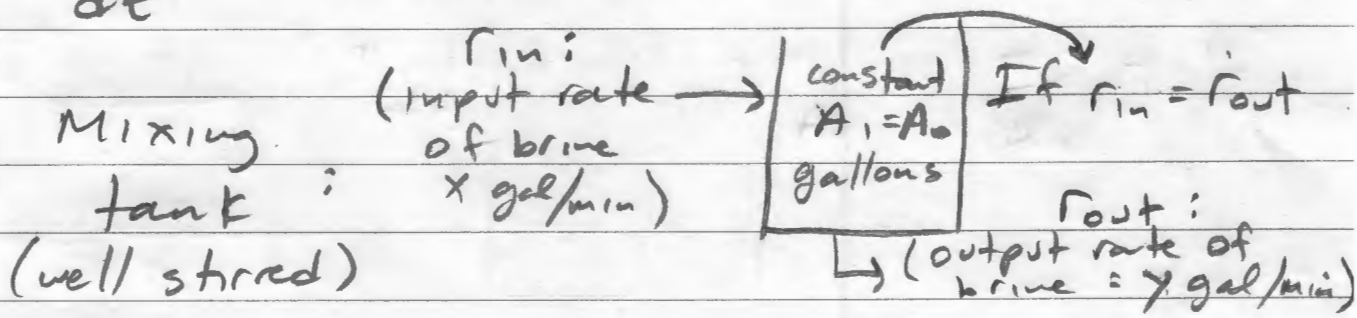
Mixtures:

A_0 = Initial amount of Brine in tank

A_1 = Amount of brine in tank at time t

$A(t)$ = amount of salt at time t

$\frac{dA}{dt}$ = Rate at which $A(t)$ changes



- The solution is pumped out at the same rate as entering the solution

$$\frac{dA}{dt} = \begin{pmatrix}\text{input rate}\\ \text{of salt}\end{pmatrix} - \begin{pmatrix}\text{output rate}\\ \text{of salt}\end{pmatrix}$$

$$= R_{in} - R_{out}$$

R_{in} → input rate at which salt enters the tank or input rate of salt

$$R_{in} = \begin{pmatrix}\text{inflow concentration}\\ \text{of salt}\end{pmatrix}\begin{pmatrix}\text{input rate}\\ \text{of brine}\end{pmatrix}$$

$$R_{out} = \begin{pmatrix}\text{outflow concentration}\\ \text{of salt } c(t)\end{pmatrix}\begin{pmatrix}\text{output rate}\\ \text{of brine}\end{pmatrix}$$

$$c(t) = \frac{A(t)}{A_1} \text{ lb/gal}$$

$$\therefore \quad \frac{dA}{dt} = \begin{pmatrix}\text{inflow concentration}\\ \text{of salt}\end{pmatrix}\begin{pmatrix}\text{input rate}\\ \text{of brine}\end{pmatrix} - \begin{pmatrix}\text{outflow concentration}\\ \text{of salt} + c(t)\end{pmatrix}\begin{pmatrix}\text{output rate}\\ \text{of brine}\end{pmatrix}$$

If r_{in} and r_{out} denote the general input and output rates of the brine solutions, then there are three possibilities:

		Gallons in tank
(1)	$r_{in} = r_{out}$	constant A_1
(2)	$r_{in} > r_{out}$	increasing
(3)	$r_{in} < r_{out}$	decreasing (at the net rate $r_{in} - r_{out}$)

Case (2): $r_{in} > r_{out}$ and # gallons of brine in tank is increasing then it is accumulating liquid at a rate of $(r_{in} - r_{out})$ gal/min. After t minutes there are $A_1 = A_0 + (r_{in} - r_{out})t$ gallons

Case (3): $r_{in} < r_{out}$ and # gallons of brine in tank is decreasing then, it is losing liquid at a rate $(r_{in} - r_{out})$ gal/min. After t minutes there are $A_1 = A_0 + (r_{in} - r_{out})t$ gallons where $r_{in} - r_{out}$ is negative.