

Hwmk 8

Math 528 Summer Session 1

Due 6/2 (Wednesday at 11:59 pm)

1 Lemonade Mixer 2.0

You have an industrial lemonade mixer that has two 5 gallon tanks completely filled with lemon juice. Tank 1 initially contains S_0 pounds of sugar dissolved in it and tank 2 initially contains no sugar. From a connecting pipe, lemon juice leaves tank 1 into tank 2 at the rate of 2 gals/min. From a separate connecting pipe, lemon juice leaves tank 2 into tank 1 at the rate of 2 gals/min.

- (a) 2 points Set up the system that will give the amount of sugar in tank 1, $S_1(t)$, and tank 2, $S_2(t)$, at any given time.
- (b) 2 points Using a phase field plotter (I recommend [Plotter](#)), plot the phase field. Then draw those trajectories on your paper for different values of S_0 (should be greater than zero for physical relevance).
- (c) 1 point Using the trajectories, what values do $S_1(t)$ and $S_2(t)$ approach as $t \rightarrow \infty$ for a given S_0 ?
- (d) 1 point Along the trajectories, what is the value of $S_1(t) + S_2(t)$ for a given S_0 ?

2 Friction Fiction

You have gained the god like ability to control friction! Explore this new found ability with the ODE:

$$y'' + \gamma y' + y = 0$$

- (a) 1 point Rewrite the ODE as a system.
- (b) 3 points Classify the 5 different types of critical points that can be achieved by varying γ and specify for what ranges of γ .