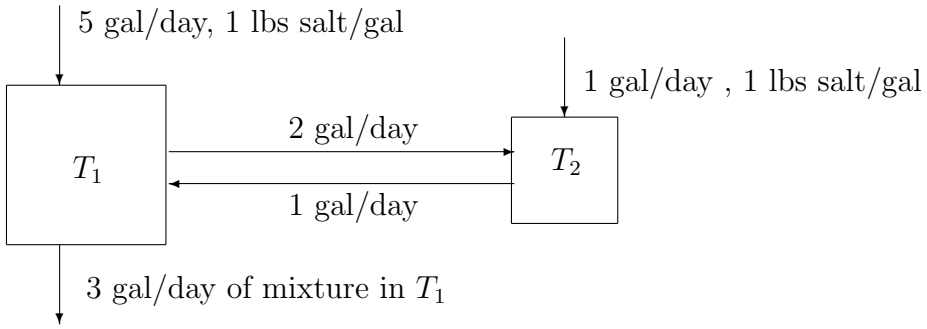
Sample Test I for M309

(1a) There are two tanks, with pipes carrying salt water as shown:



T_1 holds 10 gallons of salt water; T_2 holds 5 gallons of salt water.

Let Q_1 be pounds of salt in T_1 at time t;
Let Q_2 be pounds of salt in T_2 at time t;

Write a system of differential equations for Q_1 and Q_2.

(1b) How many lbs of salt are in T_1 and T_2 when the syatem is in equillibrium?

(2a) Find the general solution to $x' = Ax$, where $A = \begin{bmatrix} 1 & 1 \\ 4 & 1 \end{bmatrix}$

(2b) Find the solution to $x' = Ax$, where $x(0) = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$,