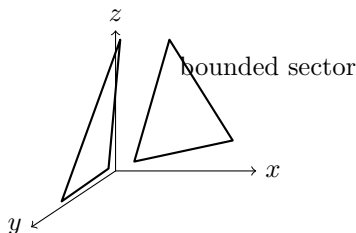


Question 7

Describe in cylindrical inequalities the solid in the first octant that lies between the cylinders $r = 1$ and $r = 3$, above $z = 0$, and below the cone $z = 4 - r$. Explain each bound.

Question 7 – Solution

Strategy Translate the geometric restrictions directly into angular, radial, and vertical bounds.



Bounds First octant in the xy -plane gives $0 \leq \theta \leq \pi/2$. Between the cylinders gives $1 \leq r \leq 3$. At each (r, θ) , the solid lies from the xy -plane up to the cone:

$$\boxed{0 \leq \theta \leq \frac{\pi}{2}, \quad 1 \leq r \leq 3, \quad 0 \leq z \leq 4 - r.}$$

Consistency On $1 \leq r \leq 3$, the upper bound $4 - r$ remains positive. The cone is rotationally symmetric, while the first-octant restriction selects only a quarter-sector.