

UDONSI VICTOR
18/ENG071014 (PETROLEUM) ENGR.
ENGMAT 282

a) Applying Balance law;
Accumulation rate = Input rate of salt - Output rate of salt.
Treating the amount of salt present in the tank at anytime t as y , its time rate of change is given as)

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

Since 50 gal of brine enters the tank per minute and one gallon contains $(1 + 50t)$ lb of salt; at $t = 1$; $(1 + 50t) = (1 + 50(1)) = 1.02$ lb of salt.

It means that the amount of salt entering the tank is;
 $y_{in} = 50 \frac{gal}{min} \times 1.02 \frac{lb}{gal} = 51 \frac{lb}{min}$

The tank contains 1200 gal of water with dissolved salt, & 25 gallons of the solution leaves the tank per minute. This is $\frac{25}{1200} = 0.025$ = 2.5% of the content of the tank. If that be the case 2.5% of the salt present in the tank will also leave the tank for minute. In other words

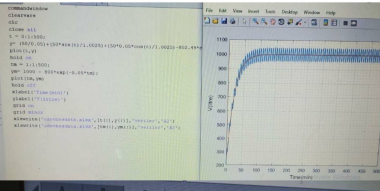
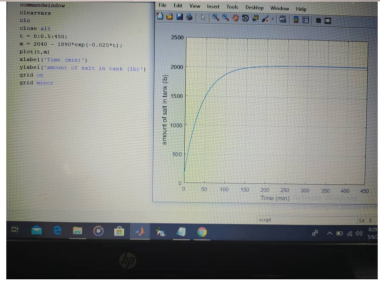
$$y_{out} = 2.5\% \text{ of } y$$

@ Therefore; $\frac{dy}{dt} \frac{lb}{min} = 51 \frac{lb}{min} - 2.5\% \text{ of } y \frac{lb}{min}$

b) $\frac{dy}{dt} = 51 - 0.025y$; $\frac{dy}{dt} = -0.025y + 51$
 $\frac{dy}{dt} = -0.025 \left[\frac{-0.025y + 51}{-0.025} - 0.025 \right]$; $\frac{dy}{dt} = -0.025(y - 2040)$
 $\frac{dy}{(y - 2040)} = -0.025 dt$; $\int \frac{dy}{(y - 2040)} = \int -0.025 dt$
 $\ln(y - 2040) = -0.025t + C$
 $y - 2040 = e^{-0.025t + C}$; $y - 2040 = e^{-0.025t} \cdot e^C$
 $y - 2040 = e^{-0.025t} y_0$; $y - 2040 = y_0 e^{-0.025t}$
 $y = y_0 e^{-0.025t} + 2040$; Given that when $t = 0$ min (initially); $y = 150$ lb

$150 = y_0 e^{0.025(0)} + 2040$; $150 - 2040 = y_0 \times 1$;
 $y_0 = 1890$

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



	A	B	C	D	E	F	G	H	I
2	1	239.0165							
3	2	276.1301							
4	3	311.4336							
5	4	345.0154							
6	5	376.9594							
7	6	407.3454							
8	7	436.2495							
9	8	463.744							
10	9	489.8975							
11	10	514.7755							
12	11	538.4402							
13	12	560.9507							
14	13	582.3634							
15	14	602.7318							
16	15	622.1068							
17	16	640.5368							
18	17	658.0681							
19	18	674.7443							
20	19	690.6072							
21	20	705.6964							
22	21	720.0498							