MEZE HANNAH CHIBUEZE

18/ENG05/031

MECHATRONICS ENGINEERING

NUMBER 1:

MEZE HANNAH CHIBUEZE
15/ENG02S/031
MECHATRONICS ENGINEERING

(1)(a) Applying balance law,

$\frac{dy}{dt} = y_{in} - y_{out}$

$y_{in} = 50 \frac{gal}{min} \times (1+\sin t) \frac{lb}{gal} = 50(1+\sin t)\ lb/min$

$\frac{30}{1200} = 0.025 = 25\%$ of the salt present in the tank will leave the tank per minute.

$y_{out} = 2.5\%$ of y

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

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

$dy/dt + Py = Q$

$P = 0.025$, $Q = 50(1+\sin t)$

$I.F = e^{\int P dt}$, $\int P dt = 0.025t$, $I.F = e^{0.025t}$

$y \cdot IF = \int Q \cdot IF$

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

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

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

$\int e^{0.025t} \sin t\, dt$, solving by integrating by part,

$\int uv\,dx = u\int v\,dx - \int u'(\int v\,dx)\,dx$

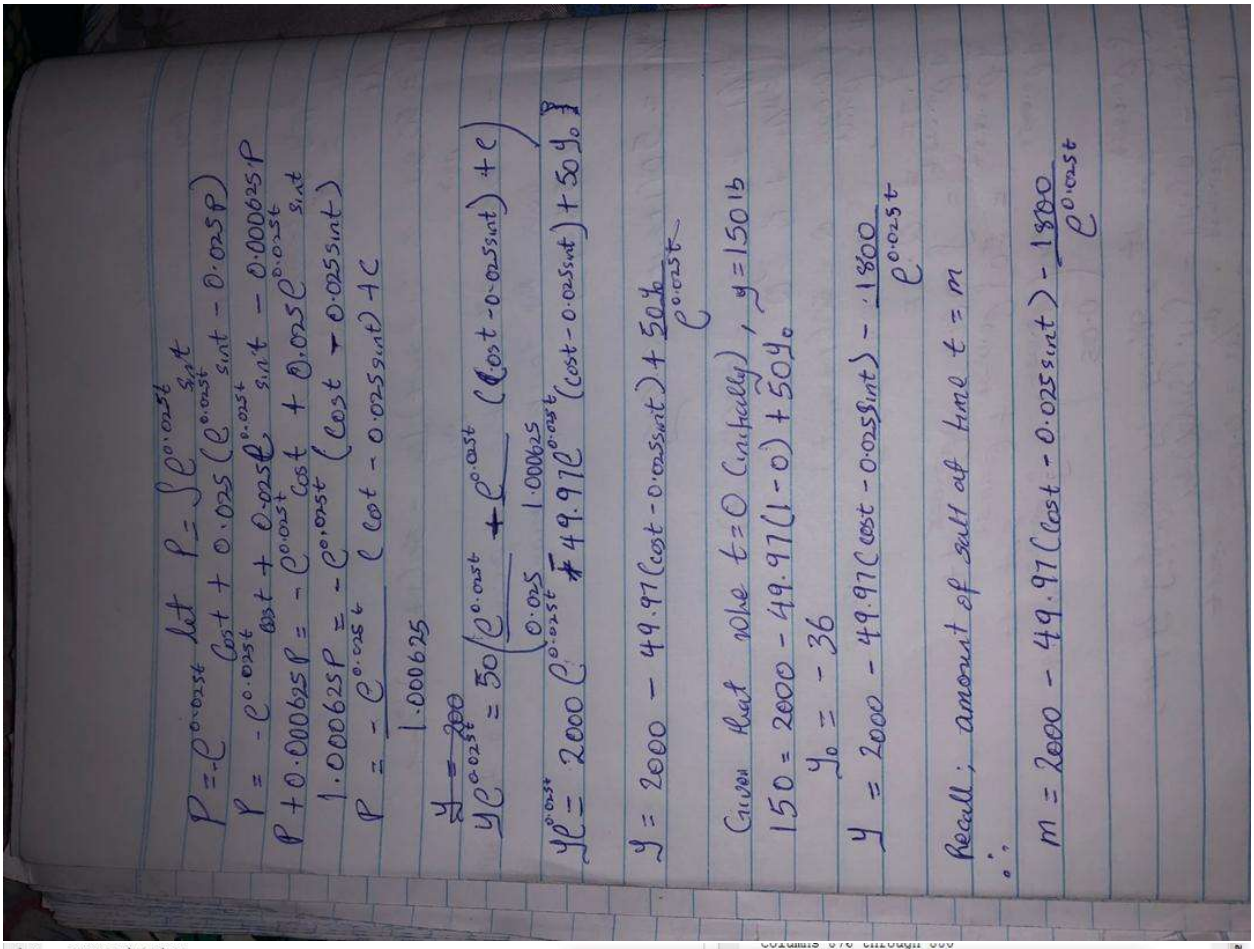
$u = e^{0.025t}$: $du/dt = 0.025e^{0.025t}$

$v = \sin t$: $\int v\,dt = \int \sin t\,dt = -\cos t$

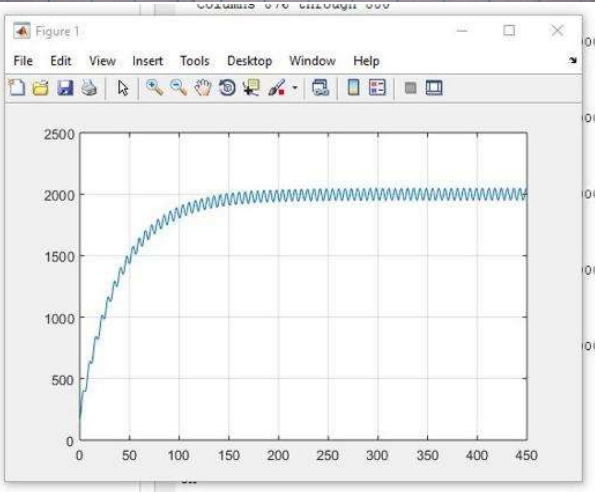
$\int e^{0.025t} \sin t\,dt = -e^{0.025t}\cos t + 0.025\int e^{0.025t}\cos t + C$

Integrating by part again,

$= -e^{0.025t}\cos t + 0.025\left(e^{0.025t}\sin t - 0.025\int e^{0.025t}\sin t\right)$

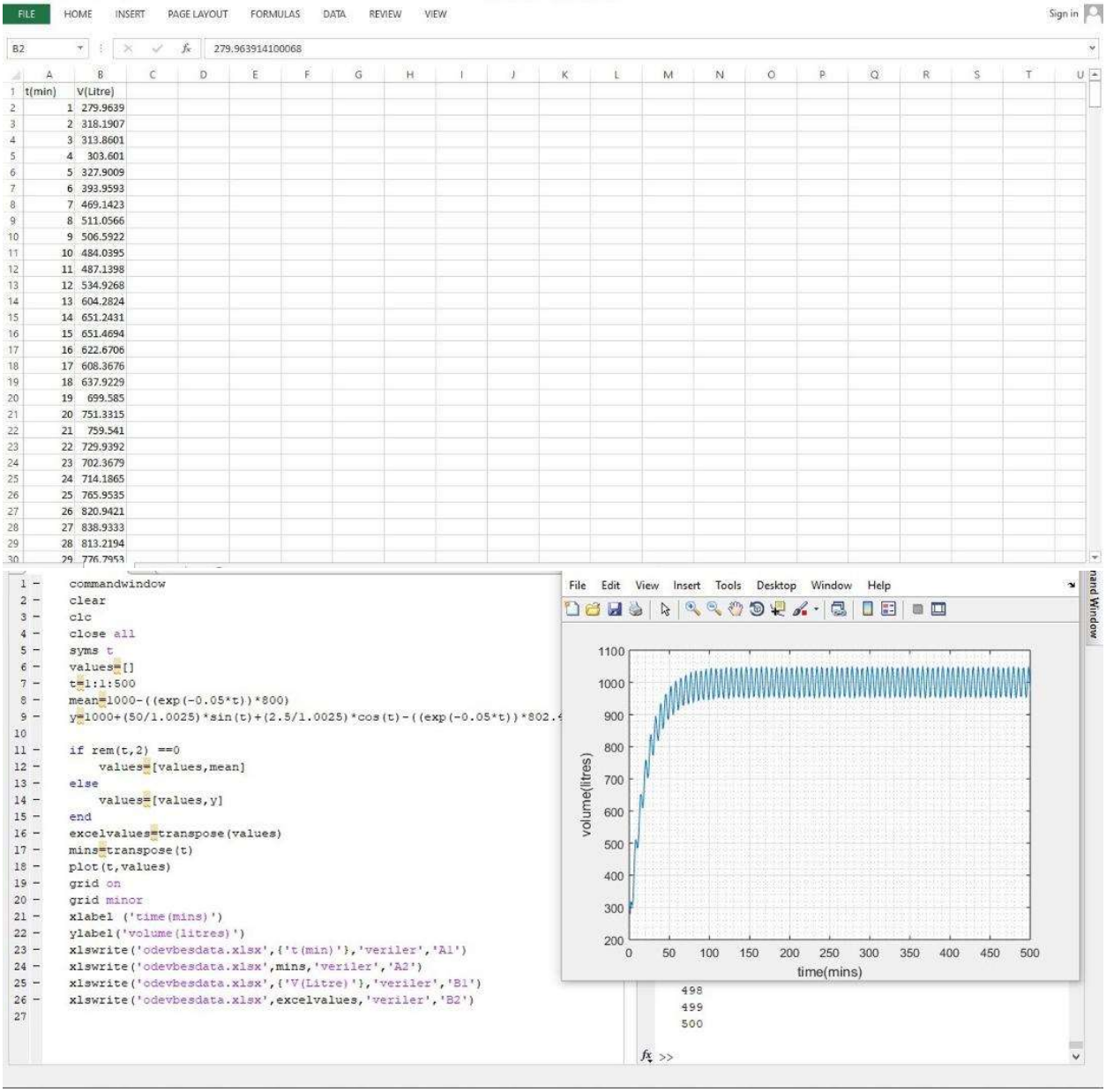



```
commandwindow
clear
clc
close all
syms m t
ans=dsolve('Dm+0.025*m=50+50*sin(t)','m(0)=150')
t=0:0.5:450
tn=subs(ans,t)
plot(t,tn)
grid on
```




```
[ 150, 2000 - (2000*1601^(1/2)*cos(atan(1/40) + 1/2))/1
>>
```

NUMBER 2:



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

```
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')
```