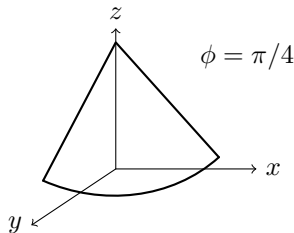


Question 4

Identify and convert the surface $\phi = \pi/4$ to rectangular and cylindrical equations. Explain why it is only one nappe of a cone.

Question 4 – Solution

Strategy Relate the polar angle to cylindrical radius and height: $r = \rho \sin \phi$, $z = \rho \cos \phi$.



Conversion At $\phi = \pi/4$,

$$\frac{r}{z} = \tan \phi = 1,$$

so $\boxed{z = r}$ in cylindrical coordinates. Therefore

$$\boxed{z = \sqrt{x^2 + y^2}}.$$

Geometry Because $\phi = \pi/4 < \pi/2$, $z = \rho \cos \phi \geq 0$. Thus this is the upper nappe only. Squaring to $z^2 = x^2 + y^2$ without retaining $z \geq 0$ would incorrectly add the lower nappe.