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PETROLEUM ENGINEERING ENG382

ASSIGNMENT II

If the maximum percentage absolute error is desired to be 1E-9 using the Newton Raphson Heration method and initial ques value of $\delta < 0.5$; Find the root of the function in the given equation (1.1).

i) Manually

ii) With the aid of matlab

Solution:

i) For manual solution

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

$f'(x) =$

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

$\partial u = -0.5e^{-0.5x}$ $\partial v = -1$

$f'(x) = u\partial v + v\partial u$

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

$x_0 = 0.5$ (Initial guess)

General Newton Raphson's Formula:

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

$f(x_n) = f(0.5) = 0.7258027407$

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

$x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 0.8388906061$ (Root 1)

$f(x_1) = 0.07814929779$

$f'(x_1) = -1.696486032$

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

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

$f'(x_2) = -1.643060762$

$x_3 = x_2 - \frac{f(x_2)}{f'(x_2)} = 0.885708605$ (Root 3)

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

$f'(x_3) = -1.642200929$

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

∴ 0.885708802 is the root of equation 1 (1-1).

(ii) MATLAB

```
function [x1,200,relerr] = assign2(x0
  max1, tol, iter, f, fprime)
x0 = 0.5;
max1 = 100
tol = 0.000000001
iter = 1
f = @(x) ((exp(-0.5*x)) * (4.0)) - x,
fprime = @(x) (-exp(-0.5*x)) + ((0.5*exp
        (-0.5*x)) * (4-x)),

for x = 1 max1
  x1 = x0 - feval(f, x0/feval(fprime, x0).
err = abs(x1-x0), relerr, abs(x1-x0)/x
fprintf('%0.2 cf%0.10-10f %0.10-10f %0.10-10f %0.10%%/x
  %r, x0, x1, err, relerr)
x0 = x1, iter = 1 + iter,
if err <= tol, break, end
end.
```