1.

1200 gal of water. ⟩ Initial aggregation.
150 lb of Salt

$$\frac{50 \text{ gal of brine (Salt & water)}}{(1+\sin t) \, lb} \Big\rangle \text{ inlet}.$$

$$\frac{30 \text{ gal Per minute}}{} \; — \; \text{Out}.$$

Using balance's law:

$$\begin{pmatrix} \text{Accumulation rate of} \\ \text{Salt with a System} \end{pmatrix} = \begin{pmatrix} \text{intake rate of} \\ \text{Salt into the System} \end{pmatrix} - \begin{pmatrix} \text{Output rate of} \\ \text{Salt within the System} \end{pmatrix}$$

Therefore $\dfrac{dm}{dt} = m_{in} - m_{out}$.

$$m_{in} = \frac{50 \text{ gal}}{min} \times \frac{(1+\sin t) \, lb}{gal} = \frac{50(1+\sin t) \, lb}{min}$$

$$m_{out} = \frac{30 \text{ gal}}{1200 \text{ gal}} = 0.025 = 2.5\% \text{ of } m$$

$$\frac{dm}{dt} \times \frac{lb}{min} = \frac{50(1+\sin t) \, lb}{min} - 2.5\% \text{ of } m \frac{lb}{min}.$$

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

Collecting $-0.025 m$ from the equation.

$$\therefore -0.025m + 50(1 + \sin t)$$

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

$$\therefore \frac{dm}{dt} = -0.025 (m - 2000(1 + \sin t))$$

Cross multiply.

$$\frac{dm}{[m-20]} \quad \therefore dm = -0.025(m - 2000(1 + \sin t)) dt.$$

Then divide it by $(m - 2000(1 + \sin t))$.

$$\frac{dm}{(m - 200(1+\sin t))} = -0.025 dt$$

$$\int \frac{dm}{(m - 2000(1+\sin t))} = \int -0.025 dt$$

$$\int \frac{dm}{[m - 2000(1+\sin t)]} = -0.025 \int dt$$

$$\ln[m - 2000(1 + \sin t)] = -0.025t + C.$$

$$m - 2000(1 + \sin t) = e^{-0.025 + C}$$

$$m - 2000(1 + \sin t) = e^{-0.025} + e^{c}$$

$$m - 2000(1 + \sin t) = e^{-0.025} \quad m_0$$

$$m - 2000(1 + \sin t) = M_0 e^{-0.025t}$$

$$m = M_0 e^{-0.025t} + 2000(1 + \sin t)$$

It was given that $t = 0$ mins initially; therefore $m = 150 lb$.

$$150 = M_0 e^{-0.025t} + 2000(1 + \sin(t))$$

$$150 = m_0 e^{-0.025(0)} + 2000(1 + \sin(0))$$

$$-m_0 = 2000 - 150$$

$$-M_0 = 1850 \quad \text{divide both sides by } (-1$$

$$= M0 = -1850_{||}.$$

$$\therefore -0.025m + 50(1 + \sin t)$$

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

$$\therefore \frac{dm}{dt} = -0.025 (m - 2000(1 + \sin t))$$

$$\frac{dm}{m - 2000} \quad \text{Cross multiply.}$$

$$\therefore dm = -0.025 (m - 2000(1 + \sin t)) dt.$$

Then divide it by $(m - 2000(1 + \sin t))$.