Homework Section 16.7

1. Evaluate the surface integral.
   a) $\iint_S zdS$, $S$ is the part of the plane $x + y + z = 2$ that lies in the first octant.
   
   b) $\iint_S y^2 z^2 dS$, $S$ is the part of the cone $f(x, y) = \sqrt{x^2 + y^2}$ that lies between the planes $z = 1$ and $z = 4$.
   
   c) $\iint_S x dS$, $S$ is the part of the paraboloid $x = y^2 + z^2$ that lies inside the cylinder $y^2 + z^2 = 4$. (Hint: use the rectangular form of $dS$ with $x = g(y, z)$).
   
   d) $\iint_S (x^2 + y^2 + z^2) dS$, $S$ is the part of the cylinder $x^2 + y^2 = 4$ between the planes $z = 0$ and $z = 3$. (Hint: parameterize the cylinder and use the parametric form of $dS$).

2. Evaluate the flux integral $\iint_S F \cdot N dS$.
   a) $F(x, y, z) = \langle x, y, z \rangle$, $S$ is the part of the plane $x + y + z = 2$ that lies in the first octant, and has upward orientation.
   
   b) $F(x, y, z) = zi + xj + k$, $S$ is part of the paraboloid $z = 9 - x^2 - y^2$ that lies above the square $0 \leq x \leq 1$, $0 \leq y \leq 1$, and has upward orientation.
   
   c) $F(x, y, z) = xi + yj + zk$, $S$ is the part of the cone $z = \sqrt{x^2 + y^2}$ between the planes $z = 1$ and $z = 4$ with downward orientation.
   
   d) $F(x, y, z) = -xi + zk$, $S$ consists of the paraboloid $z = f(x, y) = x^2 + y^2$, $0 \leq z \leq 1$, and the disk $x^2 + y^2 \leq 1$, $z = 1$. [Note: this requires evaluation of two integrals, and the paraboloid should be oriented downwards]
   
   e) $F(x, y, z) = yi - xj + zk$, $S$ is the part of the sphere $x^2 + y^2 + z^2 = 9$ in the first octant with orientation toward the origin (Hint: use the parametric form of the flux integral).