

18.034 Problem Set 2

Due Tuesday, February 21 in class.

1. On page 61 in the text is the statement, “as the examples below show, anything can happen: IVP (2) [on page 60] may have exactly one solution, many solutions, or none at all.” This statement is incorrect. As long as the function f is continuous, the IVP (2) always has at least one solution. Write a few sentences explaining why the “examples below” do *not* show that (2) may have no solutions.

2. Page 684, problem 5.

3. Page 684, problem 6.

4. Page 36, problem 5.

5. The text uses (more or less) the IVP $y' = -Ay^{1/2}$, $y(0) = 0$ to illustrate the fact that an IVP may have several solutions. Describe a physical system that is modeled by this IVP, in which y represents the kinetic energy of a particle. (Hint: you might think of a particle whose total energy is a sum of kinetic and potential energies; and whose potential energy is proportional to its height above the ground. If you write down the conservation of energy equation and differentiate it, you should get something like the differential equation written above.) (I don't actually know a really satisfactory way to answer this question; I'm curious to see what you come up with.)