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18/eng03/056
Civil engineering
Engineering maths

1) Using 'Balance law', The acceleration rate at salt within a system is equal to the input rate of salt into the sytem minus the output rate of salt from the system.

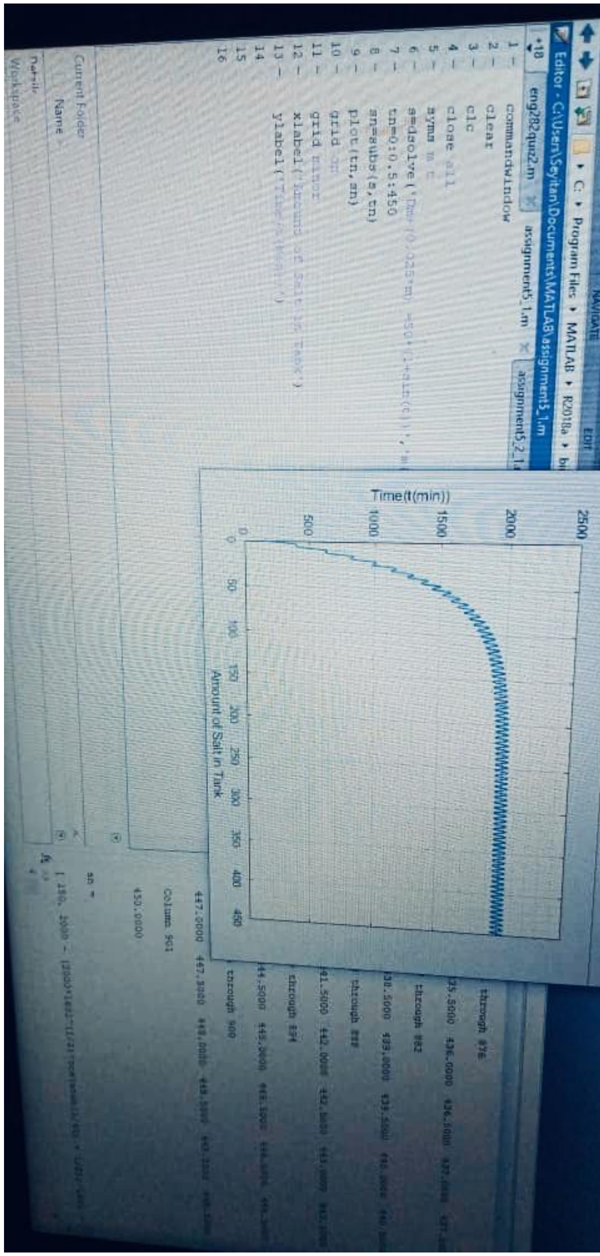
Acceleration rate of salt within a system
= Input rate of salt into the system
= Output rate of salt from the system

Let the amount of salt present in the tank at any time 't' by 'y'. Time rate of change of $y = \frac{dy}{dt} = y_{in} - y_{out}$

If 50gal of brine enters the tank per minute & one gallon contains $(1+\sin t) = (1+\sin(1)) = 1.02lb$
Hence, the amount of salt entering into the tank is

$50\,gal/min \times 1.02lb/gal = 51lb/min$

The tank contains 1200gal of water with dissolved salt and 30 gal of the solution exists the tank per min. i.e $\frac{30gal}{1200gal} = 0.025 = 2.5\%$



of the content of the tank. so 2.5% of the salt present inside the tank will also leave the tank per minute. i.e

$y_{out} = 2.5\%$ of y

a) $\frac{dy}{dt}$ lb/min = 51 lb/min − 2.5% of y lb/min

b) $\frac{dy}{dt} = 51 - 0.025y$; $\frac{dy}{dt} = -0.025y + 51$

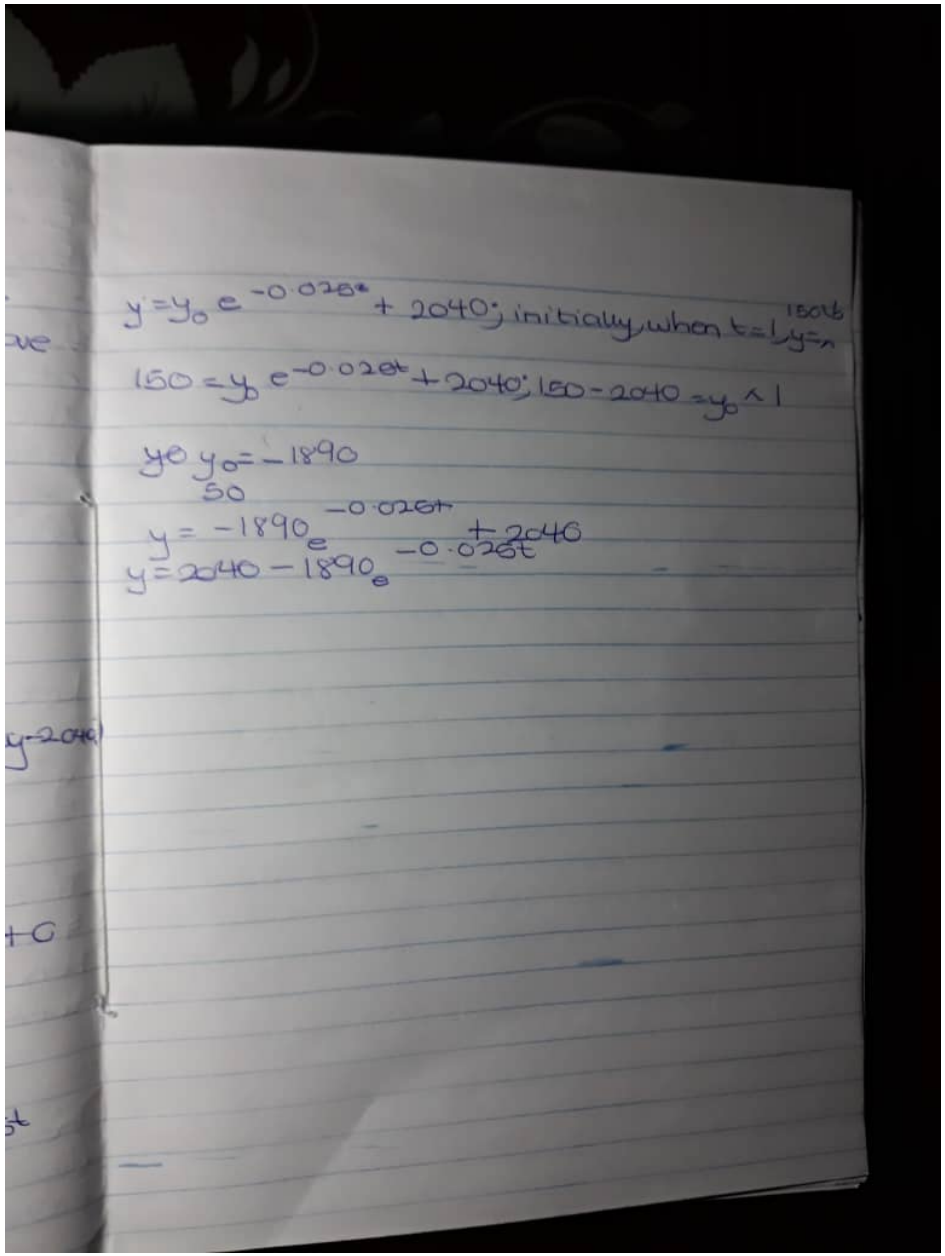
$\frac{dy}{dt} = -0.025\left(\frac{-0.025y + 51}{-0.025y - 0.025}\right)$; $\frac{dy}{dt} = -0.025(y-2040)$

$\frac{dy}{(y-2040)} = -0.025dt$; $\int \frac{dy}{(y-2040)} = \int -0.025dt$

$\int \frac{dy}{(y-2040)} = -0.025 \int dt$; $\ln(y-2040) = -0.025t + C$

$y - 2040 = e^{-0.025t} y_0$; $y = 2040 = e^{-0.024} e^{C}$

$y - 2040 = e^{-0.025t} y_0$; $y - 2040 = y_0 e^{-0.025t}$



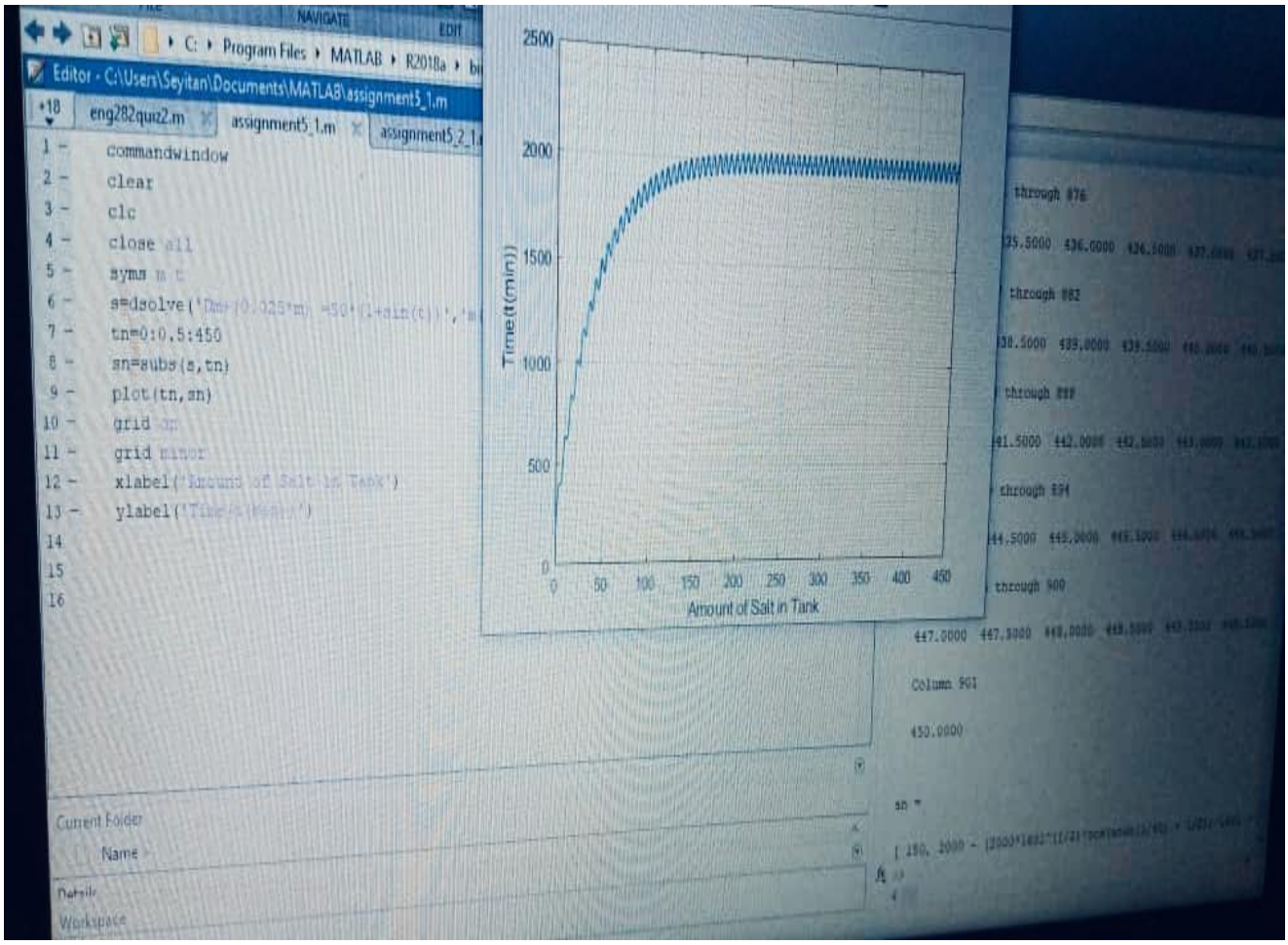
$y = y_0 e^{-0.026t} + 2040$; initially, when $t = 1$, $y = 150$

$150 = y_0 e^{-0.026t} + 2040$; $150 - 2040 = y_0 e^{-1}$

$y_0 = -1890$

$y = -1890 e^{-0.026t} + 2040$

$y = 2040 - 1890 e^{-0.026t}$


C: ▸ Program Files ▸ MATLAB ▸ R2018a ▸
Editor - C:\Users\Seyitan\Documents\MATLAB\assignment5_1.m
eng282quiz2.m
assignment5_1.m
1 - commandwindow
2 - clear
3 - clc
4 - close all
5 - syms m t
6 - s=dsolve('Dm=(0.025*m)-50*(1+sin(t))','m
7 - tn=0:0.5:450
8 - sn=subs(s,tn)
9 - plot(tn,sn)
10 - grid on
11 - grid minor
12 - xlabel('Amount of Salt in Tank')
13 - ylabel('Time(t(min))')
14
15
16
Time(t(min))
Amount of Salt in Tank
2500
2000
1500
1000
500
0
0 50 100 150 200 250 300 350 400 450
Current Folder
Name
Details
Workspace
through 876
through 882
through 888
through 894
through 900
Column 901
450.0000
sn =