Name:____________________________

Math 214 – Linear Systems

Spring Term 2000

Lab 2

Directions: This is a brief lab on determinants. You may simply fill in the information requested, giving short explanations, especially when you are asked to make a conjecture (educated guess). You may work together, but what you present here must reflect your understanding.
Due Date: Friday, 3 March, in class.

DETERMINANTS

MatLab can find the determinant of A very quickly with the command: `det(A)`.

1. Without the computer, find the following determinants, giving a brief comment on how you got your answer (they should be quite easy with a little thought). Then use MatLab's `det(A)` command to verify your answers:

(a) `I = eye(3) =` $\begin{bmatrix} \quad & \quad & \quad \\ & & \\ & & \end{bmatrix}$. `det(I) =`

(b) `B =` $\begin{bmatrix} 4 & 4 & 4 \\ 7 & 7 & 7 \\ 2 & 3 & 4 \end{bmatrix}$. `det(B) =`

(c) `C =` $\begin{bmatrix} 3 & 0 & 0 \\ -1 & 2 & 0 \\ -7 & \pi & 1 \end{bmatrix}$. `det(C) =` (Note: You can just type `pi` in MatLab.)

2. Find the determinant of A below using MatLab. Then use this value to make conjectures (educated guesses) about the remaining determinants. Give a brief comment on how your made your conjecture. Finally, check your answers by using MatLab.

$$\texttt{det(A)} = \begin{vmatrix} 1 & -2 & 1 \\ -2 & 6 & -2 \\ -3 & 6 & -2 \end{vmatrix} =$$

(a) Conjecture (w/ brief reasoning): `det(2*A)` $= |2A| =$

Check with MatLab.

(b) Conjecture (w/ brief reasoning): `det(-A)` $= |-A| =$

Check with MatLab. Is `det(-M)` always equal to `-det(M)` for any matrix M? How do you make this result consistent with part (a)?

(c) Conjecture (w/ brief reasoning): `det(A')` $= |A^T| =$

Check with MatLab.

(d) Conjecture (w/ brief reasoning): `det(inv(A))` $= |A^{-1}| =$

Check with MatLab.

3. The following problem shows that the calculation of the determinant is sometimes sensitive to small changes in the elements of the matrix. Let

$$A = \begin{bmatrix} -73 & 78 & 24 \\ 92 & 66 & 25 \\ -80 & 37 & 10 \end{bmatrix}$$

then compute the following. (Note: Recall the quick way to change just one element in a matrix is to type in the whole matrix and then type something like `A(3,3) = 10.01`.)

(a) `det(A)`

(b) `det(A)` where $a_{33} = 10.01$

(c) `det(A)` where $a_{21} = 92.01$ (Put a_{33} back to 10)

(d) `det(A)` where $a_{12} = 78.01$ (Put a_{21} back to 92)

Question for Reflection. Reflect on the following question and type a short but detailed response. The response should be well-reasoned and well-written (i.e., complete sentences, paragraphs, thoughts). Please attach your response to this lab.

- Consider section 3. Were the results surprising at first? Can you explain these results with a geometric interpretation of the determinant?