

```
1 commandwindow
2 clearvars
3 clc
4 close all
5
6 syms m(t) t
7 eqn = diff(m,t) == (50+50*sin(t))-0.025*
8 cond = m(0)==150;
9 mSol(t) = dsolve(eqn,m(0)==150)
10 t = 0:0.5:450;
11 plot(t,mSol(t))
12 xlabel('Time(hr)')
13 ylabel('Amount of substance(lb)')
14 grid on
15 grid minor
```

Question 1

If 1 gallon contains $(1 + \sin t)$ lb of salt at $t = 1$
and also 50 gallons of brine enters the tank per minute

$$(1 + \sin t) = (1 + \sin 1) = 1.01 \text{ lb} = 1.02 \text{ lb}$$

\therefore also the amount of salt entering the tank is;

$$50 \text{ gal/min} \times 1.02 \text{ lb/gal} = 51 \text{ lb/min}$$

And if also the tanks contains 1200 gallons of water with
dissolved salt while 30 gallons of the solution flows out of the
tank/min

$$\therefore \text{ we have that, } \frac{30 \text{ gal}}{1200 \text{ gal}} = 0.025 = 0.025 \times 100\% = 2.5\%$$

If 2.5% of the salt is present then
 $y_{\text{out}} = 2.5\% \text{ of } y$

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

$$ii) \frac{dn}{dt} = 51 \text{ lb/min} - 0.025y$$

$$\frac{dn}{dt} = -0.025y + 51$$

$$\frac{dn}{dt} = -0.025 \left(\frac{-0.025y + 51}{-0.025} + \frac{51}{0.025} \right)$$

$$\frac{dn}{dt} = -0.025 \left(\frac{-0.025y}{-0.025} + \frac{51}{0.025} \right)$$

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

Using

Using the method of separating the variables
Cross multiply

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

$$\frac{dn}{y-2040} = -0.025 dt$$

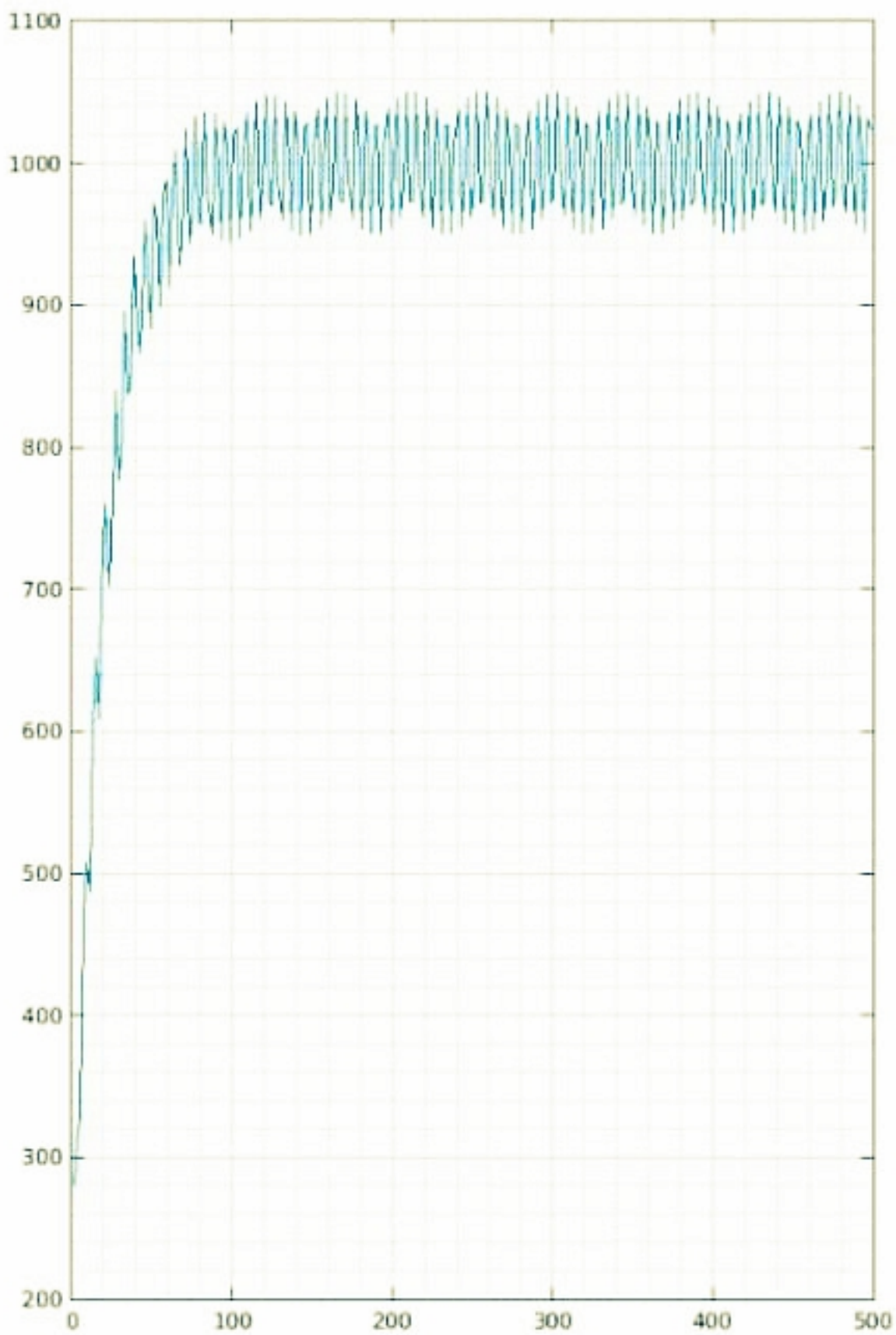
$$\int \frac{dn}{(y-2040)} = \int -0.025 dt$$

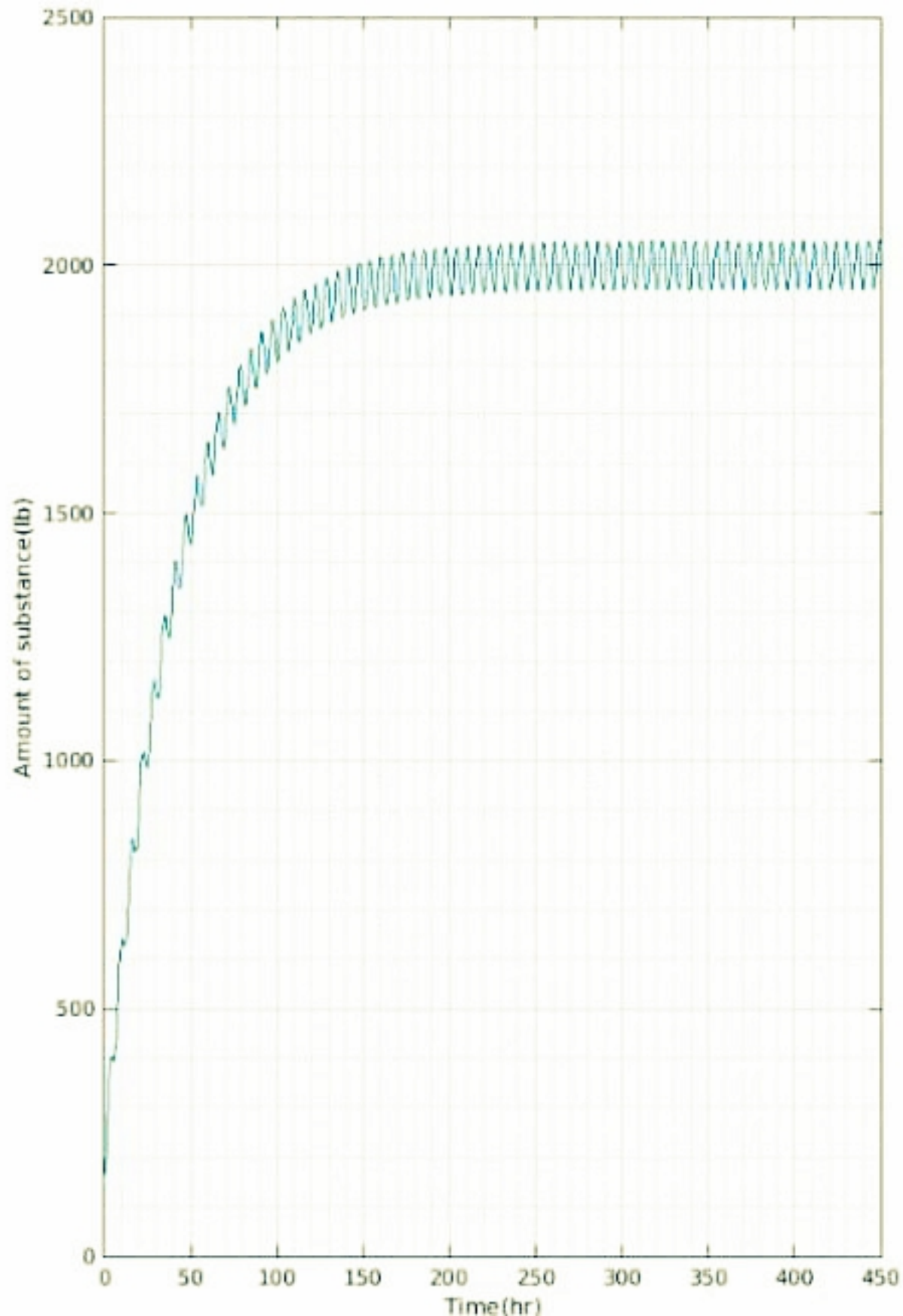
$$\int \frac{1}{(y-2040)} dn = -0.025 \int dt = -0.025t + C$$

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

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

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





```
1 commandwindow
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5
6 syms y1 y2 t1 t2
7 y(t1)=(1000)+(50/1.0025)*sin(t1)+((50*0.05)/1.0025)*cos(t1)-802.49*exp(-0.05*t1)
8 y(t2) = 1000-800*exp(-0.05*t2)
9 t1 = 1:2:499
10 t2 = 0:2:500
11 xlabel('Time values(min)')
12 ylabel('Litre')
13 plot(t1,y(t1))
14 hold on
15 plot(t2,y(t2))
```