Math 331.1 **Problem Set 1** **Fall, 2005**

Due: Friday, Sept. 16, start of class

Follow the instructions about problem set format of problem sets (see the Course Description handout or the course web site). And observe the rules there about collaboration and plagiarism!

1. Do page 14, Exercise 2.
2. Do page 17, Exercise 12.
3. Do page 34, Exercise 16. Identify the equilibrium solutions, if any.
4. (a) Determine the equilibrium solutions, if any, of the ODE $y' = y\,(1-y)$.
   (b) Solve (analytically) the initial-value problem: $y' = y\,(1-y)$, $y(0) = -2$.
5. When the coroner arrived at midnight, the corpse on the floor had a temperature of 85°F in the 65°F room. The corpse was left where it was found as the investigators went about their work. Three hours later, the temperature of the corpse had dropped to 70°F, while the room temperature continued to remain constant. When did the death occur?

   In setting up the differential equation, explicitly state the assumptions you make.
6. Do page 35, Exercise 40.
7. For the ODE $y' = 1 - y$, whose independent variable is t:
   (a) Analytically find equations for, and describe geometrically, the isoclines $f(t, y) = c$ for arbitrary constant c.
   (b) By hand, sketch these isoclines in the (t, y)-plane for
   $$c = -2, -1.5, -1, -0.5, 0, 0.5, 1, 1.5, 2$$
   and label each isocline ("$c = -2$", etc.). Then plot slope marks along these isoclines.
   (c) Using those slope marks as guide, on the same graph now plot the ODE's solution curves for each of the initial conditions:
   $$y(0) = -2, -1.5, -1, -0.5, 0, 0.5, 1, 1.5, 2$$
   (Include the portions of the solution curves for $t < 0$, too, to the extent that they fit on the graph.)
   (d) Check your work by using HPGSolver (from the textbook's CD) to draw the slope field along with those solution curves. (You must turn in a printout!)
8. Repeat Problem 7, above, but for the ODE
   $$y' = 2\,y - t.$$
   In part (d), instead of HPGSolver, use the JOde applet Slope Field Calculator—this is the one linked on the main JOde page to the task "Slope fields and solutions of equations of the form y'=f(x,y)".