Turn in starred problems, including problem 6.A below, on Wednesday, 10/19/2016. **Be sure to read the instructions below.**

Section 7.2: 1; 4 (a), (b)*; 5 (a), (c), (f); 10

Section 7.3: 1 (a), (e), (h); 9 (a), (g)*, (h)*, (j), 11 (a), (d), (e)*

6.A* Consider the second order differential equation $x'' - x + 3x^5 = 0$.

(a) Convert this second order equation to a system of two first order equations for unknowns $x(t)$ and $y(t)$ by setting $x' = y$.

(b) Find a conserved quantity for this system (for example, using the method at the bottom of page 338)

(c) Use the conserved quantity to sketch several representative phase trajectories, including enough trajectories to capture all qualitatively different possibilities. In particular, sketch trajectories that go to and from a saddle point. Use arrows to indicate the direction of movement along those trajectories.

Instructions for Section 7.2: In problems 4 and 5, the instruction to find "the equation of the phase trajectories" means to find a conserved quantity by the method indicated at the bottom of page 338 (equations (4) and (5)) and use that to plot trajectories.

Instructions for Section 7.3: In problems 9 and 11, first **find the general solution of the equations by matrix methods**—that is, using eigenvalues and eigenvectors—as we did in class. Then complete the instructions in the text. Finally, in problem 11 (as well as problem 9), **sketch some trajectories in the phase plane.** In problem 11 your sketch can be very rough.

Important note: Question 7.3.11 involves complex eigenvalues. We will cover these in class on Monday, October 17.