

## 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.