Math 244
Fall, 2004 Name: **Solutions**
Quiz #18 - Volume Integrals

Complete the following problems. Show all work to receive full credit.

Set up, but **DO NOT EVALUATE** the triple integrals necessary to find the following volumes:

1. The volume of the solid between the sphere $\rho = 2\cos\phi$ and the hemisphere $\rho = 2$, $z \geq 0$.

   In spherical coordinates:

$$V = \int_0^{2\pi} \int_0^{\frac{\pi}{2}} \int_{2\cos\phi}^{2} \rho^2 \sin\phi \; d\rho \; d\phi \; d\theta$$

2. The volume of the solid enclosed by the cone $z = \sqrt{x^2 + y^2}$ between the planes $z = 1$ and $z = 2$.

   In spherical coordinates:

$$V = \int_0^{2\pi} \int_0^{\frac{\pi}{4}} \int_{\sec\phi}^{2\sec\phi} \rho^2 \sin\phi \; d\rho \; d\phi \; d\theta$$

   In cylindrical coordinates:

$$V = \int_0^{2\pi} \int_1^{2} \int_r^{2} dz \; r \; dr \; d\theta$$

3. The volume of the region that lies inside the sphere $x^2 + y^2 + z^2 = 2$ and outside the cylinder $x^2 + y^2 = 1$.

   In cylindrical coordinates:

$$V = \int_0^{2\pi} \int_1^{\sqrt{2}} \int_{-\sqrt{2-r^2}}^{\sqrt{2-r^2}} dz \; r dr \; d\theta$$