CS559 Homework 1   name: _____
Due: September 10, 2001, 9:30 am

                                                                Cs login: _____

Linear Algebra Refresher

Please either answer in the space provided, or attach additional sheets. Be sure to write
your name AND CS login and EVERY page, and to attach multiple pages together with a
staple. Remember, your course survey is also due at the same time (but don't staple it to
your homework)

1. Prove that the determinant of the matrix $\begin{vmatrix} x1 & x2 & x3 \\ y1 & y2 & y3 \\ 1 & 1 & 1 \end{vmatrix}$ can be used to tell if the
    three 2D points ((x1,y1), (x2,y2), (x3,y3)) are co-linear. Show what value this
    determinant has when the points are co-linear and that it must have this value for
    any set of co-linear points.

2. Suppose we have n k by k matrices (A, B, C, …) and m k-vectors (a, b, c, …) and
    that we want to compute the product of all of these matrices times each vector
    (e.g. ABCa, ABCb, ABCc, …).
    Clearly, for each of these products it is faster (in terms of the number of
    arithmetic operations) to do the multiplies from right to left (doing a sequence of
    vector/matrix multiplies) than left to right.
    However, for a large enough number of vectors (m), it will be faster to compute
    the product of the matrices and to multiply this matrix by each vector.
    Write a condition that determines which is faster (it should be an "if" statement
    involving n, m, and k.

3. Consider the plane (in 3 space) 2x + 2y + z = 2. What point on this plane is
    closest to the origin? Does the unit sphere intersect this plane?