1. A salt brine tank has pure water flowing in at 10 L/min. The contents of the tank are mixed thoroughly and continuously. The brine flows out at 10 L/min. Initially, the tank contains 150 L of brine, at a concentration of 5 g/L. Follow the steps below to determine the concentration of brine after 30 minutes, and the limiting concentration of the brine.

   (a) Let $S(t)$ = amount of salt in the tank at time t (in g)
   and let $C(t)$ = concentration of salt in the tank at time t (in g/L)
   $C(0) =$ ______________________________

   $S(0) =$ ____

   Write $C(t)$ in terms of $S(t)$:
   $C(t) =$ ____________________________________

   (b) Now write a differential equation describing how fast is the salt is leaving the tank.

   (c) Solve the initial value problem $\dfrac{dS}{dt} = -\dfrac{S}{15}$, $S(0) = 750$.

   (d) What is the concentration when $t = 30$?

   (e) What is the limiting concentration of the brine?

2. As before, a salt brine tank contains 150 L of brine at a concentration of 5 g/L. But this time brine at a concentration of 2g/L is pumped into the tank at a rate of 10 L/min. The contents of the tank are mixed thoroughly and continuously and the brine flows out at 10 L/min. Follow the steps below to determine how long until the concentration is 3 g/L, and what the limiting concentration is.

   (a) Again, let $S(t)$ = amount of salt in the tank at time t (in g)
   and let $C(t)$ = concentration of salt in the tank at time t (in g/L)
   $C(0) =$ ______________________

   $S(0) =$ ______________________________

   Write $C(t)$ in terms of $S(t)$:

   $C(t) =$ ______________________

   (b) How fast is salt entering the tank?

   (c) How fast is salt leaving the tank?

   (d) What is the net change of the salt in the tank, $\frac{dS}{dt}$?

   (e) Solve the initial value problem $\frac{dS}{dt} = 20 - \frac{S}{15}$, $S(0) = 750$.

   (f) When is $C(t) = 3$ g/L? What is the limiting concentration?