

NAME:IBEZIM FAVOUR
DEPT:CHEMICAL ENGINEERING
MAT NO:16/ENG01/010
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```
commandwindow
clear
clc
format short g
syms x
h = exp(-0.5*x)*(4-x)-2
g = diff(h)
x = 0.5;
for i =1:7
    iter(i+1)=i
    xf(i) = x
    x = double(subs(x-(h/g)));
    xf(i+1) = x
    Ea(i+1)=(abs(xf(i+1)-xf(i))/xf(i+1))*100;
    if Ea(i+1)<=-1E-9
        break
    end
end
iter'
xf'
Ea'
tableau =[iter', xf', Ea']
```

xf =

0.5

xf =

0.5 0.83889

iter =

0 1 2

xf =

0.5 0.83889

xf =

0.5 0.83889 0.88496

iter =

0 1 2 3

xf =

0.5 0.83889 0.88496

xf =

0.5 0.83889 0.88496 0.88571

iter =

0 1 2 3 4

xf =

0.5 0.83889 0.88496 0.88571

xf =

0.5 0.83889 0.88496 0.88571 0.88571

iter =

0 1 2 3 4 5

xf =

0.5 0.83889 0.88496 0.88571 0.88571

xf =

0.88571 0.5 0.83889 0.88496 0.88571 0.88571

iter =

0 1 2 3 4 5 6

xf =

	0.5	0.83889	0.88496	0.88571	0.88571
0.88571					

xf =

	0.5	0.83889	0.88496	0.88571	0.88571
0.88571	0.88571				

iter =

0	1	2	3	4	5	6	7
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xf =

	0.5	0.83889	0.88496	0.88571	0.88571
0.88571	0.88571				

xf =

	0.5	0.83889	0.88496	0.88571	0.88571
0.88571	0.88571	0.88571			

ans =

0
1
2
3
4
5
6
7

ans =

0.5
0.83889
0.88496
0.88571
0.88571
0.88571
0.88571
0.88571

ans =

0
40.397
5.2054
0.084972
2.2247e-05

1.5293e-12

0

0

tableau =

0	0.5	0
1	0.83889	40.397
2	0.88496	5.2054
3	0.88571	0.084972
4	0.88571	2.2247e-05
5	0.88571	1.5293e-12
6	0.88571	0
7	0.88571	0

MANUAL SOLUTION

NAME: IREEM FAROUK
DEPT: CHEMICAL ENGINEERING
MAT NR: 16121801010

Given $f(x) = e^{-0.5x}(4-x) - 2$
absolute error = $1e-9$
Initial guess value = 0.5
Solution

$x = 0.5$
 $f(x) = e^{-0.5x}(4-x) - 2$
 $f'(x) = -0.5e^{-0.5x}(4-x) - \exp^{-0.5x}$
 $x_{i+1} = x_i - \frac{e^{-0.5x}(4-x) - 2}{-0.5e^{-0.5x}(4-x) - \exp^{-0.5x}}$

when $x = 0$
 $x_1 = 0.5 - \frac{e^{-0.5(0.5)}(4-0.5) - 2}{-0.5e^{-0.5(0.5)}(4-0.5) - \exp^{-0.5(0.5)}} = 0.7258027407$
 $x_1 = 0.5 - \frac{0.7258027407}{2.141702152} = 0.838890606$

$x_2 = 0.838890606 - \frac{e^{-0.5(0.838890606)}(4-0.838890606) - 2}{-0.5e^{-0.5(0.838890606)}(4-0.838890606) - \exp^{-0.5(0.838890606)}} = 0.884959949$
 $x_2 = 0.838890606 - \frac{0.0781492794}{-1.696486281} = 0.884959949$

$x_3 = 0.884959949 - \frac{e^{-0.5(0.884959949)}(4-0.884959949) - 2}{-0.5e^{-0.5(0.884959949)}(4-0.884959949) - \exp^{-0.5(0.884959949)}} = 0.885708605$
 $x_3 = 0.884959949 - \frac{1.236584063 \times 10^{-3}}{-1.648060768} = 0.885708605$

$x_4 = 0.885708605 - \frac{e^{-0.5(0.885708605)}(4-0.885708605) - 2}{-0.5e^{-0.5(0.885708605)}(4-0.885708605) - \exp^{-0.5(0.885708605)}} = 0.885708605$
 $x_4 = 0.885708605 - \frac{1.926925225 \times 10^{-3}}{-1.64316923} = 0.885708605$

Name
DEPT
MAT

$$x_5 = \frac{0.8568812972 - \frac{0.5(0.8568812972)}{0.5} \left(\frac{4 - 0.8568812972}{0.5} - 2 \right)}{0.5 - \frac{0.5(0.8568812972)}{0.5} \left(\frac{4 - 0.8568812972}{0.5} - 2 \right) - \exp^{-0.5(0.8568812972)}}$$

$$x_5 = \frac{0.8568812972 - (-1.924687514 \times 10^{-5})}{-1.648661982}$$

$$x_5 = 0.855708828$$

$$x_6 = \frac{0.855708828 - \frac{0.5(0.855708828)}{0.5} \left(\frac{4 - 0.855708828}{0.5} - 2 \right)}{0.5 - \frac{0.5(0.855708828)}{0.5} \left(\frac{4 - 0.855708828}{0.5} - 2 \right) - \exp^{-0.5(0.855708828)}}$$

$$x_6 = \frac{7.85808854 \times 10^{-7}}{-1.64220125} = 0.855708802$$

Absolute Error

$$E_a = \left| \frac{x_{i+1} - x_i}{x_{i+1}} \right| \times 100\% = \left| \frac{0.5 - 1}{0.5} \right| \times 100\% = 1\%$$

$$\left| \frac{0.838890606 - 0.5}{0.838890606} \right| \times 100\% = 40.89747299\%$$

$$\left| \frac{0.4849559949 - 0.838890606}{0.838890606} \right| \times 100\% = 5.20587518\%$$

$$\left| \frac{0.855708605 - 0.4849559949}{0.855708605} \right| \times 100\% = 0.84972\%$$

$$\left| \frac{0.8568812972 - 0.855708605}{0.8568812972} \right| \times 100\% = 0.132265115\%$$

$$\left| \frac{0.857088288 - 0.8568812972}{0.857088288} \right| \times 100\% = 0.19248358701\%$$

$$\left| \frac{0.85708802 - 0.857088288}{0.85708802} \right| \times 100\% = 0.000529068688$$

$$= 5.899065 \times 10^{-5}$$