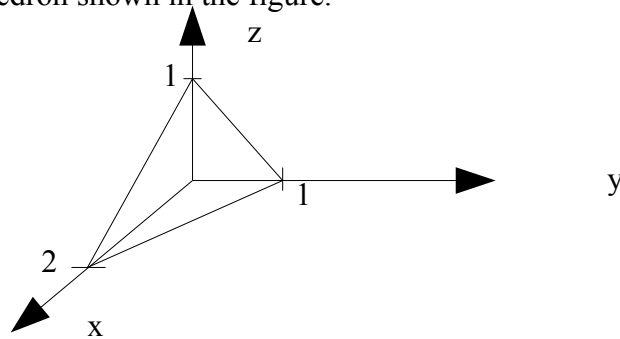


**Phys 2201 – Electricity and Magnetism**  
**Assignment 4 – Due Oct. 13, 2015 by 3pm**  
**(hand in to drop box outside 3L24)**

1. Find the total charge in the semicircle  $\{ -1 \leq x \leq 1, 0 \leq y \leq \sqrt{1-x^2} \}$ , given that the surface charge density is  $\sigma(x, y) = ay^3$  (2D problem).

2. Evaluate the integral  $\int_{y=0}^{y=1} \int_{x=y}^{x=1} \sin(x^2) dx dy$  .

3. If the volume charge density is given by  $\rho(x, y, z) = x + y + z$  , calculate the total charge Q inside the tetrahedron shown in the figure.



4. A disk of radius  $a$  with uniform surface density of charge,  $\sigma$ , has a circular hole of radius,  $b < a$ , cut in it. If the charge on the surface of the disk remains uniformly distributed, what is the electric field at a point P a distance,  $d$ , from the disk along the axis of the centre of the hole? (Note: you can do this either using an integral, or by superposition of electric fields due to a full disk minus the smaller disk that is cut out.)

5. What is the total charge inside the positive coordinate octant of a cylinder, shown in the figure below? The portion of the cylinder we are interested in extends in  $z$  from  $0$  to  $h/2$ , has a radius  $r$ , and a volume charge density  $\rho(x, y, z) = \rho_0 \frac{x y z}{R^3}$  .

