1. Determine the volume of the solid obtained by intersecting the unit sphere and a cone whose vertex is at the origin and which opens up 45 degrees (as measured from its axis to its side; see board).

2. By making an appropriate change of coordinates, simplify as much as you can the integral $\int \int_D (x-y) f(x+y) \, dx \, dy$ where D is a triangle whose vortices are at $(0,0)$, $(1/2, 1/2)$ and $(1,0)$.

3. Find the work done by the force field $F(x,y) = (-y, x)$ on a particle that moves once counterclockwise around the unit circle $x^2 + y^2 = 1$.