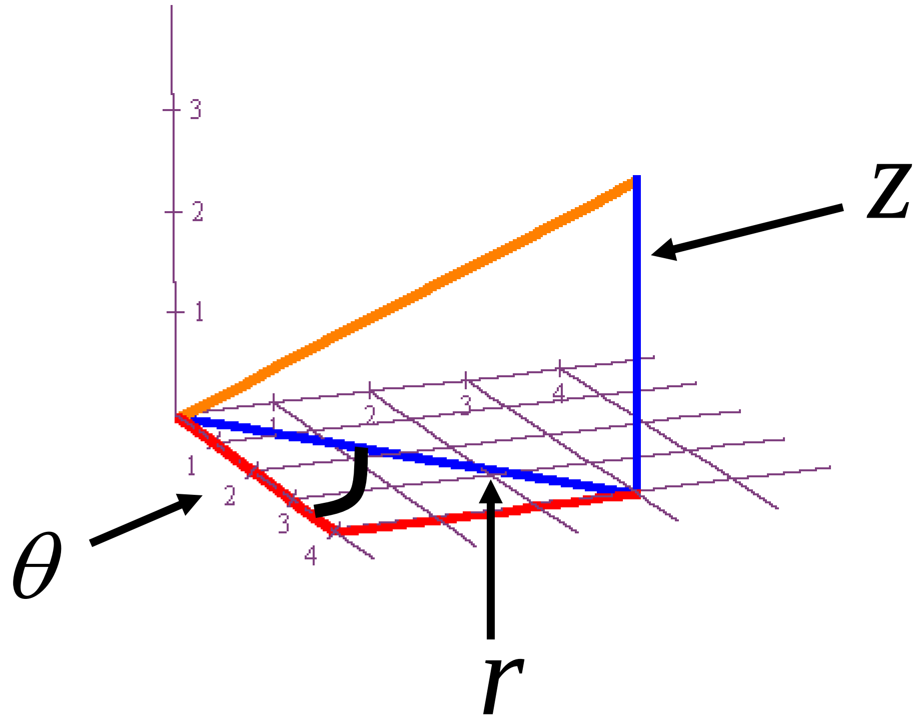
CYLINDRICAL COORDINATES (r, θ, z)



$x = r\cos(\theta)$

$y = r\sin(\theta)$

$z = z$

$r^2 = x^2 + y^2$

$\tan\theta = \dfrac{y}{x}$

$0 \le \theta \le 2\pi$

$0 \le r < \infty$

$-\infty < z < \infty$

Convert from cylindrical coordinates to rectangular

$$\left(r,\theta,z\right)_{\text{cylindrical}} = \left(2,\pi/2,3\right)_{\text{cylindrical}}$$

$$\left(r\cos\theta, r\sin\theta, z\right)_{\text{rectangular}} = \left(2\cos\frac{\pi}{2}, 2\sin\frac{\pi}{2}, 3\right)_{\text{rectangular}} = \left(0,2,3\right)_{\text{rectangular}}$$

Convert from rectangular coordinates to cylindrical

$$(x, y, z)_{\text{rectangular}} = \left(-\sqrt{3}, 1, 2\right)_{\text{rectangular}}$$

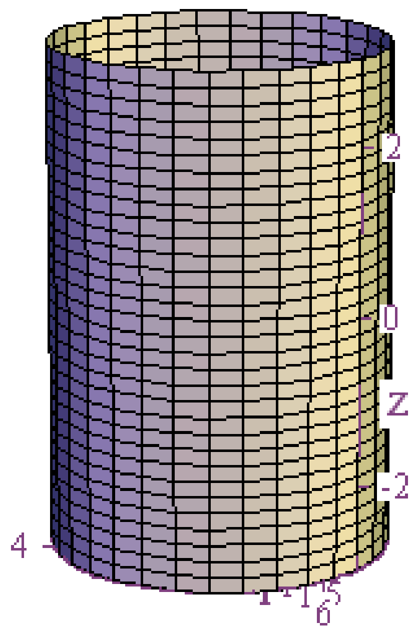
Note that with respect to *x* and *y* our point is in quadrant II.

$$\tan\theta = \frac{y}{x} = \frac{1}{-\sqrt{3}} \Rightarrow \theta = \tan^{-1}\left(\frac{1}{-\sqrt{3}}\right) = -30° = -\frac{\pi}{6}$$

The related second quadrant angle is $\frac{5\pi}{6}$

$$r = \sqrt{x^2 + y^2} = \sqrt{(-\sqrt{3})^2 + 1^2} = \sqrt{4} = 2$$

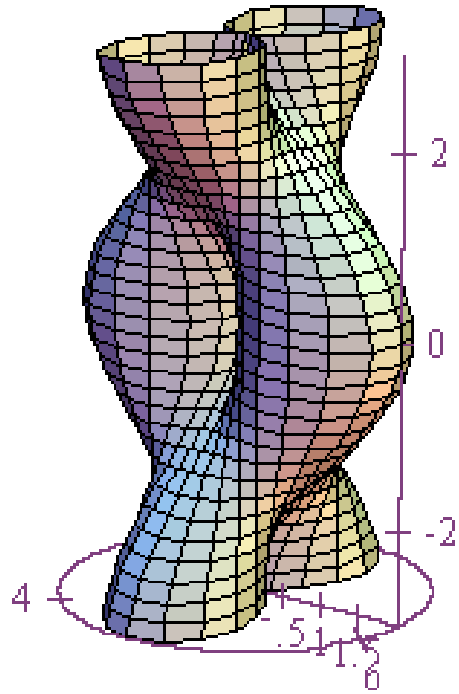
$$\left(-\sqrt{3}, 1, 2\right)_{\text{rectangular}} = \left(2, \frac{5\pi}{6}, 2\right)_{\text{cylindrical}}$$



$$r = 2$$

$$0 \le \theta \le 2\pi$$

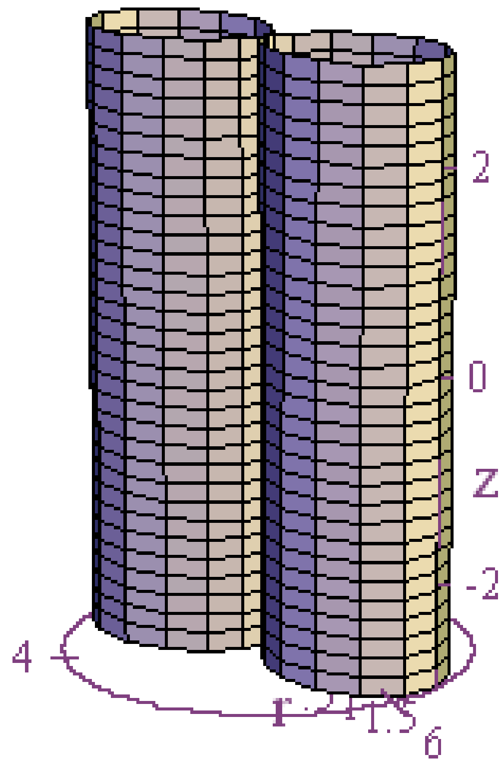
$$-3 \le z \le 3$$



$$r = 1 + \cos 2\theta \cos z$$

$$0 \le \theta \le 2\pi$$

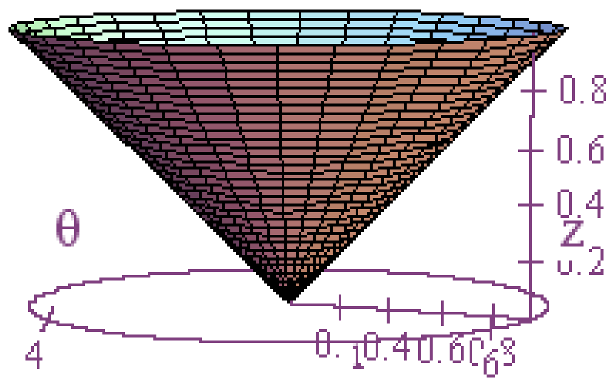
$$-3 \le z \le 3$$



$$r = 1 + \cos 2\theta$$

$$0 \le \theta \le 2\pi$$

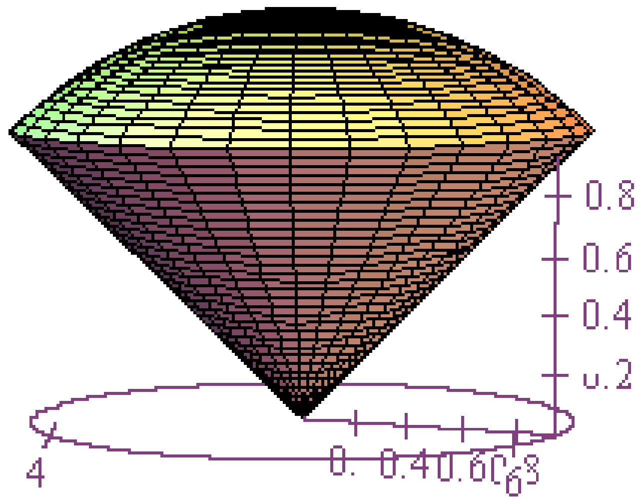
$$-3 \le z \le 3$$



$$z = \sqrt{x^2 + y^2} = \sqrt{r^2} = r$$

$$0 \le \theta \le 2\pi$$

$$0 \le r \le 1$$



$$z_1 = \sqrt{x^2 + y^2} = \sqrt{r^2} = r$$

$$z_2 = \sqrt{2 - (x^2 + y^2)} = \sqrt{2 - r^2}$$

$$0 \le \theta \le 2\pi$$

$$0 \le r \le 1$$