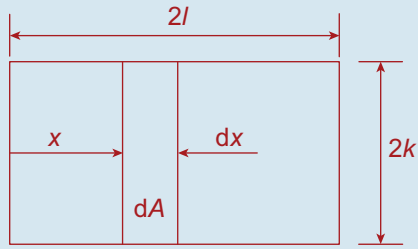


Q. 5.



$$\rho = \frac{3m}{4kl}$$

$$dm = \rho dA$$

$$= \frac{3m}{4kl} 2k dx$$

$$= \frac{3m dx}{2l}$$

$$\text{now } dI = x^2 dm$$

$$\Rightarrow I = \frac{3m}{2l} \int_0^{2l} x^2 dx$$

$$\Rightarrow I = \frac{3m}{2l} \left[x^3 \right]_0^{2l}$$

$$= \frac{8ml^3}{2l}$$

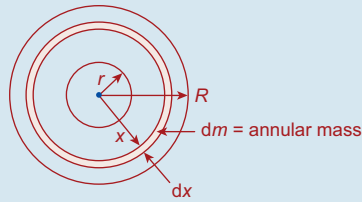
$$\Rightarrow I = 4ml^2 \quad \text{QED}$$

$$k = \sqrt{\frac{I}{m}}$$

$$k = \sqrt{\frac{4ml^2}{3m}} \quad \text{Noting, here mass} = 3m$$

$$= \frac{2l}{\sqrt{3}}$$

Q. 6.



$$\rho = \frac{\text{Mass}}{\text{Area}}$$

$$= \frac{m}{\pi(R^2 - r^2)}$$

$$dm = \rho dA$$

$$= \frac{m}{\pi(R^2 - r^2)} 2\pi x dx$$

$$= \frac{2m}{R^2 - r^2} x dx$$

$$\text{now, by Definition } dI = x^2 dm$$

$$\Rightarrow dI = \frac{2m}{R^2 - r^2} (x^3) dx$$

$$\Rightarrow I = \frac{2m}{R^2 - r^2} \int_r^R x^3 dx$$

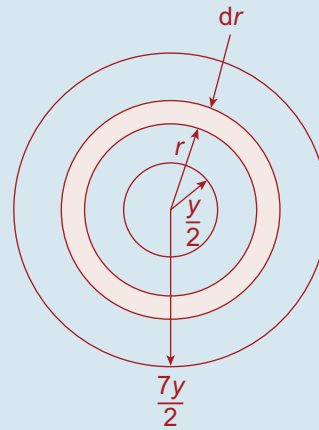
$$= \frac{2m}{4(R^2 - r^2)} \left[x^4 \right]_r^R$$

$$= \frac{m}{2(R^2 - r^2)} (R^4 - r^4)$$

$$\text{Noting that } R^4 - r^4 = (R^2 - r^2)(R^2 + r^2)$$

$$= \frac{m}{2} (R^2 + r^2) \quad \text{QED}$$

Q. 7.



Mass, $8m$

$$\rho = \frac{8m}{\pi \left(\frac{49y^2}{4} - \frac{y^2}{4} \right)} = \frac{8m}{\pi(48)y^2} \quad (4)$$

$$\Rightarrow \rho = \frac{2m}{3\pi y^2}$$

$$dm = \rho dA$$

$$= \rho 2\pi r dr$$

$$= \frac{4m}{3y^2} dr$$

$$\text{Now } dI = r^2 dm$$

$$\Rightarrow I = \frac{4m}{3y^2} \int_{\frac{y}{2}}^{\frac{7y}{2}} r^3 dr$$

$$= \frac{4m}{4(3y^2)} \left[r^4 \right]_{\frac{y}{2}}^{\frac{7y}{2}}$$

$$= \frac{m}{3y^2} \left[\frac{2,401}{16} y^4 - \frac{y^4}{16} \right]$$

$$= \frac{m}{3y^2} \left[\frac{2,400y^4}{16} \right]$$

$$\Rightarrow I = 50my^2 \quad \text{QED}$$