## Math 211 – Multivariate Calculus – Homework 3

## Due: Friday September 23rd

Please explain your answers carefully using full sentences, not only symbols. You may use the textbook and your notes, and you're welcome to discuss the problems with one another or with me. However, your final answers should be written on your own and in your own words.

At the top of the first page, please list any classmates you collaborated with while working on these exercises (so that we know to expect similar solutions).

1. Consider the surface defined by the equation

$$9x^2 + 16y^2 + 9z^2 = 25$$

- (a) Sketch the intersection between this surface and the xy, xz and yz planes.
- (b) Sketch the surface in  $\mathbb{R}^3$ . Mark the coordinates of the points where |x|, |y| or |z| is maximized.
- 2. Let  $L_1$  be the line through the points (1, 2, 6) and (2, 4, 8). Let  $L_2$  be the line of intersection between the plane  $P_1$  with equation x y + 2z + 1 = 0 and the plane  $P_2$  through the points (0, 0, 1), (3, 2, -1) and (1, 2, 1). Find the distance between the lines  $L_1$  and  $L_2$ .
- 3. (a) Find an equation for the plane P meeting the x-axis at x = a, the y-axis at y = b and the z-axis at z = c.
  - (b) Suppose a line L passes through the point (p, 0, 0) and the point (0, q, 0). When is the line L parallel to the plane P?
  - (c) Under this condition, find the distance between the line L and the plane P.
- 4. (a) Sketch the surface with equation  $x^2 + y^2 z^2 = 0$ 
  - (b) Show that the parametric curve  $r(t) = (3t\cos(3t), 3t\sin(3t), 3t)$  lies on the surface from part a). Sketch this curve.
  - (c) Find a parametric curve describing the intersection between the surface  $x^2 + y^2 z^2 = 0$  and the plane z = x + 1.