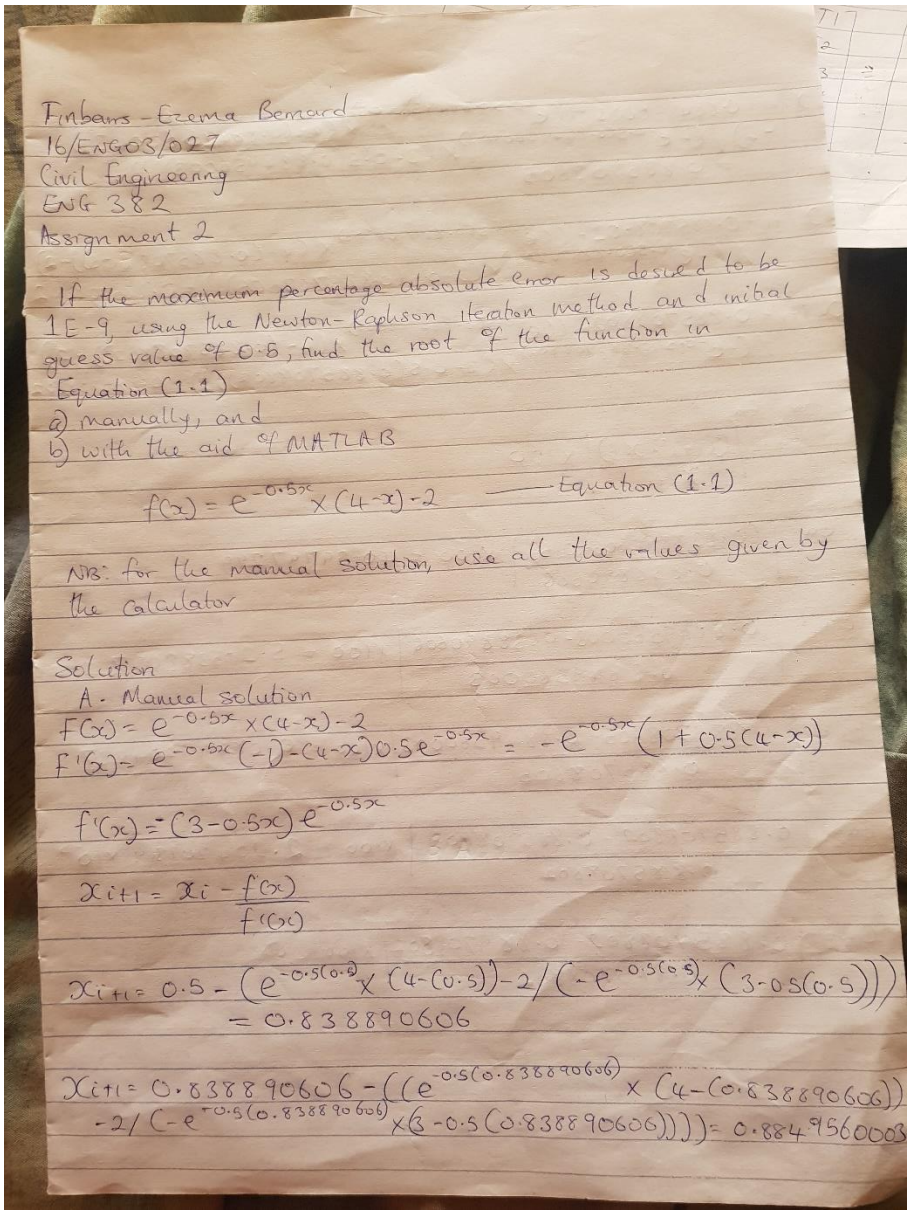
FINBARRS-EZEMA BERNARD ASSIGNMENT 2

16/ENG03/027

CIVIL ENGINEERING

ENG382



Finbarrs - Ezema Bernard
16/ENG03/027
Civil Engineering
ENG 382
Assignment 2

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 Equation (1.1)
a) manually, and
b) with the aid of MATLAB

$$f(x) = e^{-0.5x} \times (4-x) - 2 \quad \text{——Equation (1.1)}$$

NB: for the manual solution, use all the values given by the calculator

Solution
A. Manual solution

$F(x) = e^{-0.5x} \times (4-x) - 2$

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

$f'(x) = -(3-0.5x)e^{-0.5x}$

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

$x_{i+1} = 0.5 - (e^{-0.5(0.5)} \times (4-(0.5)) - 2 / (-e^{-0.5(0.5)} \times (3-0.5(0.5))))$
$= 0.838890606$

$x_{i+1} = 0.838890606 - ((e^{-0.5(0.838890606)} \times (4-(0.838890606)) - 2 / (-e^{-0.5(0.838890606)} \times (3-0.5(0.838890606)))) = 0.884956008$

$$x_{i+1} = 0.884956003 - ((e^{-0.5(0.884956003)} \times (4 - (0.884956003)) - 2) / (-e^{-0.5(0.884956003)} \times (3 - 0.5(0.884956003))))$$
$$= 0.885708605$$

$$x_{i+1} = 0.885708605 - ((e^{-0.5(0.885708605)} \times (4 - (0.885708605)) - 2) / (-e^{-0.5(0.885708605)} \times (3 - 0.5(0.885708605)))) = 0.885708802$$

$$x_{i+1} = 0.885708802 - ((e^{-0.5(0.885708802)} \times (4 - (0.885708802)) - 2) / (-e^{-0.5(0.885708802)} \times (3 - 0.5(0.885708802)))) = 0.885708802$$

for Ea,

$$Ea = \left| \frac{(x_{i+1} - x_i)}{x_{i+1}} \right| \times 100$$

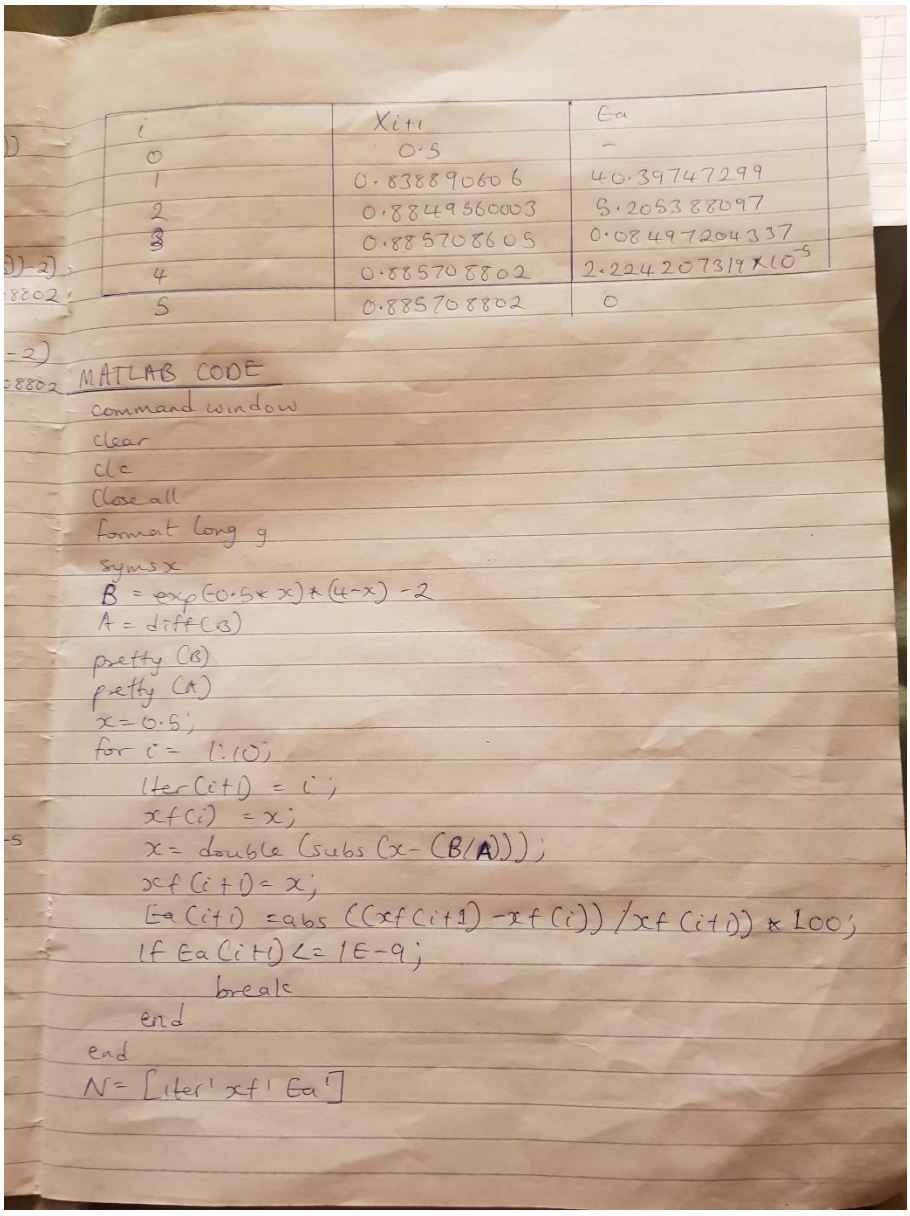
$$Ea = \left| \frac{(0.838890606 - 0.5)}{0.838890606} \right| \times 100 = 40.39747299$$

$$Ea = \left| \frac{0.884956003 - 0.838890606}{0.884956003} \right| \times 100 = 5.205388097$$

$$Ea = \left| \frac{0.885708605 - 0.884956003}{0.885708605} \right| \times 100 = 0.084972043337$$

$$Ea = \left| \frac{0.885708802 - 0.885708605}{0.885708802} \right| \times 100 = 2.224207319 \times 10^{-5}$$

$$Ea = \left| \frac{0.885708802 - 0.885708802}{0.885708802} \right| \times 100 = 0$$

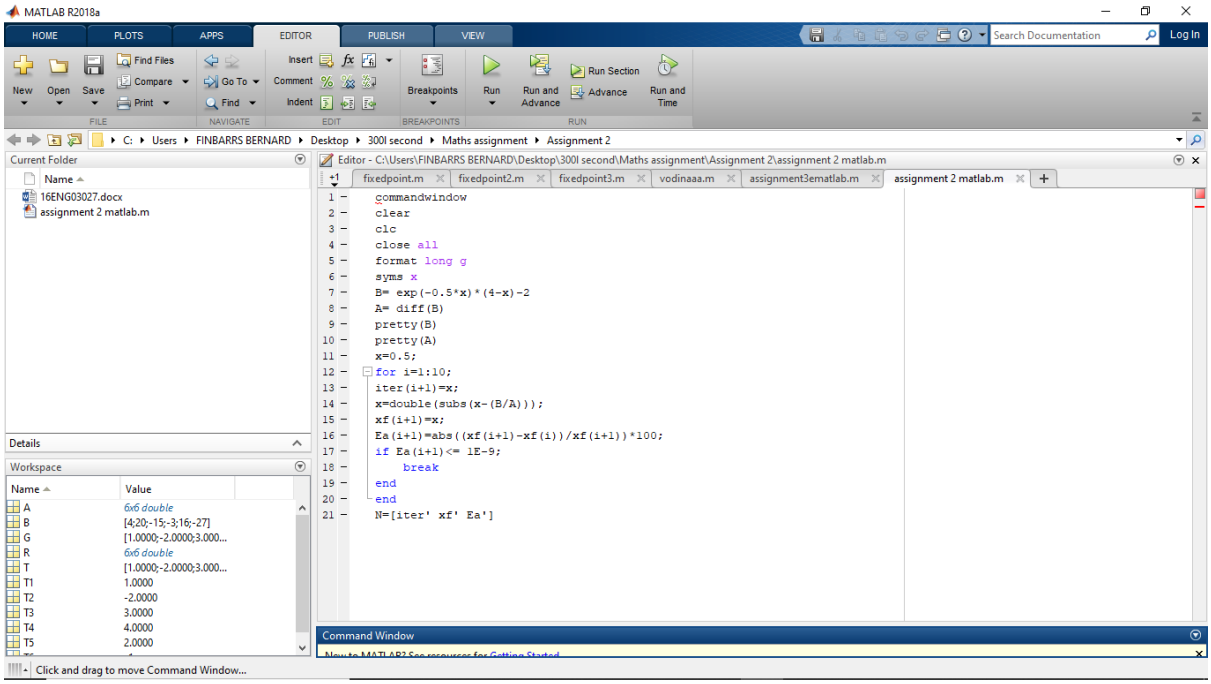


| i | Xi+1 | Ea |
|---|---|---|
| 0 | 0.5 | - |
| 1 | 0.83889606 | 40.39747299 |
| 2 | 0.884956003 | 5.205388097 |
| 3 | 0.885708605 | 0.084972043 37 |
| 4 | 0.885708802 | $2.224207319 \times 10^{-5}$ |
| 5 | 0.885708802 | 0 |

MATLAB CODE

```
command window
clear
clc
Close all
format long g
syms x
B = exp(0.5*x)*(4-x) -2
A = diff(B)
pretty (B)
pretty (A)
x=0.5;
for i = 1:10;
    iter(i+1) = i;
    xf(i) = x;
    x = double (subs (x-(B/A)));
    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
N= [iter' xf' Ea']
```

Matlab code and solution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fixedpoint3.m
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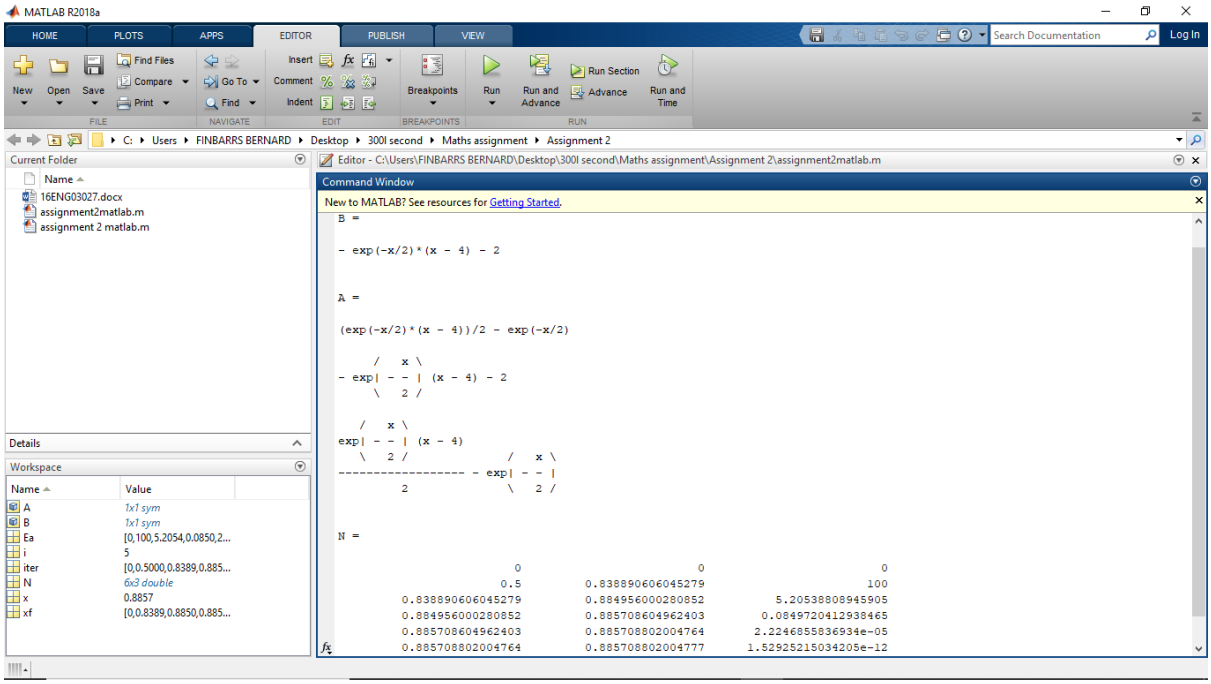
commandwindow
clear
clc
close all
format long g
syms x
B= exp(-0.5*x)*(4-x)-2
A= diff(B)
pretty(B)
pretty(A)
x=0.5;
for i=1:10;
iter(i+1)=x;
x=double(subs(x-(B/A)));
xf(i+1)=x;
Ea(i+1)=abs((xf(i+1)-xf(i))/xf(i+1))*100;
if Ea(i+1)<= 1E-9;
break
end
end
N=[iter' xf' Ea']
Details
Workspace
Name
Value
A
6x6 double
B
[4;20;-15;-3;16;-27]
G
[1.0000;-2.0000;3.000...
R
6x6 double
T
[1.0000;-2.0000;3.000...
T1
1.0000
T2
-2.0000
T3
3.0000
T4
4.0000
T5
2.0000
Command Window
Click and drag to move Command Window...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assignment 2 matlab.m
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Command Window
New to MATLAB? See resources for Getting Started.
B =
- exp(-x/2)*(x - 4) - 2
A =
(exp(-x/2)*(x - 4))/2 - exp(-x/2)
- exp(- x/2) (x - 4) - 2
exp(- x/2) (x - 4)
x
2
- exp(- x/2)
N =
0 0 0
0.5 0.838890606045279 100
0.838890606045279 0.884956000280852 5.20538808945905
0.884956000280852 0.885708604962403 0.0849720412938465
0.885708604962403 0.885708802004764 2.2246855836934e-05
0.885708802004764 0.885708802004777 1.52925215034205e-12
Details
Workspace
Name
Value
A
1x1 sym
B
1x1 sym
Ea
[0,100,5.2054,0.0850,2...
i
5
iter
[0,0.5000,0.8389,0.885...
N
6x3 double
x
0.8857
xf
[0,0.8389,0.8850,0.885...