For each problem, you may wish to set up all the integrals before evaluating any of them.

1. Consider the region bounded by \( y = \ln x \), \( x = 3 \), and \( y = 0 \).
   
   (a) Sketch this region.
   
   (b) Find the perimeter of this region. (Exact answer possible, but approximation OK.)
   
   (c) Find the area of this region.
   
   (d) Find the volume obtained by rotating this region around the \( x \)-axis.
   
   (e) Find the volume obtained by rotating this region around the \( y \)-axis.
   
   (f) Find the volume of the object having this region as its base and cross sections perpendicular to the \( y \)-axis that are squares.

2. Consider the region bounded by \( y = \sqrt{x} \) and \( y = \frac{x}{4} + \frac{3}{4} \).

   (a) Sketch this region.
   
   (b) Find the perimeter of this region. (Approximation.)
   
   (c) Find the area of this region.
   
   (d) Find the volume obtained by rotating this region around the \( x \)-axis.
   
   (e) Find the volume obtained by rotating this region around the line \( x = 1 \).
   
   (f) Find the volume of the object having this region as its base and cross sections perpendicular to the \( x \)-axis that are equilateral triangles.

3. (a) Set up and evaluate an integral giving the volume of a pyramid of height 10 m and square base 8 m by 8 m.

   (b) The pyramid in part (a) is cut off at a height of 6 m. See the figure at the right. Find the volume.

4. Find the volume of the snowman in the figure below. If \( x \) and \( y \) are in meters, and the origin is on the ground, the \( x \)-axis is horizontal and the \( y \)-axis is vertical, then the body is approximated by rotating the curve \( y = 1 - 4x^2 \) about the \( y \)-axis. The neck is a cylinder of radius 0.1 meter and length 0.15 meter; the head is spherical with radius 0.2 meter.
FOOD FOR THOUGHT!

5. The tree in the picture is 300 feet high and has a diameter of 14 feet at the base. The picture below gives some additional information about the tree. Find an approximation of the volume of the tree trunk.

6. (a) Find the volume obtained by rotating the region in Problem 1 around the line \( y = 4 \).
(b) Find the volume obtained by rotating the region in Problem 1 around the line \( y = -4 \).
(c) Find the volume obtained by rotating the region in Problem 2 around the line \( x = 2 \).
(d) Find the volume obtained by rotating the region in Problem 2 around the line \( x = -2 \).