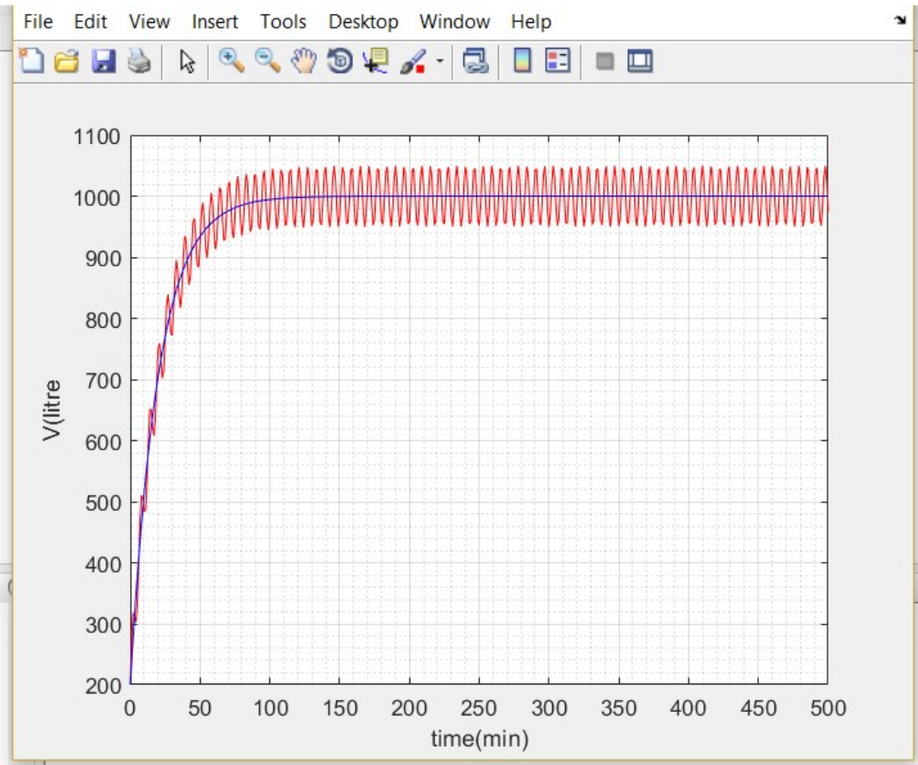
kene2.m

```
commandwindow
clear
clc
close all
syms t y yn tn
t= [0:1:500]
tn= [0:2:500]
y= 50/0.05 +50/1.0025*sin(t) + 50*(0.05)/1.0025*cos(t) - 802.49*exp(-0.05*(t))
yn= 1000 - 800*exp(-0.05*(tn))
plot(t,y,'r', tn,yn,'b')
xlabel('time(min)')
ylabel('V(litre')
grid on
grid minor
```



Command Window

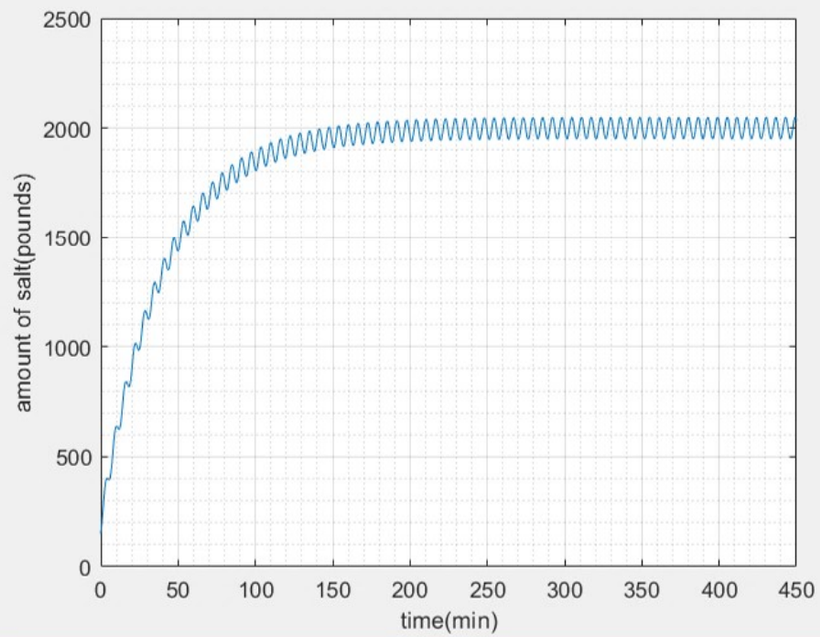
```
    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000

  Columns 233 through 240

    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000

  Columns 241 through 248

    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000

  Columns 249 through 251

    1.0000    1.0000    1.0000

fx >>
```

kene.m

```
commandwindow
clear
clc
close all
syms m(t)
saltin= (50+50*sin(t))
saltout= (0.025)*m
saltmass= dsolve(diff(m,t) == saltin - saltout, m(0) == 150)
% 7.5 hours = 450minutes
t = [0:0.5:450]
mass= subs(saltmass, t)
plot(t,mass)
grid on
grid minor
xlabel('time(min)')
ylabel('amount of salt(pounds)')
```

Figure 1

File Edit View Insert Tools Desktop Window Help



Command Window

```
  Columns 883 through 900

  441.0000  441.5000  442.0000  442.5000  443.0000  443.5000  444.

  Column 901

  450.0000


mass =

[ 150, 2000 - (2000*1601^(1/2)*cos(atan(1/40) + 1/2))/1601 - (2881
```

```
5000  448.0000  448.5000  449.0000  449.5000

1 - (2881850*exp(-1/40))/1601, 2000- (2000*1601^(1
```

>>

NNACHETTA Kenechukwu 18/ENG03/040 Civil Eng

Applying the balance law.

$$\left\{\begin{matrix}\text{Accumulation rate}\\ \text{of salt within a system}\end{matrix}\right\} = \left\{\begin{matrix}\text{Input rate of salt}\\ \text{into the system}\end{matrix}\right\} - \left\{\begin{matrix}\text{Output rate}\\ \text{of salt}\\ \text{within the system}\end{matrix}\right\}$$

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

$$m_{in} = 50\ \frac{gal}{min} \times (1+\sin t)\ \frac{lb}{gal} = 50(1+\sin t)\ \frac{lb}{min}$$

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

$$= 2.5\%\ of\ m$$

$$\frac{dm}{dt}\ \frac{lb}{min} = 50(1+\sin t)\ \frac{lb}{min} - 2.5\%\ of\ m\ \frac{lb}{min}$$

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

$$= -0.025m + 50(1+\sin t)$$

$$= -0.025\left(\frac{-0.025m}{-0.025} + \frac{50(1+\sin t)}{-0.025}\right)$$

$$\frac{dm}{dt} = -0.025\,(m - 2000(1+\sin t))$$

$$\frac{dm}{[m - 2000(1+\sin t)]} = -0.025\,dt$$

$$\int \frac{dm}{[m - 2000(1+\sin t)]} = \int -0.025\,dt$$

$$\int \frac{dm}{[m - 2000(1+\sin t)]} = -0.025 \int dt$$

$$\ln [m - 2000(1+\sin t)] = -0.025t + C$$

$$m - 2000(1+\sin t) = e^{-0.025t + C}$$
$$m - 2000(1+\sin t) = e^{-0.025t} e^{C}$$
$$m - 2000(1+\sin t) = e^{-0.025t} m_0$$
$$m - 2000(1+\sin t) = m_0 e^{-0.025t}$$
$$m = m_0 e^{-0.025t} + 2000(1+\sin t)$$

Given that when $t = 0$ min (initially), $m = 150$ lb

$$150 = m_0 e^{-0.025(0)} + 2000(1+\sin(0))$$
$$150 = m_0 + 2000$$
$$-m_0 = 2000 - 150$$
$$m_0 = -1850$$

So,

$$m = -1850 e^{-0.025t} + 2000(1+\sin t)$$
$$m = 2000(1+\sin t) - 1850 e^{-0.025t}$$