Class exercises for Week 6. To be done in class. These exercises do not need to be returned, and they are not marked.

1. Find the surface area of the part of the surface $z = x^2 + 2y$ that lies above the triangular region in the xy-plane with vertices $(0, 0), (1, 0)$ and $(1, 1)$.

2. Let E denote the solid bounded by the surfaces

$$z = 0, \qquad x = 0, \qquad y = 2, \qquad z = y - 2x.$$

   (a) Sketch the solid E.

   (b) Sketch the projections of the solid E on the $x - y$ plane, the $y - z$ plane, and the $x - z$ plane.

   (c) Express the integral

$$\iiint_E f(x, y, z)\, dV$$

   as an iterated integral in six different ways. Of course, since f is not given, you cannot evaluate these integrals.

3. Consider the solid region E that lies below $x^2 + y^2 + z^2 = 4$ and above $z = \sqrt{x^2 + y^2}$ and is in the first octant (i.e. $x \geq 0, y \geq 0, z \geq 0$).

   (a) Sketch E.

   (b) Find the volume of E using cylindrical coordinates

   (c) Find the volume of E using spherical coordinates.

4. Set up an integral in cylindrical coordinates to represent the volume of the region in the first octant (i.e. $x \geq 0, y \geq 0, z \geq 0$) that lies above the xy-plane, below the plane $z = y - x$ and inside the cylinder $x^2 + y^2 = 4$. Evaluate the integral.

5. Let E be the solid region that lies inside the sphere $x^2 + y^2 + z^2 = 2$ and above the plane $z = 1$. Let $d(x, y, z) = z^2$ be the density of E. Sketch E and write a triple integral in spherical coordinates that gives the mass of E. You do not have to evaluate the integral.