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MECHATRONICS ENGINEERING
16/ENG05/1030
ENGINEERING MATHEMATICS. IV

Assignment 2 Solution.

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

at $x_0 = 0.5$.

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

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

Using product rule

let $u = e^{-0.5x}$

$v = 4-x$.

$$\frac{dy}{dx} = u\frac{dv}{dx} + v\frac{du}{dx}.$$

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

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

at $x_0 = 0.5$.

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

$$f(x) = 0.7258027$$

$$f'(x) = -e^{-0.5(0.5)} - 0.5e^{-(0.5\times0.5)}(4-0.5)$$

$$f(x) = -2.1417022.$$

$$x_{i+1} = 0.5 - \frac{0.7258027}{-2.1417022}$$

$$x_{i+1} = 0.8388906.$$

$f(x_1) = e^{-0.5(0.83889058)^2}(4 - 0.83889058) - 2$

$f(x_1) = 0.07814934$

$f'(x_1) = -e^{-0.5(0.83889058)^2} - 0.5e^{-0.5(0.83889058)^2}(4 - 0.83889058)$

$f'(x_1) = -1.69648606$

$x_2 = 0.83889058 - \frac{0.07814934}{-1.69648606}$

$x_2 = 0.88495598$

$f(x_2) = e^{-0.5(0.88495598)^2}(4 - 0.88495598) - 2$

$f(x_2) = 0.00123658$79.

$f'(x_2) = -e^{-0.5(0.88495598)^2}[(4 - 0.88495598)0.5e^{-0.5(0.88495598)^2}$

$f'(x_2) = -1.643060765$

$x_3 = 0.88495598 - \frac{0.00123658}{-1.643060765}$

$x_3 = 0.88570861$

$f(x_3) = e^{-0.5(0.88570861)^2}(4 - 0.88570861) - 2$

$f(x_3) = \cancel{3.20469}\ 3.153104 \times 10^{-7}$

$f'(x_3) = e^{-0.5(0.88570861)^2} - 0.5e^{-0.5(0.88570861)^2}(4 - 0.88570861)$

$f'(x_3) = -1.64220$1

$x_4 = 0.88570861 - \frac{3.153104 \times 10^{-7}}{-1.642201}$

$x_4 = 0.885708802$

$f(x_4) = e^{-0.5(0.885708802)^2}(4 - 0.885708802) - 2$

$f(x_4) = 5.91988455 \times 10^{-7}$

$f'(x_4) = -e^{-0.5(0.885708802)^2} - 0.5e^{-0.5(0.885708802)^2}(4 - 0.885708802)$

f' =

$f'(x_4) = -1.6422007$

$$x_5 = 0.885709802 - \frac{5.9198455 \times 10^{-9}}{-1.6422007}$$

$x_5 = 0.8857092$

MATLAB

```
function [x1, err, relerr] = ass2(x0, max1, tol, iter, f, fprime)

    x0 = 0.5
    max = 100
    tol = 0.000000001;
    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    max]
    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
```