Cylindrical and Spherical Coordinates

Cylindrical Coordinates

1. Plot the following points whose cylindrical coordinates are given
   (a) $4, \pi/3, -2$

   (b) $4, 0, 2$

2. Convert from rectangular to cylindrical coordinates:
   (a) $(-1, 1, 1)$

   (b) $(-2, 2\sqrt{3}, 3)$

3. Convert from cylindrical coordinates to rectangular coordinates
   (a) $(4, \pi/3, -2)$

   (b) $(4, 0, 2)$

4. Sketch the solid described by the following

   (a)
   $$0 \leq r \leq 2, \quad -\pi/2 \leq \theta \leq \pi/2, \quad 0 \leq z \leq 1$$

   (b)
   $$0 \leq \theta \leq \pi/2, \quad r \leq z \leq 2$$

5. Describe in words or draw a rough sketch of the surface whose equation is given

   (a) $\theta = \pi/4$

   (b) $r = 15$

   (c) $z = 4 - r^2$

   (d) $2r^2 + z^2 = 1$

6. Convert the given equation to cylindrical coordinates

   (a) $x^2 - 4x + y^2 + z^2 = 1$

   (b) $z = x^2 - y^2$

Spherical Coordinates

7. Plot the following points whose spherical coordinates are given then find the rectangular coordinates for the same point.

   (a) $(6, \pi/3, \pi/6)$

   (b) $(3, \pi/2, 3\pi/4)$

8. Convert from rectangular to spherical coordinates:

   (a) $(0, -2, 0)$

   (b) $(1, 0, \sqrt{3})$

9. Identify or describe in words or sketch the surface whose equation is given

   (a) $\rho = 3$

   (b) $\rho = \sin\theta \sin\phi$

10. Write the equation in spherical coordinates

   (a) $z^2 = x^2 + y^2$

   (b) $x + 2y + 3z = 1$

   (c) $x^2 + z^2 = 9$