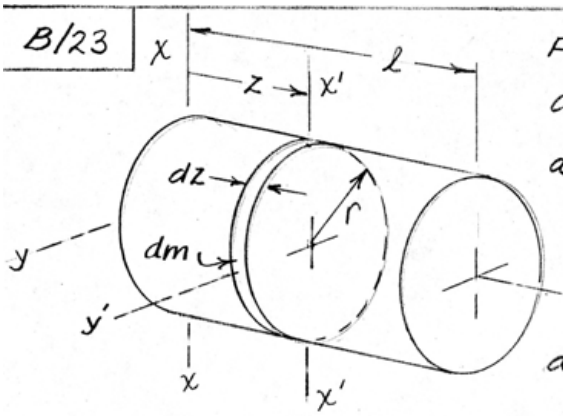
B/23



For slice of mass dm

$$dI_{zz} = \frac{1}{2} dm\,(r^2)$$

$$dI_{x'x'} + dI_{y'y'} = dI_{zz}$$

$$\therefore dI_{x'x'} = \frac{1}{2} dI_{zz}$$

$$= \frac{1}{4} r^2 dm$$

$$dI_{xx} = dI_{x'x'} + z^2 dm$$

So $dI_{xx} = \frac{1}{4} r^2 dm + z^2 dm$ but $dm = \pi r^2 \rho\, dz$

where ρ = density

$$\therefore dI_{xx} = \pi r^2 \rho \left(\frac{r^2}{4} + z^2\right) dz; \quad I_{xx} = \pi r^2 \rho \int_0^l \left(\frac{r^2}{4} + z^2\right) dz$$

$$I_{xx} = \pi r^2 \rho \left(\frac{r^2 l}{4} + \frac{l^3}{3}\right) = m\left(\frac{r^2}{4} + \frac{l^2}{3}\right)$$