Compute the center of mass of the region in the first octant enclosed by the sphere

\[ x^2 + y^2 + z^2 = 4 \]

assuming that the density is constant.

Since the radius is 2 and the density \( \delta \) is constant, the mass is

\[
\frac{\left(\frac{4}{3} \pi \delta \right) (8)(8)}{8} = \frac{4}{3} \pi \delta.
\]

To calculate the \( z \)-coordinate of the center of mass, we must calculate

\[
\iiint_R z \, dV = 8 \iiint_R z \, dV
\]

Using spherical coordinates, we have

\[
8 \int_0^{\pi/2} \int_0^{\pi/2} \int_0^2 \rho^3 \sin \phi (\rho \cos \phi) (\rho \sin \phi) \, d\phi \, d\rho \, d\theta
\]

\[
= 8 \int_0^{\pi/2} \int_0^{\pi/2} \rho^3 \left[ \int_0^1 u \, du \right] \, d\rho \, d\theta
\]

\[
= 8 \int_0^{\pi/2} \int_0^{\pi/2} \frac{\rho^3}{2} \, d\rho \, d\theta
= \frac{8}{8} \int_0^{\pi/2} [\rho^4/4]_0^2 \, d\theta
= (\frac{8}{8}) (\frac{16}{4}) = 8 \pi
\]

\[
\Rightarrow \bar{z} = \frac{8 \pi}{4 \pi \delta} = \frac{2}{4}.
\]

By symmetry, \( \bar{y} = \bar{z} = \frac{2}{4} \).