

OLOGBOSERE ANTHONIA  
MECHATRONICS

18/ENG051049

ENG 282

ASSIGNMENT V

$$1. \frac{dy}{dt} = y_{in} - y_{out} \quad y = m$$

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

$$m_{out} = \frac{30 \text{ gal}}{1200 \text{ gal}} = 0.025 \text{ m}$$

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

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

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

Using Integrating Factor Method

$$P = 0.025 \quad \int P dt = 0.025t$$

$$\therefore \text{IF} = e^{0.025t}$$

$$\text{But } m(\text{IF}) = \int Q(\text{IF}) dt$$

$$m(e^{0.025t}) = \int 50(1 + \sin t)(e^{0.025t}) dt$$

Using integration by parts

$$\text{where } u = 1 + \sin t \quad dv = e^{0.025t}$$

$$du = \cos t$$

$$v = \frac{e^{0.025t}}{0.025}$$

$$\therefore m(e^{0.025t}) = 50 \left[ \frac{(1 + \sin t)(e^{0.025t})}{0.025} - \int \frac{e^{0.025t}}{0.025} \cdot \cos t dt \right]$$

用微

$$m(e^{0.025t}) = 50 \left[ \frac{(1+\sin t)(e^{0.025t})}{0.025} - \frac{1}{0.025} \int e^{0.025t} \cdot \cos t \cdot dt \right]$$

$$m(e^{0.025t}) = 2000 \left( (1+\sin t)(e^{0.025t}) - \int e^{0.025t} \cdot \cos t \cdot dt \right)$$

Applying Integration by Parts

$$u = \cos t$$

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

$$du = -\sin t$$

$$v = e^{0.025t} / 0.025$$

$$m(e^{0.025t}) = 2000 \left[ (1+\sin t)(e^{0.025t}) - \left[ \frac{\cos t (e^{0.025t})}{0.025} - \int \frac{e^{0.025t}}{0.025} (-\sin t) dt \right] \right]$$

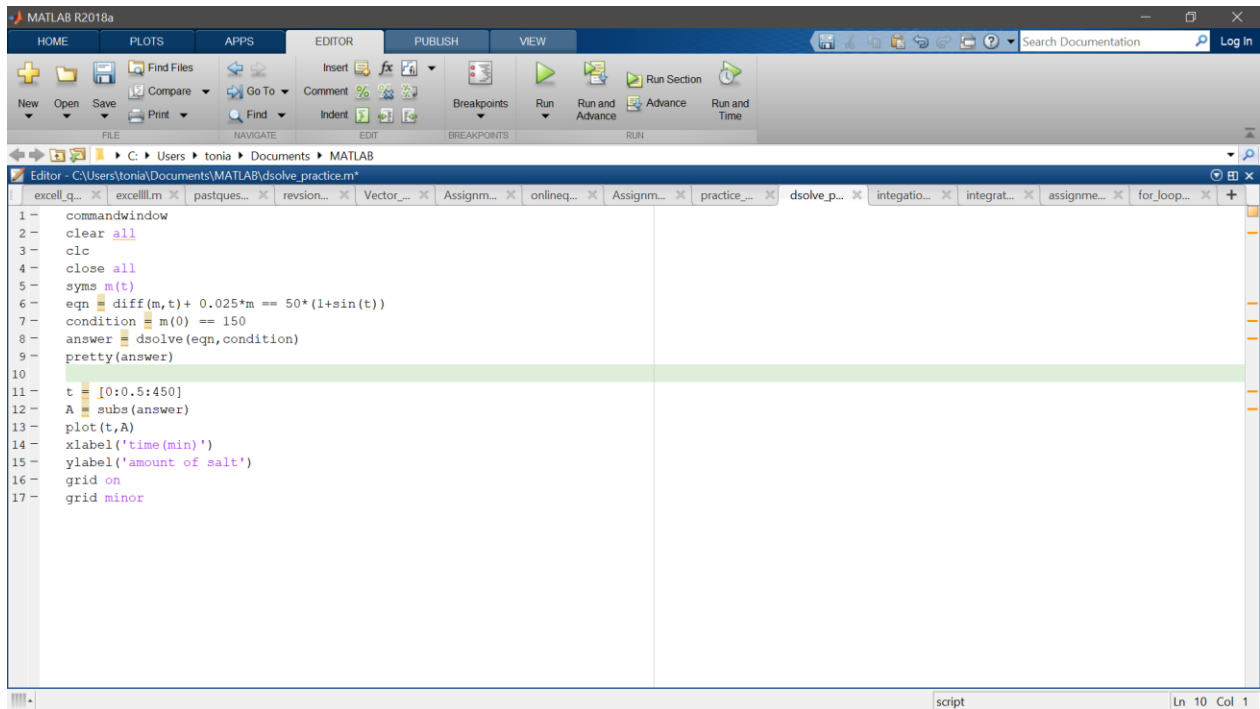
$$m(e^{0.025t}) = 2000 \left[ (1+\sin t)(e^{0.025t}) - \frac{(\cos t)(e^{0.025t})}{0.025} - \frac{1}{0.025} \int e^{0.025t} \cdot \sin t \cdot dt \right]$$

$$m(e^{0.025t}) = 2000(1+\sin t)(e^{0.025t}) - 8000(\cos t)(e^{0.025t}) - 800 \left( \int e^{0.025t} \cdot dt \right)$$

Solving using matlab mfile and solve function

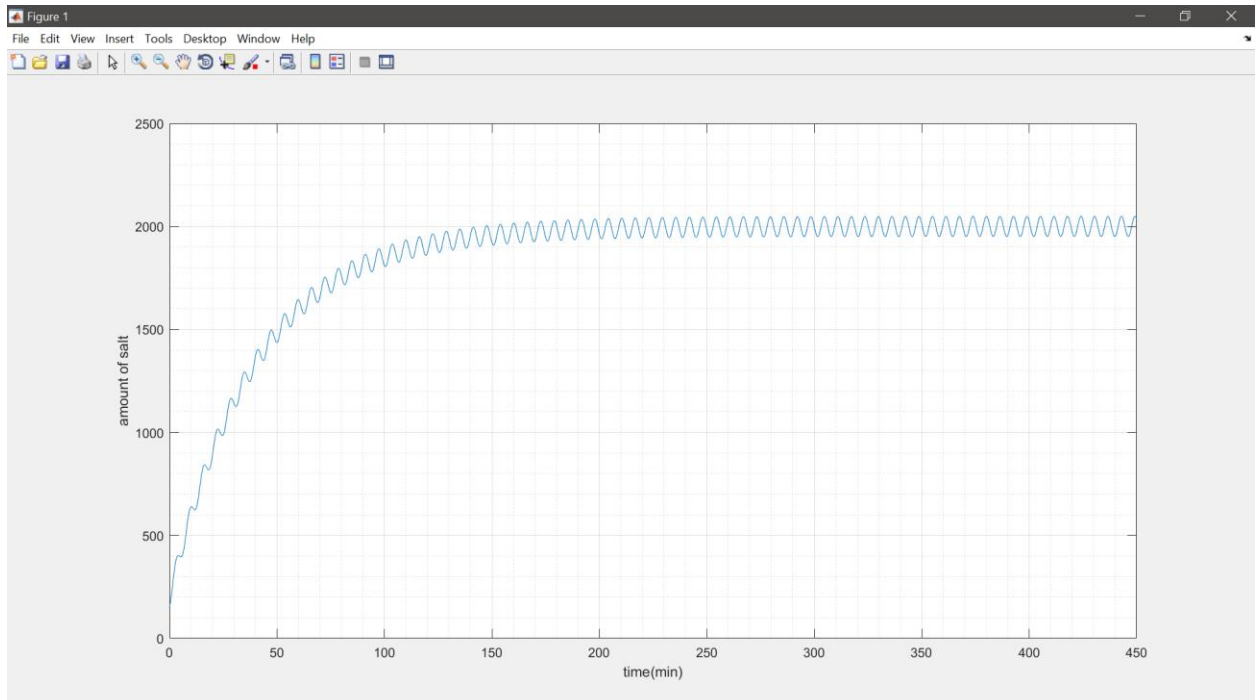
$$m = 2000 - \frac{(2000\sqrt{1601})}{1601} \cos(t + \arctan(\sqrt{40})) - \frac{2881850 \cdot e^{(t/40)}}{1601}$$

## NUMBER 1b

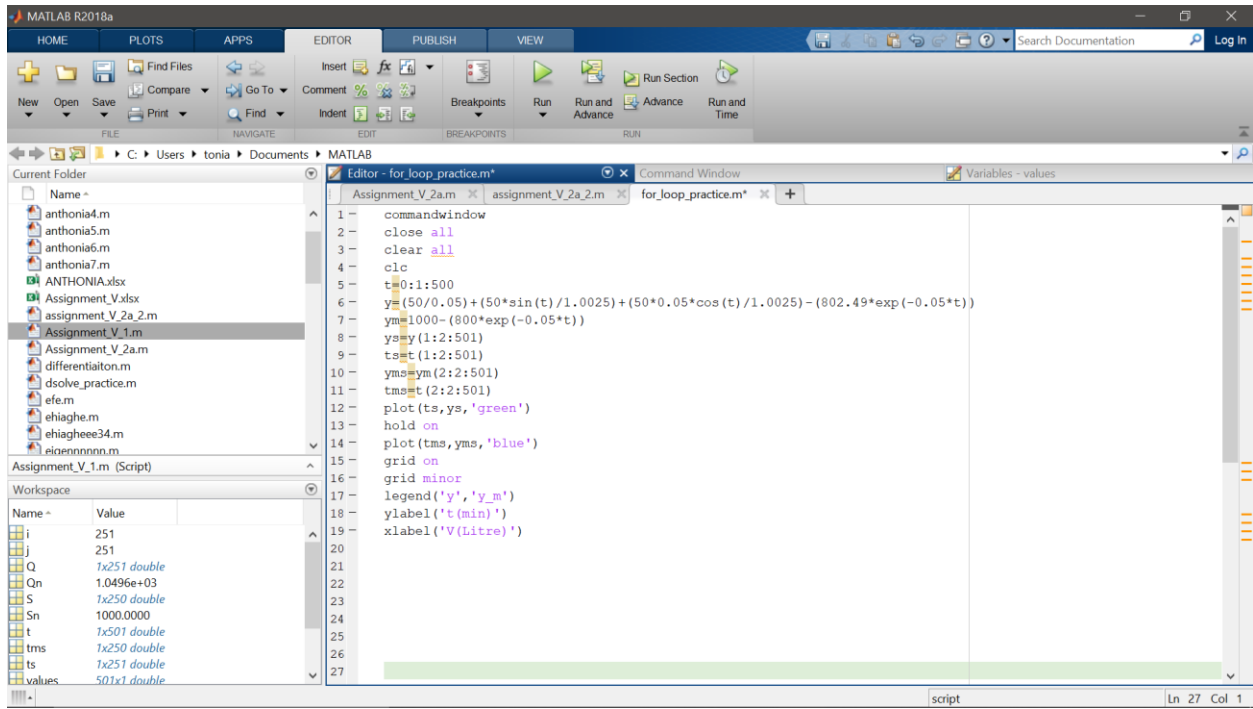


```
1- commandwindow
2- clear all
3- clc
4- close all
5- syms m(t)
6- eqn = diff(m,t)+ 0.025*m == 50*(1+sin(t))
7- condition = m(0) == 150
8- answer = dsolve(eqn,condition)
9- pretty(answer)
10-
11- t = [0:0.5:450]
12- A = subs(answer)
13- plot(t,A)
14- xlabel('time(min)')
15- ylabel('amount of salt')
16- grid on
17- grid minor
```

## Number 1b, dynamic response



## Number 2a



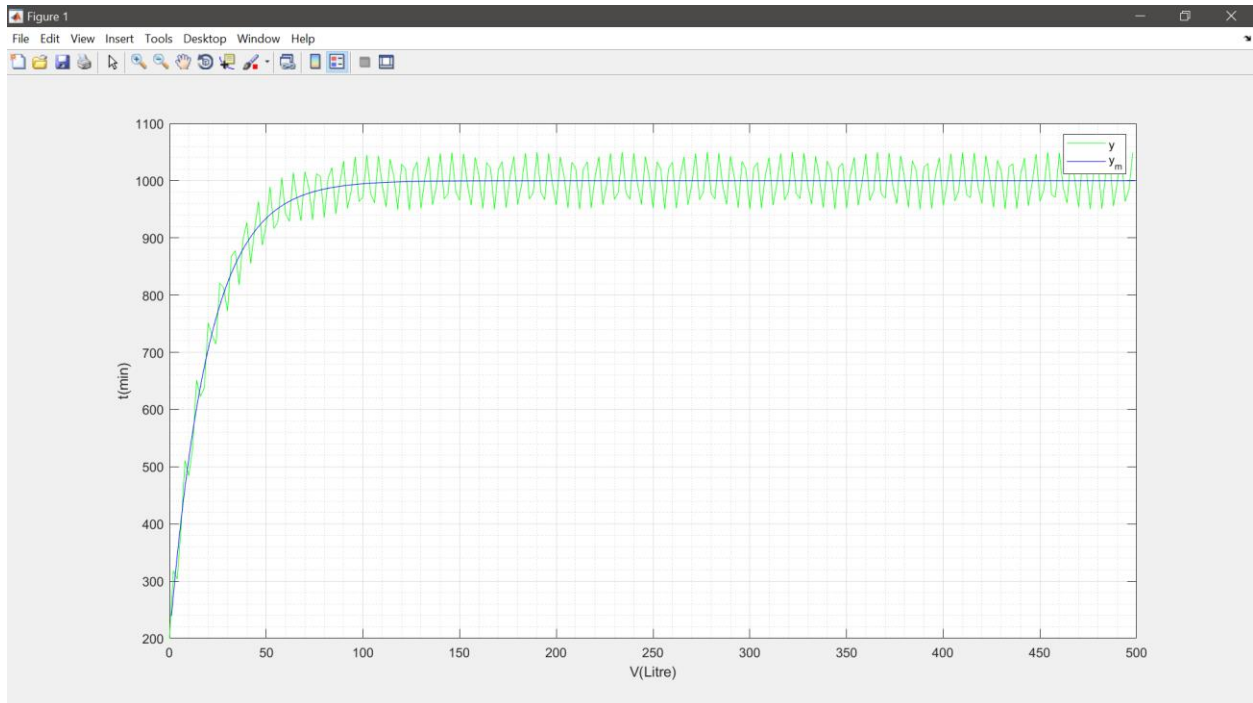
The image shows the MATLAB R2018a Editor window. The script in the Editor is as follows:

```
1- commandwindow
2- close all
3- clear all
4- clc
5- t=0:1:500
6- y=(50/0.05)+(50*sin(t)/1.0025)+(50*0.05*cos(t)/1.0025)-(802.49*exp(-0.05*t))
7- ym=1000-(800*exp(-0.05*t))
8- ys=y(1:2:501)
9- ts=t(1:2:501)
10- yms=ym(2:2:501)
11- tms=t(2:2:501)
12- plot(ts,ys,'green')
13- hold on
14- plot(tms,yms,'blue')
15- grid on
16- grid minor
17- legend('y','y_m')
18- ylabel('t(min)')
19- xlabel('V(Litre)')
```

The Workspace window shows the following variables:

Name	Value
i	251
j	251
Q	1x251 double
Qn	1.0496e+03
S	1x250 double
Sn	1000.0000
t	1x501 double
tms	1x250 double
ts	1x251 double
values	501x1 double

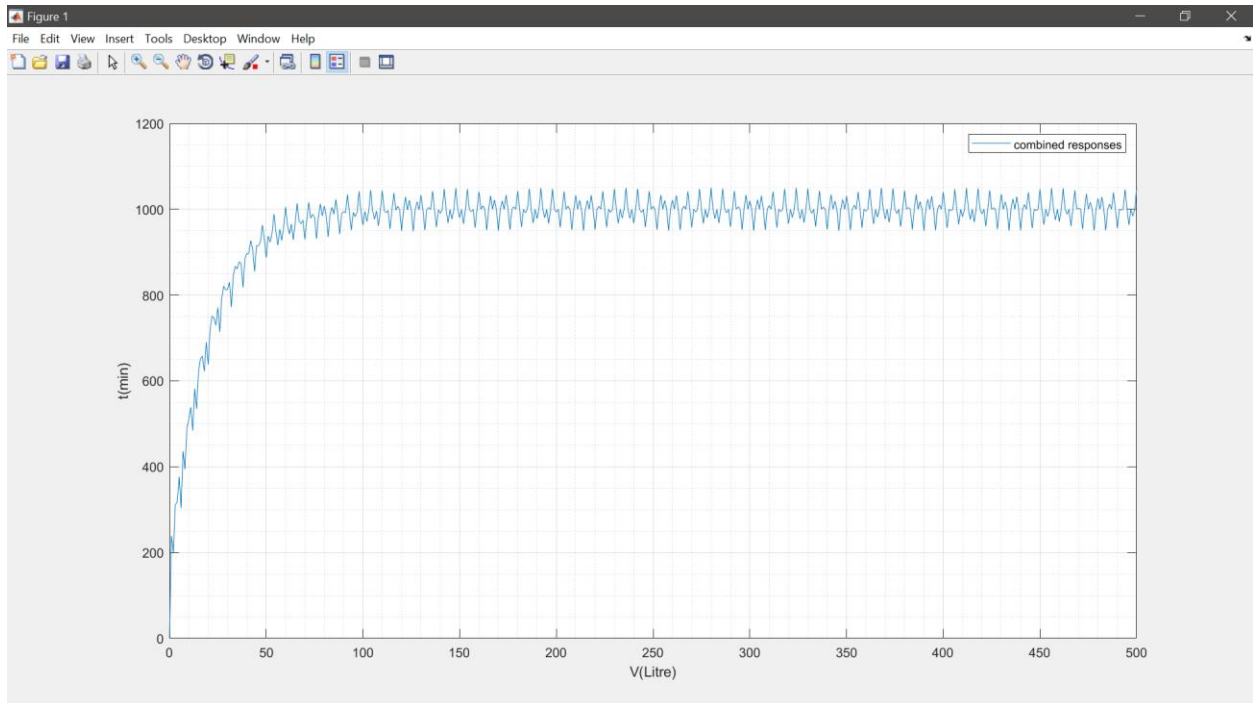
## Number 2a



## Number 2b

```
MATLAB R2018a
HOME PLOTS APPS EDITOR PUBLISH VIEW
New Open Save Compare Find Files Go To Comment % Indent Breakpoints Run Run and Advance Run and Time
FILE NAVIGATE EDIT BREAKPOINTS RUN
C:\Users\tonia\Documents\MATLAB
Editor - C:\Users\tonia\Documents\MATLAB\for_loop_practice.m
Assignment_V_2a.m assignment_V_2a_2.m for_loop_practice.m
1- commandwindow
2- close all
3- clc
4- t=0:1:500
5- y=(50/0.05)+(50*sin(t)/1.0025)+(50*0.05*cos(t)/1.0025)-(802.49*exp(-0.05*t))
6- ym=1000-(800*exp(-0.05*t))
7- ys=y(1:2:501)
8- ts=t(1:2:501)
9- yms=ym(2:2:501)
10- tms=t(2:2:501)
11- values = [0]; S=[yms]; Q=[ys]; i=1; j=1;
12- while (i<=250 && j <= 255)
13-     Sn=S(i)
14-     values=[values;Sn]
15-     Qn=Q(j)
16-     values=[values;Qn]
17-     i=i+1;
18-     j=j+1;
19- end
20- plot(t,values)
21- grid on; grid minor;
22- ylabel('t(min)')
23- xlabel('V(Litre)')
24- legend('combined responses')
25- title {'t(min)', 'V(litre)'}
26- xlsxwrite('odevbesdata.xlsx',[t(:),values(:)], 'veriler', 'A2')
27- xlsxwrite('odevbesdata.xlsx', title, 'veriler', 'A1')
```

## Number 2b



## Number 2c

t(min)	V(litre)
0	239.0165
1	200.0038
2	311.4336
3	318.1907
4	376.9594
5	303.601
6	436.2495
7	393.9593
8	489.8975
9	511.0566
10	538.4402
11	484.0395
12	582.3634
13	534.9268
14	622.1068
15	651.2431
16	658.0681
17	622.6706
18	690.6072
19	637.9229
20	720.0498
21	751.3315
22	746.6906
23	729.9392

OLOGBOSERE ANTHONIA EFE

MECHATRONICS

18/ENG05/049