

Engineering Maths II

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Computer Engineering

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

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

using the linear method

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

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

$$\therefore \int P \cdot dt = 0.025t$$

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

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

$$\therefore y \cdot I.F = \int 50(1 + \sin t) e^{0.025t} dt$$

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

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

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

Using integration by part

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

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

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

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

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

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

Using integration by part,

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

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

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

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

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

$$\text{Let } Q = e^{0.025t} \sin t$$

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

$$Q = -e^{0.025t} \cos t + 0.025 e^{0.025t} \sin t - 0.00625 Q$$

$$Q + 0.00625 Q = -e^{0.025t} \cos t + 0.025 e^{0.025t} \sin t$$

$$1.00625 Q = -e^{0.025t} \cos t + 0.025 e^{0.025t} \sin t$$

$$1.00625 Q = e^{0.025t} (\cos t - 0.025 \sin t)$$

$$Q = \frac{e^{0.025t} (\cos t - 0.025 \sin t)}{1.00625} + C$$

$$1.00625$$

$$Q = \frac{e^{0.025t} (\cos t - 0.025 \sin t)}{1.00625} + C$$

$$1.00625$$

$$\int e^{0.025t} \sin t = \frac{e^{0.025t} (\cos t - 0.025 \sin t)}{1.00625} + C$$

$$1.00625$$

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

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

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

Divide by $e^{0.025t}$

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

\therefore When $y = 150$
 $t = 0$

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

$$150 = 2000 - 49.768(1) + 50C$$

$$150 = 1950.232 + 50C$$

$$-1800.232 = 50C$$

$$C = -36.00464$$

\therefore From

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

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

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

∴ Separating the variables

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

Multiply both ~~side~~ sides by dt

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

$$\frac{0.025y^2}{2} [50 + 50\sin t] dt$$

$$\frac{0.025y^2}{2} = 50t - 50\cos t + C$$

$$0.0125y^2 = 50t - 50\cos t + C$$

divide through by 0.0125

$$y^2 = 4000t - 4000\cos t + 80C$$

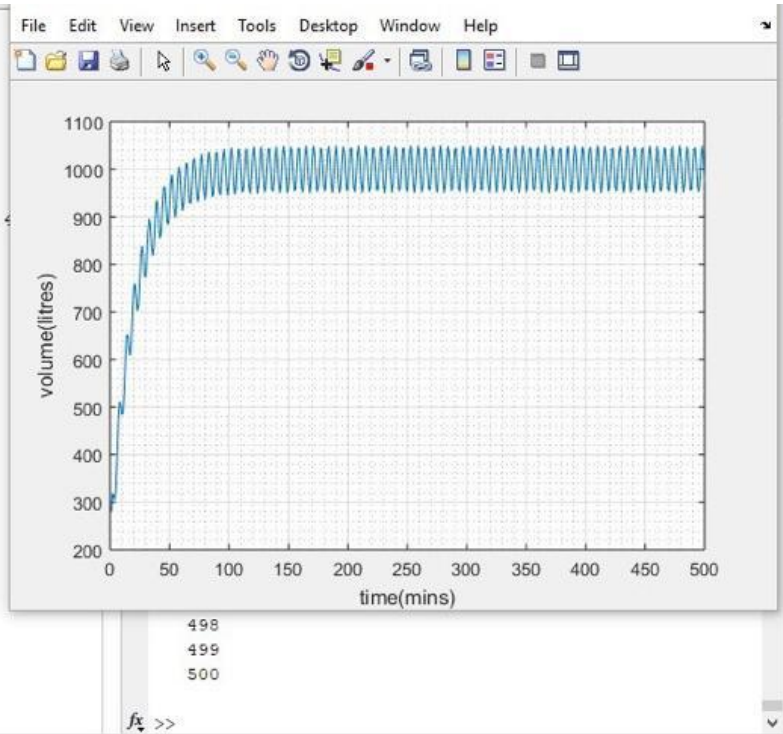
$$y^2 = 4000(t - \cos t) + 80C$$

$$y = \sqrt{4000(t - \cos t) + 80C}$$


```

1 - commandwindow
2 - clear
3 - clc
4 - close all
5 - syms t
6 - values=[]
7 - t=1:1:500
8 - mean=1000-((exp(-0.05*t))*800)
9 - y=1000+(50/1.0025)*sin(t)+(2.5/1.0025)*cos(t)-((exp(-0.05*t))*802.4
10
11 - if rem(t,2) ==0
12 -     values=[values,mean]
13 - else
14 -     values=[values,y]
15 - end
16 - excelvalues=transpose(values)
17 - mins=transpose(t)
18 - plot(t,values)
19 - grid on
20 - grid minor
21 - xlabel('time(mins)')
22 - ylabel('volume(litres)')
23 - xlswrite('odevbesdata.xlsx',{'t(min)'},'veriler','A1')
24 - xlswrite('odevbesdata.xlsx',mins,'veriler','A2')
25 - xlswrite('odevbesdata.xlsx',{'V(Litre)'},'veriler','B1')
26 - xlswrite('odevbesdata.xlsx',excelvalues,'veriler','B2')
27

```



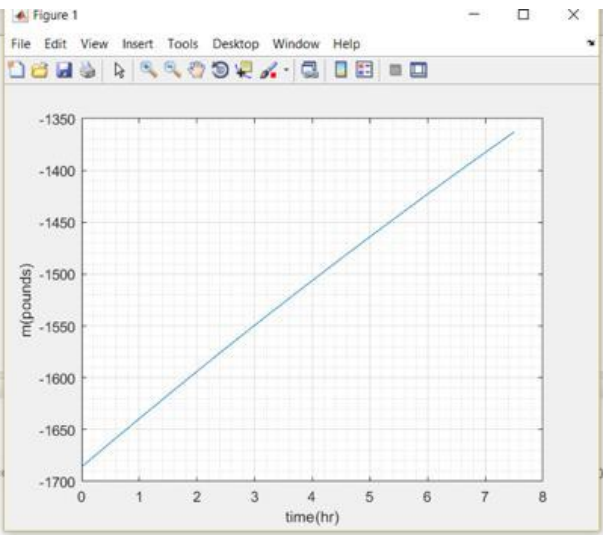
```
okopido.m x +
1 - commandwindow
2 - clear
3 - clc
4 - close all
5 - syms m t
6 - t = [0:0.5:7.5]
7 - m = 204 - 1890*exp(-0.025*(t))
8 - plot(t,m)
9 - xlabel('time(hr)')
10 - ylabel('m(pounds)')
11 - grid on
12 - grid minor
```

Command Window

t =
0 0.5000 1.0000 1.5000 2.0000 2.5000 3.0000

m =
1.0e+03 *
-1.6860 -1.6625 -1.6393 -1.6164 -1.5938 -1.5715 -1.5494 -1.5277 -1.5061 -1.4849 -1.4639 -1.4432 -1.4227 -1.4025 -1.3826 -1.3629

f >>



Activate Windows
Go to Settings to activate Windows.