Math 209

Assignment 9

Due: 12 Noon on Thursday, December 1, 2005.

1. Evaluate $\displaystyle\iint_S \sqrt{4y+1}\,dS$ where S is the first octant part of $y = x^2$ cut out by $2x+y+z = 1$.

2. Evaluate $\displaystyle\iint_S xy\,dS$ where S is the first octant part of $z = \sqrt{x^2+y^2}$ cut out by $x^2+y^2 = 1$.

3. Calculate the surface area of the curved portion of a right circular cone of radius R and height h.

4. Evaluate $\displaystyle\iint_S \frac{dS}{x^2+y^2}$ where S is the part of the sphere $x^2+y^2+z^2 = 4R^2$ between the planes $z = 0$ and $z = R$.

5. Evaluate $\displaystyle\iint_S (yz^2\vec{i} + ye^x\vec{j} + x\vec{k})\cdot\vec{n}\,dS$ where S is defined by $y = x^2$, $0 \leqslant y \leqslant 4$, $0 \leqslant z \leqslant 1$, and $\vec{n}$ is the unit normal to the surface S with positive y-component.

6. Evaluate $\displaystyle\iint_S (x\vec{i} + y\vec{j})\cdot\vec{n}\,dS$ where S is the part of $z = \sqrt{x^2+y^2}$ below $z = 1$, and $\vec{n}$ is the unit normal to the surface S with negative z-component.

7. Evaluate $\displaystyle\iint_S (x^2y\vec{i} + xy\vec{j} + z\vec{k})\cdot\vec{n}\,dS$ where S is defined by $z = 2 - x^2 - y^2$, $z \geqslant 0$, and $\vec{n}$ is the unit normal to the surface S with negative z-component.

8. Find the centroid of the surface S consisting of the part of $z = 2 - x^2 - y^2$ above the xy-plane.

9. Find the moment of inertia about the z-axis of the surface S consisting of the part of $z = 2 - x^2 - y^2$ above the xy-plane.

10. A circular tube $S:\ x^2+z^2 = 1$, $0 \leqslant y \leqslant 2$ is a model for a part of an artery. Blood flows through the artery and the force per unit area at any point on the arterial wall is given by
$$\vec{F} = e^{-y}\vec{n} + \frac{1}{y^2+1}\vec{j},$$
where $\vec{n}$ is the unit outer normal to the arterial wall. Blood diffuses through the wall in such a way that if dS is a small area on S, the amount of diffusion through dS in one second is $\vec{F}\cdot\vec{n}\,dS$. Find the total amount of blood leaving the entire wall per second.