NAME: TOWURU JESUTOFUNMI NISSI
MAT NOS: 18/ENG02/095
DEPT: COMPUTER ENGINEERING
Course code & title: ENG 282 / ENG MATHS II

1a. formulate an ordinary differential equation for studying the dynamics of the amount of salt in the tank

Soln

Accumulation ratio = {Input ratio into system − output ratio from system}

$= dy/dt = y_{in} - y_{out}$ ---①

from

$dy/dt = y_{in} - y_{out}$

$dy/dt = 50(1+\sin t) - 2.5\%$ of y

$dy/dt = 50(1+\sin t) - 0.025y$

∴ By seperation

$= dy/dt + 0.025y\,dy = 50(1+\sin t)dt$

$= dy/dt = -0.025y + 50(1+\sin t)$

$dy/dt = -0.025\left[\frac{-0.025y}{-0.025} + \frac{50(1+\sin t}{-0.025}\right]$

OR

$= -0.025y + 50 + (1+\sin t)$ / OR

$1 + 0.025y\,dy = 50(1+\sin t)dt$

B Solve the differential equation manually

$$dy/dt = 50(1+\sin t) - 0.025y$$

$$\therefore dy/dt + 0.025y = 50(1+\sin t)$$

$$= dy/dt = dy/dt \; 50(1+\sin t) - 0.025y$$

$$\therefore dy/dt + 0.025y = 50(1+\sin t)$$

$$dy/dt = (-0.025(y - 2000(1+\sin t)))$$

$$dy/dt = -0.025(y - 2000(1+\sin t))$$

$$\frac{dy}{(y - 2500(1+\sin t)} = -0.025t$$

$$\therefore \text{We integrate both sides}$$

$$\int \frac{dy}{y - 2000(1+\sin t)} - \int -0.025\,dt$$

$$\ln(y - 2000(1+\sin t)) = -0.025t + C$$

$$y - 2000(1+\sin t) = e^{-0.025+C}$$

$$y - 2000(1+\sin t) = e^{-0.0025} + y_0$$

$$y = y_0 e^{-0.025t} + 2000(1+\sin t)$$

don't forget $t = 1$, $y = 150$ (b)

$$150 = y_0 e^{-0.025t} + 2000(1+\sin 0)$$

$$150 = y_0 + 2000$$

$$y_0 = 150 - 2000$$

$$y_0 = -1850$$

50',

$\therefore y = 150 - 2000e^{-1850}$

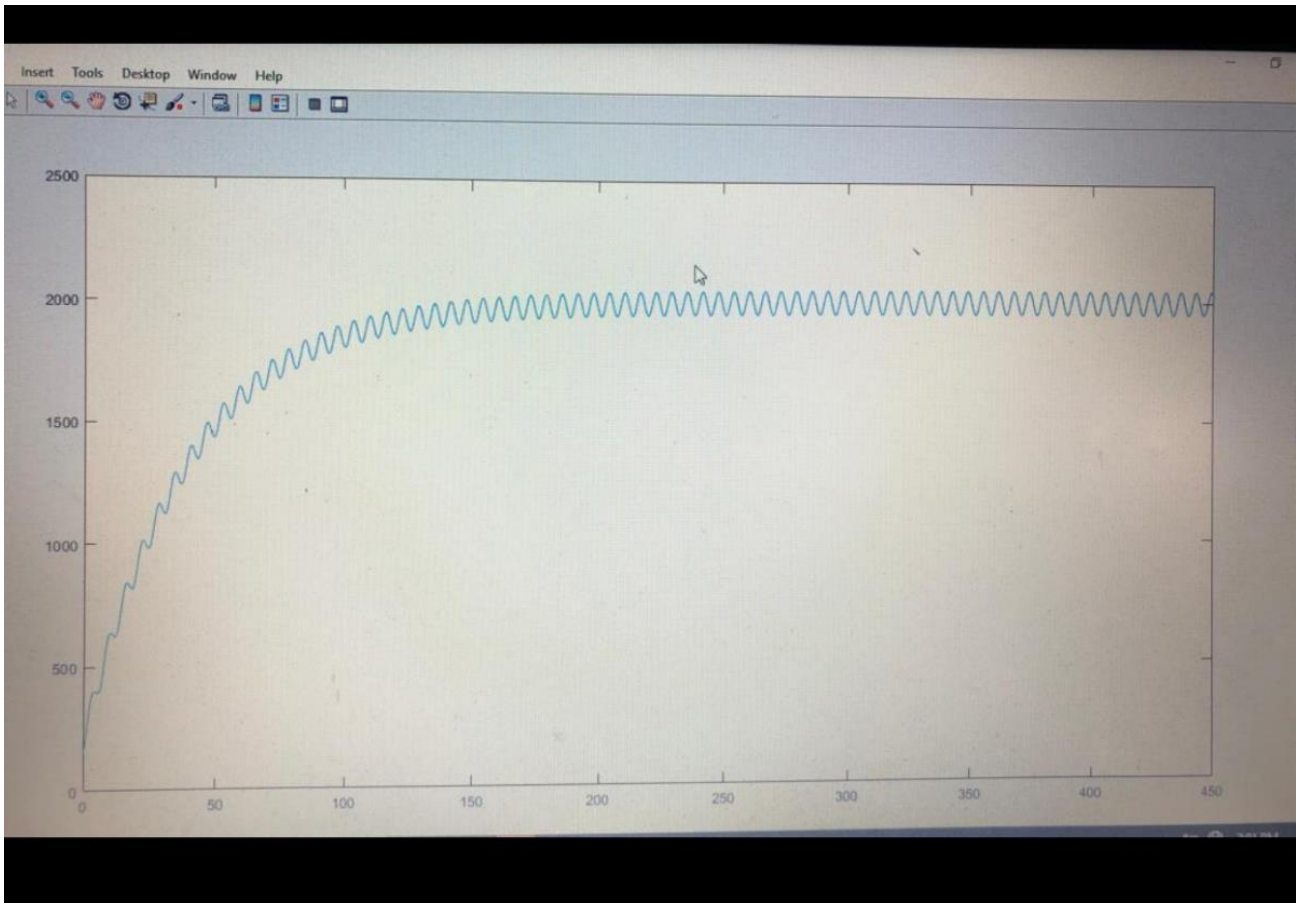
$y = 2000(1 + \sin t) - 1850e^{-0.025t}$ //

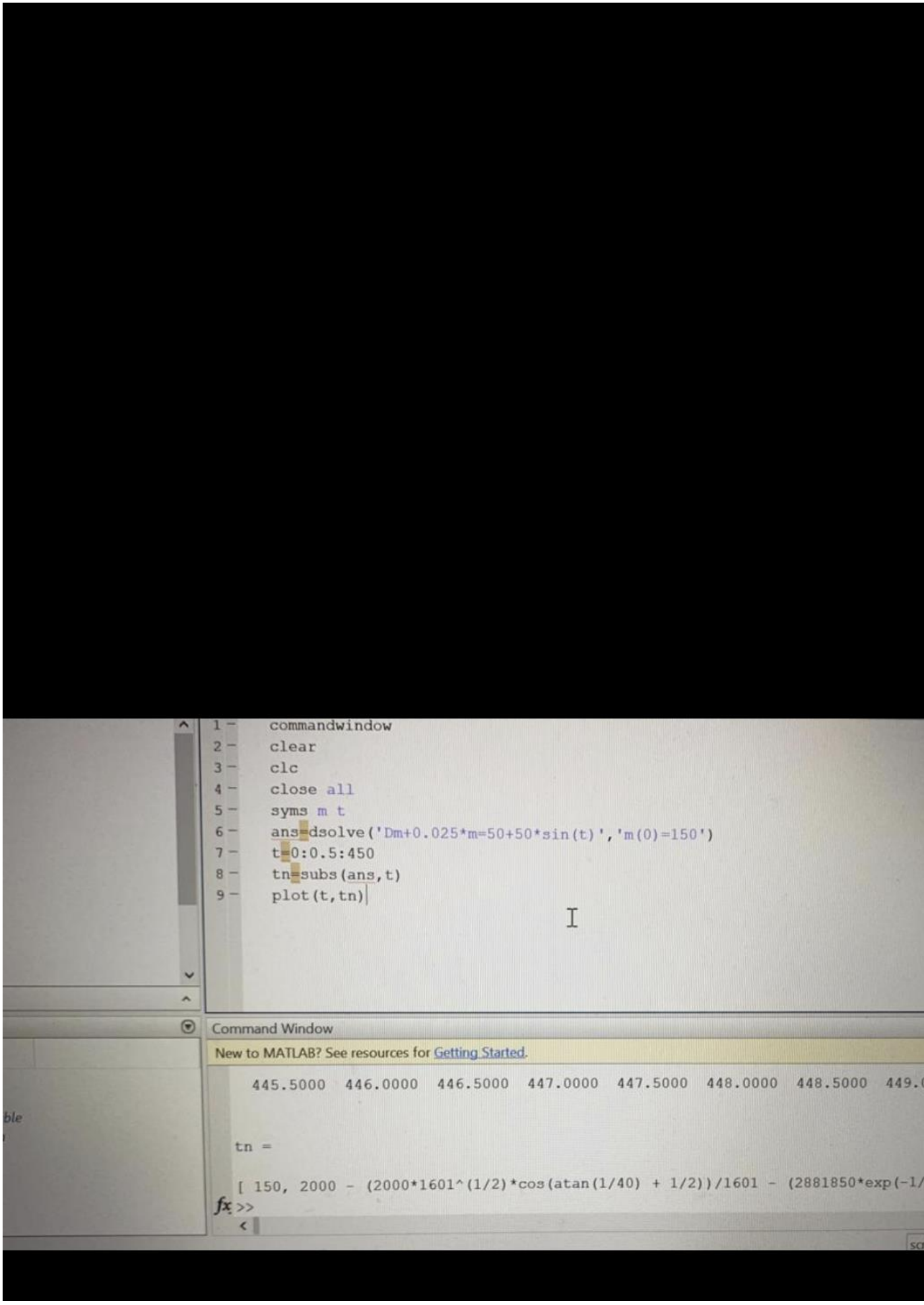
$y = 2000 - 1850e^{-0.025t}$ //

(c) Write the MATLAB file.

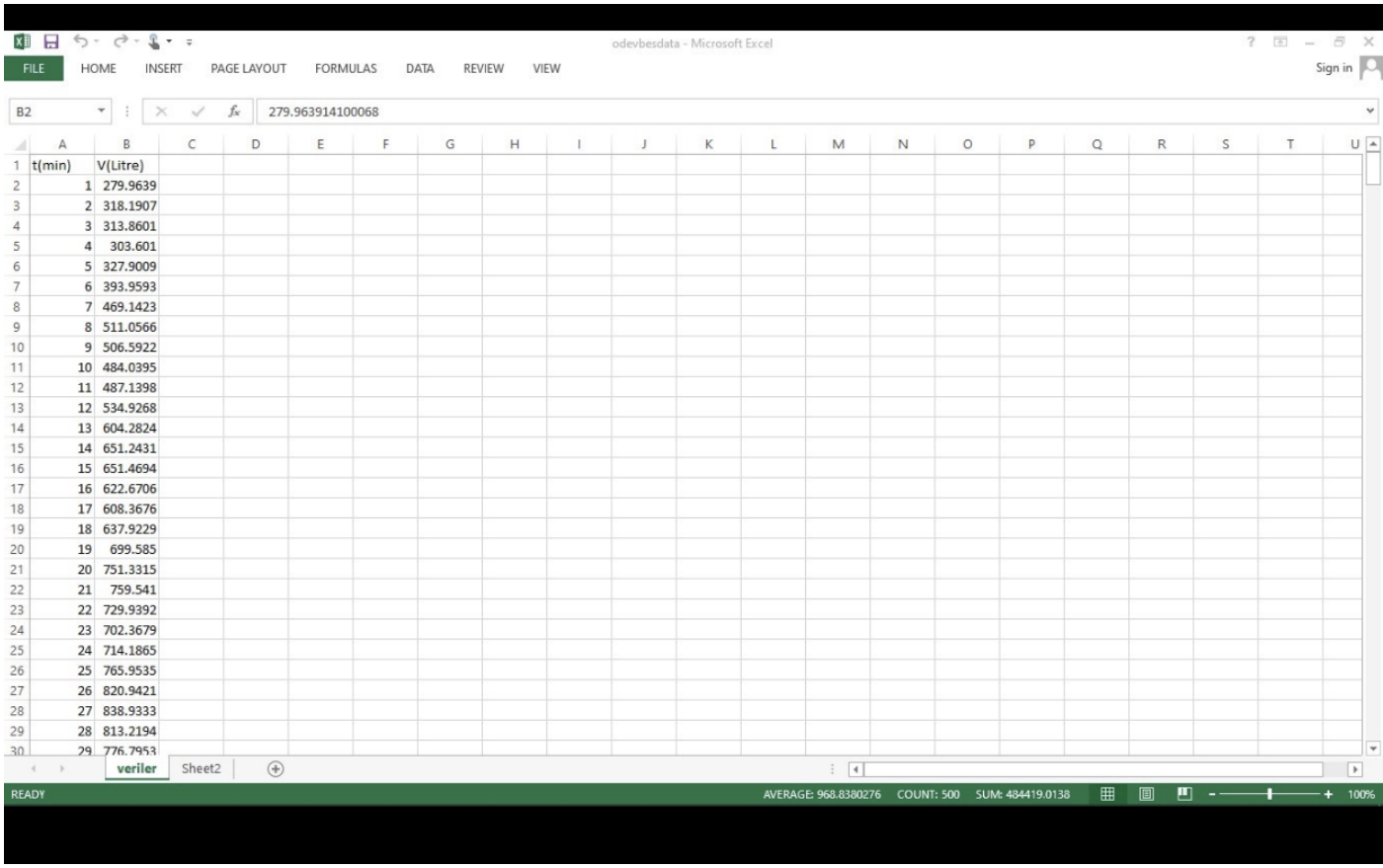
```
Command window
clear
clc
close all
Symsmt
ans = dSolve('Dm + 0.025*m = 50x50*sin(t)', m(0) = 150')

t = 0 : 0-5 : 450
tn = subs(ans, t)
plot(t, tn)
```


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


1 - commandwindow
2 - clear
3 - clc
4 - close all
5 - syms m t
6 - ans=dsolve('Dm+0.025*m=50+50*sin(t)','m(0)=150')
7 - t=0:0.5:450
8 - tn=subs(ans,t)
9 - plot(t,tn)
Command Window
New to MATLAB? See resources for Getting Started.
445.5000 446.0000 446.5000 447.0000 447.5000 448.0000 448.5000
tn =
[150, 2000 - (2000*1601^(1/2)*cos(atan(1/40) + 1/2))/1601 - (2881850*exp(-1/
>>

NUMBER 2

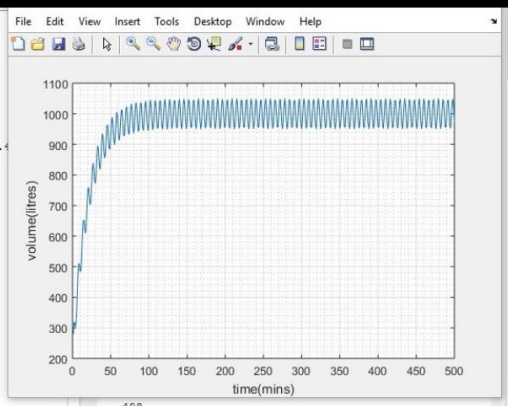


	A	B
1	t(min)	V(Litre)
2	1	279.9639
3	2	318.1907
4	3	313.8601
5	4	303.601
6	5	327.9009
7	6	393.9593
8	7	469.1423
9	8	511.0566
10	9	506.5922
11	10	484.0395
12	11	487.1398
13	12	534.9268
14	13	604.2824
15	14	651.2431
16	15	651.4694
17	16	622.6706
18	17	608.3676
19	18	637.9229
20	19	699.585
21	20	751.3315
22	21	759.541
23	22	729.9392
24	23	702.3679
25	24	714.1865
26	25	765.9535
27	26	820.9421
28	27	838.9333
29	28	813.2194
30	29	776.7953

```
commandwindow
clear
clc
close all
syms t
values=[]
t=1:1:500
mean=1000-((exp(-0.05*t))*800)
y=1000+(50/1.0025)*sin(t)+(2.5/1.0025)*cos(t)-((exp(-0.05*t))*802.4

if rem(t,2) ==0
    values=[values,mean]
else
    values=[values,y]
end
excelvalues=transpose(values)
mins=transpose(t)
plot(t,values)
grid on
grid minor
xlabel ('time(mins)')
ylabel('volume(litres)')
xlswrite('odevbesdata.xlsx',{'t(min)'},'veriler','A1')
xlswrite('odevbesdata.xlsx',mins,'veriler','A2')
xlswrite('odevbesdata.xlsx',{'V(Litre)'},'veriler','B1')
xlswrite('odevbesdata.xlsx',excelvalues,'veriler','B2')

```




```
498
499
500
>>
```