Change of Variables in Triple Integrals

1. Compute the Jacobian $\partial(x, y, z)/\partial(u, v, w)$ for the change of variables

$$x = u^2 + vw,\ y = 2v + w,\ z = uw.$$

2. For the region bounded by the spherical co-ordinates

$$0 \leq \phi \leq \frac{\pi}{4},\ 0 \leq \theta \leq 2\pi,\ 0 \leq r \leq 2,$$

   (a) what shape does this region look like?

   (b) what is the volume of this shape?