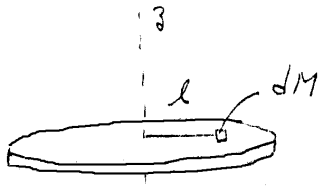
5-4.3a



Use polar coords, since Disk is of no extent along z.

$\ell = r \qquad \ell^2 = r^2$

$dI_z = \rho \ell^2 dV$

$$I_z = \rho \int_{r=0}^{a} \int_{\theta=0}^{2\pi} r^2 \cdot r \, dr \, d\theta = 2\pi\rho \int_0^a r^3 dr$$

$$I_z = 2\pi\rho \left. \frac{r^4}{4} \right|_0^a = \frac{2\pi\rho a^4}{4}$$

$$\boxed{I_z = \frac{\pi\rho a^4}{2}}$$

5-4.16

Bees # 16, -p. 226 Find Jacobian for transformation from x, y to u, v, where

$$x = \tfrac{1}{2}(u^2 - v^2) \qquad y = uv$$

$$\frac{\partial x}{\partial u} = \tfrac{1}{2} \cdot 2 \cdot u \qquad \frac{\partial x}{\partial v} = -\tfrac{1}{2} \cdot 2 \cdot v$$

$$\frac{\partial y}{\partial u} = v \qquad \frac{\partial y}{\partial v} = u$$

$$J = \begin{vmatrix} \frac{\partial x}{\partial u} & \frac{\partial x}{\partial v} \\ \frac{\partial y}{\partial u} & \frac{\partial y}{\partial v} \end{vmatrix} = \begin{vmatrix} u & -v \\ v & u \end{vmatrix} = u^2 - (-v)(v) = u^2 + v^2$$

$$\boxed{J = u^2 + v^2}$$