1) A thin rod 10 m long has a density which varies uniformly from 4 kg/m to 24 kg/m. Find.

(a) The mass, M.

(b) The center of mass, $\overline{x}$.

(c) The rotational inertia about an axis perpendicular to the rod and through the center of mass, I_m . Give your answer as a multiple of the mass, M.

(d) The rotational inertia about an axis perpendicular to the rod and passing through the thick end, I. Give your answer as a multiple of the mass, M.

2)

(a) Using spherical coordinates, find the volume inside the cone $z^2 = x^2 + y^2$ and between the planes $z = 1$ and $z = 2$.

(b) Do (a) using cylindrical coordinates.

3) Find the Jacobian $\partial(x,y)/\partial(u,v)$ for the transformation from cartesian coordinates to parabolic cylindrical coordinates:

$$x = \frac{1}{2}\left(u^2 - v^2\right)$$
$$y = uv$$
$$z = z$$