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1a) the given equation

$$\frac{dm}{dt} = \frac{m}{40} + 50(1 + \sin ct)$$

We can rewrite as

$$\frac{dm}{dt} - \frac{m}{40} = 50(1 + \sin ct)$$

Using IF: $IF = e^{-\int P dt}$

$$\int P dt = \int 1/40 = t/40 \therefore e^{\int P dt} = e^{t/40}$$

recall

$$If = \int Q If$$

$$m \cdot e^{t/40} = \int (50(1 + \sin ct)) \cdot e^{t/40}$$

$$m \cdot e^{t/40} = 50 \int (1 + \sin ct) \cdot e^{t/40}$$

$$\therefore m \cdot e^{t/40} = 50 \left(\int e^{t/40} dt + \int e^{t/40} \sin ct dt \right)$$

$$m \cdot e^{t/40} = 50 \left(40 e^{t/40} + \int e^{t/40} \sin ct dt \right) \quad \text{--- (1)}$$

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

$$u = \sin ct, dv = e^{t/40}$$

$$du = \cos ct, v = 40 e^{t/40}$$

$$\therefore \int e^{t/40} \sin ct dt = 40 e^{t/40} \sin ct - \int 40 e^{t/40} \cos ct dt \quad \text{--- (2)}$$

Integration by parts.

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

$$u = \cos ct, dv = 40 e^{t/40}, du = -\sin ct, v = 1600 e^{t/40}$$

$$\int 40 e^{t/40} \cos ct dt = 1600 e^{t/40} \cos ct - \int -1600 e^{t/40} \sin ct dt$$

$$= 1600 e^{t/40} \cos ct + 1600 \int e^{t/40} \sin ct dt \quad \text{--- (3)}$$

By substituting (3) in (1)

$$\int e^{t/40} \sin ct dt = 40 e^{t/40} \sin ct - (1600 e^{t/40} \cos ct + 1600 \int e^{t/40} \sin ct dt)$$

$$= 40 e^{t/40} \sin ct - 1600 e^{t/40} \cos ct - 1600 \int e^{t/40} \sin ct dt$$

By simplifying.

$$\int e^{t/40} \sin ct dt + 1600 \int e^{t/40} \sin ct dt = 40 e^{t/40} \sin ct - 1600 e^{t/40} \cos ct$$

$$1600 \int e^{t/40} \sin ct dt = 40 e^{t/40} \sin ct - 1600 e^{t/40} \cos ct$$

$$\int e^{t/40} \sin ct dt = \frac{40 e^{t/40} \sin ct - 1600 e^{t/40} \cos ct}{1600}$$

1600

substituting ③ in ①

$$m \cdot e^{t/40} = \frac{50(40e^{t/40} + 40e^{t/40} \sin(t) - 1600e^{t/40} \cos(t))}{1601}$$

$$m \cdot e^{t/40} = \frac{2000e^{t/40} + 2000e^{t/40} \sin(t) - 80000e^{t/40} \cos(t) + C}{1601}$$

dividing by $e^{t/40}$

$$m = \frac{200 + 2000 \sin(t) - 80000 \cos(t)}{1601} + e^{-t/40}$$

$$C = m_0, \text{ when } t=0 \quad m=150$$

$$150 = \frac{200 + 2000 \sin(0) + 80000 \cos(0) + m_0 e^{-0/40}}{1601}$$

$$150 = \frac{200 + - \left(\frac{80000 + m_0}{1601} \right)}{1601}$$

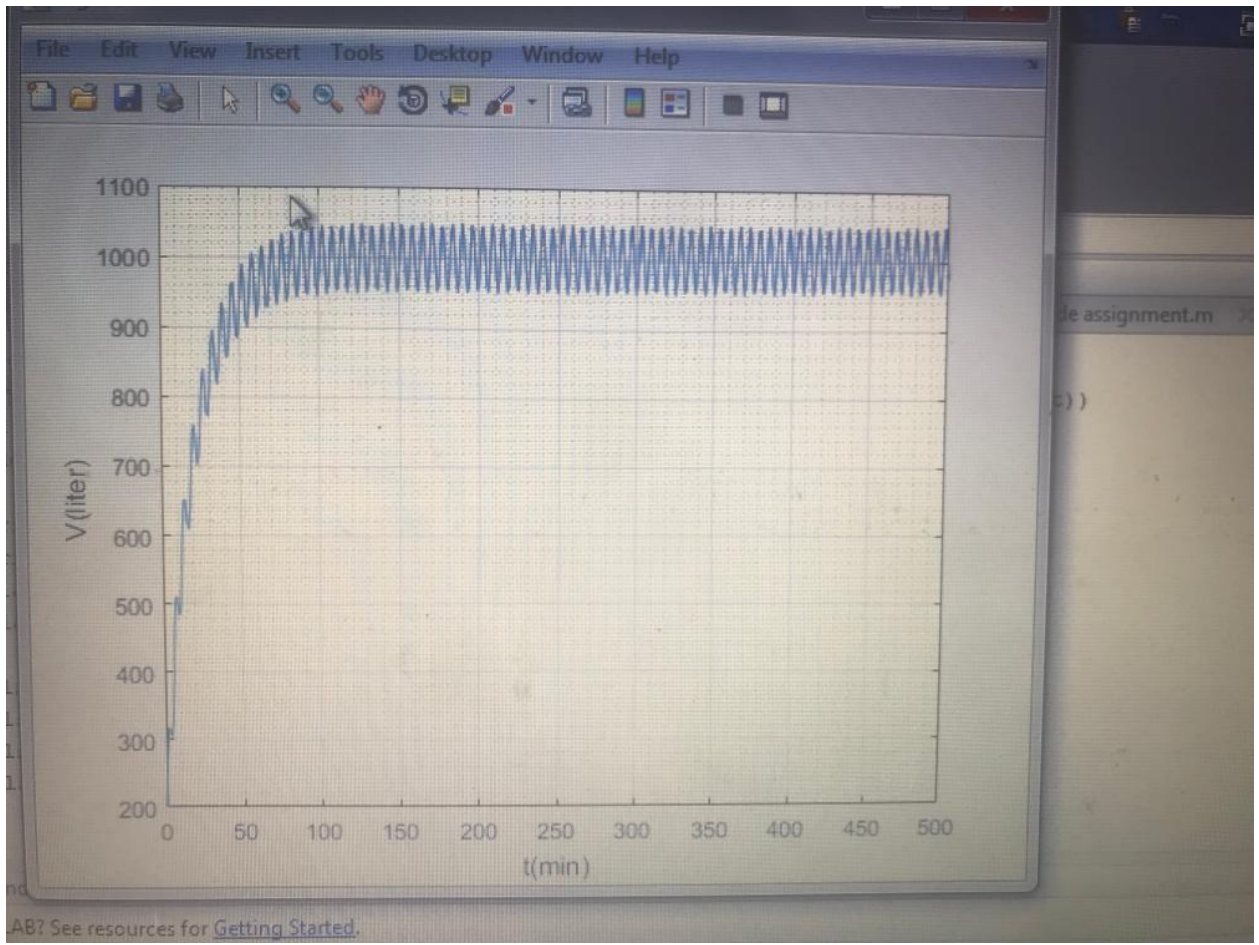
$$150 = 1950 + m_0$$

$$m_0 = 150 - 1950$$

$$m_0 = -1800$$

∴ Equation for m

$$= \frac{2000 + 2000 \sin(t) - 80000 \cos(t) + 1800 e^{-t/40}}{1601}$$



AB? See resources for [Getting Started](#).

symfun

Insert Command Window Breakpoints Run Run and Advance Run Section Advance Run and Time

EDIT BREAKPOINTS RUN

Editor - C:\Users\olotu\Untitled6.m

olamideone.m x olala.m x Assignment 6.m x Untitled2.m x Untitled3* x Untitled5 x Olamide assignment.m x Untitled6.m

```

1 - commandwindow
2 - clear all
3 - clc
4 - close all
5 - syms t
6 - t=0:1:500
7 - if t/2==0
8 -     y=1000-(800*exp(-0.05*t))
9 - else
10 -     y=(50/0.05)+(50*sin(t)/1.0025)+(50*0.05*cos(t)/1.0025)-(802.49*exp(-0.05*t))
11 - end
12 - V=double(y)
13 -     plot(t,V)
14 -     grid on
15 -     grid minor
16 -     xlabel('t(min)')

```

Command Window

New to MATLAB? See resources for [Getting Started](#).

1.0288	0.9812	0.9509	0.9658	1.0121	1.0473	1.0390	0.9949	0.9554	0.9570	0.9570
Columns 493 through 501										
1.0462	1.0089	0.9635	0.9516	0.9842	1.0313	1.0496	1.0223	0.9745		

