① $\frac{dy}{dt} = y_{in} - y_{out}$

$\frac{dy}{dt} = 50(1+\sin t) - 2.5\% y$

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

∴ variable seperation

$\frac{dy}{dt} + 0.025y = 50(1+\sin t)$

mutiply both side by dt

$1 + 0.025y\,dy = 50(1+\sin t)\,dt$

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

$\frac{dy}{dt} + 0.025y = 50(1+\sin t)$

utilizing linear equation method :-

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

∴ $P = 0.025$, $Q = 50(1+\sin t)$

∴ $\int P.dt = 0.025t$

I.F $= e^{\int P.dt}$

$= e^{0.025t}$

$$y e^{0.025t} = 50 \int e^{0.025t} + e^{0.025t} \sin t \cdot dt$$

$$y e^{0.025t} = 50 \int e^{0.025t} \int e^{0.025t} \sin t \cdot dt$$

$$y e^{0.025t} = 50 \cdot \frac{e^{0.025t}}{0.025t} + \int e^{0.025t} \sin t \cdot dt$$

Intergration by part

$$\int e^{0.025t} \sin t \cdot dt \qquad \int u dv = vu - \int v du$$

$$u = e^{0.025t} \qquad dv = \sin t$$

$$dv = 0.025 \cdot e^{0.025t}$$

$$v = -\cos t$$

$$\therefore \int e^{0.025t} \sin t = e^{0.025t} \cdot -\cos t - \int -\cos t \cdot 0.025t$$

$$\int e^{0.025t} \sin t = e^{0.025t} \cos t \cdot \int -\cos t \cdot 0.025 e^{0.025t} + C$$

Intergating parts

$$\int u dv = uv - \int v du$$

$$u = e^{0.025t}, \quad dv = \cos t$$

$$du = 0.025 e^{0.025t} \qquad V = \sin t$$

$$0.025t$$

$q = -e^{0.025t} \cos t + 0.025\, e^{0.025t} - 6.25^{-4} q$

$q + 6.25^{-4} q = -e^{0.025t} \cos t + 0.025 e^{0.025t}$

$q + 0.000625 q = -e^{0.025t} \cos t + 0.025\, e^{0.025t}$

$1.000625 q = -e^{0.025t} \cos t + 0.025 e^{0.025t}$

$1.000625 q = e^{0.025t} (\cos t - 0.025)$

$$q = \frac{-e^{0.025t}}{1.000625} (\cos t - 0.025) + C$$

$$\int e^{0.025t} \sin t = \frac{-e^{0.025t}}{1.000625} (\cos t - 0.025) + C$$

Since $\int e^{0.025t} \sin t = \frac{-e^{0.025t}}{1.000625} (\cos t - 0.025) + C$

$$\therefore y e^{0.025t} = 50 \left[\frac{e^{0.025t}}{0.025} - \frac{e^{0.025t}}{1.000625} (\cos t - 0.025) \right]$$

$$y e^{0.025t} = 2000 e^{0.025t} - 50 \cdot \frac{e^{0.025t}}{1.000625} (\cos t - 0.025) + 50$$

Divide through by $e^{0.025t}$

when $y = 150$

$t = 0$

$$150 = 2000 - \frac{50}{1.000625}(1-0) + \frac{50c}{1}$$

$$150 = 2000 - 49968(1) + 50c$$

$$150 = 1950.032 + 50c$$

$$\frac{-1800.032}{50} = \frac{50c}{50}$$

$$c = -36.00064$$

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

$$\frac{dy}{dt} = 50(1 + \sin t) - 25\% \text{ of } y$$

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

Seperate the variable

$$\frac{dy}{dt} + 0.025y = 50(1 + \sin t)$$

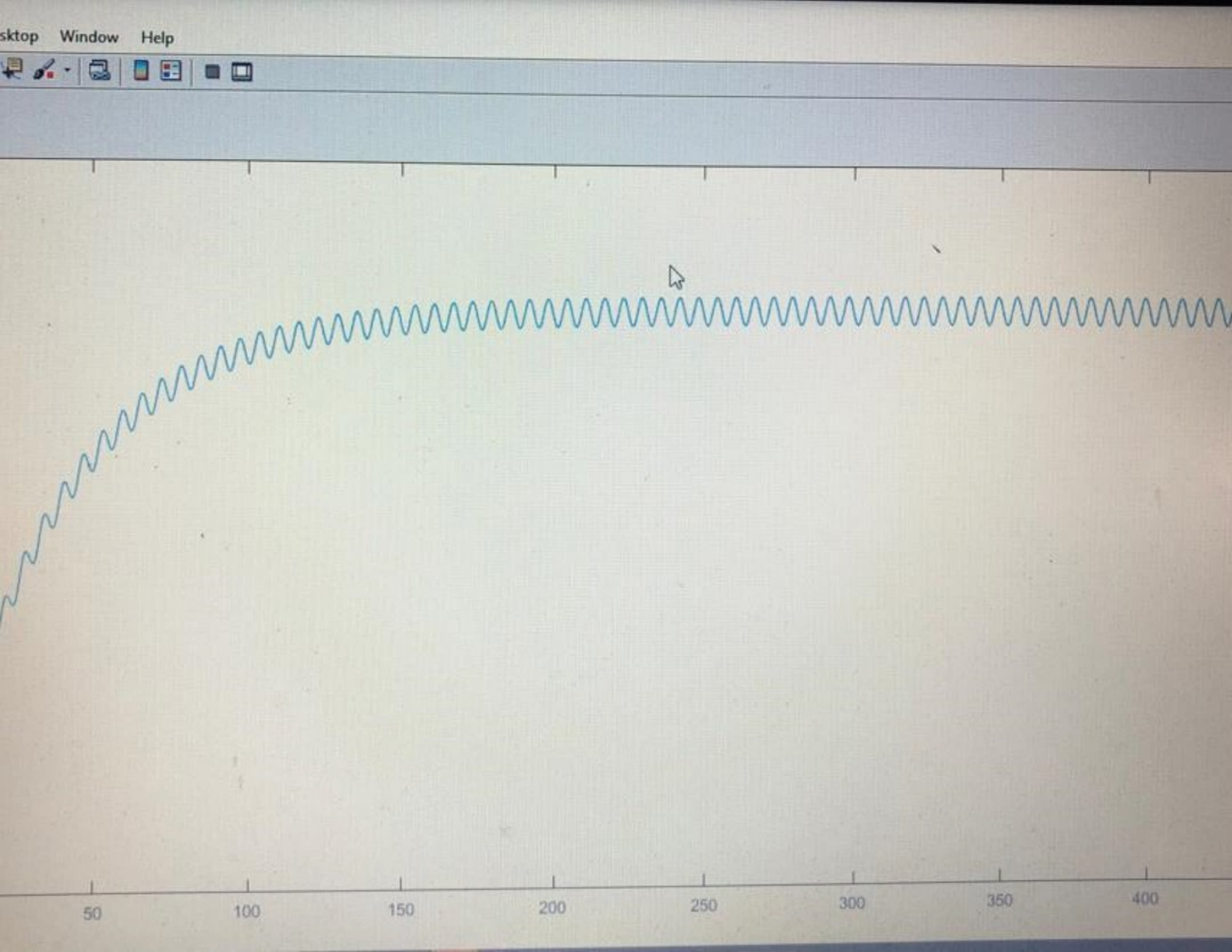
multiply both side by dt

$$0.025y\,dy = 50(1 + \sin t)\,dt$$

$$\frac{0.025y^2}{2} = \int [50 + 50\sin t]\,dt$$

$$y^2 = 4000\,(t - \cos t) + 80c$$

$$y = \sqrt{4000(t - \cos t) + 80c}$$


sktop Window Help
50
100
150
200
250
300
350
400

```
1 -  commandwindow
2 -  clear
3 -  clc
4 -  close all
5 -  syms m t
6 -  ans=dsolve('Dm+0.025*m=50+50*sin(t)','m(0)=150')
7 -  t=0:0.5:450
8 -  tn=subs(ans,t)
9 -  plot(t,tn)
```

Command Window

New to MATLAB? See resources for Getting Started.

```
   445.5000   446.0000   446.5000   447.0000   447.5000   448.0000   448.5000   4


  tn =

  [ 150, 2000 - (2000*1601^(1/2)*cos(atan(1/40) + 1/2))/1601 - (2881850*exp(
fx >>
```