

Name: Hamza Abdallah Sambo

Matric Number: 18/ENG09/003

Department: Aerospace Engineering

Course: ENG282

1. 1000g
100

10 gallons each of 5U

10 gal/min

$0 \leq t \leq 900$

1200g

150

50 gallons each of

30 gal/min

$0 \leq t \leq 450$

$$\frac{dy}{dt} = y_{in} - y_{out}$$

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

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

$$\frac{dy}{dt} \cdot \frac{\text{lb}}{\text{min}} = 50(1 + \sin t) \text{ lb/min} - 2.5\% \text{ of } y \text{ lb/min}$$

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

$$= -0.025 \left(\frac{-0.025y + 50 + 50 \sin t}{-0.025} \right) \\ = -0.025 \left(y - 2000(1 + \sin t) \right)$$

$$\therefore -0.025 \left(y - 2000(1 + \sin t) \right)$$

$$\frac{dy}{dt} = 0.025 (y - 2000)$$

$$\frac{dy}{[y - 2000]} = -0.025 dt$$

$$\int \frac{dy}{[y - 2000]} = \int -0.025 dt$$

$$2. \frac{dy}{(y - 2040)} = -0.025 dt; \int \frac{dy}{(y - 2040)} = \int -0.025 dt$$

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

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

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

$$y = y_0 e^{-0.025t} + 2040; \text{ Given that when } t = 1 \text{ (initially)}$$

$$y = 150;$$

$$150 = y_0 e^{-0.025} + 2040$$

$$150 - 2040 = y_0 \times 1$$

$$y_0 = -1890$$

$$y = -1890 e^{-0.025t} + 2040$$

$$y = 2040 - 1890 e^{-0.025t}$$

```
1 - commandwindow
2 - clear
3 - clc
4 - close all
5 - syms m t
6 - t = [0:0.5:7.5]
7 - m = 50*(1+sin(t)) - (0.025)*150
8 - plot(t,m)
9 - xlabel('time(hr)')
10 - ylabel('m(lb)')
11 - grid minor
12 - grid on
```

Command Window

t =
0 0.5000 1.0000 1.5000 2.0

m =
46.2500 70.2213 88.3235 96.1247 91.7149 76.1736 53.3060 28.7108 8.4099 -2.6265 -1.6962 10.9730 32.2792 57.0060 79.0993 93.1500

