol, Iter, f, fprime)

- $x_0 = 0.5$
- max1 = 100
- tol = 0.000000001
- Iter = 1
- f = @(x) [(exp(-0.5 * x)) * (4-x)] - 2;
- fprime = @(x) [(exp(-0.5* x)) + ((-0.05* exp(0.05*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 (f% 10.10f % 10.10f% 10.10f % % 10.10f)x; i,
  x0, x1, err, relerr)
- x0 - x1, Iter = Iter+1,
- Iferr <= tol, b
- break, end