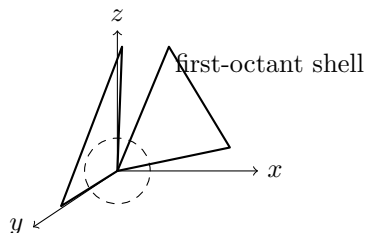


Question 7

Write spherical-coordinate bounds for the first-octant portion of the shell between the spheres of radii 1 and 3. Justify the angular bounds.

Question 7 – Solution

Strategy Separate radial shell bounds from the two angular restrictions defining the first octant.



Bounds Between the spheres,

$$1 \leq \rho \leq 3.$$

The first quadrant in the xy -plane requires $0 \leq \theta \leq \pi/2$. Being above the xy -plane requires $0 \leq \phi \leq \pi/2$. Therefore

$$\boxed{1 \leq \rho \leq 3, \quad 0 \leq \theta \leq \frac{\pi}{2}, \quad 0 \leq \phi \leq \frac{\pi}{2}}.$$

These bounds impose $x, y, z \geq 0$ while retaining every point of the radial shell in that octant.