Section 11.7

CYLINDRICAL AND SPHERICAL COORDINATES


Review: A point $P$ in the plane can be represented in **polar coordinates** by . . .

Here: $r =$ 

$\theta =$

Ex 1: Plot the points $P = (2, \pi/4)$ and $Q = (-2, \pi/4)$ given in polar coordinates in the plane.

RECALL that to convert to rectangular...

$x =$ 

$y =$

Def: A point $P$ in 3-space can be represented in **cylindrical coordinates** by . . .

Ex 2: Plot the point $P = (r, \theta, z) = (3, \pi/4, -2)$ given in cylindrical coordinates.

**IMPORTANT NOTE:** ALL plots take place in 3 space with an x-axis, y-axis and a z-axis, we never draw a $\theta$ axis or $r$-axis.
Converting Cylindrical Coordinates to Rectangular Coordinates:
\[ x = \quad y = \quad z = \]

Converting Rectangular Coordinates to Cylindrical Coordinates:
\[ r = \quad \theta = \quad z = \]

Ex 3: Express the point \( P = (3, \pi/4, -2) \), given in cylindrical coordinates, in rectangular coordinates.

Ex 4: Express the point \( P = (-1, -2, 3) \), given in rectangular coordinates, in cylindrical coordinates.

Ex 5: Write the equation \( x^2 + y^2 = 2z \) in cylindrical coordinates and sketch its graph.
Def: A point $P$ in 3-space can be represented in spherical coordinates by . . .

Ex 6: Plot the following points given in spherical coordinates.

(a) $P = (2, \pi/3, \pi/6)$
(b) $Q = (3, 3\pi/4, 0)$

(c) $R = (4, 0, 3\pi/4)$

Converting Between Coordinate Systems:
GO via cylindrical and use the picture

- Rectangular to Spherical:
  $\rho = \quad \phi = \quad \theta =$

- Spherical to Rectangular:
  $y = \quad x = \quad z =$
Ex 7: Given the point $P = (\rho, \theta, \phi)$ in spherical coordinates, express $P$ in cylindrical coordinates.

Ex 8: Express $x^2 + y^2 + z^2 = 9$ in spherical coordinates and sketch its graph.

Ex 9: Plot each of the following (hint 2 radians is about 120 degrees).
(a) $z = 2$
(b) $\theta = 2$
(c) $\rho = 2$
(d) $\phi = 2$