

Math 233 - December 1, 2009

- Spherical coordinates

1. Find the determinant:

$$\begin{vmatrix} \sin \phi \cos \theta & \rho \cos \phi \cos \theta & -\rho \sin \phi \sin \theta \\ \sin \phi \sin \theta & \rho \cos \phi \sin \theta & \rho \sin \phi \cos \theta \\ \cos \phi & -\rho \sin \phi & 0 \end{vmatrix} =$$

Lecture Problems

2. Convert the spherical equation to a Cartesian equation: $\rho = \sec \phi$
3. Convert the Cartesian equation to a spherical equation: $x^2 + y^2 + 4z^2 = 10$
4. Convert the Cartesian equation to a spherical equation: $x^2 + y^2 - 2z^2 = 0$
5. Convert the Cartesian equation to a spherical equation: $x + y + z = 1$
6. Convert the spherical equation to a Cartesian equation: $\rho \sin \phi = 1$
7. Find the volume of the ice cream cone—the solid below the sphere $x^2 + y^2 + z^2 = 1$ and above the cone $z^2 = x^2 + y^2$.

$$V =$$

8. Find the mass of the solid inside the sphere $\rho = 3$ and outside the sphere $\rho = 2$ with density equal to the distance from the origin.

$$m =$$

- 9.

$$\int_{-3}^3 \int_{-\sqrt{9-x^2}}^{\sqrt{9-x^2}} \int_{-\sqrt{9-x^2-z^2}}^{\sqrt{9-x^2-z^2}} (x^2 + y^2 + z^2)^{3/2} dy dz dx =$$