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COMPUTER ENGINEERING
18/ENG02/054

ENG 282

1. Applying the modelling formula.

Rate of accumulation of salt = Rate of input of salt − Rate of output of salt

$$\frac{dy}{dt} = y_{in} - y_{out}$$ {Time rate of change of the amount of salt in the tank at any time t}

(1+ sint) lb of dissolved salt runs into the tank per minute

At time, t = 1 ; $(1+\sin t) \Rightarrow (1+\sin(1)) \Rightarrow 1.02\,lb$

Hence, $y_{in} = 50\ gal/min \times 1.02\ lb/gal \Rightarrow 51\ lb/min$

The tank contains 1200 gal of water. 30 gal of the solution leaves the tank per minute, hence;

$$\frac{30gal}{1200gal} = 0.025 \simeq 2.5\%$$

2.5% of the salt present in the tank will leave the tank per minute (y_{out})

1a) $$\frac{dy}{dt} = y_{in} - y_{out}$$

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

1b) $$\frac{dy}{dt} = 51 - 0.025y \Rightarrow -0.025y + 51$$

$$\frac{dy}{dt} = -0.025\left[\frac{-0.025y}{-0.025} + \frac{51}{-0.025}\right]$$

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

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

$$\int \frac{dJ}{(J-2040)} = -0.025\int dt, \quad \ln(J-2040) = -0.025t + c;$$

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

$$J - 2040 = e^{-0.025t}e^{c};$$

$$J - 2040 = e^{-0.025t}J_0;$$

$$J - 2040 = J_0 e^{-0.025t};$$

$$J = J_0 e^{-0.025t} + 2040;$$

$J = 150\text{lb}$ (At initial time, t)

$$150 = J_0 e^{-0.025(0)} + 2040$$

$$150 - 2040 = J_0 \times 1;$$

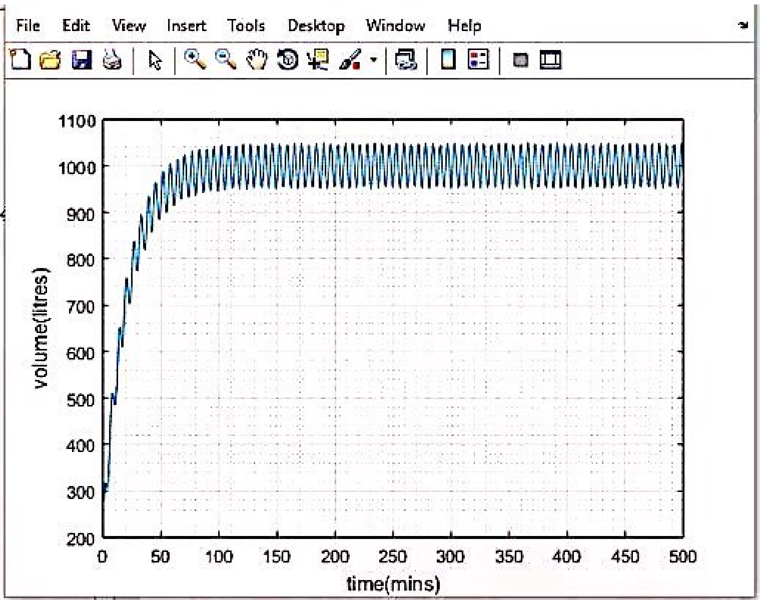
$$J_0 = -1890$$

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

$$J = 2040 - 1890e^{-0.025t}$$

```
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 >>
```

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B2 | f_x 279.963914100068

	A	B
1	t(min)	V(Litre)
2	1	279.9639
3	2	318.1907
4	3	313.8601
5	4	303.601
6	5	327.9009
7	6	393.9593
8	7	469.1423
9	8	511.0566
10	9	506.5922
11	10	484.0395
12	11	487.1398
13	12	534.9268
14	13	604.2824
15	14	651.2431
16	15	651.4694
17	16	622.6706
18	17	608.3676
19	18	637.9229
20	19	699.585
21	20	751.3315
22	21	759.541
23	22	729.9392
24	23	702.3679
25	24	714.1865
26	25	765.9535
27	26	820.9421
28	27	838.9333
29	28	813.2194
30	29	776.7953