1. Let R denote the region in the first quadrant of the x-y plane bounded by the line $y = x$ and the parabola $y = x^2$. Compute
   (a) the area of R,
   (b) the center of gravity of R.

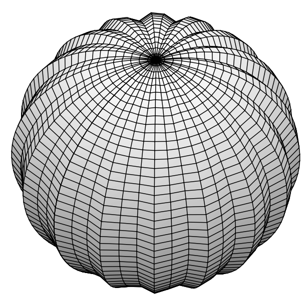
2. Rewrite $\displaystyle\int_{-1}^{2} dx \int_{x}^{x^3} f(x, y)\, dy$ as an iterated integral in the other order.

3. Let R denote the closed unit square: the region in the first quadrant of the x-y plane defined by the inequalities $0 \le x \le 1$ and $0 \le y \le 1$. Give a concrete example
   (a) of a function f that is not uniformly continuous on R but that is Riemann integrable on R,
   (b) of a function f that is defined everywhere on R but that is not Riemann integrable on R.

4. Compute the surface area of the piece of the unit sphere $x^2+y^2+z^2 = 1$ on which all three coordinates x, y, and z are positive and in addition $x < 1/2$.

5. Prove from first principles that if f and g are continuous functions on a compact region R, and if $f(x, y) \le g(x, y)$ for all points (x, y) in R, then $\iint_R f(x, y)\, dS \le \iint_R g(x, y)\, dS$.

6. Model the surface of a pumpkin by the equation $r = 1 + a(\sin\varphi)|\cos 8\theta|$ in spherical coordinates, where a is a small positive number. As usual, r is the distance from the origin, the angle θ is the polar angle, and the angle φ is the co-latitude (the angle measured down from the positive z-axis). The figure illustrates the case $a = 1/10$.



   Set up an integral that expresses the volume of the pumpkin. Do not evaluate the integral.