Linear Algebra

Just make sure you have the appropriate linear algebra down. See lecture notes for specifics. Anyway, you'll know what you need by attempting 8.1,2.

Section 8.1

- Convert between system and matrix form.
- Understand what an initial value problem is and what it means to solve it.
- Understand what the superposition principle is saying.
- Be able to show a set of solution vectors is linearly independent or dependent (e.g., the Wronskian for linear independence, and $v = cu$ for some $c \neq 0$ implies v and u are linearly dependent).
- Identifying a fundamental set.
- Using a fundamental set to construct the general solution.

Section 8.2

In each case below, be able to solve an initial value problem in addition to finding the general solution.

Distinct Eigenvalues

- General solution for distinct eigenvalue case for general n.
- Be able to find general solution for distinct eigenvalue case for 2x2's and 3x3'.

Repeated Eigenvalues

- If λ has multiplicity 2 or 3, and you can find 2 or 3 linearly independent eigenvectors, respectively, be able to find general solution (this is the first example we did for repeated eigenvalues). This pertains only to 2x2 or 3x3 matrices.
- If A is 2x2, and λ is a repeated eigenvalue (i.e., has multiplicity 2), and if λ has only one eigenvalue up to scaling, find general solution (this is the last example we did for repeated eigenvalues).

Complex Eigenvalues

- Make sure you are comfortable with finding complex eigenvalues and eigenvectors!
- If the 2x2 A has complex eigenvalues, find the general solution.

Phase Portraits

(This depends on far we get on Tuesday)

Ultimately, you need to classify the equilibrium point, and the long term behavior of solutions. We only consider A as a 2x2 and with $\det A \neq 0$.

The cases to consider are as follows.

- Distinct eigenvalues λ_1, λ_2, with $\lambda_1, \lambda_2 > 0$ or $\lambda_1, \lambda_2 < 0$ or $\lambda_1 > 0$,$\lambda_2 < 0$.
- Distinct eigenvalues λ_1, λ_2 with $\lambda_1 \neq 0$ and $\lambda_2 = 0$.
- Repeated eigenvalue λ with λ positive or negative.
- Complex eigenvalue $\lambda = a + ib$ with $b \neq 0$, and a positive or negative or zero.