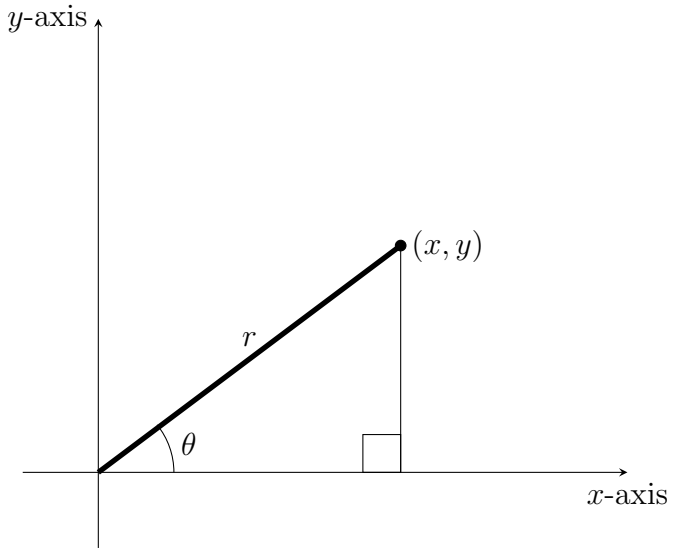
Cylindrical and Spherical Coordinates (HW #2)

Review of Polar Coordinates



Write the rectangular coordinates in terms of the polar, and vice versa. In this class we will assume $r \geq 0$ unless otherwise stated.

Cylindrical Coordinates

$$(x, y, z) = (r, \theta, z)_C$$

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Convert $(1, -1, -4)$ to cylindrical coordinates.

Write $x^2 + y^2 = 3$ using cylindrical coordinates. What is the surface?

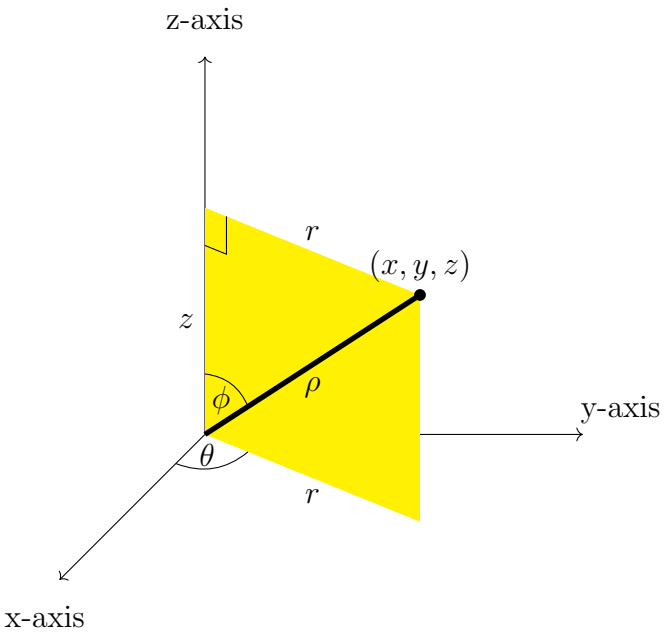
What surface does $r^2 + z^2 = 2r\cos(\theta)$ represent in xyz-space? Convert to cartesian coordinates.

What surfaces do $r = k^2$, $\theta = k$, and $z = k$ represent in xyz-space if k is a constant real number? These are **coordinate surfaces**. The coordinate surfaces for cartesian coordinates are the planes $x = k$, $y = k$, and $z = k$.

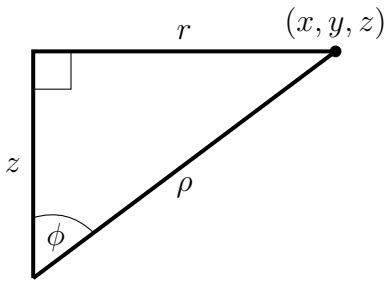
Spherical Coordinates

$$(x, y, z) = (\rho, \theta, \phi)_S$$

where $0 \leq \phi \leq \pi$.



Pay attention to this triangle:



Write formulas for the cylindrical coordinates in terms of spherical coordinates and vice versa.

Convert $(-1, 1, \sqrt{6})$ to cylindrical and spherical coordinates.

Convert $(2, \pi/3, \pi/4)_S$ to cylindrical and rectangular coordinates.

Convert $x^2 + y^2 = 4$ to spherical coordinates.

Convert $x^2 + y^2 + z^2 = 2x$ to spherical coordinates.

What are the coordinate surfaces in xyz-space for spherical coordinates?