

Homework 5 Due March 8

1. (4 points) Consider the following IVP:

$$x'(t) = \frac{2 - \sin(tx)}{3 + \cos(t + x)}, \quad x(0) = -1.$$

- a) Show *local* existence and uniqueness of solutions for the above IVP. Next, use the argument presented in class to prove *global* existence of solutions (*Hint*: Prove that $x(t)$ is bounded if t is bounded, i.e. the solution does not go to infinity in finite time).
- b) Use Euler's formula with $h = 0.02$ to find an approximation for $x(1)$. (write a program in Maple for this task).
2. (3 points) Write a system of DEs that models the flow of saline solution in three interconnected tanks. Every minute 3 gallons of pure water flow in the first tank. The well mixed solution flows from tank 1 into tank 2 at a rate of 2 gal/min and 2 gal/min flow from tank 1 out of the system. From tank 2 the solution leaves at a rate of 5 gal/min and enters tank 3. A solution containing 2 lbs of salt per gallon enters tank 3 at the rate of 3 gal/min. Some solution leaves the third tank at the rate of 1 gal/min. Initially, there were 100 gal of water in the first tank, 90 in the second, and 150 in the third. Will any of these tanks empty out? When?
3. (3 points) In 15-20 lines describe in your own words the project on which you are working this semester. You may not consult your teammates on this task. Type the description, print it, and attach it to this week's homework. This task has to be completed by everyone who wishes to receive credit for the poster presentation(s).