# 136.272

# Assignment 1 (Sections 13.1-13.7, 14.1-14.2)

Handed: Oct. 3, 2005. Due: Oct. 10, 2005 in class
Show your work (of course). Providing answers without justifying them will not be sufficient.

**1.** [5 marks] Find the equation of the plane which contains the point $(3,-1,5)$ and is perpendicular to the intersection of the planes $x-5y+2z=3$ and $4x+y-z=2$.

**2.** [4 marks] Sketch the surface $x^2+z^2=-y$. Sketch at least two traces of that surface with planes of type $y=c$ (c various constants) and at least two traces with planes of type $z=c$ (c various constant).

**3.** [8 marks]

[1.5] (a) Find the rectangular coordinates of the point $(r,\theta,z)=\left(1,\frac{\pi}{4},1\right)$ given in cylindrical coordinates.

[1.5] (b) Find the rectangular coordinates of the point $(\rho,\theta,\phi)=\left(\frac{1}{2},\frac{3\pi}{2},\frac{\pi}{4}\right)$ given in spherical coordinates.

[2] (c) Find the cylindrical coordinates of the point $(x,y,z)=(3,-3,4)$ given in rectangular coordinates.

[2] (d) Find the spherical coordinates of the point $(x,y,z)=(0,6,8)$ given in rectangular coordinates. Do not simplify here (specifically, instead of finding $\phi$, find, say, $\cos\phi$).

[1] Plot all of the above points in a single coordinate system.

**4.** [8 marks].

[3] (a) Find all points on the curve $\vec{\mathbf{r}}(t)=\left(3t^6,4t^2-1,t^4-8t^2\right)$ where that curve has horizontal tangent lines.

[3] (b) Suppose *l* is any line perpendicular to the plane $x+y+z=2$. Find the angle between that line and the tangent vector to the curve $\vec{\mathbf{r}}(t)=\left(t^2-1,t^3+t,3+t^2\right)$ when $t=-1$.

[2] (c) Find the unit tangent vector of the curve $x=t$, $z=t^2$ at the point $(2,4)$.