Problem 1

Let $\mathbf{F} = x^2\mathbf{i} - 2xy\mathbf{j} + 3xz\mathbf{k}$ and S be the surface in the first octant cut by $x^2 + y^2 + z^2 = 4$. Find the flux of $\mathbf{F}$ over S.

Problem 2

Let $\mathbf{F} = 2xz\mathbf{i} - xy\mathbf{j} - z^2\mathbf{k}$ and S the surface in the first octant bounded above by the plane $y + z = 4$ and on the sides by the elliptical cylinder $4x^2 + y^2 = 16$. Draw a picture of this region then find the flux of $\mathbf{F}$ over S.