DUE: Start of recitation, 3/31/15 (T3) or 4/2/15 (T2).

PLEASE BRING TEXTBOOK TO LAB since problems refer to the text! For this assignment, please download sample Maple code[1] available on UBlearns or at http://www.nsm.buffalo.edu/∼mangahas/Math306/Samplecode.html.

1. Consider the matrix
$$\mathbf{A} = \begin{bmatrix} 4 & 3 & 2 \\ 5 & 6 & 3 \\ 3 & 5 & 2 \end{bmatrix}$$
Modify the sample code to find the inverse of this matrix. Then show that the matrix you found satisfies the definition of a multiplicative inverse, by computing AA^{-1} and $A^{-1}A$ (both products should give the I matrix).

2. Find a 3-by-4 matrix X such that
$$\begin{bmatrix} 4 & 3 & 2 \\ 5 & 6 & 3 \\ 3 & 5 & 2 \end{bmatrix} X = \begin{bmatrix} 3 & -1 & 2 & 6 \\ 7 & 4 & 1 & 5 \\ 5 & 2 & 4 & 1 \end{bmatrix}$$
Use Maple to show that the matrix you find for X satisfies the above equation.

3. Revisit homework problems **2, 6, and 10 in Chapter 4.2** and:
    a. For each problem, rewrite the system of equations in form $v' = Pv$, where
    $$v = \begin{bmatrix} x \\ y \end{bmatrix}, \qquad v' = \begin{bmatrix} x' \\ y' \end{bmatrix}, \qquad \text{and} \qquad P \text{ is a 2-by-2 matrix.}$$
    Hint for 10: it may be easier to first write $Av' = Bv$ and then show that A has an inverse A^{-1}. Then $v' = A^{-1}Bv$ so let $P = A^{-1}B$.
    b. For each problem, modify the sample code to find the eigenvalues and eigenvectors for the matrix P.
    c. For each problem, modify the sample code to generate phase portraits for the given system of equations. You should select sufficiently many ICs in the code, so that the phase portrait clearly shows the flow of the solution in each region.

4. Solve textbook problems (a) 5.2.46, (b) 5.2.48, and (c) 5.2.49 using both Maple and the **eigenvalue method** discussed in class and chapter 5.2. That is, use commands `eigenvectors(A)`, `eigenvalues(A)` and `charpoly(A,lambda)` in Maple; use this information to write the general solution, in vector form, for each of these problems. Note that Maple is not used to write the general solutions! That's what the eigenvalue method is for.

[1] Code taken from Shared Software for 306, UB Department of Mathematics