Math 35, Homework 4 on Sections 15.4, 15.5
due Wed, Mar 5 at the start of class.

---

(1) Sketch the region whose area is given by the following integral and evaluate the integral:

$$\int_{\pi/2}^{\pi} \int_1^3 r\,dr\,d\theta$$

(2) Let D be the disk of radius 4 centered at the origin. Evaluate: $\iint_D xy\,dA$

(3) Graph the cardioid $r = 1 + \cos\theta$ in polar coordinates and then find its area.

(4) Find the volume inside the sphere $x^2 + y^2 + z^2 = 16$ and outside the cylinder $x^2 + y^2 = 4$ using polar coordinates.

(5) Electric charge is distributed over the disk $x^2 + y^2 \leqslant 4$ so that the charge density at (x, y) is
$$\sigma(x, y) = x + y + x^2 + y^2$$
coulombs per square meter. Find the disk's total charge.

(6) A triangular lamina with uniform density has boundary lines $x = 0$, $y = 0$ and $x + y = 2$. Find its center of mass.

(7) A lamina occupies the part of the disk $x^2 + y^2 \leqslant 4$ in the first quadrant. If its density at (x, y) is
$$\rho(x, y) = x$$
kg per square meter, find its total mass.

(8) Find the center of mass of the lamina from question (7).

(9) Let D be the region bounded by $y = e^x$, $y = 0$, $x = 0$ and $x = 1$. Suppose this lamina has density $\rho(x, y) = y$. Find its moments of inertia I_x, I_y and I_0.