PROBLEM SET 9. DUE MONDAY, 18 SEPTEMBER

Reading. *Quick Calculus*, pp. 199–207.

Supplementary reading. Simmons, Chapters 18, 19, 20.

(1) There is a tent that has a circular base of radius 1 meter. The tent consists of stretching nylon fabric over a vertical semicircular pole (also of radius 1 meter) attached to the base at the opposite ends of a diameter. What is the volume of the tent? (Hint: The cross-sections are triangles.)

(2) Rotate the circle $(x-4)^2 + y^2 = 1$ around the y-axis. The solid that you get is a doughnut, also called a *torus*. Calculate the volume of this torus using the disc method. (Your discs will look like washers.)

(3) There is a 3-dimensional solid with base in the xy-plane. The base is triangular, with vertices $(0,0,0)$, $(2,2,0)$ and $(2,-2,0)$. The cross-sections of the solid when it is cut by planes perpendicular to the x-axis are squares. Compute the volume of this solid.

(4) There is a 3-dimensional solid with base in the xy-plane. The base is triangular, with vertices $(0,0,0)$, $(2,2,0)$ and $(2,-2,0)$. The cross-sections of the solid when it is cut by planes perpendicular to the x-axis are semi-circles. Compute the volume of this solid.

(5) Compute the following multiple integrals.

    (a) $\int_{y=0}^{1} \int_{x=0}^{1} x^2 y + xy^2 \, dx \, dy$

    (b) $\int_{y=0}^{1} \int_{x=0}^{y} 2\sqrt{y^2+1} \, dx \, dy$

    (c) $\int_{x=0}^{1} \int_{y=0}^{e^x} 4y \, dy \, dx$