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161ENG041031

Elect (Elect Engr.

ENG 382 Assignment II

Assignment 2.

A) Manually;

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

$$f'(x) = Udv + Vdu.$$

$$\text{Let } u = e^{-0.5x} \quad v = (4-x)$$

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

$$f'(x) = Udv + Vdu$$

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

Initial guess,  $x_0 = 0.5$

Using General Newton-Raphson's formula.

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

$$f(x_0) = f(0.5) = 0.7258027407$$

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

$$x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 0.5 + \frac{0.7258027407}{2.141702153}$$

$$\therefore x_1 = 0.8388906061 \text{ (Root 1)}$$

$$f(x_1) = 0.07814929779$$

$$f'(x_1) = -1.696486032$$

$$x_2 = x_1 - \frac{f(x_1)}{f'(x_1)} = 0.8388906061 + \frac{0.07814929779}{-1.696486032}$$

$$= 0.8849560003 \text{ (Root 2)}$$

$$\therefore x_2 = 0.8849560003 \text{ (Root 2)}$$

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

$$f'(x_2) = -1.643060762$$

$$x_3 = x_2 - \frac{f(x_2)}{f'(x_2)} = 0.8849560003 + \frac{1.236575203 \times 10^{-3}}{1.643060762}$$

$$\therefore x_3 = 0.885708605 \text{ (Root 3)}$$

$$f(x_3) = 3.23583557 \times 10^{-3}$$

$$f'(x_3) = -1.642200929$$

$$x_4 = x_3 - \frac{f(x_3)}{f'(x_3)} = 0.885708605 + \frac{3.23583557 \times 10^{-3}}{1.642200929}$$

$$x_4 = 0.885708802 \text{ (root 4).}$$

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

$$f'(x_4) = -1.642200704$$

$$x_5 = x_4 - \frac{f(x_4)}{f'(x_4)} = 0.885708802 + \frac{7.845 \times 10^{-12}}{1.642200704}$$

$$x_5 = 0.885708802 \text{ (root 5).}$$

$\Rightarrow$   $x_5 = 0.885708802$  is the root of eqn (1.1).

B) On MATLAB;

- Function [x1, err, reterr] = assign2(x0, max1, tol, iter, f, fprime)
- x0 = 0.5;
- max1 = 100
- tol = 0.000000001
- iter = 1
- f = @(x) [(exp(-0.5\*x)) \* (4-x)] - 2;
- fprime = @(x) [-0.5\*exp(-0.5\*x) + (4-x)];
- for i = 1 max1
  - x1 = x0 - f(x0)/fprime(x0);
  - err = abs(x1 - x0), reterr = abs(x1 - x0) / x1;
  - fprintf('%2.0f %10.10f %10.10f %10.10f %10.10f\n', x0, x1, err, reterr)
  - x0 = x1; iter = iter + 1;
  - if err <= tol, break;
  - break; end
  - end