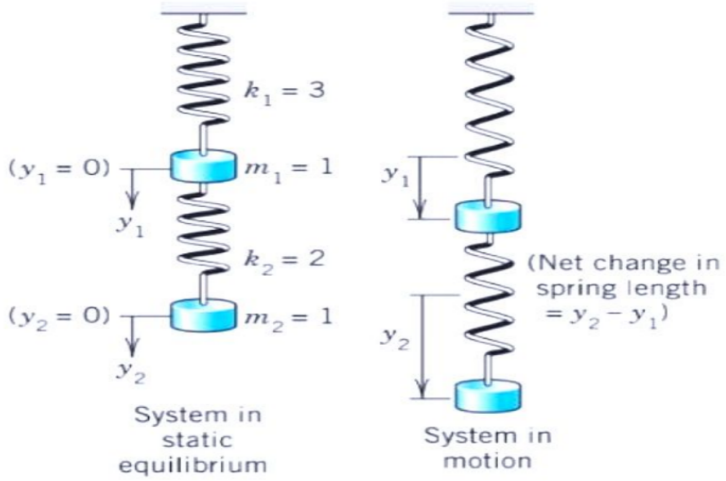
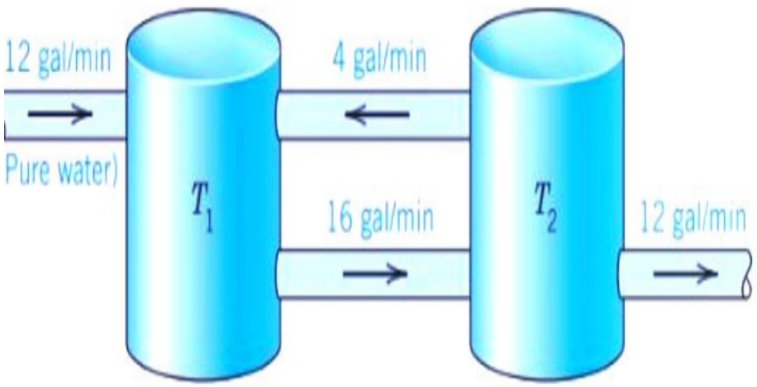
MTH204: Worksheet 8

April 5, 2023

1. **Two masses on springs** **(3)**
   (a) Set up the model for the (undamped) system in the figure below.
   (b) Solve the system of ODEs obtained. Hint. Try $y = xe^{\omega t}$ and set $\omega^2 = \lambda$.



2. **Mixing problem.** Each of the two tanks contains 200 gal of water, in which initially 40 lb (Tank T_1) and 20 lb (Tank T_2) of fertilizer are dissolved. The inflow, circulation, and outflow are shown in the figure given below. The mixture is kept uniform by stirring. Find the fertilizer contents $y_(t)$ in T_1 and $y_2(t)$ in T_2. **(3)**



3. **Network.** Show that a model for the currents $I_1(t)$ and $I_2(t)$ in the figure is

$$\frac{1}{C}\int I_1 dt + R(I_1 - I_2) = 0,\ LI_2' + R(I_2 - I_1) = 0.$$

Find a general solution, assuming that $R = 5\Omega,\ L = 5H,\ C = 1/25F$. **(4)**