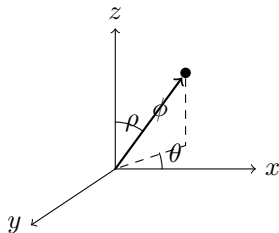


Question 1

Convert the point $(1, \sqrt{3}, 2\sqrt{3})$ to spherical coordinates, using $\rho \geq 0$, $0 \leq \theta < 2\pi$, and $0 \leq \phi \leq \pi$. Verify the result.

Question 1 – Solution

Strategy Find distance, azimuth, and polar angle in that order.



Coordinates

$$\rho = \sqrt{1 + 3 + 12} = 4, \quad \theta = \arctan(\sqrt{3}) = \frac{\pi}{3}.$$

Also $\cos \phi = z/\rho = \sqrt{3}/2$, so $\phi = \pi/6$. Thus

$$\boxed{(\rho, \theta, \phi) = \left(4, \frac{\pi}{3}, \frac{\pi}{6}\right)}.$$

Verification Using $x = \rho \sin \phi \cos \theta$, $y = \rho \sin \phi \sin \theta$, and $z = \rho \cos \phi$ gives $1, \sqrt{3}, 2\sqrt{3}$, respectively.