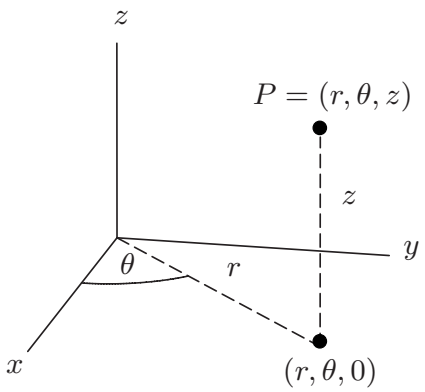
Problem 1: Using the diagram below, write down equations that relate the cylindrical coordinates (r, θ, z) of a point to its cartesian (rectangular) coordinates (x, y, z).



Problem 2:

(a) Plot the point with cylindrical coordinates $(2, 2\pi/3, 1)$ and find its cartesian coordinates.

(b) Find the cylindrical coordinates of the point with cartesian coordinates $(3, -3, -7)$.

Problem 3:

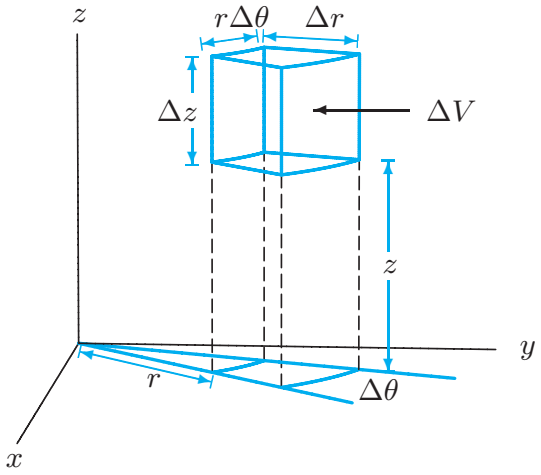
(a) Describe the surface whose equation in cylindrical coordinates is $z = r$.

(b) Describe the surface whose equation in cylindrical coordinates is $r = 1$.

(c) Describe the surface whose equation in cylindrical coordinates is $\theta = \pi/4$.

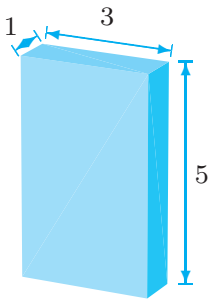
Problem 4: Describe in cylindrical coordinates a wedge of cheese cut from a cylinder 4 cm high and 6 cm in radius; this wedge subtends an angle of $\pi/6$ at the center.

Problem 5: Using the diagram below, express the volume element dV in cylindrical coordinates.

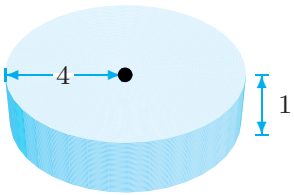


Problem 6: For each object below, set up a triple integral of a function f over the object.

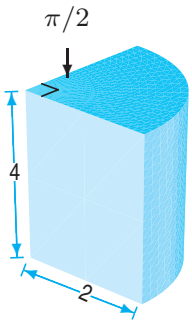
(a)



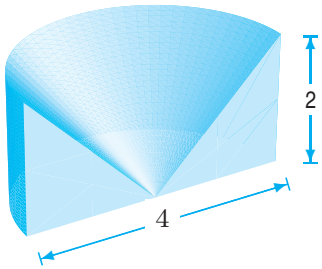
(b)



(c)



(d)



Problem 7: Evaluate

$$\int_W \sin\left(x^2+y^2\right)\, dV$$

where W is the solid cylinder with height 4 and with base of radius 1 centered on the z-axis at $z=-1$.

Problem 8: Find the volume between the cone $z=\sqrt{x^2+y^2}$ and the plane $z=10+x$ above the disk $x^2+y^2\le 1$.