Consider the given tank containing 50 gallons of salt water solution in the diagram below. Let $x$ represent the pounds of salt in the tank at time $t$. Initially, the tank contains 15 pounds of salt. Assume that a solution containing $1/2$ pound of salt per gallon flows into the tank at the rate of 10 gal./min and the well-stirred mixture flows out of the tank at the same rate. Set up a differential equation describing the rate of change of the amount $x$ of salt in the tank at time $t$ with initial condition, then solve the differential equation.

Let $X$: lbs. of salt in tank at time $t$
$t$: minutes

$$\frac{dX}{dt} = \text{(rate in)} - \text{(rate out)}$$
$$= \left( \frac{\frac{1}{2} \text{ lbs.}}{\text{gal.}} \right) \left( 10 \text{ gal.} \right) - \left( \frac{x \text{ lbs.}}{50 \text{ gal.}} \right) \left( 10 \text{ gal.} \right)$$
$$\rightarrow \frac{dX}{dt} = 5 - \frac{1}{5} x \text{ (lbs.)} \left( \text{min.} \right)$$

$10$ gal./min.

$t=0$, $X=15$ lbs.

$$X = 25 - 10e^{-\frac{t}{5}}$$

$10$ gal./min.