

Problem 3.19 Convert the coordinates of the following points from Cartesian to cylindrical and spherical coordinates:

(a) $P_1(1, 2, 0)$,

Solution: Use the “coordinate variables” column in Table 3-2.

(a) In the cylindrical coordinate system,

$$P_1 = (\sqrt{1^2 + 2^2}, \tan^{-1}(2/1), 0) = (\sqrt{5}, 1.107 \text{ rad}, 0) \approx (2.24, 63.4^\circ, 0).$$

In the spherical coordinate system,

$$\begin{aligned} P_1 &= (\sqrt{1^2 + 2^2 + 0^2}, \tan^{-1}(\sqrt{1^2 + 2^2}/0), \tan^{-1}(2/1)) \\ &= (\sqrt{5}, \pi/2 \text{ rad}, 1.107 \text{ rad}) \approx (2.24, 90.0^\circ, 63.4^\circ). \end{aligned}$$

Note that in both the cylindrical and spherical coordinates, ϕ is in Quadrant I.