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Civil Engineering

D (length of water)

160 m of sand  $\rightarrow M_0$

$M_0 \rightarrow 30 \text{ gal/m}^3$  sand having  $(1+\sin\theta)$

$M_{\text{tot}} \rightarrow 30 \text{ gal/m}^3$

$$\frac{M_0}{M_{\text{tot}}} = M_0 - M_{\text{tot}}$$

$$M_0 = \frac{30 \text{ gal}}{\text{m}^3} \times (1 + \sin\theta) \cdot \frac{M_{\text{tot}}}{M_0} = 5 \cdot (1 + \sin\theta)$$

$$M_{\text{tot}} = \frac{M_0}{2(1 + \sin\theta)} = 0.025 = 2.5 \text{ gal/m}^3$$

$$\frac{dy_1}{dt} = 5(1 + \sin\theta) - 0.025t$$

$$\text{recall } \frac{dy}{dt} + py = Q$$

$$\Rightarrow \frac{dy_1}{dt} + 0.05t = 5(1 + \sin\theta)$$

$$P = 0.05t$$

$$\therefore y_1 = e^{\int P dt} \cdot \int e^{-\int P dt} Q dt = e^{0.05t^2}$$

$$\Rightarrow M \cdot y_1 = 50 \cdot t^2$$

$$\Rightarrow M \cdot e^{0.05t^2} = \int (50 + 50 \sin\theta) - (M + 0.025t) dt$$

$$M \cdot e^{0.05t^2} = \int (50(1 + \sin\theta)) \cdot e^{0.05t^2} dt$$

the RHS

$$\int (50(1 + \sin\theta)) \cdot e^{0.05t^2} dt$$

$$\Rightarrow 50 \int e^{0.05t^2} (50 + 1) dt$$

$$\Rightarrow 5e^{0.05t^2} (50t + 1) dt$$

$$\text{let } u = 0.05t^2, \frac{du}{dt} = 0.1t, dt = \frac{du}{0.1t}$$

$$\Rightarrow 5e^{u/0.1} (\sin(u) + 1) du$$

$$\Rightarrow 40e^{u/0.1} (\sin(u) + 1) du$$

$$\Rightarrow 40e^{u/0.1} (\sin(u) + 1) du$$

$$y_2 = y_1 - f_1' g$$

$$u = t - 2\pi n(400)t + 1, g = e^u$$

$$g' = 400n(400)e^u, g' = e^u$$

$$f_1' = 400n(400), g = e^u$$

$$\Rightarrow \int f_1' g - \int f_1' g$$

$$+ \int (50 + 1) dt, g = e^u$$

$$f_1' = -400n(400), g = e^u$$

$$\Rightarrow e^{u/0.1} \cos(400u) - \int -400e^{u/0.1} \sin(400u) du$$

$$f_1 = -400n(400), g = e^u$$

$$f_1' = -1600 \cos(400u), g = e^u$$

$$\Rightarrow e^{u/0.1} \cos(400u) - (-400e^{u/0.1} \sin(400u)) du$$

$$\Rightarrow e^{u/0.1} \cos(400u) - (-400e^{u/0.1} \sin(400u))$$

$$1600 \int e^{u/0.1} \cos(400u) du$$

$$\Rightarrow \frac{1600e^{u/0.1} \cos(400u) + e^{u/0.1} \sin(400u)}{1600}$$

recall

$$40 \int e^{u/0.1} \cos(400u) du$$

$$\Rightarrow \frac{40e^{u/0.1} \sin(400u) + e^{u/0.1} \cos(400u)}{1600}$$

else

$$e^{u/0.1} \cos(400u) - \int 40e^{u/0.1} \cos(400u) du$$

$$\Rightarrow e^{u/0.1} \cos(400u) - \frac{40(40e^{u/0.1} \sin(400u) + e^{u/0.1} \cos(400u))}{1600}$$

multiply through by 40

$$\Rightarrow 40e^{u/0.1} \cos(400u) - \frac{160(40e^{u/0.1} \sin(400u) + e^{u/0.1} \cos(400u))}{1600}$$

$$\frac{+ e^{u/0.1} \cos(400u)}{1600}$$

recall,  $u = t/40$

$$\Rightarrow 40^{t/40} (amt + 1) - \frac{1600(40^{t/40} \sin t + e^{t/40} \cos t)}{1601}$$

Multiply through by 50

$$\Rightarrow 2000e^{t/40} (amt + 1) - \frac{8000(40e^{t/40} \sin t + e^{t/40} \cos t)}{1601}$$

$$\Rightarrow 2000e^{t/40} (amt + t) - \frac{8000(40e^{t/40} \sin t + e^{t/40} \cos t) + C}{1601}$$

$$\Rightarrow 2000e^{t/40} (amt - 4a\cos t + 160) + C$$

such that  $\frac{1}{1601}$

$$\Rightarrow M.e^{-\frac{0.025t}{1601}} = 2000e^{t/40} (amt - 4a\cos t + 160) + C$$

at  $t = 0$  (initially),  $M = 150$

let  $C = M_0$

$$M_0 = 150 \cdot e^{-\frac{0.025(0)}{1601}} - \frac{2000(e^{0.025(0)}) (40 + 160)}{1601}$$

$$M_0 = -1800.6312^3$$

$$m = \frac{2000e^{t/40} (amt - 4a\cos t + 160) - 1800.6312^3}{e^{t/40}}$$

$$m = \frac{2000e^{t/40} (amt - 4a\cos t + 160) - 1800.6312^2}{1601 \cdot e^{t/40}}$$

```
1 - commandwindow
2 - clear
3 - clc
4 - close all
5 - syms m t
6 - dsolve('Dm+(0.025*m) =50*(1+sin(t))','m(0)=150')
7 - tm=0:0.5:450
8 - sn=subs(s,tm)
9 - plot(tm,sn)
10 - grid on
11 - grid minor
12 - ylabel('Amount of Salt in Tank')
13 - xlabel('Time(t(min))')
```



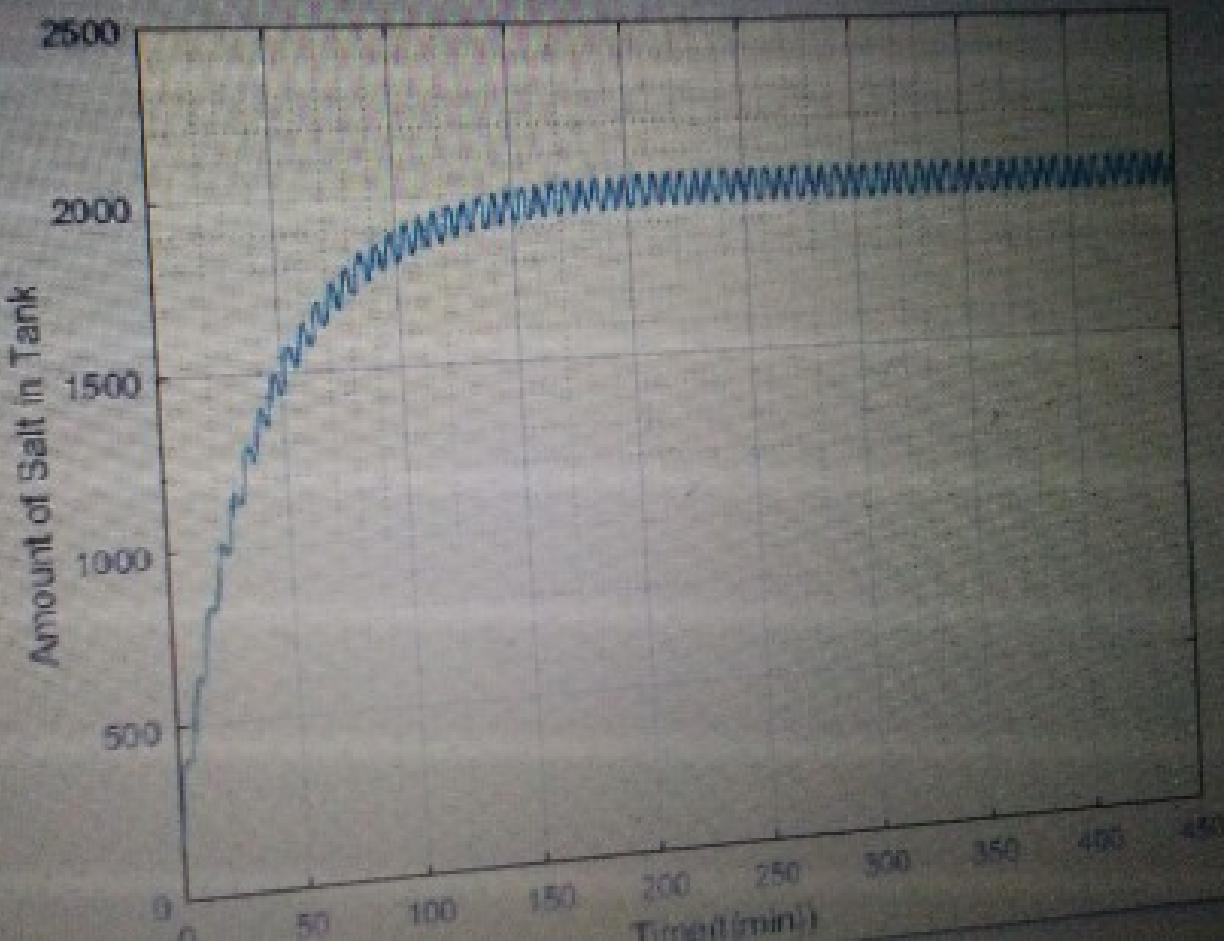
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```
1 - exceltomatlab.m X onlineclass1radioactivity.m X eng282quiz2.m X assignment1.m X assignment2.m
2 - commandwindow
3 - clear
4 -clc
5 - close all
6 - ta=2:2:500
7 - tb=1:2:500
8 - y=(50/0.05)+((50/1.0025)*sin(tb))+(((50*0.05)/(1.0025))*cos(tb))-802.49*exp(-0.05
9 - ym=1000-(800*exp(-0.05*ta))
10 - yg=[y ym]
11 - tg=[ta tb]
12 - plot (tg,yg)
13 - grid on
14 - grid minor
15 - xlabel ('V(litre)')
16 - ylabel ('T(min)')
17 - col_header={'t(min)', 'v(litre)'}
```

