

Math 256
Applied Honors Calculus IV: Differential Equations, Fall 2007

Homework Set 1
Due Friday, September 14

Problems to Study:

- Section 1.3, # 10, 11. Practice verifying that a given function satisfies a differential equation. While it is often difficult and in fact usually impossible to find an explicit solution of a differential equation, it is very easy to check whether a candidate function is indeed a solution or not. This is an easy way to check your work on exams.
- Section 1.3 # 1,2,3,4. Classification of differential equations.

Problems to Hand In:

- Section 1.1, # 4. Plotting a direction field by hand. For this problem, use a calculator to find the slopes on a 3×3 grid of equally spaced points in the (t, y) -plane corresponding to $t = 0, 0.5, 1$ and $y = 0, 0.5, 1$. Plot the slopes on graph paper with arrowheads pointing in the direction of increasing t . Include a table of your values as well as your plot. Can you guess the behavior of solutions from this relatively sparse grid of slopes?
- Section 1.1, # 22. Evaporation of a raindrop.
- Section 1.1, # 25. Nonlinear friction.
- Section 1.2, # 17. The discharge process for an electric capacitor. Hints: (1) The parameters R , C , and V are all constants. (2) When we say that the battery is removed from the circuit at time $t = t_1$ we mean that the two wires that were attached to the $+$ and $-$ ends of the battery before are now suddenly joined together at this time. What should V be set equal to once the wires have been joined in this way?
- Plotting a direction field using the computer. Use the MATLAB command `dfield` to plot and print the direction field for the differential equation discussed on pages 86-88 of the text. Play with the ranges of t and y and the parameter values r and T and K to make an easily read graph.
- Section 2.1, # 27. Practice solving initial-value problems for first-order linear equations. It is good to see what the solution tells you about the solutions. That is why I like the last part of this and the next questions.
- Section 2.2, # 23. Practice with separation of variables.
- Section 2.2, # 30. Homogeneous first-order equations. This is a persistent theme in differential equations. When equations have a symmetry (in this case homogeneity) it is often useful in making simplifications.