1. For each part, describe, in English, the set of points satisfied by the given equation in the indicated coordinate system. You should give a complete, concise, and clear English description; a graph and/or equation in rectangular coordinates is helpful but not sufficient.

   (a) \( \rho = 4y \) (spherical)  
   (b) \( \varphi = \frac{\pi}{4} \) (spherical)  
   (c) \( r = 5 \) (cylindrical)  
   (d) \( r = 2\sec(\theta) \) (polar)  
   (e) \( z = r^2 \) (cylindrical)  
   (f) \( r^2 + z^2 = 16 \) (cylindrical)

2. For each part, describe the given set of points with an equation of the form \( z = f(r, \theta) \) for cylindrical coordinates or \( \rho = f(\theta, \varphi) \) for spherical coordinates.

   (a) the surface \( z = 3xy \) (cylindrical)  
   (b) the sphere centered at the origin with radius 3 (spherical)  
   (c) the sphere centered at the origin with radius 3 (cylindrical)  
   (d) the cylinder \( y^2 + z^2 = 4 \) (cylindrical)  
   (e) the upper part of the cone \( x^2 + y^2 = z^2 \) (cylindrical)  
   (f) the plane \( z = 5 \) (spherical)

3. Find equations \( r = f(\theta, z) \) (cylindrical) and \( \rho = f(\theta, \varphi) \) (spherical) for the hyperboloid \( x^2 + y^2 = z^2 + 1 \). Do there exist points on the hyperboloid with \( \varphi = 0 \) or \( \varphi = \pi \)? Which values of \( \varphi \) occur for points on the hyperboloid? (A graph of the hyperboloid may help explain what is happening.)