Q8

Polar Coordinate System

$(x, y) \longrightarrow (r, \theta)$

$r = \sqrt{x^2+y^2} \quad \theta = \tan^{-1}\left[\frac{y}{x}\right]$

$x = r\cos\theta \quad y = r\sin\theta$

Spherical coordinate system

$(x, y, z) \longrightarrow (\rho, \theta, \phi)$

$\rho = \sqrt{x^2+y^2+z^2} \quad \theta = \tan^{-1}\left[\frac{y}{x}\right]$

$\phi = \cos^{-1}\left[\frac{z}{\rho}\right] \quad z = \rho\cos\phi$

$x = \rho\sin\phi\cos\theta \quad y = \rho\sin\phi\sin\theta$

$z = \sqrt{\rho^2 - r^2}$

Cylindrical coordinate system

$(x, y, z) \longrightarrow (r, \theta, z)$

$r = \sqrt{x^2+y^2} \quad \theta = \tan^{-1}\left[\frac{y}{x}\right]$

$z = z \quad x = r\cos\theta \quad y = r\sin\theta$

Examples

Rectangular (x,y,z)	Cylindrical (r,θ,z)	Spherical (ρ,θ,ϕ)
$(0,0,0)$	$(0,0,0)$	$(0,0,0)$
$(1,0,0)$	$(1,0,0)$	$(1,0,\pi/2)$
$(0,1,0)$	$(1,0,0)$	$(1,0,\pi/2)$
$(0,0,1)$	$(0,0,1)$	$(1,0,0)$
$(1,0,0)$	$(1,0,0)$	$(1,0,\frac{\pi}{2})$
$(\sqrt{2},0,1)$	$(\sqrt{2},0,1)$	$(\sqrt{3},0,$
$(0,1,1)$	$(1,\frac{\pi}{2},1)$	