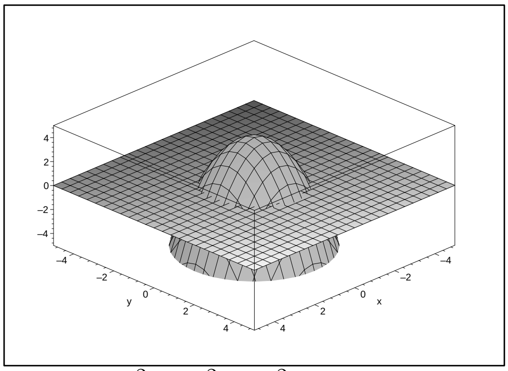
Problem Set #9

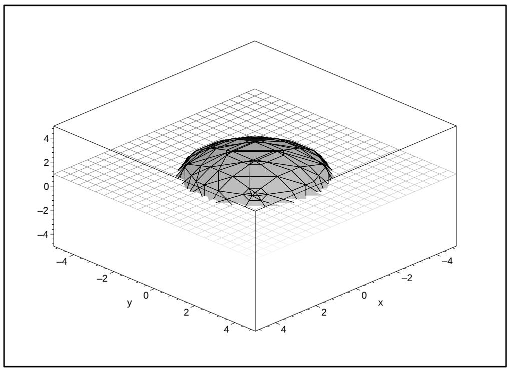
Due: Wednesday, Apr. 5

1. Find the area of the following surface.

(a) The part of the paraboloid $z = 9 - x^2 - y^2$ that lies above the $x - y$ plane.



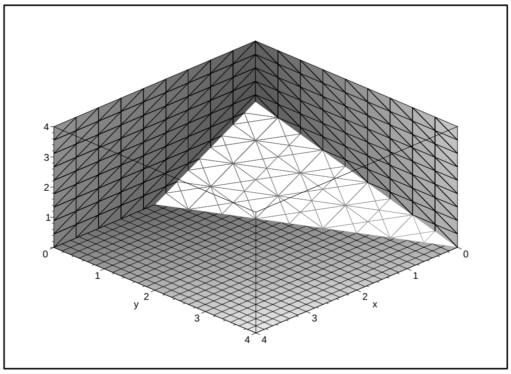
(b) The part of the sphere $x^2 + y^2 + z^2 = 4$ that lies above the plane $z = 1$.



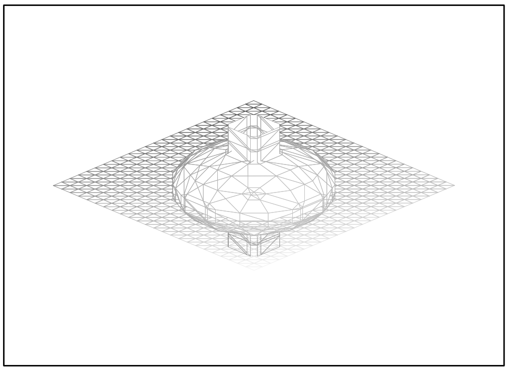
2. Evaluate the following triple integrals:

(a) $\int\int\int_E yz\sin(x^5)dV$ where E is the region $\{(x, y, z)|0 \le x \le 1, 0 \le y \le x, x \le z \le 2x\}$

(b) $\int\int\int_E zdV$ where E is the region bounded by $x = 0$, $y = 0$, $z = 0$ and $2x + y + 2z = 4$.



3. A bead is made by drilling a cylindrical hole of radius 1 mm through a sphere of radius 9 mm Set up a triple integral in cylindrical coordinates representing the volume of the bead. Evaluate the integral. (Hint: Express the region $E = \{(x, y, z)|x^2 + y^2 + z^2 \leq 9 \text{ and } x^2 + y^2 \leq 1\}$ in cylindrical coordinates and find $\int\int\int_E dV$.)



4. **(a)** A spherical cloud of gas of radius 3 km is more dense at the center than toward the edge. At a distance of ρ km from the center, the density is $\delta(\rho) = 3 - \rho$. Write an integral representing the total mass of the cloud of gas and evaluate it.

(b) A half-melon is approximated by the region between two concentric spheres, one a radius 1 and the other of radius 2. Write a triple integral, including limits of integration, giving the volume of the half-melon. Evaluate the integral.