Problem Set 2   Calculus 3   Due 9/10/2004

You are encouraged to work in groups of two to four on this assignment and make a single group submission. Each problem is worth 5 points. For full credit indicate clearly how you reached your answer. All work must be legible and submitted on clean paper without ragged edges.

1. Have Maple generate a graph of the function $f(x,y) = x^2 - y^2 + 2x - 5y - 5$.

   a) Look at the point (1, -3, 4). If the x value is increased from this point, should the z value increase or decrease?
   b) From the point (1, -3, 4), increase the x value by 1, find the corresponding z value, and find the slope of the secant line through these two points.
   c) From the point (1, -3, 4), increase the x value by 0.1, find the corresponding z value, and find the slope of the secant line through these two points.
   d) From the point (1, -3, 4), increase the x value by 0.01, find the corresponding z value, and find the slope of the secant line through these two points.
   e) Express what you've been doing in a-d in terms of a limit and evaluate that limit to verify what you should have already conjectured as the value your answers in a-d were approaching.

   a′) Look at the point (1, -3, 4). If the y value is increased from this point, should the z value increase or decrease?
   b′) From the point (1, -3, 4), increase the y value by 1, find the corresponding z value, and find the slope of the secant line through these two points.
   c′) From the point (1, -3, 4), increase the y value by 0.1, find the corresponding z value, and find the slope of the secant line through these two points.
   d′) From the point (1, -3, 4), increase the y value by 0.01, find the corresponding z value, and find the slope of the secant line through these two points.
   e′) Express what you've been doing in a-d in terms of a limit and evaluate that limit to verify what you should have already conjectured as the value your answers in a-d were approaching.

2. This problem walks you through the general procedure for finding a plane passing through three points, using the points (1, 3, -2), (0, 4, 1), and (-2, -5, 0).

   a) Find two vectors in this plane.
   b) Find a vector perpendicular to those two vectors.
   c) Write an equation for the plane containing those three points.
   d) There were a couple of arbitrary choices in this process. One was your choice in part a of which points to make your vectors start and end at. Does this choice affect your final equation? Why or why not?
   e) Another choice you made was which point to use when you wrote your equation in part c. Does the point you select when writing an equation for the plane affect the result? Why or why not?