Integrate $f(x,y,z) = z$ over the region above the cone $z^2 = x^2 + y^2$ and inside the sphere of radius 2, $x^2 + y^2 + z^2 = 4$.

(a) Convert the boundary surfaces, $z^2 = x^2 + y^2$ and $x^2 + y^2 + z^2 = 4$, and $f(x,y,z) = z$ into spherical coordinates.

(b) Use the boundaries to set up bounds on $\rho$, $\theta$, and $\phi$.

(c) Evaluate the integral in spherical coordinates.

For reference, the integral in rectangular coordinates is

$$
\int_{-\sqrt{2}}^{\sqrt{2}} \int_{-\sqrt{2-x^2}}^{\sqrt{2-x^2}} \int_{\sqrt{4-x^2-y^2}}^{\sqrt{4-x^2-y^2}} z \, dz \, dy \, dx
$$