Adah Osama Victor
18/Eng02/1004
Engineering Mathematics

1a. ∴ From

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

$$\frac{dy}{dt} = 50(1+\sin t) - 2.5\% \text{ of } y$$

$$\frac{dy}{dt} = 50(1+\sin t) - 0.025y.$$

∴ By seperating the variables.

$$\frac{dy}{dt} + 0.025y = 50(1+\sin t).$$

multiply both sides by dt.

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

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

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

using the linear equation method,

$dy/dx + Py = Q.$

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

$\therefore \int P.\, dt = 0.025t$

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

$I.F = e^{0.025t}$

$\therefore y \cdot I.F = \int Q\ I.F.\, dt$

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

Ardali Osama Victor
18/Engo2/1004

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

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

$$\int e^{0.025t}\sin t\cdot dt$$

$u = e^{0.025t} \quad du = \sin t$

$du = 0.025e^{0.025t} \quad v = -\cos t$

$$\therefore \int e^{0.025t}\sin t = e^{0.025t}\cdot -\cos t - \int -\cos t\cdot 0.025 e^{0.025t}$$

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

Using integrating by part

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

$u = e^{0.025t} \quad du = \cos t$

$du = 0.025e^{0.025t} \quad V = \sin t$

$$= -e^{0.025t}\cos t + 0.025\left[e^{0.025t}\cdot\sin t - \int \sin t\cdot 0.025e^{0.025t}\right]$$
$$= -e^{0.025t}\cos t + 0.025\left[e^{0.025t}\sin t - 0.025\int \sin t e^{0.025t}\right]$$

let $Q = \int e^{0.025t}\sin t$.

$$\therefore Q = -e^{0.025t}\cos t + 0.025\left[e^{0.025t}\sin t - 0.025Q\right]$$
$$Q = -e^{0.025}\cos t + 0.025e^{0.025t} - 6.25^{-4}Q$$
$$Q + 6.25^{-4}Q = -e^{0.025t}\cos t + 0.025e^{0.025t}$$
$$Q + 0.000625Q = -e^{0.025t}\cos t + 0.025e^{0.025t}$$
$$1.000625Q = -e^{0.025t}\cos t + 0.025e^{0.025t}$$
$$1.000625Q = -e^{0.025t}(\cos t - 0.025)$$
$$Q = \frac{-e^{0.025t}(\cos t - 0.025)}{1.000625} + C$$

Adah Osama Victor
181Eng02004

$$Q = \frac{-e^{0.025t}}{1.000625}(\cos t - 0.025) + c$$

$$\int e^{0.025t}\sin t = \frac{-e^{0.025t}}{1.000625}(\cos t - 0.025) + c$$

Since $\int e^{0.025t}\sin t = \frac{-e^{0.025t}}{1.000625}(\cos t - 0.025) + C$

$$\therefore ye^{0.025t} = 50\left[\frac{e^{0.025t}}{0.025} - \frac{e^{0.025t}}{1.000625}(\cos t - 0.025)\right] + c$$

$$ye^{0.025t} = 2000e^{0.025t} - 50\cdot\frac{e^{0.025t}}{1.000625}(\cos t - 0.025) + 50C$$

$$y = 2000 - \frac{50}{1.000625}(\cos t - 0.025) + \frac{50c}{e^{0.025t}}$$

when $y = 150$
$t = 0$

$$150 = 2000 - \frac{50}{1.000625}(1 - 0) + \frac{50c}{1}$$

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

$$150 - 1950.032 + 50c$$

$$-1800.032 = 50c$$

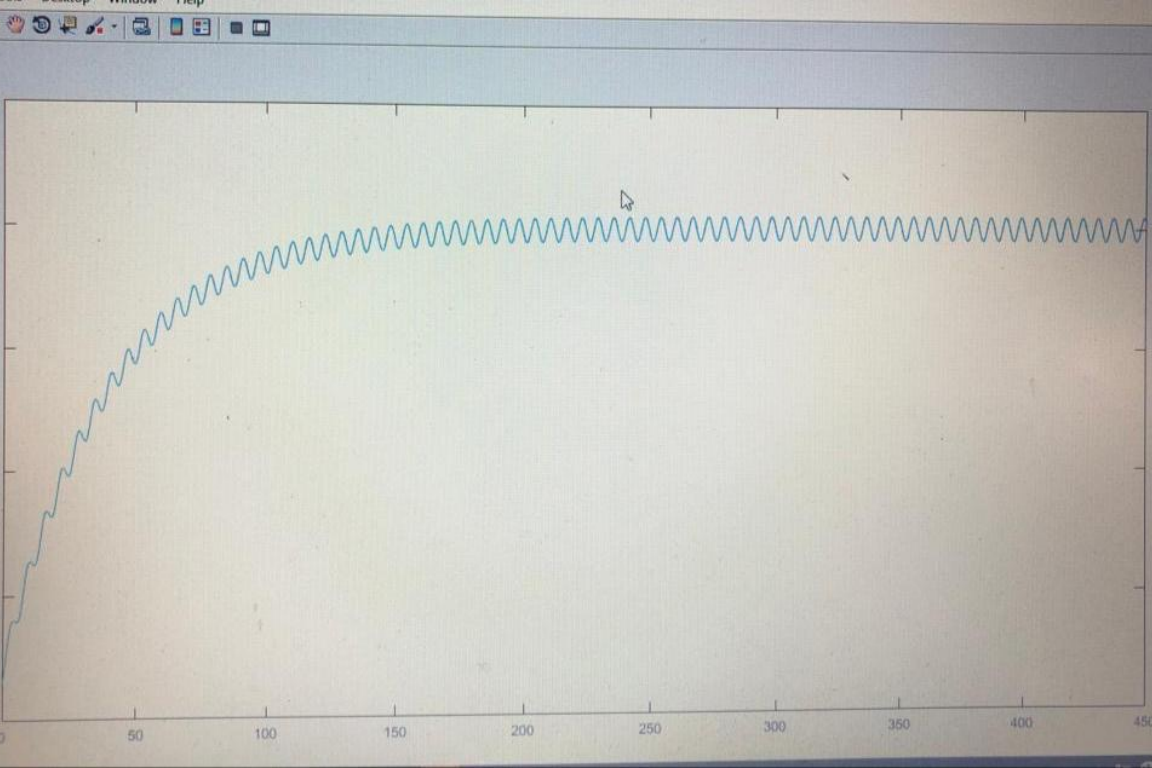
$$C = -36.00064$$

```
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)
```

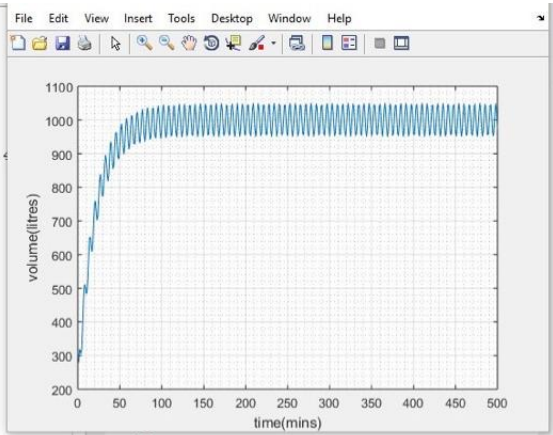
and Window

MATLAB? See resources for Getting Started.

```
445.5000   446.0000   446.5000   447.0000   447.5000   448.0000   448.5000   449.0000   449.50

 =

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


50
100
150
200
250
300
350
400

```
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
```

INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW

279.963914100068

C D E F G H I J K L M N O P Q R S

39
07
01
01
09
93
23
66
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06
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er Sheet2