

ATI JOSHUA GAMBO  
18/ENGO1/001  
CHEMICAL ENGINEERING

$$\frac{dm}{dt} = m_{in} - m_{out}$$

$$m_{in} = 50 \times (1 + \sin t)$$

$$m_{out} = 30 \times \left( \frac{m}{120 + 2t} \right)$$

$$\frac{dm}{dt} = 50(1 + \sin t) - \frac{3m}{120 + 2t}$$

$$\frac{dm}{dt} + \frac{3m}{120 + 2t} = 50(1 + \sin t)$$

Using IF

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

$$P = \frac{3}{120 + 2t}, \quad Q = 50(1 + \sin t)$$

$$\int P dx = \frac{3}{2} \ln(120 + 2t)$$

$$I.F. = e^{\int P dx} = e^{\frac{3}{2} \ln(120 + 2t)} = (120 + 2t)^{\frac{3}{2}}$$

$$I.F. = (120 + 2t)^{\frac{3}{2}}$$

$$y \cdot I.F. = \int Q \cdot I.F. dx$$

$$m(120 + 2t)^{\frac{3}{2}} = 50 \int (120 + 2t)^{\frac{3}{2}} (1 + \sin t) dt$$

$$m(120 + 2t)^{\frac{3}{2}} =$$

$$2t^4 + 480t^3 + 43200t^2 + 1728000t -$$

$$105t(120 + 2t)^{\frac{3}{2}} + 6\sin t(120 + 2t)^{\frac{3}{2}} + C$$

$$m = \frac{(2t^4 + 480t^3 + 43200t^2 + 1728000t) - 105t + 6\sin t + C}{(120 + 2t)^{\frac{3}{2}}}$$

$$\text{at } t = 0$$

$$m = 150$$

$$150 = 50 \left( \frac{-1 + C}{(120)^{\frac{3}{2}}} \right)$$

$$150 = -50 + \frac{50C}{120^{\frac{3}{2}}}$$

$$C = 518377$$

$$\therefore m = \frac{(2t^4 + 480t^3 + 43200t^2 + 1728000t)}{(120 + 2t)^{\frac{3}{2}}}$$

$$- 105t + \frac{6\sin t}{(120 + 2t)^{\frac{3}{2}}} + \frac{518377}{(120 + 2t)^{\frac{3}{2}}}$$

Current Folder: eqn, m, s, t, y

```

commandwindow
clear all
clc
syms m(t) t
eqn = diff(m,t)+ 3*m(t)/(120+2*t) == (50*(1+sin(t)))
s = dsolve (eqn,m(0)==150)
y=simplify(s)
t=0:0.5:450
plot(subs(y,t))
grid on
grid minor
xlabel('Time (min)')
ylabel('Amount of Salt(Lbs)')
    
```

eqn(t) =

$$\frac{\partial}{\partial t} m(t) + \frac{3 m(t)}{2 t + 120} = 50 \sin(t) + 50$$

s =

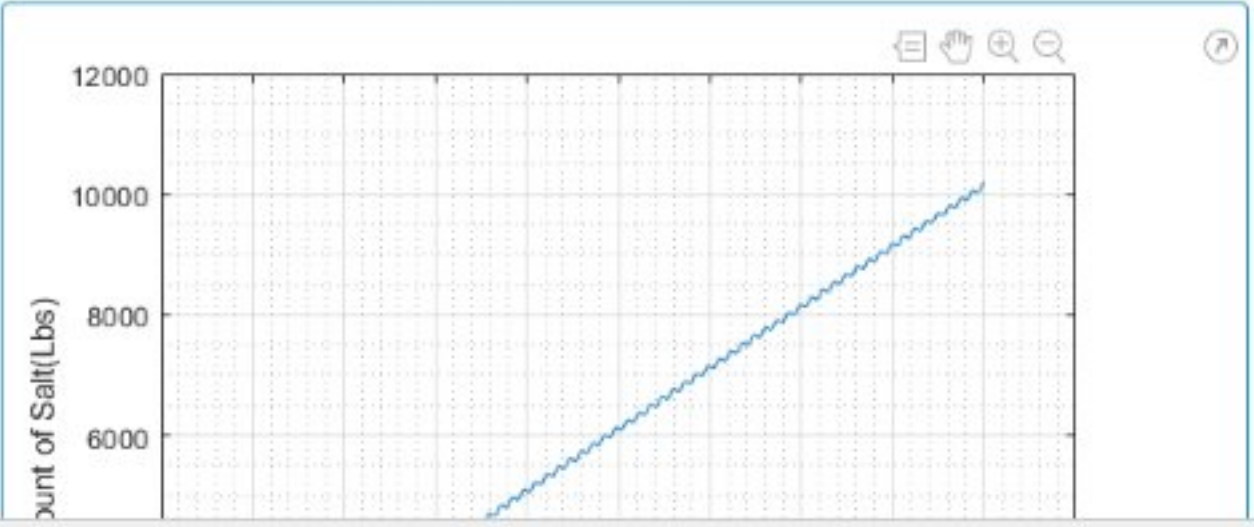
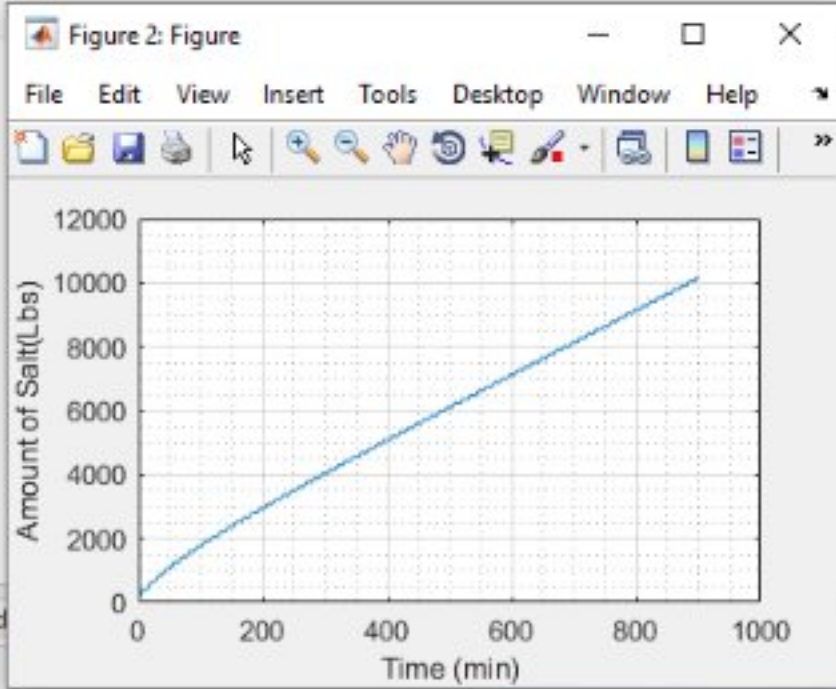
$$\frac{\int_0^t 50 (\sin(x) + 1) (x + 60)^{3/2} dx}{(t + 60)^{3/2}} + \frac{9000 \sqrt{60}}{(t + 60)^{3/2}}$$

y =

$$\frac{9000 \sqrt{60} + \int_0^t 50 (\sin(x) + 1) (x + 60)^{3/2} dx}{(t + 60)^{3/2}}$$

t = 1x981

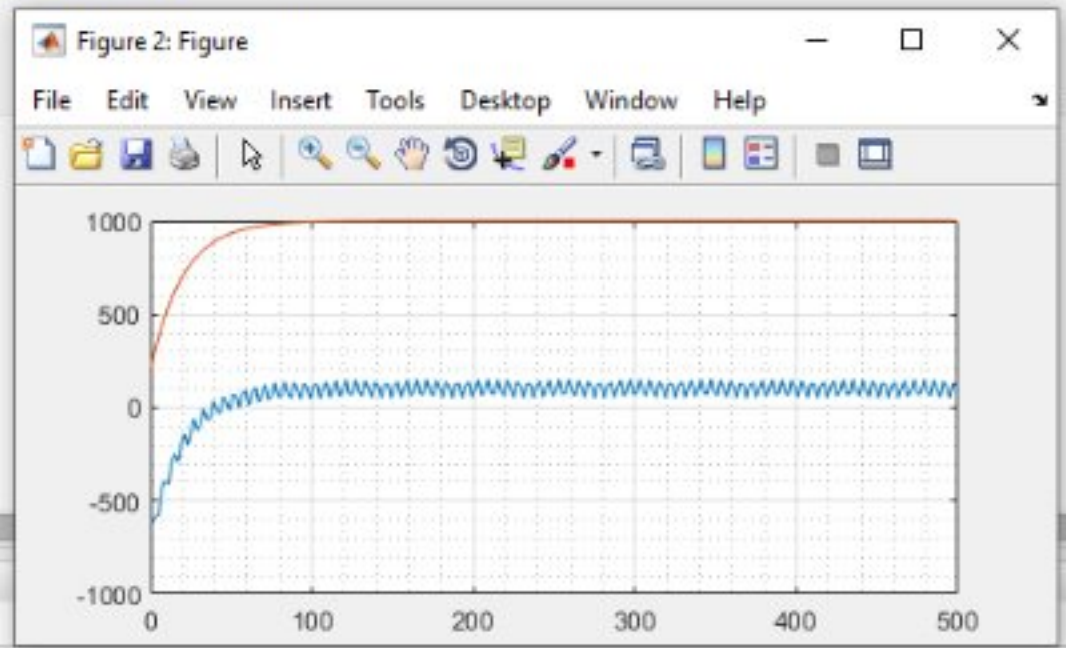
0 0.5000 1.0000 1.5000 2.0000 2.5000 3.0000 3.5000 ...



- W...
- Name
- mdata
- t
- T
- T1
- T2
- y
- Y
- ym
- Ym

```

commandwindow
clear
clc
close all
format short g
syms t
y=(50/0.5)+((50/1.0025)*sin(t))+((50*0.05/1.0025)*cos(t))-(802.49*exp(-0.05*t))
ym=1000-(800*exp(-0.05*t))
T=0:1:500
T1=T(2:2:500)
T2=T(1:2:500)
Y=subs(y,T1)
Ym=subs(ym,T2)
mdata={'t(minutes)', 'V(litres)'; Y, Ym}
plot(T1,Y,T2,Ym)
grid on
grid minor
    
```



$$y = \frac{1000 \cos(t)}{401} - \frac{80249 e^{-\frac{t}{20}}}{100} + \frac{20000 \sin(t)}{401} + 100$$

$$ym = 1000 - 800 e^{-\frac{t}{20}}$$

T = 1x501

0	1	2	3	4	5	6	7	8	9	...
---	---	---	---	---	---	---	---	---	---	-----

T1 = 1x250

1	3	5	7	9	11	13	15	17	19	...
---	---	---	---	---	----	----	----	----	----	-----

T2 = 1x250

0	2	4	6	8	10	12	14	16	18	...
---	---	---	---	---	----	----	----	----	----	-----

$$Y = \left( \frac{1000 \cos(1)}{401} - \frac{80249 e^{-\frac{1}{20}}}{100} + \frac{20000 \sin(1)}{401} + 100 \quad \frac{1000 \cos(3)}{401} - \frac{80249 e^{-\frac{3}{20}}}{100} \right)$$

$$Ym = \left( 200 \quad 1000 - 800 e^{-\frac{1}{10}} \quad 1000 - 800 e^{-\frac{3}{5}} \quad 1000 - 800 e^{-\frac{3}{10}} \quad 1000 - 800 e^{-\frac{1}{5}} \right)$$

mdata = 2x2 cell array

{'t(minutes)'} {1x250 sym }	{'V(litres)'} {1x250 sym }
--------------------------------	-------------------------------