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18/ENG04/051
ENG 282
MATHS II

{Accumulated salt} = {Input rate of salt} - {Output rate of salt}

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

Brine containing 50 gal/min enters a mixture and each gallon contains (1 + sin t) lb of salt

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

$= 50 (1 + \sin t) \frac{lb}{min}$.

Tank contains 1200 gal of water and 80 gal will leave the mixture. $= \frac{80 gal}{1200 gal} = 0.02\overline{6}$

$= 2\overline{6}\% gal$ of y.

$y_{out} = 2\overline{6}\% gal$ of y.

$\frac{dy}{dt} \cdot \frac{lb}{min} = 50 (1 + \sin t) \frac{lb}{min} - 2\overline{6}\% \frac{gal}{min} \frac{lb}{min}$

$= 50 (1 + \sin t) \frac{lb}{min} - 2\overline{6}\% \frac{lb}{min}$

$\frac{dy}{dt} = 50 (1 + \sin t) - 2\overline{6}\% y$

$\frac{dy}{dt} = -2\overline{6}\% + 50 (1 + \sin t)$

$\frac{dy}{dt} = -0.02\overline{6}\% + 50 (1 + \sin t)$

using $\frac{dy}{dx} + Py = Q$

$P = 0.00\overline{6}$ $Q = 50 (1 + \sin t)$.

$\int P \cdot dx = 0.00\overline{6} t$

$$I.f = e^{\int p\,dx}$$

$$I.f = e^{0.02t}$$

$$y \cdot I.f = \int Q \cdot I.f\,dt$$

$$y e^{0.02t} = \int 50(1+\sin t)\, e^{0.02t}\,dt$$

$$y e^{0.02t} = 50 \int (1+\sin t)\, e^{0.02t}\,dt$$

$$y e^{0.02t} = 50 \int e^{0.02t}\,dt + \int e^{0.02t} \sin t\,dt$$

$$y e^{0.02t} = 50 \left[\frac{e^{0.02t}}{0.02} + \int e^{0.02t} \sin t\,dt \right]$$

$$y e^{0.02t} = \frac{50\, e^{0.02t}}{0.02} + 50 \int e^{0.02t} \sin t\,dt \quad \text{---} *$$

Using $\int u\,dv = uv - \int v\,du$

$$\int e^{0.02t} \sin t \cdot dt$$

$$u = e^{0.02t}, \quad dv = \sin t$$

$$du = 0.02 e^{0.02t}, \quad v = -\cos t$$

$$\int e^{0.02t} \cdot \sin t = e^{0.02t} \cdot -\cos t - \int -\cos t \cdot 0.02 e^{0.02t}$$

$$\int e^{0.02t} \sin t = -e^{0.02t} \cos t + 0.02 \int e^{0.02t} \cos t + C \quad //$$

Still using $\int u\,dv = uv - \int v\,du$.

$$u = e^{0.02t}, \quad dv = \cos t$$

$$du = 0.02 e^{0.02t}, \quad v = \sin t$$

$$= -e^{0.02t} \cdot \cos t + 0.02 \left(e^{0.02t} \cdot \sin t - \int \sin t \cdot 0.02 e^{0.02t} \right)$$

$$= -e^{0.02t} \cos t + 0.02 \left(e^{0.02t} \sin t - 0.02 \int e^{0.02t} \right)$$

$$\text{Let } I = \int e^{0.02t} \sin t\,dt$$

$$I = -e^{0.02t} \cos t + 0.02 \left(e^{0.02t} \sin t - 0.02 I \right)$$

$$I = -e^{0.02t} \cos t + 0.02 e^{0.02t} \sin t - 6.25 \times 10^{-4} I$$

$$I + 6.25 \times 10^{-4} I = -e^{0.02t} \cos t + 0.02 e^{0.02t} \sin t$$

$$1.000625\, I = -e^{0.02t} \cos t + 0.02 e^{0.02t} \sin t$$

$$1.000625\, I = -e^{0.02t} (\cos t - 0.02 e^{-0.02t} \sin t)$$

~~$F = 0.0625F$~~

$$F = \frac{-e^{0.02t}}{1.00025}(\cos t - 0.025 e^{0.025t} \sin t).$$

Let's recall that $F = \int e^{0.025t} \sin t\, dt$.

$$\int e^{0.025t} \sin t = \frac{-e^{0.025t}}{1.00025}(\cos t - 0.025 \sin t).$$

from equation *

$$\int e^{0.025t} = \frac{50 \cdot e^{0.025t}}{0.025} + 50\int e^{0.025t} \sin t + C$$

$$\int e^{0.025t} = \frac{50e^{0.025t}}{0.025} + \frac{50\, e^{0.025t}}{1.00025}(\cos t - 0.025 \sin t) + C$$

Rewrite through with $e^{0.025t}$

$$y = \frac{50}{0.025} - \frac{50}{1.00025}(\cos t - 0.025 \sin t) + \frac{50C}{e^{0.025t}}$$

$$y = 2000 - \frac{50}{1.00025}(\cos t - 0.025 \sin t) + \frac{50C}{e^{0.025t}}$$

When $y = 150$ & $t = 0$

$$150 = 2000 - \frac{50}{1.00025}(\cos(0) - 0.025 \sin(0)) + \frac{50C}{e^{0.025(0)}}$$

$$150 = 2000 - \frac{50}{1.00025}(1 - 0) + 50$$

$$150 = 2000 - 49.968(1) + 50C$$

$$150 = 1950.032 + 50C$$

$$150 - 1950.032 = 50$$

$$\frac{-1800.032}{50} = \frac{50C}{50}$$

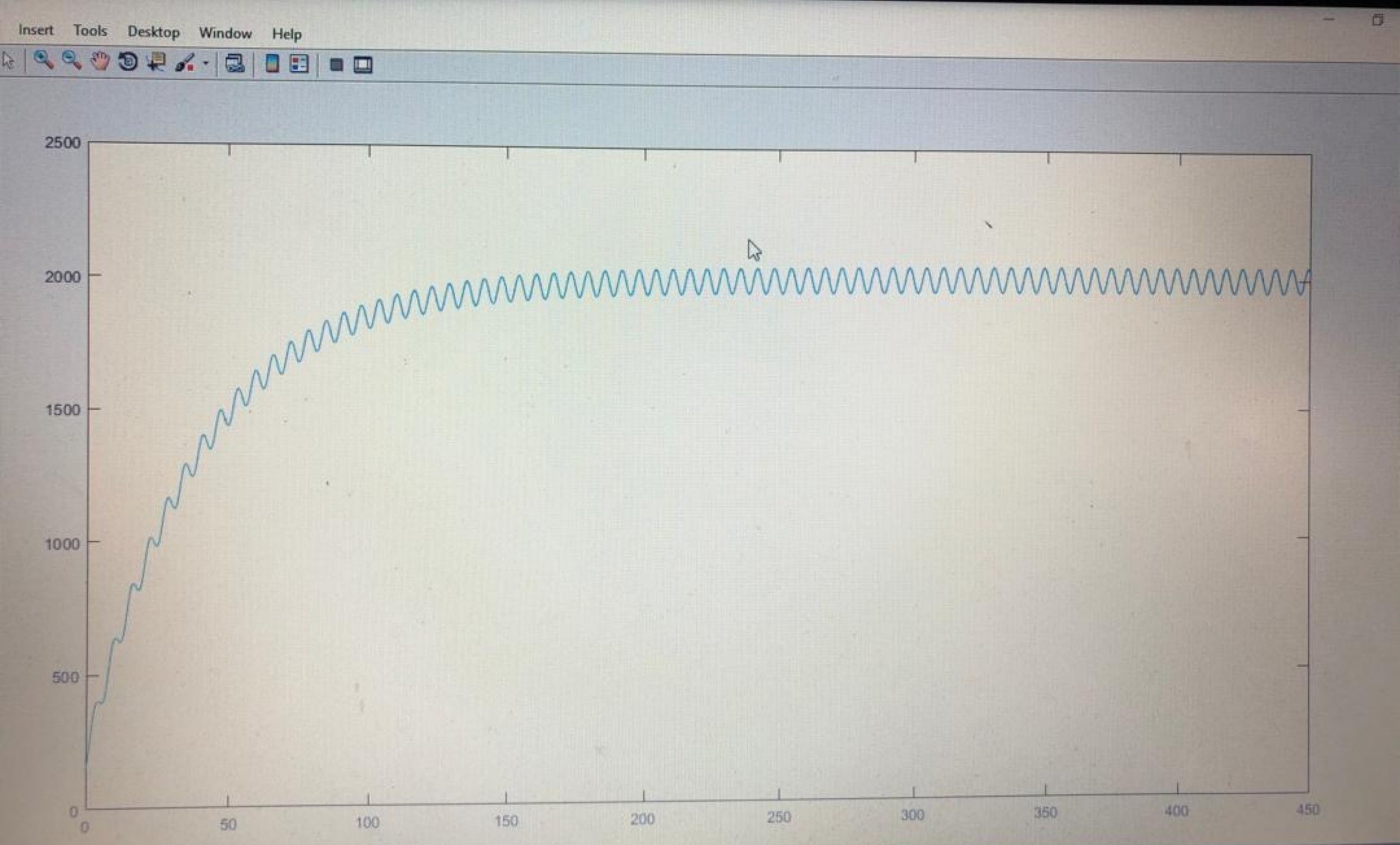
$$C = -36.0064$$

$$C = -36.0$$

$$y = 2000 - \frac{50}{1.00062^{\pi}}\left(\cos t - 0.02\pi \sin t\right) + \frac{70\left(\sin 360.0\right)}{e^{0.02\pi t}}$$

$$y = 2000 - 49.9687\left(\cos t - 0.027 \sin t\right) - \frac{1400}{e^{0.025t}}$$

Insert Tools Desktop Window Help



```
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)
```

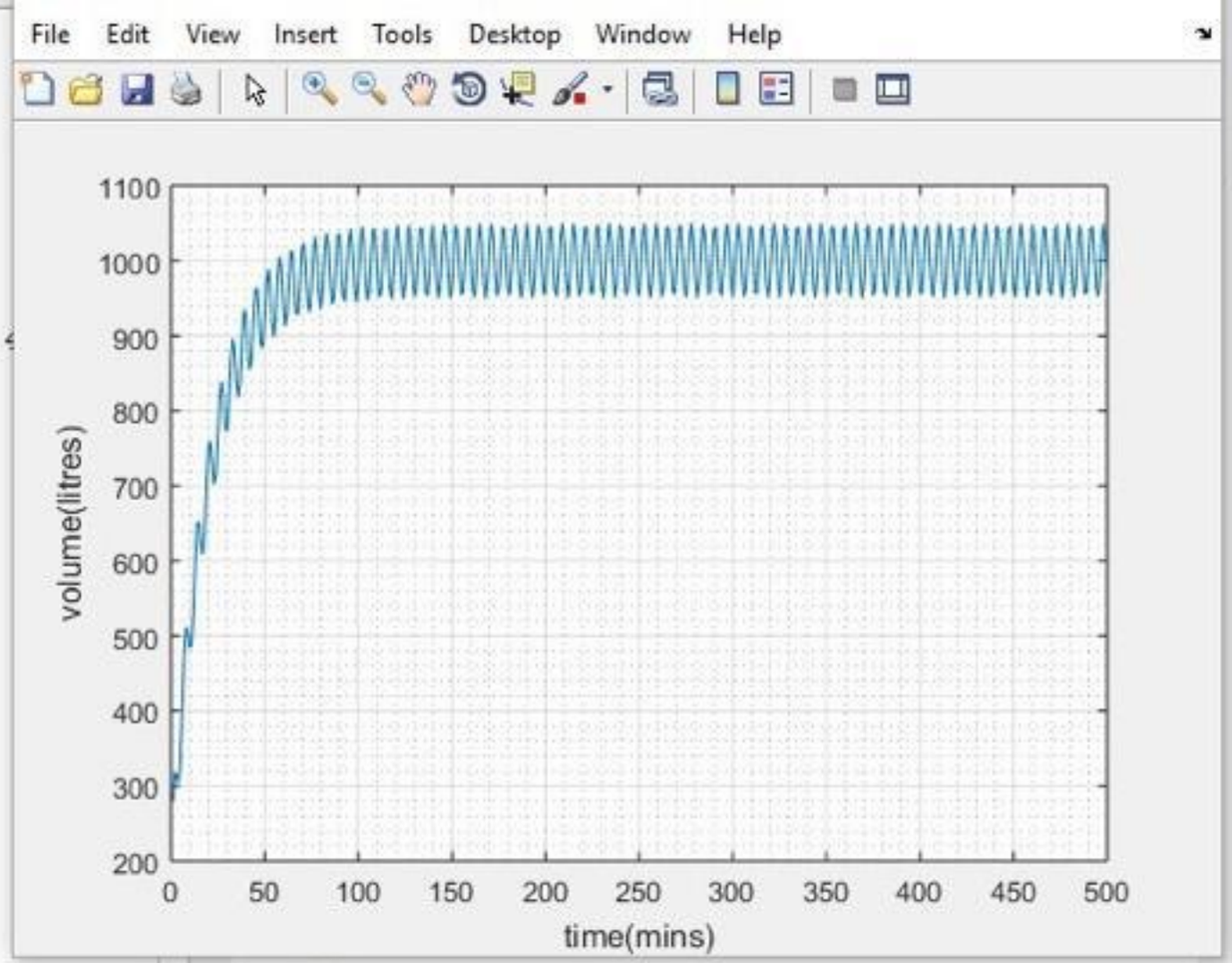
Command Window

New to MATLAB? See resources for Getting Started.

```
   445.5000   446.0000   446.5000   447.0000   447.5000   448.0000   448.5000   449.0000   449.5000   450.0

tn =

[ 150, 2000 - (2000*1601^(1/2)*cos(atan(1/40) + 1/2))/1601 - (2881850*exp(-1/80))/1601, 2000 - (20
fx >>
```

script

```
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
```

fx >>