1. Find the surface area of the surface $z = \frac{1}{2}(x^2 + y^2)$ over the region $D = \{(x, y)|x^2 + y^2 \leq 1, -x \leq y \leq x\}$.

2. Suppose we wish to make a thin metal washer with constant density, ρ g/cm.^{2}, with outer radius 2 cm., and inner radius a cm. for some constant a, $0 < a < 2$. We represent the washer by the region in the x, y plane, $D = \{(x, y) | \ a^2 \leq x^2 + y^2 \leq 4\}$.

   (a) Compute a formula for the mass of the washer, m, in terms of a and ρ.

   (b) Compute a formula for the moment of intertia of the washer about the y-axis, I_y, in terms of a and ρ.

   (c) If we want $m = 9$ g. and $I_y = 13$ g.cm.^{2}, what value must we choose for a?

3. Usa a change of variables to evaluate the double integral

$$\int\int_D e^{2x^2+9y^2}\, dA,$$

where D is the elliptical domain $2x^2 + 9y^2 \leq 1$.

Note: if you forget how to approach this problem, then for a maximum of 7 points you may integrate:

$$\int\int_D e^{x^2+y^2}\, dA,$$

where D is the domain $x^2 + y^2 \leq 1$.

4. Let S denote the surface defined by the equation $x^2 + y^2 + z = 4$ above the xy-plane.

   (a) Find a parametrization for S.

   (b) Evaluate:

$$\int\int_S \frac{1}{\sqrt{1+4x^2+4y^2}} dS.$$

5. The hyperbolic sine and cosine functions are given by:

$$\cosh t = \frac{e^t + e^{-t}}{2}, \qquad \sinh t = \frac{e^t - e^{-t}}{2}$$

(Notice $\cosh^2 t - \sinh^2 t = 1$) The object of this problem is to use a change of variables, $x = r\cosh t$, $y = r\sinh t$, to compute $\iint_D x - y\, dA$, where $D = \{(x, y)|\ 0 \leq y, y < x, x^2 - y^2 \leq 1\}$.

   (a) Compute the Jacobian $\frac{\partial(x,y)}{\partial(r,t)}$

   (b) Describe the region that corresponds to D in the r, t plane.
   (**Solution:** $D = \{(r, t)|\ 0 < r \leq 1, 0 \leq t < \infty\}$)

   (c) Use change of variables to compute $\iint_D x - y\, dA$.