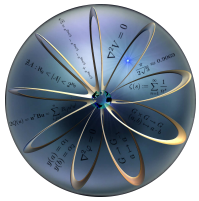

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cylindrical coordinates

Canonical name	CylindricalCoordinates
Date of creation	2013-03-22 17:01:54
Last modified on	2013-03-22 17:01:54
Owner	Wkbj79 (1863)
Last modified by	Wkbj79 (1863)
Numerical id	6
Author	Wkbj79 (1863)
Entry type	Definition
Classification	msc 51M05
Related topic	PolarCoordinates
Related topic	SphericalCoordinates

Cylindrical coordinates are a system of coordinates for $\mathbb{R}^3$. Two of the coordinates correspond to the polar coordinates of $\mathbb{R}^2$, and the third coordinate corresponds with the z axis. Thus, the coordinates are given by

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} r\cos\theta \\ r\sin\theta \\ z \end{pmatrix},$$

where r is the distance from $(0,0,0)$ to $(x,y,0)$ and θ is the azimuthal angle defined for $\theta \in [0, 2\pi)$.

Just as with polar coordinates, one can convert from Cartesian coordinates to cylindrical coordinates for any point not lying on the z axis via

$$\begin{aligned} r(x,y) &= \sqrt{x^2+y^2}, \\ \theta(x,y) &= \arctan(x,y), \end{aligned}$$

where arctan is defined `http://planetmath.org/OperatornamearcTanWithTwoArguments`here