1. Suppose that a is a positive constant and that R is the region bounded above by $y = 1/x^a$, below by $y = 0$, and on the left by the line $x = 1$.

a) Sketch the curves $y = 1/x^a$ for $a = .5$, 1 and 2. Which of these is closest to the x-axis?

b) For which positive numbers a do you get a convergent integral when you attempt to calculate the area of R? (Here and in the next two parts you should consider *all* positive values of a, not just those checked in a), and you should briefly *explain* your conclusions.)

c) Same as b), but for the volume of the solid obtained by rotating R around the x-axis.

d) Same as c), but for the volume of the solid obtained by rotating R around the y-axis.

2. Sketch carefully the graphs of $f(x) = (1+e^{-x})^2$ and $g(x) = (1+e^{-2x})^2$ for $x > 0$, and compute how much area there is between them in the first quadrant.

3. When a capacitor of capacitance C is charged by a source of voltage V, the power expended at time t is $P(t) = \frac{V^2}{R}\left(e^{-t/RC} - e^{-2t/RC}\right)$, where R is the resistance in the circuit. The total energy stored in the capacitor is $W = \int_0^\infty P(t)\,dt$.
Show that $W = \frac{1}{2}CV^2$. (This is problem 81 in section 7.7 of the textbook.)

One problem will be selected for a writeup to be handed in at the next recitation meeting. Please see Professor Greenfield's Math 152 webpage for this semester to learn which problem to hand in.