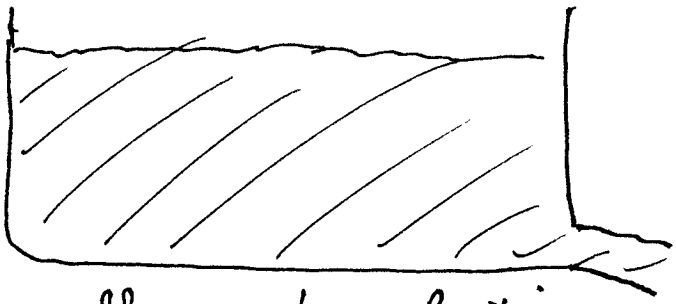
MIXTURE PROBLEMS

t: minutes

$S(t)$: lbs. of salt in tank at time t

CASE 1.) Flow rate IN EQUALS flow rate OUT

IN: $\frac{\alpha \text{ lbs.}}{\text{gal.}}$, $\boxed{\frac{\beta \text{ gal.}}{\text{min.}}}$



G gallons of solution

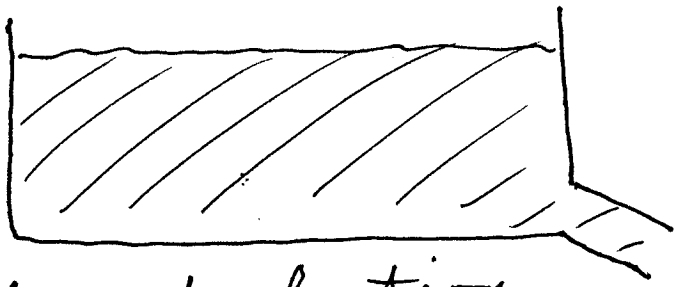
OUT: $\frac{S(t) \text{ lbs.}}{G \text{ gal.}}$, $\boxed{\frac{\beta \text{ gal.}}{\text{min.}}}$,

Then $\frac{dS}{dt} = (\text{Rate IN}) - (\text{Rate OUT})$

$= \left(\frac{\alpha \text{ lbs.}}{\text{gal.}}\right)\left(\frac{\beta \text{ gal.}}{\text{min.}}\right) - \left(\frac{S(t) \text{ lbs.}}{G \text{ gal.}}\right)\left(\frac{\beta \text{ gal.}}{\text{min.}}\right)$

CASE 2.) Flow rate IN does NOT EQUAL flow rate OUT

IN: $\frac{\alpha \text{ lbs.}}{\text{gal.}}$, $\boxed{\frac{\beta \text{ gal.}}{\text{min.}}}$



G gallons of solution INITIALLY

OUT: $\frac{S(t) \text{ lbs.}}{G+(\beta-\lambda)t \text{ gal.}}$, $\boxed{\frac{\lambda \text{ gal.}}{\text{min.}}}$,

Then

$$\frac{dS}{dt} = (\text{Rate IN}) - (\text{Rate OUT})$$

$$= \left(\frac{\alpha \text{ lbs.}}{\text{gal.}}\right)\left(\frac{\beta \text{ gal.}}{\text{min.}}\right) - \left(\frac{S(t) \text{ lbs.}}{G+(\beta-\lambda)t \text{ gal.}}\right)\left(\frac{\lambda \text{ gal.}}{\text{min.}}\right)$$