Math 251. WEEK in REVIEW 10. Fall 2013

1. Evaluate the surface integral $\iint\limits_S (x^2\, z + y^2\, z) dS$ where

   (a) S is the part of the plane $z = 4 + x + y$ that lies inside the cylinder $x^2 + y^2 = 4$.

   (b) S is the portion of the sphere $x^2 + y^2 + z^2 = 25$ such that $z \le 0, y \ge 0$.

2. Evaluate the surface integral $\iint\limits_S (x + y + z) dS$ where S is the surface of the cube defined by the inequalities $0 \le x, y, z \le 1$.

3. Find the mass of the lamina that is the portion of the surface $z = 10 - x^2/2$ between the planes $x = 0$, $x = 1$, $y = 0$, $y = 1$, if the density is $\rho(x, y, z) = x$.

4. Find flux of the vector field $\vec{F} =< x, y, 1 >$ across the surface S which is the boundary of the region enclosed by the cylinder $y^2 + z^2 = 1$ and the planes $x = 0$ and $x + y = 5$. Use positive (outward) orientation for S.

5. Evaluate the surface integral $\iint\limits_S < x, y, 1 > \cdot d\vec{S}$ where S is the portion of the paraboloid $z = 1 - x^2 - y^2$ in the first octant, oriented by downward normals.

6. Use Stokes' Theorem to evaluate $\oint_C \vec{F} \cdot d\vec{r}$, where $\vec{F}(x, y, z) =< 3z, 5x, -2y >$ and C is the ellipse in which the plane $z = y + 3$ intersects the cylinder $x^2 + y^2 = 4$, with positive orientation as viewed from above.

7. Find the work performed by the forced field $\vec{F} = \langle -3y^2, 4z, 6x \rangle$ on a particle that traverses the triangle C in the plane $z = \dfrac{1}{2}y$ with vertices $A(2, 0, 0)$, $B(0, 2, 1)$, and $O(0, 0, 0)$ with a counterclockwise orientation looking down the positive z-axis.