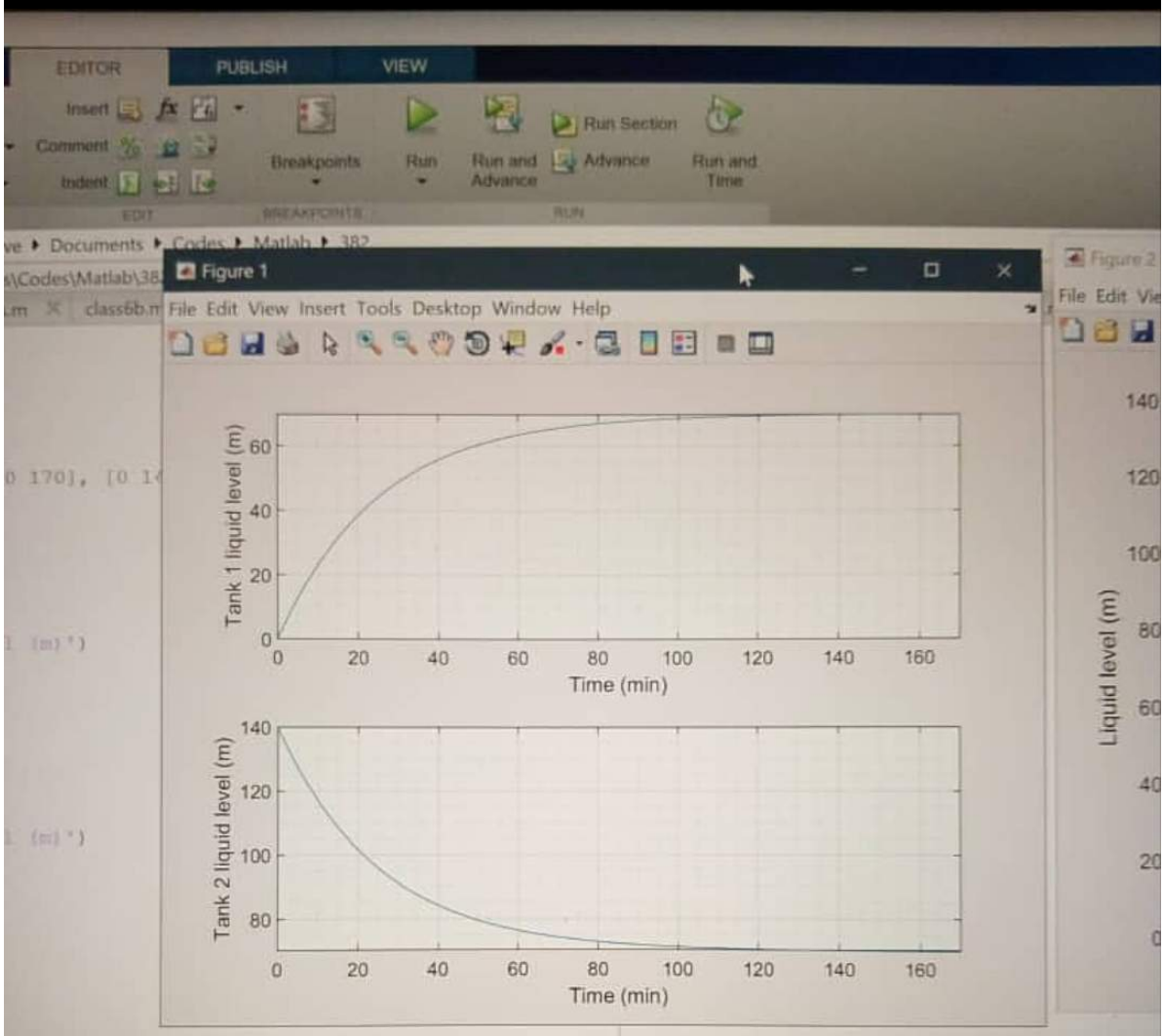
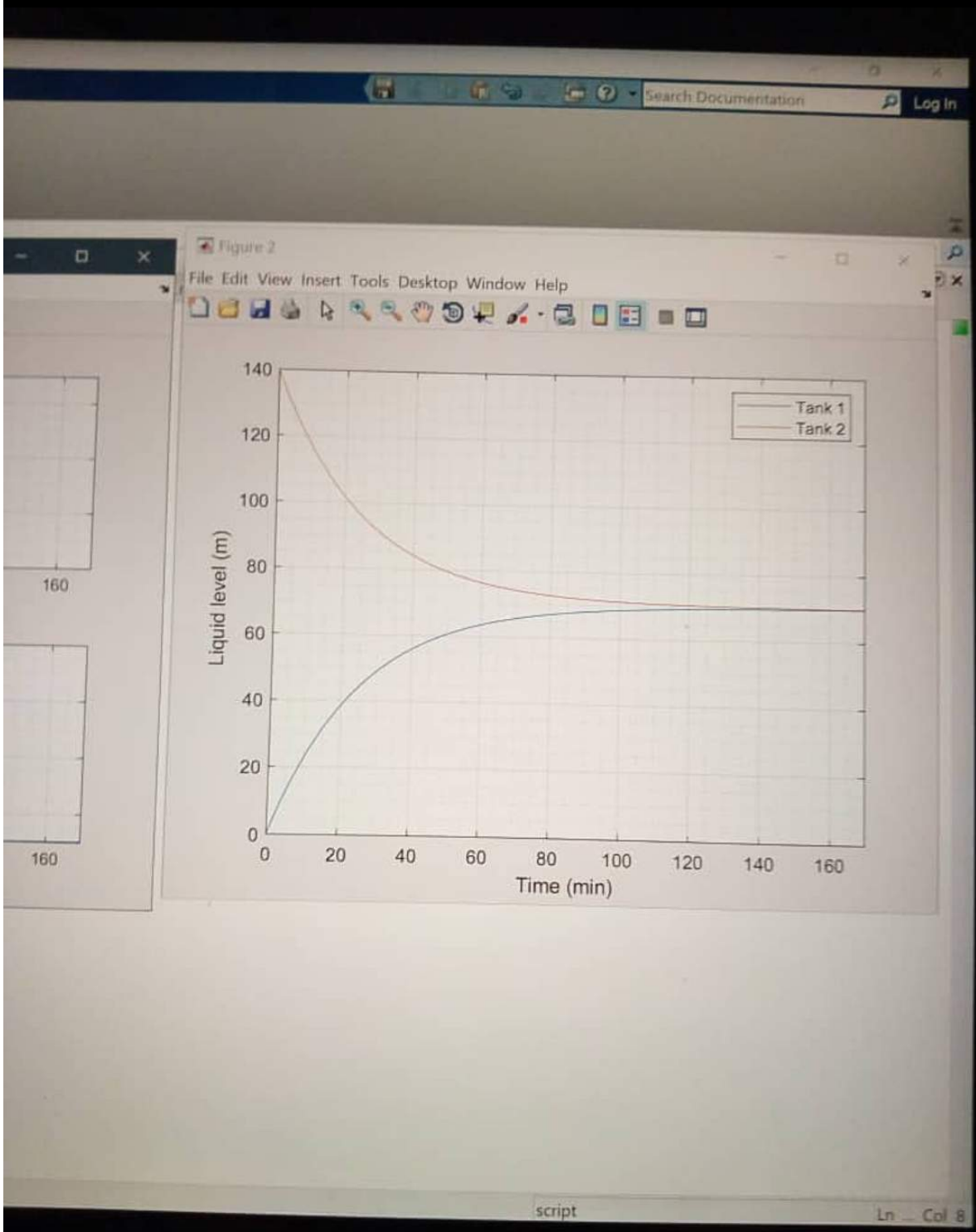

EDITOR
PUBLISH
VIEW
Insert
Comment
Indent
Breakpoints
Run
Run and Advance
Run Section
Advance
Run and Time
Figure 1
File Edit View Insert Tools Desktop Window Help
Tank 1 liquid level (m)
Time (min)
Tank 2 liquid level (m)
Time (min)
Liquid level (m)


Search Documentation
Log In
Figure 2
File Edit View Insert Tools Desktop Window Help
Tank 1
Tank 2
Liquid level (m)
Time (min)
0
20
40
60
80
100
120
140
160
script
Ln
Col 8

	A	B	C	D	E	F	G	H	I
1									
2					A			T	B
3		2	2	-4	2	6	-2	T1	12
4		4	-2	2	4	2	-6	T2	60
5		2	6	-6	-2	4	2	T3	-45
6		10	4	-2	-2	4	2	T4	-9
7		-6	-2	4	6	2	6	T5	48
8		8	6	2	-12	-6	-4	T6	-81
9									
10					INVERSE OF A			T	IN KELVIN
11		-0.1514085	0.07746479	0.04225352	0.09859155	-0.0528169	-0.0492958	1.5	274.5
12		-0.2746479	0.27230047	0.40610329	-0.1079812	0.11737089	0.05399061	-3	270
13		0.16549296	-0.0187793	-0.1314554	-0.0011737	0.16431925	0.12558685	4.5	277.5
14		-0.4577465	0.342723	0.39906103	-0.0410798	0.00117371	-0.1044601	6	279
15		0.54577465	-0.2676056	-0.3732394	0.04577465	0.0915493	0.10211268	3	276
16		-0.0774648	-0.07277	-0.0093897	0.08920188	0.01173709	-0.0446009	-1.5	271.5
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									
51									
52									
53									
54									
55									
56									
57									
58									
59									
60									
61									
62									
63									
64									
65									
66									

Sheet1 Sheet2 ...

	A	B	C	D	E	F	G	H	I	J
1					A			T	B	
2		2	2	-4	2	6	-2	T1	12	
3		4	-2	2	4	2	-6	T2	60	
4		2	6	-6	-2	4	2	T3	-45	
5		10	4	-2	-2	4	2	T4	-9	
6		-6	-2	4	6	2	6	T5	48	
7		8	6	2	-12	-6	-4	T6	-81	
8										
9					A			T	B	
10		2	2	-4	2	6	-2	T1	12	
11		0	-6	10	0	-10	-2	T2	36	2
12		0	4	-2	-4	-2	4	T3	-57	1
13		0	-6	18	-12	-26	12	T4	-69	5
14		0	4	-8	12	20	0	T5	84	-3
15		0	-2	18	-20	-30	4	T6	-129	4
16										
17					A			T	B	
18		2	2	-4	2	6	-2	T1	12	
19		0	-6	10	0	-10	-2	T2	36	
20		0	0	4.66666667	-4	-8.6666667	2.66666667	T3	-33	-0.6666667
21		0	0	8	-12	-16	14	T4	-105	1
22		0	0	-1.3333333	12	13.3333333	-1.3333333	T5	108	-0.6666667
23		0	0	14.6666667	-20	-26.666667	4.66666667	T6	-141	0.33333333
24										
25					A			T	B	
26		2	2	-4	2	6	-2	T1	12	
27		0	-6	10	0	-10	-2	T2	36	
28		0	0	4.66666667	-4	-8.6666667	2.66666667	T3	-33	
29		0	0	0	-5.1428571	-1.1428571	9.42857143	T4	-48.428571	1.71428571
30		0	0	0	10.8571429	10.8571429	-0.5714286	T5	98.5714286	-0.2857143
31		0	0	0	-7.4285714	0.57142857	-3.7142857	T6	-37.285714	3.14285714
32										
33					A			T	B	
34		2	2	-4	2	6	-2	T1	12	
35		0	-6	10	0	-10	-2	T2	36	
36		0	0	4.66666667	-4	-8.6666667	2.66666667	T3	-33	
37		0	0	0	-5.1428571	-1.1428571	9.42857143	T4	-48.428571	
38		0	0	0	0	8.44444444	19.3333333	T5	-3.6666667	-2.1111111
39		0	0	0	0	2.22222222	-17.333333	T6	32.6666667	1.44444444
40										
41					A			T	B	
42		2	2	-4	2	6	-2	T1	12	
43		0	-6	10	0	-10	-2	T2	36	
44		0	0	4.66666667	-4	-8.6666667	2.66666667	T3	-33	
45		0	0	0	-5.1428571	-1.1428571	9.42857143	T4	-48.428571	
46		0	0	0	0	8.44444444	19.3333333	T5	-3.6666667	
47		0	0	0	0	0	-22.421053	T6	33.6315789	0.26315789
48										
49				IN KELVIN						
50		T1	1.5	274.5						
51		T2	-3	270						
52		T3	4.5	277.5						
53		T4	6	279						
54		T5	3	276						
55		T6	-1.5	271.5						
56										
57										
58										
59										
60										
61										
62										
63										
64										
65										

Name: Etak Gabriel Edima
Department: Petroleum Engineering
Matric No: 17/ENG07/011

```
1- Command window
2- Clear vars
3- clc
4- close all
5- [t,h] = ode45('ebonafun',[0 170],[0 14]);
6- figure(1)
7- subplot(2,1,1)
8- plot(t,h(:,1))
9- xlabel('Time (mins)')
10- ylabel('Tank1 liquid level (m)')
11- grid on
12- grid minor
13- axis right
14- subplot(2,1,2)
15- plot(t,h(:,2))
16- xlabel('Time (mins)')
17- ylabel('Tank 2 liquid level (m)')
18- grid on
19- grid minor
20- axis right
21- figure(2)
22- plot(t,h)
23- xlabel('Time (mins)')
24- ylabel('Liquid level (m)')
25- legend('Tank 1','Tank 2')
26- grid on
27- grid minor
28- axis right.
29-
```

```
1- Function dydt = ebonafun(t,y)
2-
3- dydt(1) = -0.02*y(1) + 0.02*y(2);
4- dydt(2) = -0.02*y(1) - 0.02*y(2);
5- dydt = dydt';
6-
```

Using MATLAB Built In ODE Commands

- ODEs can be solved with the aid of MATLAB using built-in commands like ode23, ode113, ode15s, ode23s, ode23t and ode23tb
- To use any of these commands to solve ODE's, two m-files are required: (1) a Function File and (2) a simulation file.

Example.

The mathematical model set of a two tank system as given in Equation (1) and (2) form of two differential equations, to be as

$$\frac{dh_1}{dt} = -0.02h_1 + 0.02h_2 \quad (1)$$

$$\frac{dh_2}{dt} = 0.02h_1 - 0.02h_2 \quad (2)$$

$$h_1(0) = 0 \quad (3)$$

$$h_2(0) = 0 \quad (4)$$

Solution

Simulation File.

```
Command window
clear vars
clc
close all
[t,h] = ode45('ebonafun',[0 170],[0 14]);
figure(1)
subplot(2,1)
plot(t,h(:,1))
xlabel('Time (mins)')
ylabel('Tank 1 liquid level (m)')
grid on
grid minor
axis tight
```

Using the mathematical coefficients given in Equation (3) and (4) give the model set of the system for $0 \le t \le 170$ mins.

Function File

```
Function dydt = ebonafun(t,y)
dydt(1) = -0.02*y(1) + 0.02*y(2);
dydt(2) = 0.02*y(1) - 0.02*y(2);
dydt = dydt';
```

Simulation File (cont.)

```
subplot(2,1,2)
plot(t,h(:,2))
xlabel('Time (mins)')
ylabel('Tank 2 liquid level (m)')
grid on
grid minor
grid tight

figure(2)
plot(t,h)
xlabel('Time (mins)')
ylabel('Liquid level (m)')
legend('Tank 1','Tank 2')
grid on
grid minor
axis tight
```