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Computer Engineering

① Applying the balance law
Accumulation rate of salt = Input rate of salt - Output rate of salt
within a system into the system from the system.

② Denoting the amount of salt present in the tank at any time t as y , its time rate of change is given as

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

Since 50 gal of brine enter the tank per minute and one gallon contains (1.02 sint) lb of salt;

① at $t=1$, $(1.02 \text{ sint}) = (1.02 \text{ sin } 1) \approx 1.02 \text{ lb of salt.}$

\therefore the amount of salt entering in tank is

$$y_{in} = \frac{50 \text{ gal}}{\text{min}} \times \frac{1.02 \text{ lb}}{\text{gal}} = 51 \frac{\text{lb}}{\text{min}}$$

$\frac{30 \text{ gal}}{1200 \text{ gal}} = 0.025 = 2.5\%$ of the content of the tank.

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

Therefore, $\frac{dy}{dt} \frac{\text{lb}}{\text{min}} = 51 \frac{\text{lb}}{\text{min}} - 2.5\% \text{ of } y \frac{\text{lb}}{\text{min}}$.

$$\text{b) } \frac{dy}{dt} = 51 - 0.025y, \quad \frac{dy}{dt} = -0.025y + 51$$

$$\frac{dy}{dt} = -0.025 \left[\begin{array}{c} -0.025y + 51 \\ -0.025y \quad -0.025 \end{array} \right]$$

$$\frac{dy}{dt} = -0.025 (y - 2040)$$

$$\frac{dy}{(y-2040)} = -0.025 dt$$

$$\int \frac{dy}{(y-2040)} = \int -0.025 dt$$

$$\int \frac{dy}{(y-2040)} = -0.025 \int dt$$

$$\ln(y-2040) = -0.025t + c$$

$$y-2040 = e^{-0.025t+c}$$

$$y-2040 = e^{-0.025t} e^c$$

$$\text{but, } e^c = y_0$$

$$y-2040 = e^{-0.025t} y_0$$

$$y = y_0 e^{-0.025t} + 2040$$

Given that when $t=0$ min (initially)

$$y = 150 \text{ lb}$$

$$150 = y_0 e^{-0.025(0)} + 2040$$

$$y_0 = -1890$$

$$y = -1890 e^{-0.025t} + 2040$$

$$y = 2040 - 1890 e^{-0.025t} //$$

```
okopido.m
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

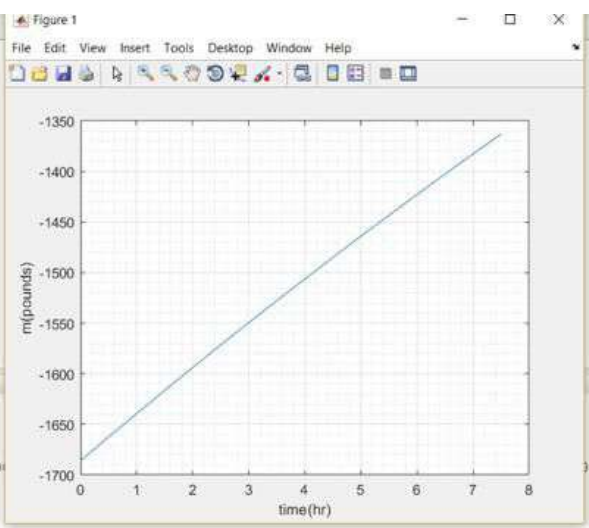
t =

0	0.5000	1.0000	1.5000	2.0000	2.5000	3.0000
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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
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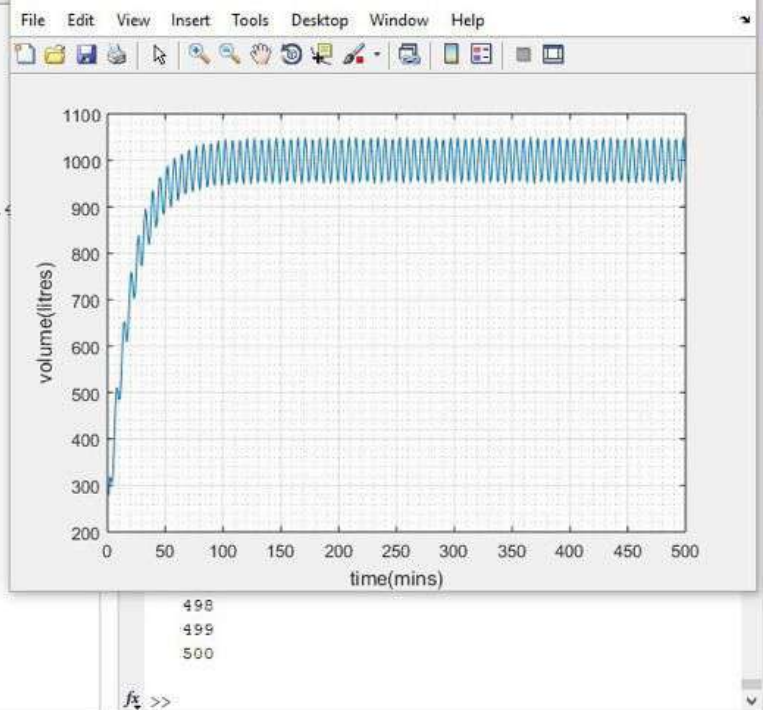
7.0000 7.5000

Activate Windows
Go to Settings to activate Windows.

```

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

```



498
499
500

fx >>

