

Exercise 8

- (a) Describe the surfaces $r = \text{constant}$, $\theta = \text{constant}$, and $z = \text{constant}$ in the cylindrical coordinate system.
- (b) Describe the surfaces $\rho = \text{constant}$, $\theta = \text{constant}$, and $\phi = \text{constant}$ in the spherical coordinate system.
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Solution

Part (a)

$r = \text{constant}$ represents a circular cylinder with a constant radius and a height that extends indefinitely in the z -direction. Its axis of symmetry is the z -axis.

$\theta = \text{constant}$ represents a half-plane that starts at the z -axis and extends indefinitely in the radial direction.

$z = \text{constant}$ represents a plane perpendicular to the xy -plane.

Part (b)

$\rho = \text{constant}$ represents a sphere with constant radius centered at the origin.

$\theta = \text{constant}$ represents a half-plane that starts at the z -axis and extends indefinitely in the radial direction.

$\phi = \text{constant}$ represents a cone with constant polar angle that extends indefinitely in the radial direction.