Test 3: Chapter 15

Complete the following problems to the best of your ability. **SHOW ALL OF YOUR WORK.** Unshown work will not be graded. You may not use a calculator.

1. For each of the following shapes, give an equation that describes it in the requested coordinate system.

   (a) [6] The unit circle in the xy-plane in rectangular coordinates.

   (b) [6] The circle of radius 2 in the zy-plane in rectangular coordinates.

   (c) [6] The xy-plane in spherical coordinates.

   (d) [6] The sphere of radius 2 in spherical coordinates.

   (e) [10] The sphere of radius 3 in cylindrical coordinates.

   (f) [10] The circle of radius 1 centered at the point $(0, 1)$ on the xy-plane in polar coordinates.

2. [15] Calculate $\iint_R \dfrac{\cos(x)}{x}\, dA$ over the triangle in the xy-plane with corners $(0,0)$, $(1,0)$ and $(1,1)$.

3. [15] Convert $\displaystyle\int_{-1}^{0}\int_{0}^{\sqrt{1-x^2}} e^{x^2+y^2}\, dy\, dx$ to an integral in polar coordinates, and evaluate it.

4. [15] Convert $\displaystyle\int_0^2 \int_{-\sqrt{4-y^2}}^{\sqrt{4-y^2}} \int_1^{4-x^2-y^2} dz\,dx\,dy$ into an integral in cylindrical coordinates. You do not need to evaluate the integral.

5. [15] Set up a triple integral to calculate the volume of the region above the half-cone $z = \sqrt{x^2 + y^2}$ and below the sphere $\rho = 3$. You don't need to actually evaluate it.