1. A 100 gallon tank contains a brine mixture with concentration 0.1 pounds of salt per gallon. A brine mixture of concentration 0.2 pounds of salt per gallon is flowing in at a rate of 2 gal/min. The tank is well mixed and the resulting mixture is flowing out at 2 gal/min. Find the amount of salt in the tank as a function of time.

\[ \frac{dx}{dt} = 2 \cdot (0.2) - \frac{x}{100} \cdot (2) = \frac{2}{5} - \frac{x}{50} = \frac{20 - x}{50} \]

\[ \int \frac{dx}{20 - x} = \int \frac{dt}{50} \]

\[ - \ln |20 - x| = \frac{1}{50} t + C \]

\[ 20 - x = Ce^{-\frac{t}{50}} \]

\[ x(0) = 10 \quad \Rightarrow \quad C = 10 \]

\[ x(t) = 20 - 10 e^{-\frac{t}{50}} \]

2. Set up an initial value problem for the tank described above if the flow out is increased to 4 gal/min. Do Not Solve.

\[ \frac{dx}{dt} = 2 \cdot (0.2) - \left( \frac{x}{100 - 2 \cdot 4} \right) (4) \quad , \quad x(0) = 10 \]