

## Exercise 11

Let  $S$  be the sphere of radius  $R$  centered at the origin. Find the equation for  $S$  in cylindrical coordinates.

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### Solution

The equation for a sphere is given by

$$x^2 + y^2 + z^2 = R^2.$$

Substitute  $x = r \cos \theta$ ,  $y = r \sin \theta$ , and  $z = z$  to get the equation in cylindrical coordinates.

$$(r \cos \theta)^2 + (r \sin \theta)^2 + z^2 = R^2$$

$$r^2 \cos^2 \theta + r^2 \sin^2 \theta + z^2 = R^2$$

$$r^2(\cos^2 \theta + \sin^2 \theta) + z^2 = R^2$$

$$r^2 + z^2 = R^2$$