Math 274 Quiz 9 **Name:** _____

Sections: 7.6 Point values in boxes.

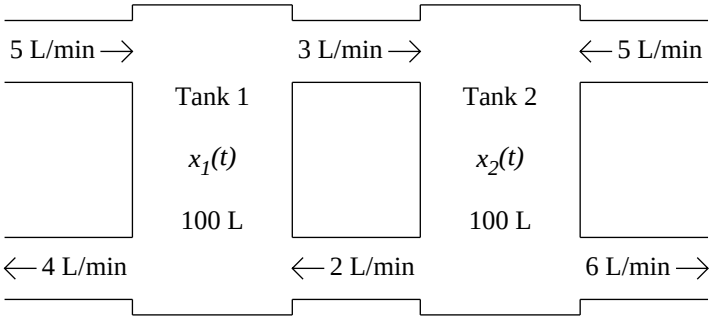
30 May 2018

1. [3] Consider the system given by

$$\begin{aligned} x' &= 2x - 5y + 7, & x(0) &= 5 \\ y' &= x + 4y + e^{t^2}, & y(0) &= 1. \end{aligned}$$

Convert the system into a second order initial value problem in **standard form** in y. **Do not solve.**

2. [2] Tank 1 initially contains 100 L of a brine mixture with concentration 0.2 kg/L of salt. Tank 2 initially contains 100 L of a brine mixture with concentration 0.4 kg/L of salt. Both tanks are well mixed. A mixture containing 0.3 kg/L of salt is flowing into each tank at the rate specified in the figure. Similarly, the figure shows the rate the mixtures are flowing between each tank and being drained. Let $x(t)$ be the amount of salt in tank 1 in kg, and $y(t)$ be the amount of salt in tank 2 in kg.



Set up a system of first order equations to model the amount of salt in each tank. Include initial data. **Do not convert to second order nor solve.**

3. [4] Consider the mass-spring system given by the symbolic initial value problem

$$y'' + y = \sqrt{3}\delta(t - \pi/2), \qquad y(0) = 0, y'(0) = 1. \tag{1}$$

(a) Find the solution to (1). Express your solution as a piecewise defined function.

(b) [1] Find the magnitude of the impulse needed to stop the motion of the system when it first returns to equilibrium at time $t_1 = 4\pi/3$, i.e., after the impulse at $t_1 = 4\pi/3$ the solution has the following graph.