

ATOGWE VICTORIA ALOKE.

18/ENG08/003.

BIOMEDICAL ENGINEERING.

ENG 282 Assignment.

$$1. a) \frac{dm}{dt} = m_{in} - m_{out}$$

Each gallon contains $(1 + \sin t)$ lb

Sogard goes inside.

$$\therefore m_{in} = 50 \cdot (1 + \sin t)$$

Rate of going out = 30 g/minute

Total amount = 1200

$$m_{out} = \frac{30}{40} \text{ of } m = \frac{m}{40}$$

$$\text{i.e. } \frac{dm}{dt} = 50(1 + \sin t) - \frac{m}{40}$$

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

b. Using: y. IF = $\int Q \cdot IF dt$ i.e. Integrating Factor
m. IF = $\int Q \cdot IF dt$

$$\frac{dm}{dt} + Py = Q$$

The equation: $\frac{dm}{dt} = -\frac{m}{40} + 50(1 + \sin t)$

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

$$\therefore P = \frac{1}{40} \quad \& \quad Q = 50(1 + \sin t)$$

$$IF = e^{\int P dt}$$

$$e^{5t/40} = \int 5/40 dt$$

$$= e^{1/40 t} = e^{t/40}$$

$$\therefore \text{IF} = e^{t/40}$$

$$\text{m. IF} = \int Q \cdot \text{IF}$$

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

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

BHS:

$$50 \int e^{t/40} + e^{t/40} \sin t = \int 40 e^{t/40} + e^{t/40} \sin t$$

Using integration by parts for $e^{t/40} \sin t$:

$$\text{Let } 0.025t = t/40$$

$$fg' = fg - f'g$$

$$f = \sin t, \quad g' = e^{t/40}$$

$$f' = \cos t, \quad g = 40 e^{t/40}$$

$$40 e^{t/40} (\sin t) = \int 40 e^{t/40} \cos t$$

for $40 e^{t/40} \cos t$:

$$f = \cos t, \quad g' = 40 e^{t/40}$$

$$f' = -\sin t, \quad g = 1600 e^{t/40}$$

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

$\sin(t) dt$

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

making $e^{t/40}$ the subject of formula:

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

$$1601 \int e^{t/40} \sin t = 40 e^{t/40} \sin t - 1600 e^{t/40} \cos t$$

$$\int e^{t/40} \sin(t) = \frac{40 e^{t/40} \sin(t) - 1600 e^{t/40} \cos(t)}{1601}$$

$$\text{From } 50 \int 1/40 e^{t/40} + e^{t/40} \sin t + c$$

$$m \cdot e^{t/40} = 50 \left[\frac{40 e^{t/40} + 40 e^{t/40} \sin t - 1600 e^{t/40} \cos t}{1601} \right] + C$$

$$m \cdot e^{t/40} = 50 \left[\frac{64040 e^{t/40} + 40 e^{t/40} \sin t - 1600 e^{t/40} \cos t}{1601} \right] + C$$

Divide both sides by 1601 on RHS

$$m \cdot e^{t/40} = 2000 e^{t/40} + 1.25 e^{t/40} \sin t - 50 e^{t/40} \cos t + C$$

~~Divide~~ Divide both sides by $e^{t/40}$

$$m = 2000 e^{t/40} + 1.25 e^{t/40} \sin t - 50 e^{t/40} \cos t + C e^{-t/40}$$

where $m = 150, t = 0$

$$150 = 2000 - 50 + C$$

$$150 = 1950 + C$$

$$C = 1800$$

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

$$t = 0,$$

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



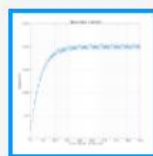
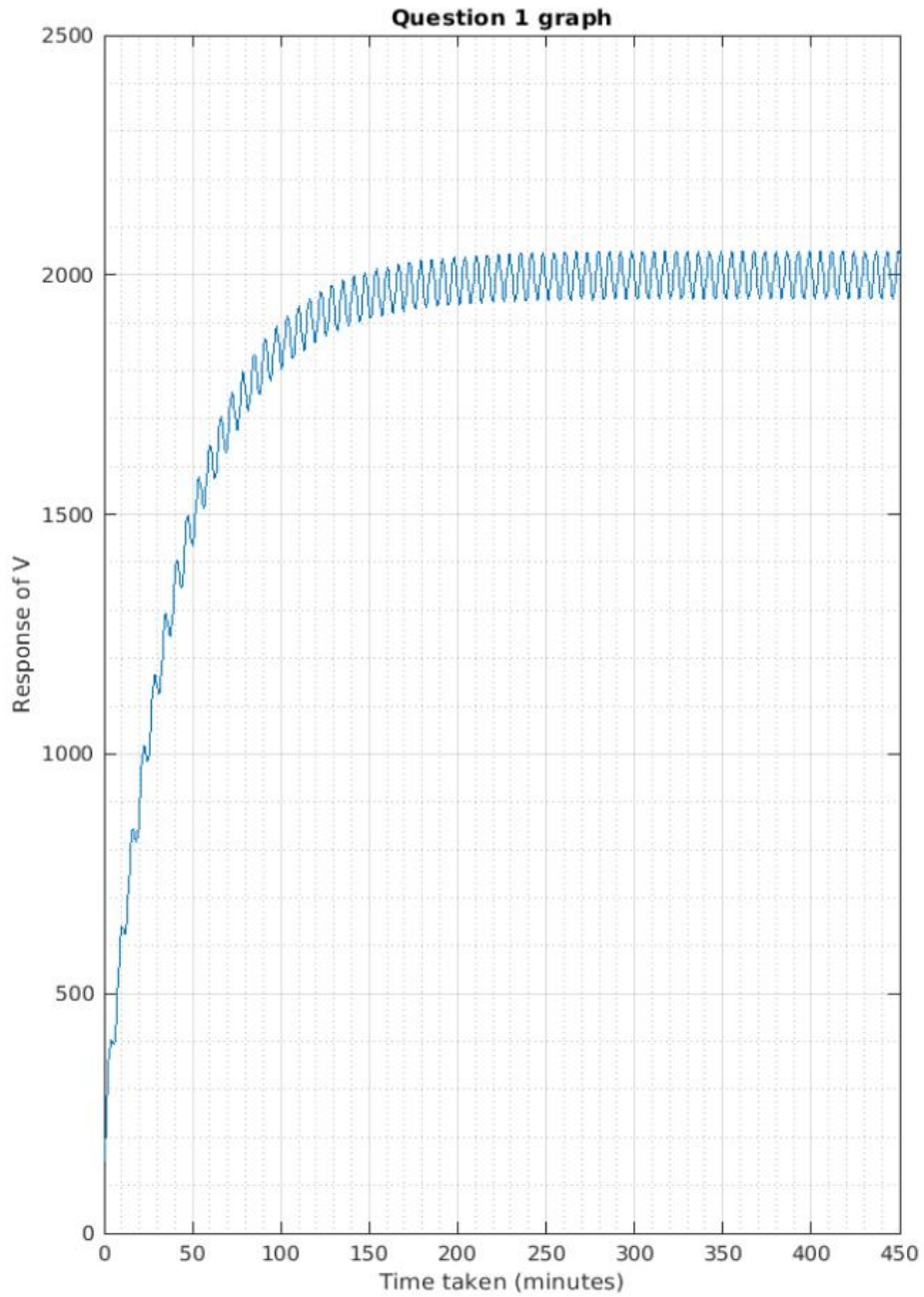
```
>> Mathassignment
```

```
>> Mathassignment
```

```
>> syms t
t=0:0.5:450
Vf=subs(V,t)
plot(t,Vf)
Mathassignment
syms t
t=0:0.5:450
V=dsolve('Dm+(0.025*m)=50*(1+sin(t))','m(0)
=150');
Vf=subs(V,t)
plot(t,Vf)
title('Question 1 graph')
xlabel('Time taken (minutes)')
ylabel ('Response of V')
grid on
grid minor
```

```
...
2881850*exp(-187/40))/1601, 2000 -
(2000*1601^(1/2)*cos(atan(1/40) + 375/2))/
1601 - (2881850*exp(-75/16))/1601, 2000 -
(2000*1601^(1/2)*cos(atan(1/40) + 188))/
1601 - (2881850*exp(-47/10))/1601, 2000 -
(2000*1601^(1/2)*cos(atan(1/40) + 377/2))/
1601 - (2881850*exp(-377/80))/1601, 2000 -
(2000*1601^(1/2)*cos(atan(1/40) + 189))/
1601 - (2881850*exp(-189/40))/1601, 2000 -
(2000*1601^(1/2)*cos(atan(1/40) + 379/2))/
1601 - (2881850*exp(-379/80))/1601, 2000 -
(2000*1601^(1/2)*cos(atan(1/40) + 190))/
1601 - (2881850*exp(-19/4))/1601, 2000 -
(2000*1601^(1/2)*cos(atan(1/40) + 381/2))/
1601 - (2881850*exp(-381/80))/1601, 2000 -
(2000*1601^(1/2)*cos(atan(1/40) + 191))/
1601 - (2881850*exp(-191/40))/1601, 2000 -
(2000*1601^(1/2)*cos(atan(1/40) + 383/2))/
>> |
```

Figure 1: syms t t=0:0.5:450 Vf=subs(V,t) plot(t,Vf) Mathassignment syms t...





```
>> close all
t1=1:2:499
t2=0:2:500
y1=(50/0.05)+(50/1.0025)*sin(t1)+
((50*(0.05))/
1.0025)*cos(t1))-802.49*exp(-0.05*t1)
yn=1000-800*exp(-0.05*t2)
time=[t1,t2];
resp=[y1,yn];
plot(time,resp)
```

```
t1 =
```

```
Columns 1 through 7
```

```
1 3 5 7 9 11 13
```

```
Columns 8 through 14
```

```
15 17 19 21 23 25 27
```

```
Columns 15 through 21
```

```
29 31 33 35 37 39 41
```

```
Columns 22 through 28
```

```
43 45 47 49 51 53 55
```

```
Columns 29 through 35
```

```
57 59 61 63 65 67 69
```

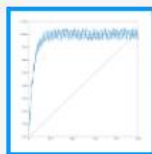
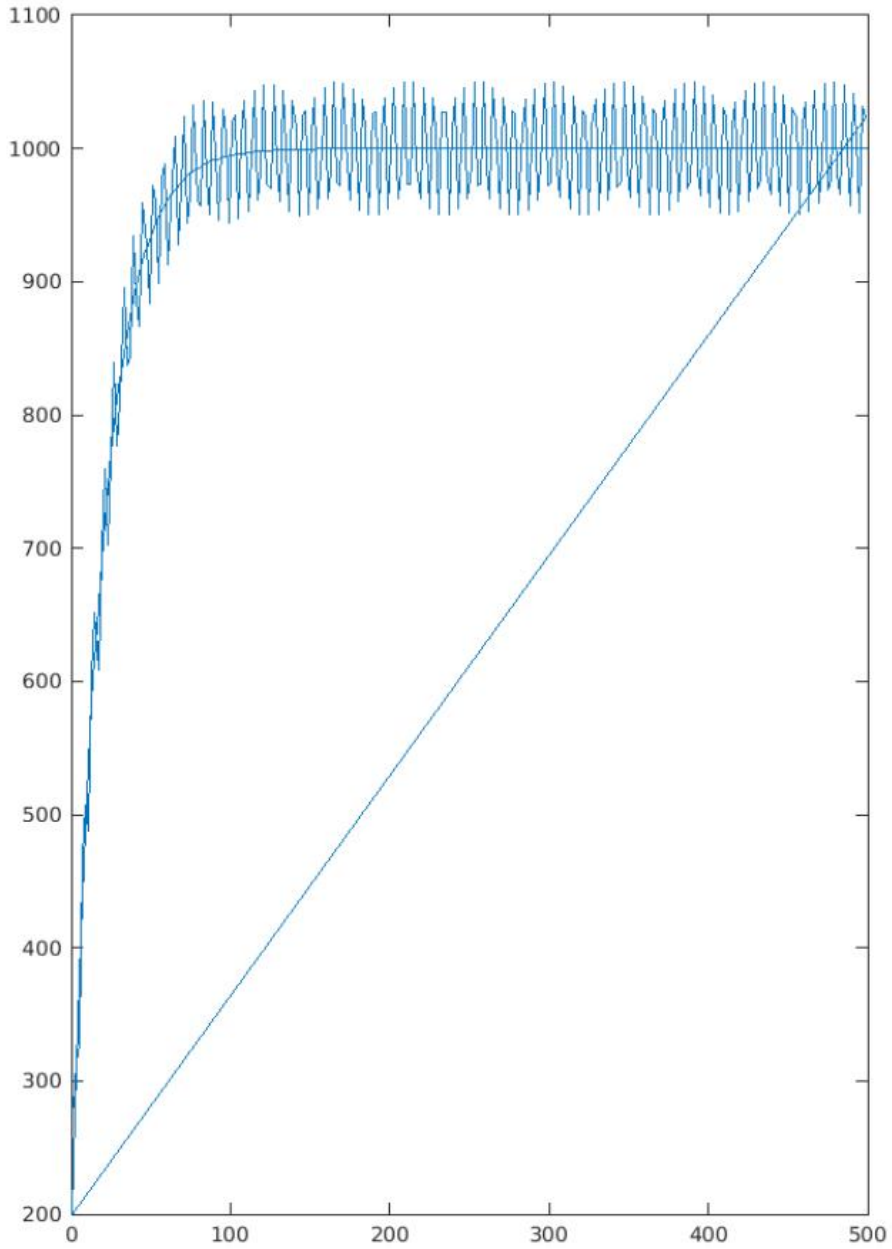
```
Columns 36 through 42
```

```
71 73 75 77 79 81 83
```

```
Columns 43 through 49
```

```
>>
```


Figure 1: close all t1=1:2:499 t2=0:2:500 y1=(50/0.05)+(50/1.0025)*sin(t1...





1.0000 1.0000 1.0000 1.0000

Columns 249 through 251

1.0000 1.0000 1.0000

col_header =

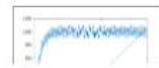
't(min)V(litre)'

Warning: Unable to write to Excel format, attempting to write file to csv format. To write to an Excel file, convert your data to a table and use writetable.

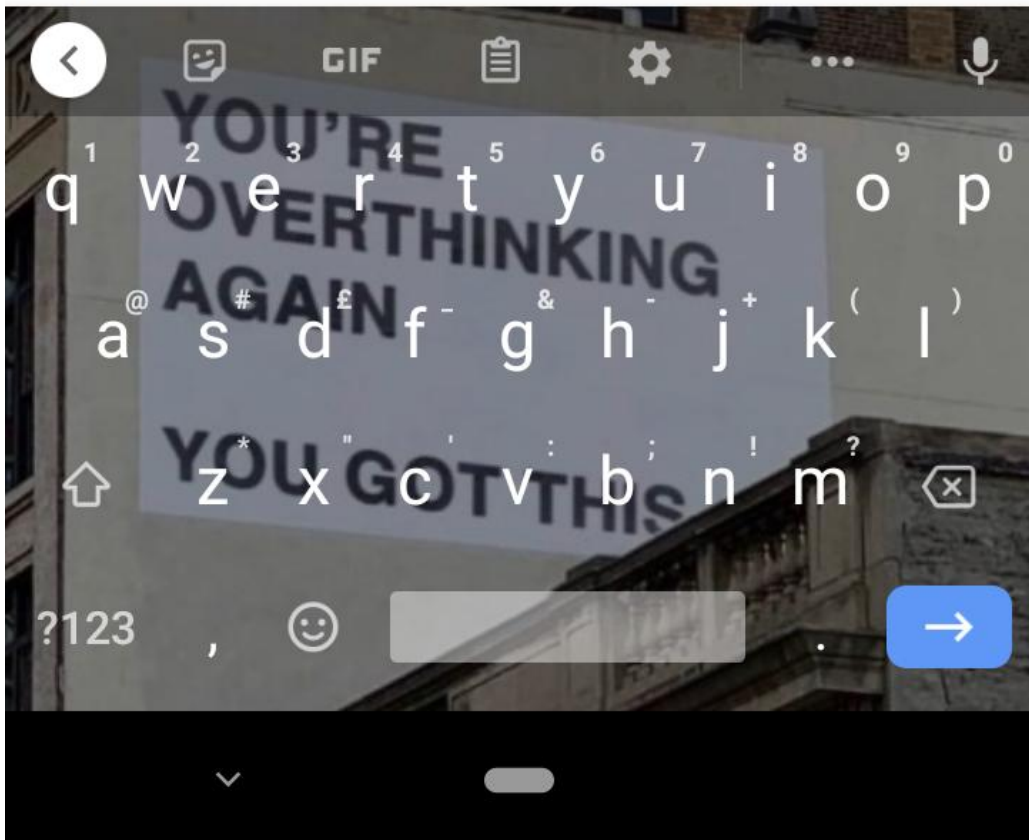
> In [xlswrite](#) (line 179)

Warning: Unable to write to Excel format, attempting to write file to csv format. To write to an Excel file, convert your data to a table and use writetable.

> In [xlswrite](#) (line 179)



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Good afternoon sir. I ho



Editing

06/05/2020 13:00

Good afternoon sir. I hope you're doing well. For my assignment, I wasn't able to get the excel table because matlab can't install on my system. I used MATLAB on my phone for the assignment instead. I also got excel on my phone but the table still didn't save. So I just wrote the code correctly. I really hope you'll put my condition into consideration while marking. Thank you sir and please stay safe 😊

