1. The double integral \( \iint_{R} \sqrt{1-x^2} \, dA \) where \( R = \{(x, y) \mid -1 \leq x \leq 1, -2 \leq y \leq 2\} \) represents the volume of a solid. Sketch the solid and find the value of the double integral using any method. Justify your answer.

2. Given \( \iint_{D} e^{\frac{x}{y}} \, dA \) where \( D = \{(x, y) \mid 1 \leq y \leq 2, y \leq x \leq y^3\} \):
   a. Write as one or more double integrals (as appropriate) in the order \( dydx \). DO NOT EVALUATE.
   
b. Write as one or more double integrals (as appropriate) in the order \( dxdy \). DO NOT EVALUATE.
3. Use a double integral to find the area between the curves \( r = \cos \theta \) and \( r = \sin \theta \)

4. Change the order of integration:

\[
\int_0^2 \int_{\sqrt{y}}^8 e^x \, dx \, dy
\]
5. Given the solid bounded by \( z = 3x^2 + 3y^2 \) and \( z = 4 - x^2 - y^2 \):

   a. Set up, **but DO NOT EVALUATE** one or more double integrals (as appropriate) to find the volume of this solid

   b. Set up, **but DO NOT EVALUATE** one or more triple integrals (as appropriate) to find the volume of this solid

6. Set up, **but DO NOT EVALUATE**, an integral to find the mass of the solid tetrahedron \( \iiint_{E} x^2 \, dV \) where \( E \) is the solid that lies within \( x^2 + y^2 = 1 \), above \( z = 0 \), and below \( z^2 = 4x^2 + 4y^2 \)
7. Sketch the solid whose volume is given by the integral
\[ \int_0^\pi \int_0^\pi \int_0^{\rho^2} r \, dz \, dr \, d\theta \, . \]

8. Set up, but **DO NOT EVALUATE**, a triple integral to find the volume of the part of the ball \( \rho \leq a \) that lies between the cones \( \phi = \frac{\pi}{6} \) and \( \phi = \frac{\pi}{3} \).
9. Given transformation $T: x = \frac{1}{2}(u + v), \quad y = \frac{1}{2}(u - v)$, find the Jacobian of $T$.