Math 233 - November 30, 2009

- Cylindrical Coordinates

1. Find the area of an “elementary polar region”:

\[ \{(x, y) | r_1 \leq r \leq r_2; \theta_1 \leq \theta \leq \theta_2\} \]

\[ A = \]

**Lecture Problems**

2. Find the cylindrical equation for the cartesian equation \( x^2 + y^2 = 4 \)

3. Find the Cartesian equation for the cylindrical equation \( z = 4 \)

4. Find the cylindrical equation for the Cartesian equation \( x - y = 0 \).

5. Find the cylindrical equation for the cone \( z^2 = x^2 + y^2 \).

6. Find the Cartesian equation of the cylindrical equation \( r^2 + 4z^2 = 16 \).

7. Find the Cartesian equation of the cylindrical equation \( r^2 \cos 2\theta = z \).

   Hint: \( \cos 2\theta = \cos^2 \theta - \sin^2 \theta \).

8. Find the volume of the solid bounded above by the sphere centered at the origin having radius 5 and bounded below by the plane \( z = 4 \).

\[ V = \]

9. Find the volume of the solid bounded above by the plane \( z = y + 4 \), below by the \( xy \)-plane and laterally by the right circular cylinder with radius 4 and whose axis is the \( z \)-axis.

\[ V = \]

10. Find the volume of the solid inside \( x^2 + y^2 = 4 \), outside \( x^2 + y^2 = 1 \), below \( z = 12 - x^2 - y^2 \) and above \( z = 0 \).

\[ V = \]