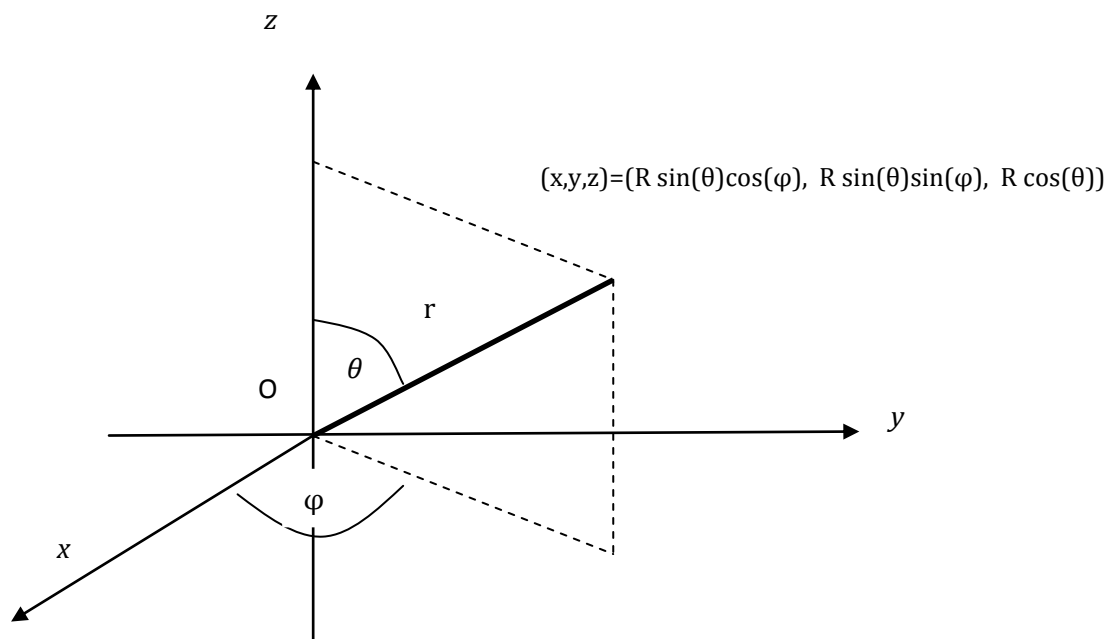


Spherical Polar Coordinates

Spherical polar coordinates or cylindrical polar coordinates are often more natural to use in describing three-dimensional systems than the more usual Cartesian coordinate system¹. In the spherical polar coordinate system every point P is defined in the form (r, θ, φ) , where r is the distance from a point to the origin O, θ is the angle that the line OP makes with the z-axis and φ is the angle between the z-x plane and the plane containing P and the z-axis.

The following diagram illustrates the relationship between a point defined in Cartesian coordinates with its representation in spherical polar coordinates. (x,y,z) are the Cartesian coordinates of a point and (r, θ, φ) are the spherical polar coordinates of the same point. The angle φ is also known as the azimuthal coordinate and it is normally restricted to $(-\pi, \pi]$ or $[0, 2\pi)$. The angle θ lies in the range $[0, 2\pi]$.



The formulas can be rearranged so that $r = \sqrt{x^2 + y^2 + z^2}$, $\cos(\theta) = \frac{z}{(x^2 + y^2 + z^2)^{1/2}}$ and $\tan(\varphi) = y/x$. See the document on the polar coordinate system² for further explanation.

¹ [Cartesian Coordinates](#)