1. Evaluate the integral $\int_{-1}^{1}\int_{0}^{\sqrt{1-x^2}} \sqrt{1-y^2}\,dy\,dx$. [6]

   (You can do it without reversing the order of integration, but it's not recommended.)

2. The integral below computes the area of a region. Sketch the area, and compute it by converting to polar coordinates. [6]

$$\int_{-2}^{-1}\int_{-x}^{\sqrt{8-x^2}} dy\,dx + \int_{-1}^{1}\int_{\sqrt{2-x^2}}^{\sqrt{8-x^2}} dy\,dx + \int_{1}^{2}\int_{x}^{\sqrt{8-x^2}} dy\,dx$$

3. Evaluate the integral $\int_0^2 \int_0^{\sqrt{2x-x^2}} \sqrt{x^2+y^2}\, dy\, dx$ by converting to polar coordinates. [6]

4. Find the centroid (geometric center) of the triangle with vertices $(0,0)$, $(-4,-2)$, and $(4,2)$. [8]

5. Set up, but do not evaluate, the integral $\iiint_E x^2\cos(yz)\,dV$, where E is the tetrahedron with vertices $(2,0,0)$, $(0,4,0)$, and $(0,0,1)$. $(0,0,0)$ [6]

6. Let $E \subseteq \mathbb{R}^3$ be the region bounded below by the cone $z = \sqrt{x^2+y^2}$ and above by the sphere $x^2+y^2+z^2=2z$. Express the volume of E as a triple integral in **both** cylindrical and spherical coordinates. You do not have to compute the volume. [6]