Supplementary Exercises for Sections 13.1 and 13.2

1. Classify the following surfaces, completing the square where necessary.

   (a) $z^2 = 4x^2 + 9y^2 + 144$
   (b) $x^2 - y^2 + z^2 - 2x + 2y + 4z + 2 = 0$
   (c) $-4x^2 + y^2 - 4z^2 = 4$

2. Find the domain of the following functions of two variables:

   (a) $\sqrt{9 - x^2} + \sqrt{y^2 - 4}$
   (b) $\arcsin(x^2 + y^2 - 2)$
   (c) $\sqrt{16 - x^2 - 4y^2}$

3. Determine
$$\lim_{(x,y)\to(0,0)} \frac{e^{-x^2-y^2} - 1}{x^2 + y^2}$$
   and
$$\lim_{(x,y)\to(0,0)} \frac{x^3 + y^3}{x^2 + y^2}$$

   (Hint: Use Polar Coordinates)

4. Does the function $f(x, y) = \frac{x-y}{1+x+y}$ have any discontinuities? What about $f(x, y) = \frac{x-y}{1+x^2+y^2}$?
   Explain.

5. Below are two sets of level curves. One is for a cone, one is for a paraboloid. Which is which?
   Explain.