16.4 and 16.5: More Integrals in Polar, Cylindrical, and Spherical Coordinates

Calculus III

College of the Atlantic. Winter 2016

1. Sketch or describe the following surfaces:

   (a) In cylindrical coordinates:

      i. $z = 3$
      ii. $\theta = \pi/6$
      iii. $\theta = \pi$
      iv. $r = 4$

   (b) In spherical coordinates:

      i. $\rho = 4$
      ii. $\theta = \pi/6$
      iii. $\theta = \pi$
      iv. $\phi = \pi/6$
      v. $\phi = \pi/2$

2. Set up a triple integral for a density function integrated over the first octant of a sphere of radius 9.

3. Set up a triple integral for a density function integrated over the eighth octant of a sphere of radius 9 (i.e., the octant in which x is positive, y and z are negative.)

4. Casey is eating a wedge of cheese. The wedge was taken from a cylinder with a radius of 7 cm. The height of the cheese is 3 cm. The angle at the tip of the wedge is 30 degrees. The yumminess density of the cheese, in units of yumminess per cubic cm, is proportional to the distance from the edge. (I.e., the middle of the cheese wheel is tastier.) Write an iterated triple integral for the total yumminess of the wedge of cheese.

5. Determine a formula for the volume of a sphere of radius R by setting up and evaluating a a triple integral in spherical coordinates.

6. Determine a formula for the volume of a sphere of radius R by setting up and evaluating a a triple integral in cylindrical coordinates.