Math 2250-004
Homework due January 31.

Recall that problems which are not underlined are good for seeing if you can work with the underlying concepts; only the underlined problems need to be handed in; and that the Wednesday quiz will be drawn from all of these concepts and from these or related problems.

2. 1 Modeling with differential equations and solving 1st order autonomous DE's from model descriptions:
10, 12, **23**, 33 (In 10, note that delta is the morality rate (deaths per week, per fish), not the death rate (deaths per week). In 23, notice this is just a logistic DE, so you may use the general solution formula.)

w3.1) In problem 23, use technology (e.g. dfield) to plot the differential equation slope field for $0 \le t \le 3$ and $-50 \le x \le 250$. Use the dfield option which lets you specify initial values in order to add the graph of the solution to the IVP in 23, along with the graphs of the two equilibrium solutions. (If you're using other software do something analogous.) Notice that as you move your mouse over the dfield plot, its location is tracked by the dfield applet. Use your mouse to find the time when the solution to the IVP in 23 satisfies $x(t) = 100$, and record this information. Print out a copy of your plot; add the coordinates of this intersection point at which $x = 100$. Is the $t-$ coordinate of this point consistent with your work in 23b?

2.2: *equilibria, stability, phase portraits, slope fields for autonomous first order DE's:*
5, 7, 9, 11
w3.2) Consider the differential equation

$$\frac{dx}{dt} = -4\,x^4 + x^2 .$$

a) Find the equilibria; draw the phase portrait;
b) classify the equilbria as stable, asymptotically stable, or unstable (possibly one-sided stable, i.e. semi-stable);

2.3: improved velocity-acceleration models:
2, 3, 9, *10: constant, or constant plus linear drag forcing*
13, 14, *15, 16, 17, 18,* ***19****: quadratic drag*

2.4-2.6: *numerical methods for approximating solutions to first order initial value problems. Your Maple/Matlab lab assignment this week will address these topics.*
2.4: 4: Euler's method
2.5: 4: improved Euler
2.6: 4: Runge-Kutta