Math 233 **<u>Practice Exam 3</u>** **Spring 2006**

1. (a) (6 points) Find the line of intersection of the planes given by equations $2x - 3y + 4z + 5 = 0$ and $y - z = 7$.
(b) Where does the line from part (a) intersect the plane $x + y + z = 0$?

2. (a) Given the points $A = (1, 0, 0)$, $B = (0, 1, 0)$ and $C = (0, 0, 1)$, find the point P on the line segment $\overrightarrow{AB}$ that is closest to C.
(b) Find the area of the triangle with vertices A, B, and C.
(c) Find the plane that contains the points A, B, and C.

3. For the surface $z^2 = x^2 + y^2 - 1$, do the following
(a) Write down the equation of the slice (intersection) of this surface with the plane $z = 3$, and use it to completely describe the curve.
(b) Sketch the slices of this surface in all three coordinate planes.
(c) Find a vector valued function $\vec{r}(t)$ that gives the cuurve in part (a).

4. Consider the line L_1 given by $x = 4 + t, y = 3 + t, z = 1 + 2t$ and the line L_2 given by $x = 1 - t, y = 2t, z = 1 + t$, and also the point $P = (3, 2, -1)$.
(a) Find a parametric equation of a line L that passes through P and is perpendicular to both L_1 and L_2.
(b) Show that P lies on L_1 and find the point Q at which L and L_2 meet.
(c) What is the distance between lines L_1 and L_2? Why?

5. The acceleration vector of a particle moving in space at a time t is $\mathbf{a}(t) = -2t\mathbf{i} + 4\mathbf{j}$.
(a) Find the position $\mathbf{r}(t)$ of the particle as a function of t, if at the time $t = 0$ the velocity vetor is $\mathbf{v}(0) = \langle 3, 0, 4 \rangle$ and at time $t = 3$ the particle is at the point $(0, 1, 0)$.
(b) Find an equation of the tangent line to the curve at the point $(0, 1, 0)$.
(c) Find the length of the trajectory traveled from time $t = 0$ to time $t = 2$.