1. Use a double integral to find the area of the region inside the circle $r = 3\cos(\theta)$ and outside the cardioid $r = 1 + \cos(\theta)$.
   
   Answer: $\pi$

2. Find the volume of the region above the paraboloid $z = x^2 + y^2$ and below the half-cone $z = \sqrt{x^2 + y^2}$.
   
   Answer: $\frac{\pi}{6}$

3. Calculate the iterated integral by first reversing the order of integration
   
   $\int_0^1 \int_x^1 \cos(y^2) dy \, dx$
   
   Answer: $\frac{\sin(1)}{2}$

4. Calculate $\int \int_D y \, dA$ where $D$ is the region in the first quadrant bounded by the parabolas $x = y^2$ and $x = 8 - y^2$.
   
   Answer: 8