4/20- Nwosu Ifeoma.
18/ENG05/065
Mechatronics.

The rate of change (y') = Input rate − Output rate.

Since 50 gal enters per mins, 1 gal contains $(1 + \sin t)$ lb of salt then the amount of salt entering the tank is.

$$\text{Min} = 50\,\text{gal/min} \times (1 + \sin t)\,\text{lb/gal}$$
$$= 50(1 + \sin t)\,\text{lb/min}.$$

The tank contains 1200 gal of water dissolved salt and 30 gallons of solution leaves the tank per minutes.

$$\therefore \quad \frac{30\,\text{gal}}{1200\,\text{gal}} = 0.025 = 2.5\%.$$

It means that 2.5% of salt in the tank leaves per minute

$$\text{Mout} = 2.5\% \text{ of } m$$

$$m' = \frac{dm}{dt} = 50(1 + \sin t) - 0.025m$$

$$\frac{dm}{dt} + 0.025m = 50(1 + \sin t)$$

using integrating factor.

$$I.F = e^{\int p\,dt}$$

$$\int p\,dt = \int 0.025\,dt = 0.025t$$

$$IF = e^{\int p\,dt} = e^{0.025t}$$

$$y \cdot e^{\int p\,dt} = \int Q \cdot e^{\int p\,dt}\,dt$$

$$y \cdot e^{0.025t} = \int 50(1+\sin t) \cdot e^{0.025t}\,dt$$

$$y \cdot e^{0.025t} = \int (50 + 50\sin t)\, e^{0.025t}\, dt$$

$$y\, e^{0.025t} = \int 50 e^{0.025t}\, dt + \int 50\, e^{0.025t} \sin t\, dt$$

$$y \cdot e^{0.025t} = 2000 e^{0.025t} + 50 \int e^{0.025t} \sin t\, dt$$

$$50 \int e^{0.025t} \sin t\, dt = 50 \left[-e^{0.025t} \cdot \cos t - \int -\cos t\, e^{0.025t} \times 0.025\, dt \right]$$

$$50 \int e^{0.025t} \sin t\, dt = +50 \left[e^{0.025t} \cos t + \int 0.025 e^{0.025t} \cos t\, dt \right]$$

$$50 \int e^{0.025t} \sin t\, dt = -50 e^{0.025t} \cos t + 1.25 \int e^{0.025t} \cos t\, dt$$

$$1.25 \int e^{0.025t} \cos t\, dt = 1.25 \left[e^{0.025t} \cdot \sin t - \int \sin t \times e^{0.025t} \times 0.025\, dt \right]$$

$$= 1.25 e^{0.025t} \sin t - 0.03125 \int e^{0.025t} \sin t\, dt$$

$$50 \int e^{0.025t} \sin t\, dt = -50 e^{0.025t} \cos t + 1.25 e^{0.025t} \sin t - 0.03125 \int e^{0.025t} \sin t\, dt$$

$$50.03125 \int e^{0.025t} \sin t\, dt = -50 e^{0.025t} \cos t + 1.25 e^{0.025t} \sin t$$

$$50 \int e^{0.025t} \sin t\, dt = -50 e^{0.025t} \cos t + 1.25 e^{0.025t} \sin t$$

$$y\, e^{0.025t} = -50 e^{0.025t} \cos t + 1.25 e^{0.025t} \sin t + 2000 e^{0.025t} + C$$

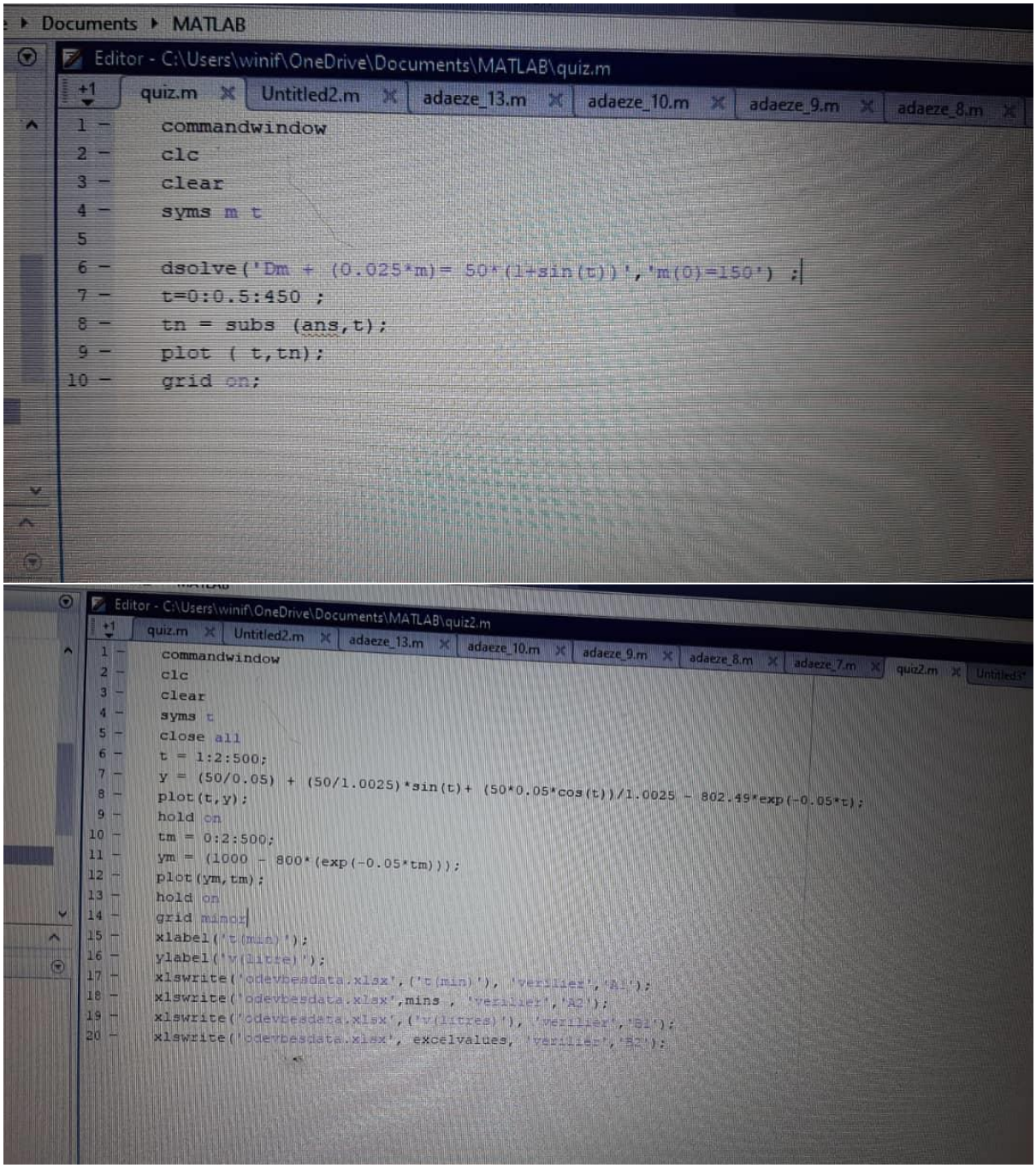
$$y = 2000 - 50\cos t + 1.25 \sin t + C e^{-0.025t}$$

$$y(0) = 2000 - 50 + C$$

$$150 = 2000 - 50 + C$$

$$C = 150 + 50 - 2000 = 1800$$

$$y(t) = 2000 - 50\cos t + 1.25 \sin t - 1800 e^{-0.025t}$$



Documents ▸ MATLAB

Editor - C:\Users\winif\OneDrive\Documents\MATLAB\quiz.m

quiz.m | Untitled2.m | adaeze_13.m | adaeze_10.m | adaeze_9.m | adaeze_8.m

```
commandwindow
clc
clear
syms m t

dsolve('Dm + (0.025*m)= 50*(1+sin(t))','m(0)=150') ;
t=0:0.5:450 ;
tn = subs (ans,t);
plot ( t,tn);
grid on;
```


Editor - C:\Users\winif\OneDrive\Documents\MATLAB\quiz2.m

quiz.m | Untitled2.m | adaeze_13.m | adaeze_10.m | adaeze_9.m | adaeze_8.m | adaeze_7.m | quiz2.m | Untitled3*

```
commandwindow
clc
clear
syms t
close all
t = 1:2:500;
y = (50/0.05) + (50/1.0025)*sin(t)+ (50*0.05*cos(t))/1.0025 - 802.49*exp(-0.05*t);
plot(t,y);
hold on
tm = 0:2:500;
ym = (1000 - 800*(exp(-0.05*tm)));
plot(ym,tm);
hold on
grid minor
xlabel('t(min)');
ylabel('v(litre)');
xlswrite('odevbesdata.xlsx',('t(min)'), 'verilier','A1');
xlswrite('odevbesdata.xlsx',mins , 'verilier','A2');
xlswrite('odevbesdata.xlsx',('v(litres)'), 'verilier','B1');
xlswrite('odevbesdata.xlsx', excelvalues, 'verilier','B2');
```

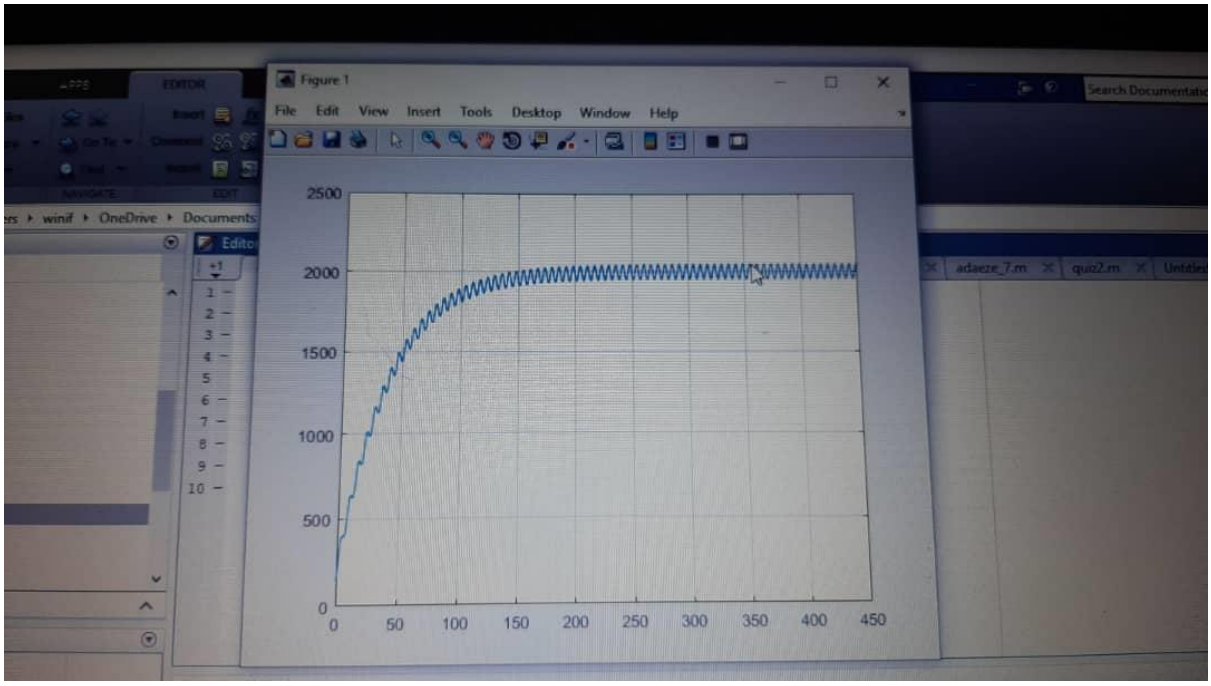


Figure 1
File Edit View Insert Tools Desktop Window Help
2500
2000
1500
1000
500
0
0 50 100 150 200 250 300 350 400 450

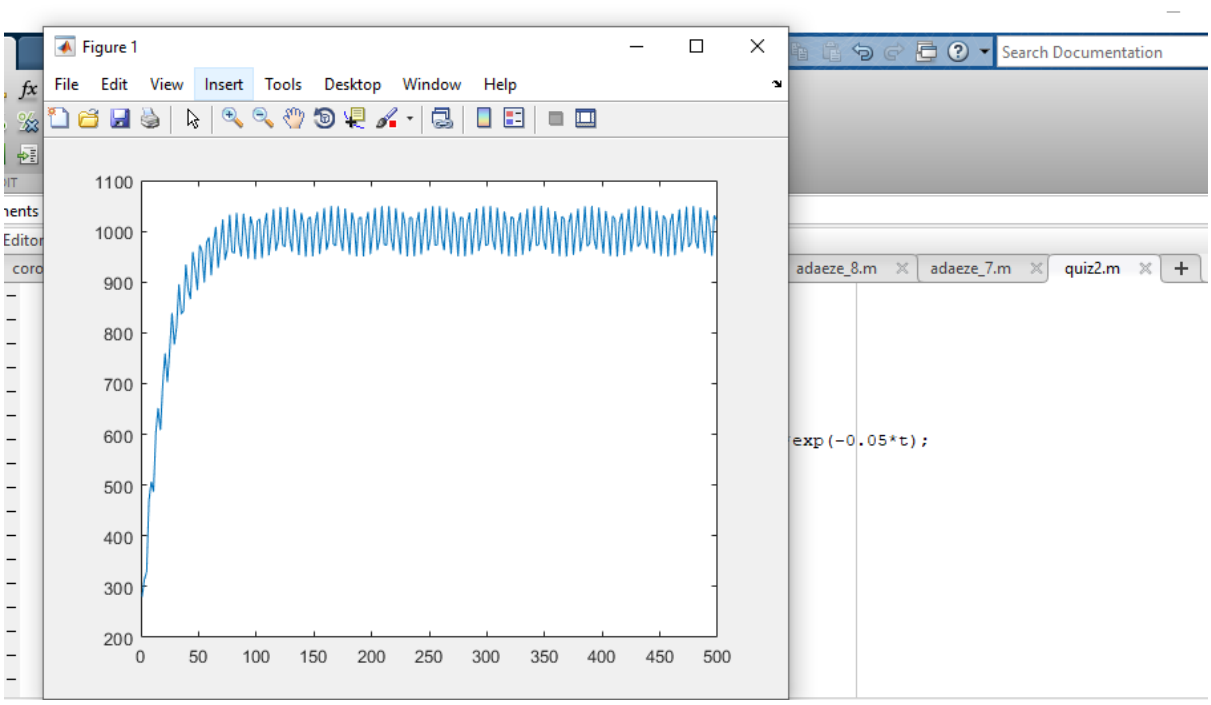
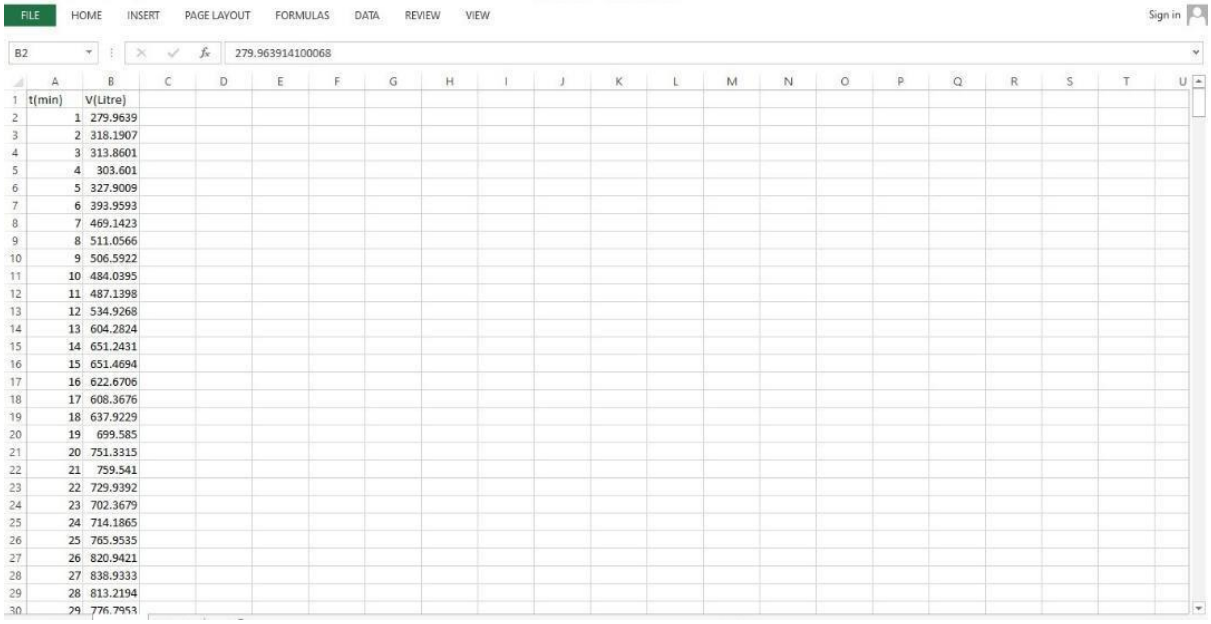


Figure 1
File Edit View Insert Tools Desktop Window Help
1100
1000
900
800
700
600
500
400
300
200
0 50 100 150 200 250 300 350 400 450 500
Search Documentation
adaeze_8.m
adaeze_7.m
quiz2.m
exp(-0.05*t);



t(min)	V(Litre)
1	279.9639
2	318.1907
3	313.8601
4	303.601
5	327.9009
6	393.9593
7	469.1423
8	511.0566
9	506.5922
10	484.0395
11	487.1398
12	534.9268
13	604.2824
14	651.2431
15	651.4694
16	622.6706
17	608.3676
18	637.9229
19	699.585
20	751.3315
21	759.541
22	729.9392
23	702.3679
24	714.1865
25	765.9535
26	820.9421
27	838.9333
28	813.2194
29	776.7953