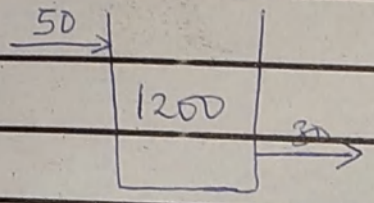
RAJI UMMU-SALMA ONIZE

18/ENG08/020

BIOMEDICAL ENGINEERING

ASSIGNMENT

Let m(t) 'lb' be the amount of brine salt in tank at any time t.



By principle of continuity

$$\frac{dm}{dt} = \text{Rate of inflow} - \text{Rate of outflow}$$

$$\frac{dm}{dt} = 50\frac{gal}{min} \times (1+\sin t)\frac{lb}{gal} - 30\frac{gal}{min} \times \left(\frac{x}{1200}\right)\frac{lb}{gal}$$

$$\frac{dm}{dt} = 50(1+\sin t) - \frac{30x}{1200} \quad ; \quad m(0) = 150 \text{ lbs}$$

$$\frac{dm}{dt} + \frac{x}{40} = 50(1+\sin t) \quad \text{[Bernoulli's equation]}$$

Integrating factor;

$$\mu = e^{\int \frac{dt}{40}} = e^{\frac{t}{40}}$$

$$\rightarrow \int d(xe^{t/40}) = \int 50(1+\sin t)e^{t/40}\,dt$$

$$xe^{t/40} = \int (50e^{t/40} + 50\sin t\, e^{t/40})\,dt + C$$

$$\rightarrow xe^{t/40} = \frac{50e^{t/40}}{1/40} + 50\int e^{t/40}\sin t\,dt + C$$

$$\rightarrow xe^{t/40} = 2000e^{t/40} + 50 \times \frac{40}{1601}\left[e^{t/40}((\sin t) - 40\cos t) + 40\right] + C$$

$$m(0) = 150 \text{ lb}$$

$$\Rightarrow 150 = 2000 + \frac{2000}{1601}(-40+40) + C$$

$$C = -2000 + 150$$

$$C = -1850$$

$$\Rightarrow m(t) = 2000 + \frac{2000}{160\pi}\left[(8\sin t + 40\cos t) + 40e^{-t/40}\right] - 1850e^{-t/40}$$

$$m(t) = 2000 + \frac{2000}{160\pi}(\sin t - 40\cos t) + \left(\frac{80000 - 1850}{160\pi}\right)e^{-t/40}$$

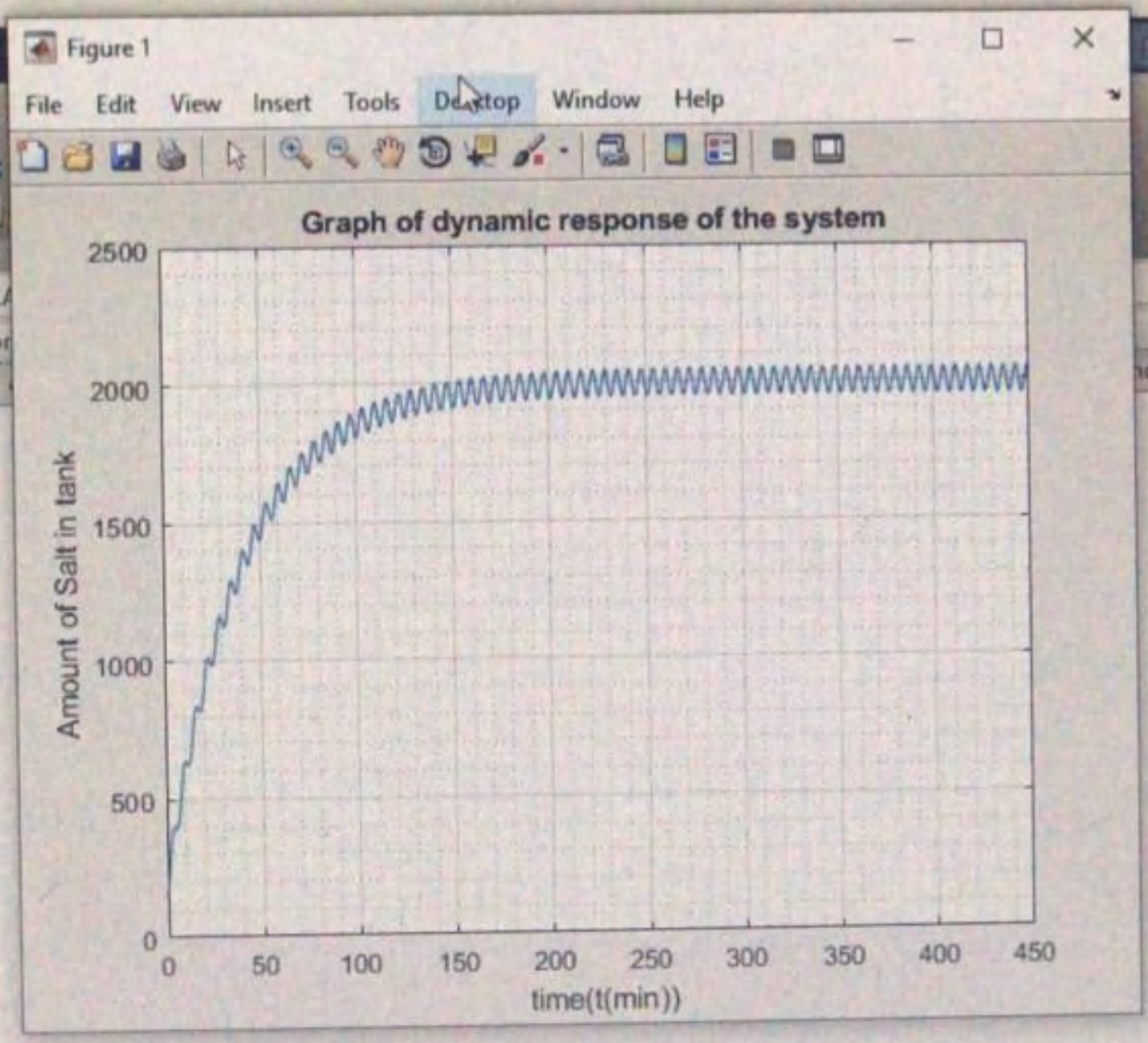
```
commandwindow
clear
clc
close all
syms t m
s=dsolve('Dm+(0.025*m)=50*(1+sin(t)),m(0)=150')
kn=0:0.5:450
rn=subs(s,kn)
plot(kn,rn)
title('Graph of dynamic response of the system')
ylabel('Amount of Salt in tank')
xlabel('time(t(min))')
grid on
grid minor
```

nand Window

to MATLAB? See resources for Getting Started.

```
 =

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

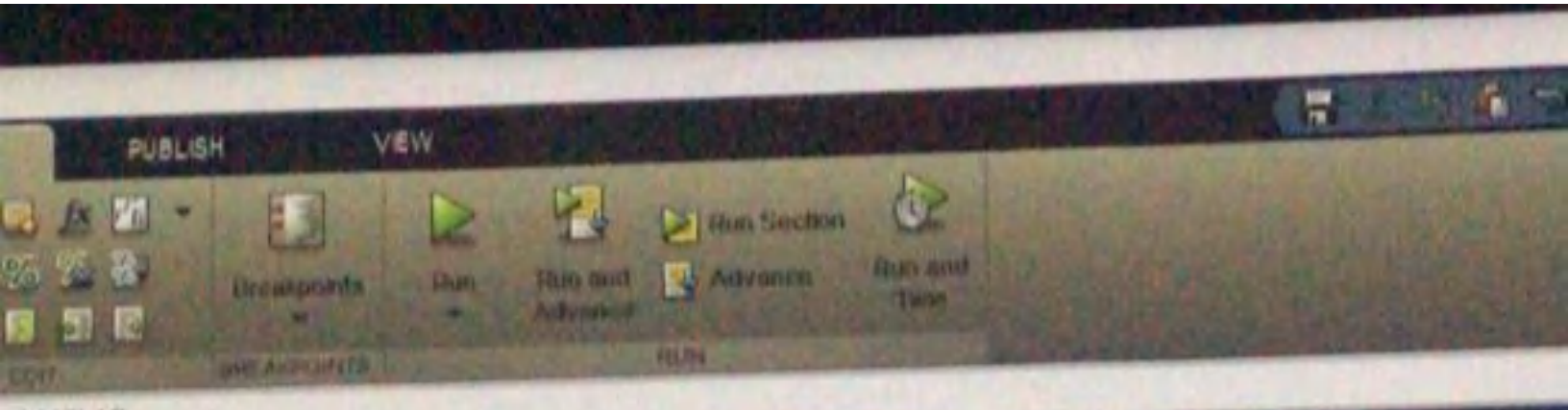


ommand Window

lew to MATLAB? See resources for Getting Started.

```
rn =

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



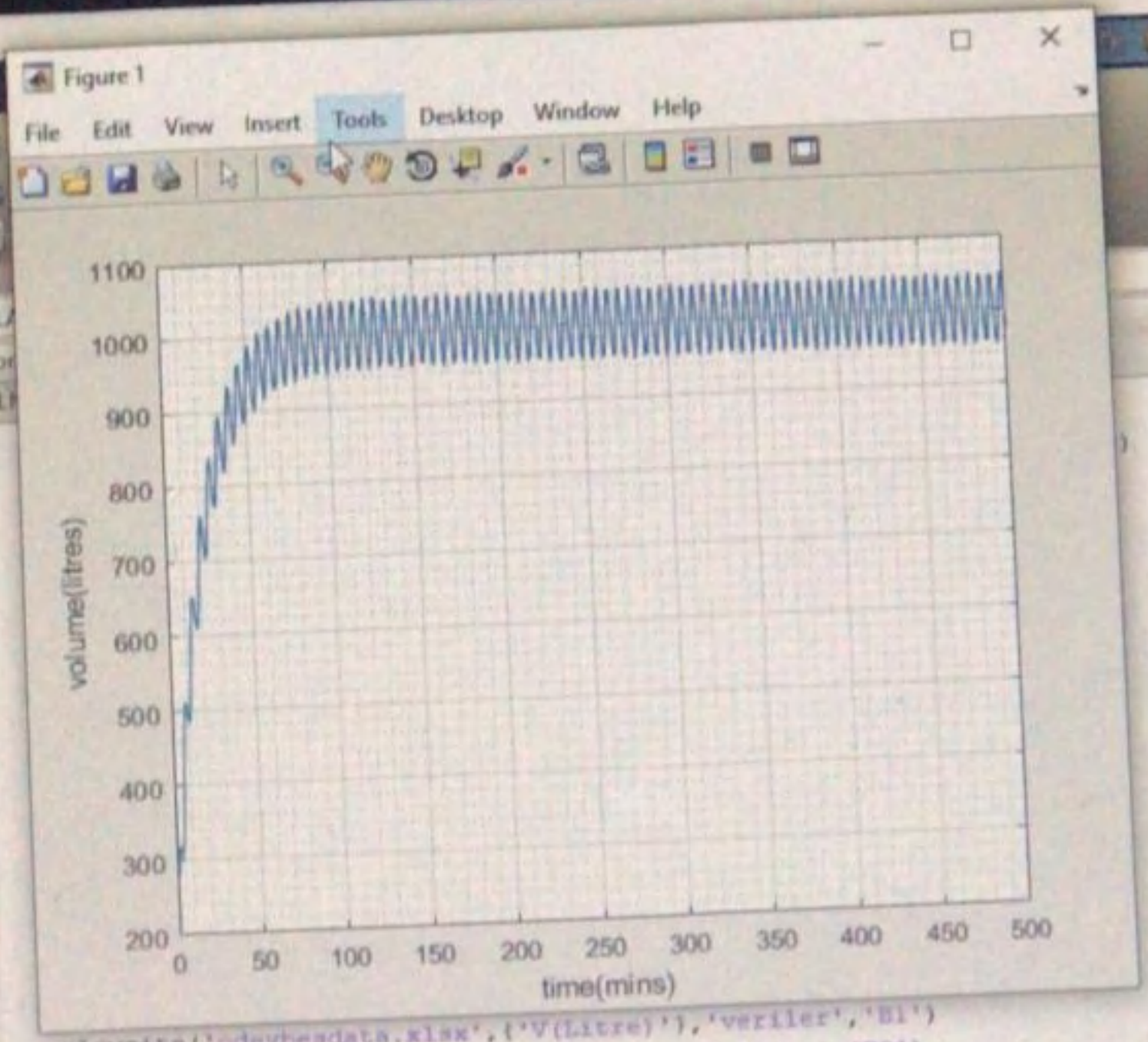
MATLAB

Editor - C:\Users\amanda\Documents\MATLAB\UMMIIIII.m

SALMAAA.m | UMMIIIII.m | +

```
commandwindow
clear
clc
close all
syms t
values=[]
t=1:1:500
y=1000+((50/1.0025)*sin(t))+(2.5/1.0025)*cos(t)-((exp(-0.05*t))*802.4)
mean=1000-((exp(-0.05*t))*800)
if rem(t,2)==0
    values=[values,mean]
else
    values=[values,y]
end
excelvalues=transpose(values)
mins=transpose(t)
plot(t,values)
grid on
grid minor
xlabel('time(mins)')
ylabel('volume(litres)')
xlswrite('odevbesdata.xlsx',{'t(min)'},'veriler','A1')
xlswrite('odevbesdata.xlsx',mins,'veriler','A2')
xlswrite('odevbesdata.xlsx',{'V(Litre)'},'veriler','B1')
xlswrite('odevbesdata.xlsx',excelvalues,'veriler','B2')
```

Command Window



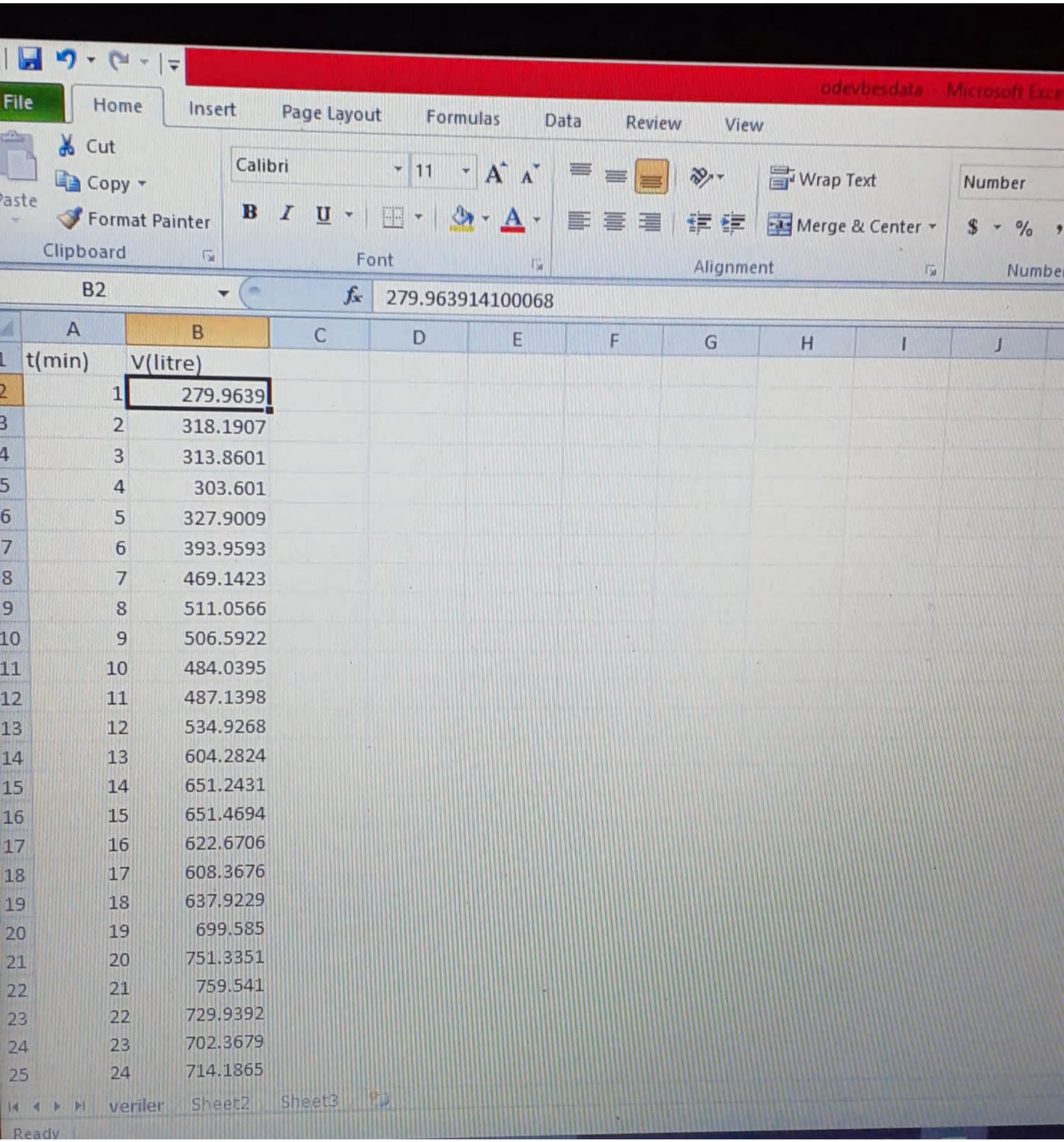

```
xlswrite('odevbesdata.xlsx',{'V(Litre)'},'veriler','B1')
xlswrite('odevbesdata.xlsx',excelvalues,'veriler','B2')
```

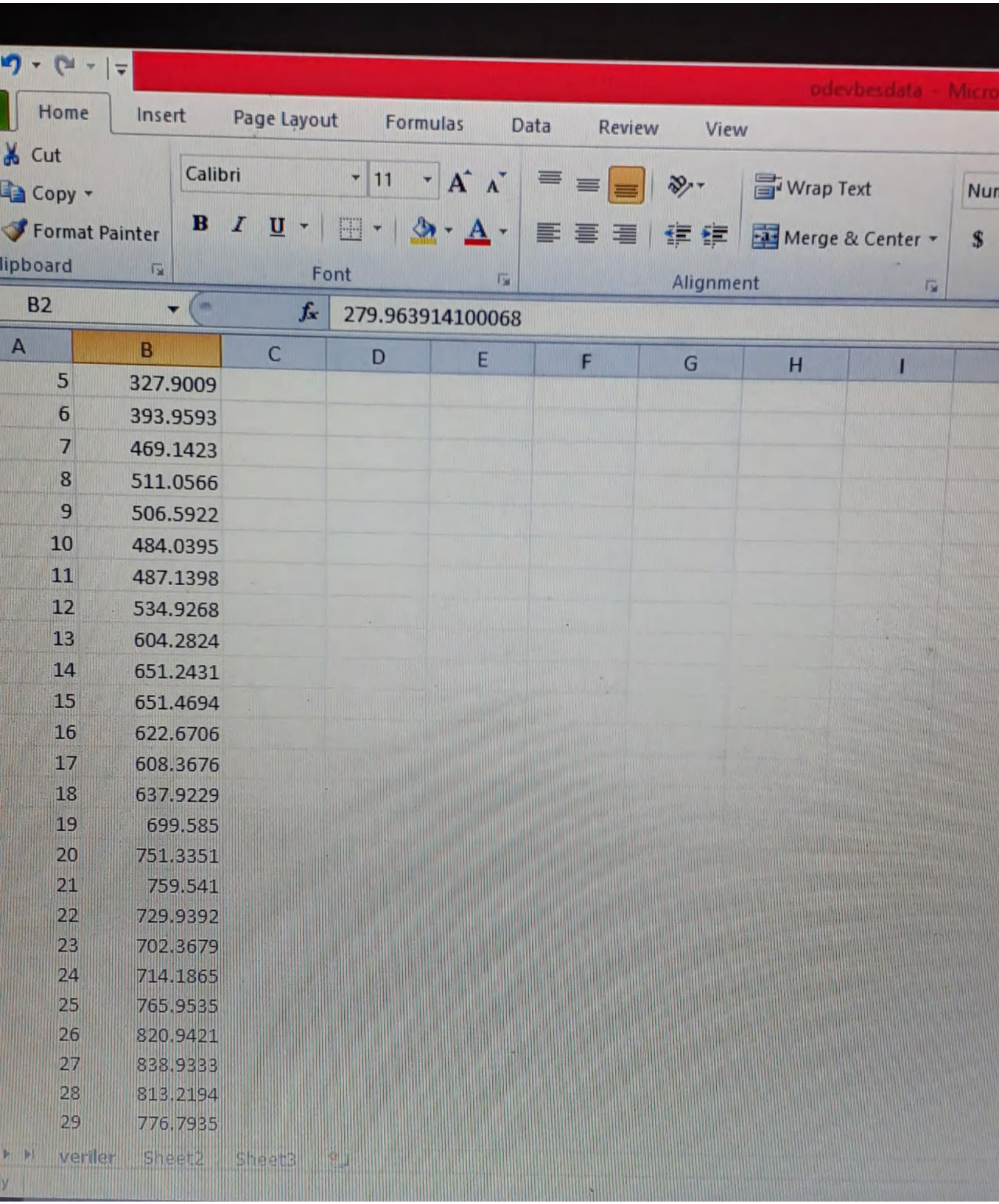
Command Window

New to MATLAB? See resources for Getting Started.

```
498
499
500
```

fx >>


File
Home
Insert
Page Layout
Formulas
Data
Review
View
Cut
Copy
Format Painter
Clipboard
Calibri
11
Font
Wrap Text
Merge & Center
Alignment
Number
B2
279.963914100068
t(min)
V(litre)
1 279.9639
2 318.1907
3 313.8601
4 303.601
5 327.9009
6 393.9593
7 469.1423
8 511.0566
9 506.5922
10 484.0395
11 487.1398
12 534.9268
13 604.2824
14 651.2431
15 651.4694
16 622.6706
17 608.3676
18 637.9229
19 699.585
20 751.3351
21 759.541
22 729.9392
23 702.3679
24 714.1865
veriler
Sheet2
Sheet3
Ready



A	B	C	D	E	F	G	H	I
5	327.9009							
6	393.9593							
7	469.1423							
8	511.0566							
9	506.5922							
10	484.0395							
11	487.1398							
12	534.9268							
13	604.2824							
14	651.2431							
15	651.4694							
16	622.6706							
17	608.3676							
18	637.9229							
19	699.585							
20	751.3351							
21	759.541							
22	729.9392							
23	702.3679							
24	714.1865							
25	765.9535							
26	820.9421							
27	838.9333							
28	813.2194							
29	776.7935							