Math 2250-004
Week 14-15 concepts and homework
sections 7.3-7.4 Due Tuesday April 24 at 6:00 p.m.

Carried over from last week:

7.3) the eigenvalue-eigenvector method for finding the solution space to homogeneous constant coefficient first order systems of differential equations: real and complex eigenvalues.
7.3: 3, 13, 29, 31, **34**, 36. *In* **34** *you may use technology to find the eigendata to save time, or if you want practice working by hand, just use technology to check your answer.*

w14.1 Use the eigenvalue-eigenvector method (with complex eigenvalues) to solve the first order system initial value problem which is equivalent to the second order differential equation IVP on the Wednesday April 18 notes. This is the reverse procedure from Wednesday, where we use the solutions from the equivalent second order DE IVP to deduce the solution to the first order system IVP. Of course, your answer here should agree with our work there!

$$\begin{bmatrix} x'(t) \\ v'(t) \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -5 & -2 \end{bmatrix} \begin{bmatrix} x \\ v \end{bmatrix}$$

$$\begin{bmatrix} x(0) \\ v(0) \end{bmatrix} = \begin{bmatrix} 4 \\ -4 \end{bmatrix}$$

New homework:

7.4) Second order systems of differential equations arising from conservative systems. Identifying fundamental modes and natural angular frequencies; forced oscillation problems and the potential for practical resonance when the forcing frequency is close to a natural frequency.
7.4: **2**, 3, **8**, **12**, 13, **14, 16**, **18** .

w14.2) This is a continuation of **18**. In physics you learn that you can recover the final velocities from the initial ones in a conservative problem like 18 by equating the initial momentum $m_1 v_0$ to the final momentum $m_1 v_1 + m_2 v_2$ and the initial kinetic energy $\frac{1}{2} m_1 v_0^2$ to the final kinetic energy $\frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2$, and solving this system of equations for v_1 and v_2. Carry this procedure out for the data in **18** and show that your answer agrees with your work in that problem.