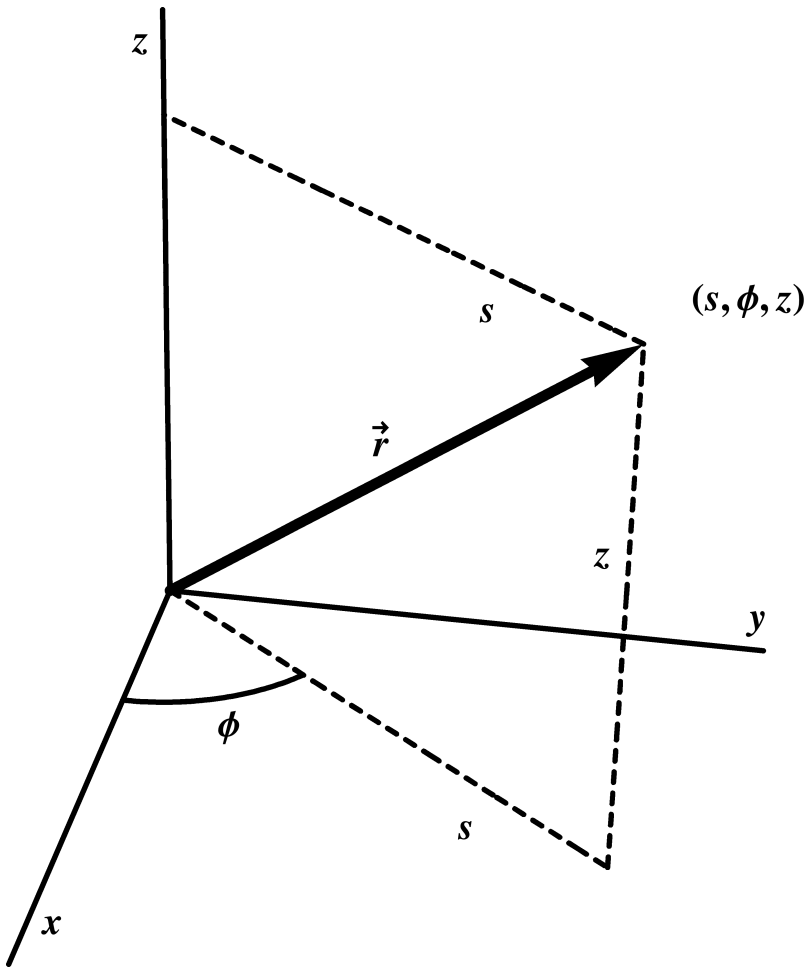
1 Cylindrical Coordinates

For the cylindrical coordinate system shown below, draw three surfaces: one for constant s, one for constant ϕ, and one for constant z.

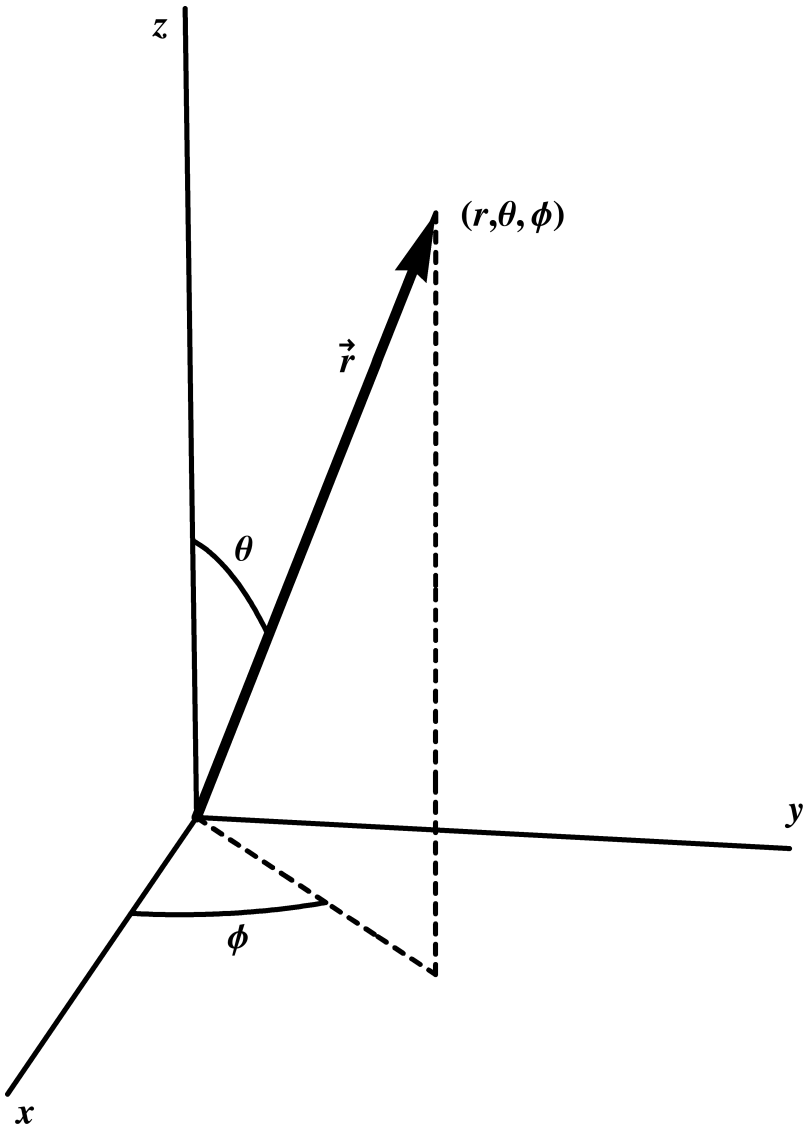


$$x = s\cos\phi \tag{1}$$
$$y = s\sin\phi \tag{2}$$
$$z = z \tag{3}$$

$$0 \leq s < \infty \tag{4}$$
$$0 \leq \phi < 2\pi \tag{5}$$
$$-\infty < z < \infty \tag{6}$$

2 Spherical Coordinates

For the spherical coordinate system shown below, draw three surfaces: one for constant r, one for constant θ, and one for constant ϕ.



$$x = r\ \sin\theta\ \cos\phi \tag{7}$$
$$y = r\ \sin\theta\ \sin\phi \tag{8}$$
$$z = r\ \cos\theta \tag{9}$$

$$0 \leq r < \infty \tag{10}$$
$$0 \leq \theta < \pi \tag{11}$$
$$0 \leq \phi < 2\pi \tag{12}$$
$$\tag{13}$$