Difficulty guide for worksheet:	
C-level or B-level exam problem:	1, 2
A-level exam problem or challenge for extra study:	3
beyond the scope and/or removed from syllabus:	none

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) $\varphi = \dfrac{\pi}{4}$ (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 φ occur for points on the hyperboloid? (A graph of the hyperboloid may help explain what is happening.)