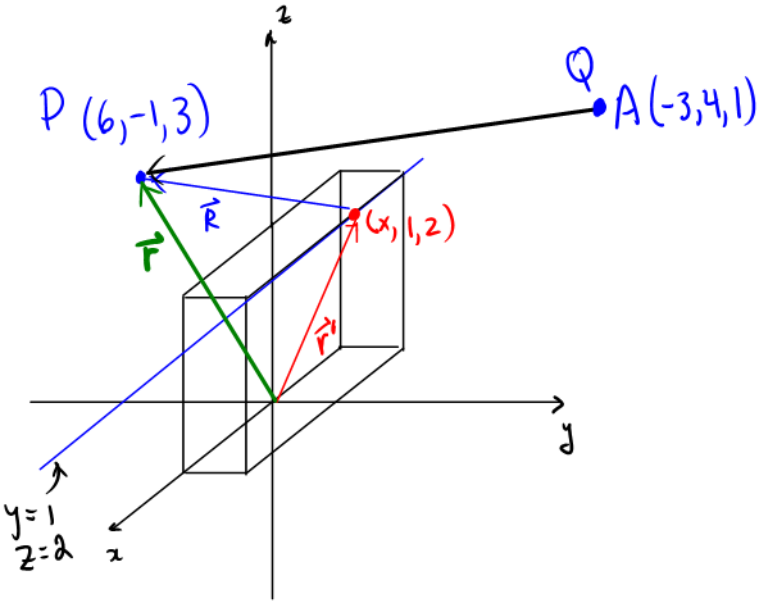
Engineering 5812 Tutorial 3 **Winter 2010**

1. A line charge density of 24 nC/m in free space exists on the line $y = 1$, $z = 2$. (a) Find the electric field intensity at $P(6, -1, 3)$. (b) What point charge Q located at $A(-3, 4, 1)$ would be required to make E_y equal zero at P.



2. Within the spherical shell, $3 < r < 4$ m, the electric flux density is given as

$$\vec{D} = 5(r-3)^3 \hat{r} \text{ C/m}^2 .$$

Determine (a) the volume charge density at $r = 4$; (b) the electric flux density at $r = 4$; (c) how much electric flux leaves the sphere $r = 4$; and (d) how much charge is contained within the sphere, $r = 4$.

3. In the region of free space that includes the volume $2 < x, y, z < 3$,

$$\vec{D} = \frac{2}{z^2}(yz\hat{x} + xz\hat{y} - 2xy\hat{z}) \text{ C/m}^2 .$$

a) Evaluate the volume integral side of the divergence theorem for the volume defined here. (b)Evaluate the surface integral side for the corresponding closed surface.