

Question 1

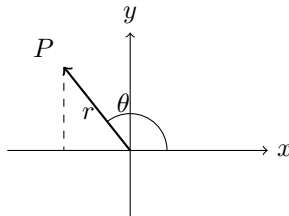
Convert $P = (-3, 3\sqrt{3}, 4)$ from Cartesian to cylindrical coordinates.

Tasks

1. Find r , a principal angle $0 \leq \theta < 2\pi$, and z .
2. Give two other equivalent cylindrical representations.
3. Verify by converting back.

Question 1 – Solution

Strategy. Use $r = \sqrt{x^2 + y^2}$ and determine the quadrant before choosing θ .



Step 1: Radius $r = \sqrt{9 + 27} = 6$.

Step 2: Angle Since $x < 0$ and $y > 0$, the point is in quadrant II. Also $\tan \theta = -\sqrt{3}$, so $\theta = 2\pi/3$. The height is unchanged. Thus

$$(r, \theta, z) = (6, 2\pi/3, 4).$$

Step 3: Equivalent forms Adding 2π gives $(6, 8\pi/3, 4)$. Reversing the radial sign and adding π gives $(-6, 5\pi/3, 4)$.

Verification. $6 \cos(2\pi/3) = -3$, $6 \sin(2\pi/3) = 3\sqrt{3}$, and $z = 4$.