(1) Accumulation rate is = Input rate − Output rate

Salt Amount present in tank $t = y$

change rate $= \frac{dy}{dt}$

$\therefore dy/dt = y_{in} - y_{out}$

$\therefore y_{in}$ = Input rate $= 50\,(1 + \sin t)$ Lb

y_{out} = output rate $= \frac{30}{1200} \times 100 = 25\%$ of y

$\therefore y_{out} = 0.025y$

$\frac{dy}{dt} = 20\,(Y + \sin t) - 0.025y$

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

using this formular : $dy/dx + Py = Q$

where, $x = t$, $P = 0.025$, $Q = 50(1 + \sin t)$

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

$\int P dt = \int 0.025\, dt = 0.025t$

$IF = e^{0.025t}$

$y \cdot IF = \int IF\ Q\, dt$

$y \cdot e^{0.025t} = \int e^{0.025t} \cdot 50\,(1 + \sin t)\, dt$

$\int e^{0.025t} 50 (1 + \sin t \ldots = 50 \left[\int e^{0.025t} (1 + \sin t)\, dt\right]$

$= 50 \left[\int (e^{0.025t} + e^{0.025t} (1 + \sin t)\, dt\right]$

$= 50 \left[\int e^{0.025t} dt + \int e^{0.025t} \sin t\, dt\right]$

$= 50 \left[\frac{e^{0.025t}}{0.025} + \int e^{0.025t} \sin t\, dt\right]$

let $u = e^{0.025t}$ $\quad du = 0.025 e^{0.025}$

$v = -\cos t$: $dv = \sin t$

$\int e^{0.025t} \sin t\, dt = (e^{0.025t} \times -\cos t)$

$- \int -\cos t \; 0.025 e^{0.025t}\, dt$

$= -e^{0.025t} \cos t + 0.025 \int \cos t \, 0.$

$u = e^{0.025t}$ $du = 0.025e^{0.025t}$

$v = \sin t$ $dv = \cos t$.

$$= \int \cos t \, e^{0.025t} \, dt =$$

$$e^{0.025t} \sin t - \int \sin t \; 0.025 e^{0.025t}$$

$$= e^{0.025t} \sin t - 0.025 \int \sin t \, e^{0.025t}$$

Let $I = \int \sin t \, e^{0.025t}$ so substitute

$$= e^{0.025t} \sin t - 0.025 I$$

so;

$$z = e^{0.025t} \cos t + 0.025 \{ e^{0.025t} \sin t - 0.025 I \}$$

$$z = e^{0.025t} \cos t + 0.025 e^{0.025t} \sin t - 6.25 \times 10^{-4} I.$$

$\therefore$ since $I = \int \sin t \, e^{0.025t} \, dt$

$$I = -e^{0.025t} \cos t + 0.025 e^{0.025t} \sin t - 6.25 \times 10^{-4} I$$

$$I + 6.25 \times 10^{-4} I = -e^{0.025t} \cos t + 0.025 e^{0.025t}$$

$$\therefore I = e^{0.025t} (0.025 \sin t - \cos t) + c$$

where $y = \int$ [illegible]

And $I = e^{0.025t}(0.025\sin t) - \cos t)$

$\therefore y \cdot e^{0.025t} = 50\left[\frac{e^{0.025t}}{0.025} + e^{0.025t}\right.$

$\left.(0.025\sin t - \cos t) + c\right]$

$y \cdot e^{0.025t} = 50e^{0.025t}\left[\frac{1}{0.025} + (0.025\sin t - \cos t)\right.$

$\left. + \frac{c}{e^{0.025t}}\right]$

$\therefore y = 50\left[\frac{1}{0.025} + (0.025\sin t - \cos t\right.$

$\left. + \frac{c}{e^{0.025t}}\right]$

when $t = 0$, $y = 150$

$150 = 50\left[\frac{1}{0.025} + (0.025\sin 0 - \cos 0)\right.$

$\left. + c/e^{0.025\times 0}\right]$

$$150 = 50\left[\frac{1}{0.025} + (0-1) + C\right]$$

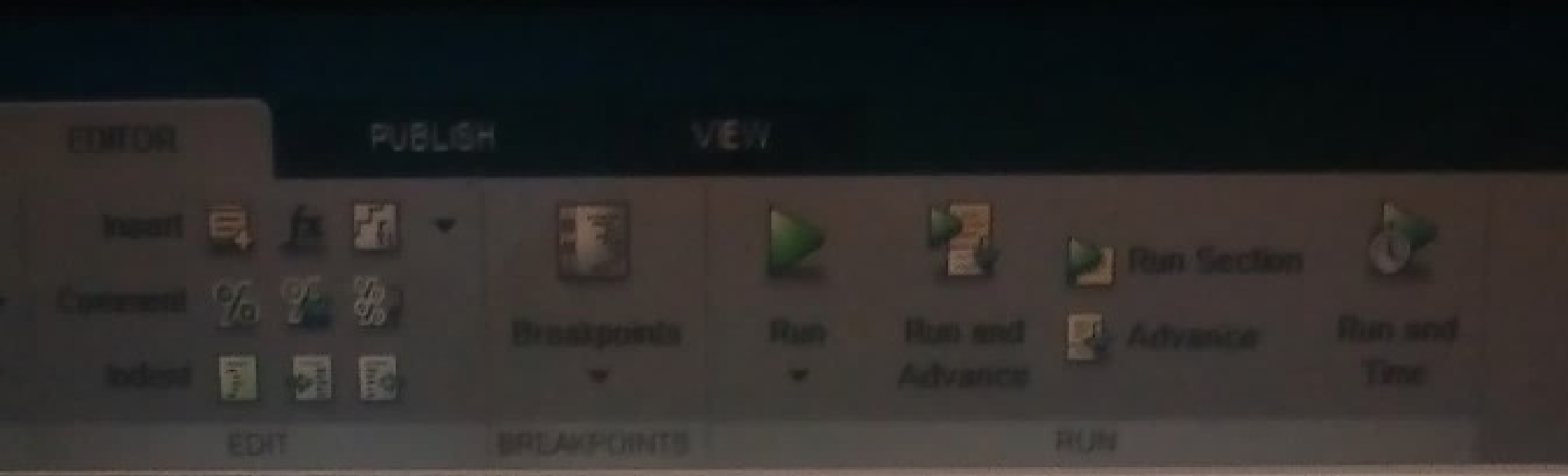
$$3 = 40 - 1 + C$$

$$3 = 39 + C$$

$$3 - 39 = C_1 \quad \therefore C = -36$$

$$y = 50\left[\frac{1}{0.025} + (0.025\sin t - \cos t) - 36e^{0.025t}\right]$$

$$y = 2000 + 50(0.025\sin t - \cos t) - \frac{1800}{e^{0.025t}}$$



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1 -    commandwindow
2 -    clear
3 -    clc
4 -    close all
5 -    syms y t
6 -    x=dsolve('Dy =(50*(1+sin(t))-(0.025*y)','y(0)=150','t')
7 -    ezplot(x,[0:0.5:450])
8 -    axis([0 450 0 2500])
9 -    grid on
10 -   grid minor
```