Date 18/02/2026
MJC-PHYSICS, Paper-V
Sem-IV, Unit-01

spherical coordinates →

Spherical and cylindrical coordinates are two generalizations of polar coordinates to three dimensions. For a point (x, y, z) in three dimensional space, the spherical coordinates are defined as follows.

ρ → the length of the ray from the origin to the point.

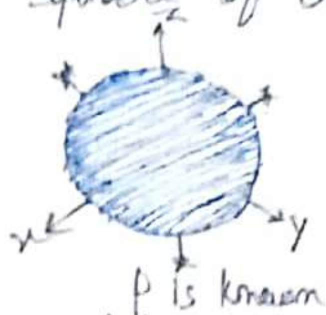
θ – The angle between the positive x-axis and the ray from the origin to the point $(x, y, 0)$

ϕ – the angle between the positive z-axis and the ray from the origin to the point of interest.

The spherical coordinates are determined by (ρ, ϕ, θ). The relation between these and the cartesian coordinate (x, y, z) for a point are as follows.

$$x = \rho \sin(\phi) \cos(\theta), \quad \phi \in [0, \pi]$$
$$y = \rho \sin(\phi) \sin(\theta), \quad \theta \in [0, 2\pi]$$
$$z = \rho \cos\phi, \quad \rho \geq 0$$

By pictures, The first illustrates the surface whe ρ is known, Which is a sphere of radius ρ.



ρ is known
fig (a)

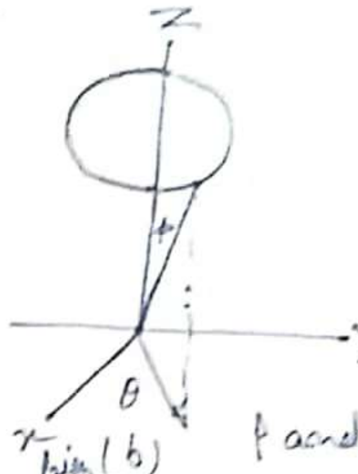


fig (b) ρ and φ are known

By picture (b) corresponds to Knowing both ρ and φ, Which results in a circle about the z-axis. Suppose the fig (a) demonstrates a graph of ~~the~~ the Earth. Then the circle in the fig (b) would correspond to a particular latitude. Giving the third coordinate, θ completely specifies the point of interest. This is demonstrated in the following fig. If the latitude corresponds to φ, then θ as the longitude. ρ, φ and θ are known.