Conversion Formulas For Cylindrical, Spherical

Cylindrical ⟷ Rectangular

$r = \sqrt{x^2+y^2}$	$x = r\cos\theta$
$0 \le \theta \le 2\pi \rightarrow \theta = \tan^{-1}(y/x)$	$y = r\sin\theta$
$z = z$	$z = z$

Spherical ⟷ Rectangular

$\rho = \sqrt{x^2+y^2+z^2}$	$x = \rho\sin\phi\cos\theta$
$0 \le \phi \le \pi \rightarrow \phi = \cos^{-1}(z/\rho)$	$y = \rho\sin\phi\sin\theta$
$0 \le \theta \le 2\pi \rightarrow \theta = \tan^{-1}(y/x)$	$z = \rho\cos\phi$

Spherical ⟷ Cylindrical

$\rho = \sqrt{r^2+z^2}$	$r = \rho\sin\phi$
$\theta = \theta$	$\theta = \theta$
$0 \le \phi \le \pi$ $\quad \phi = \tan^{-1}(\frac{r}{z})$	$z = \rho\cos\phi$

Jacobians:

$$\frac{\partial(x,y,z)}{\partial(r,\theta,z)} = r \qquad \frac{\partial(x,y,z)}{\partial(\rho,\theta,\phi)} = \rho^2\sin\phi$$

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