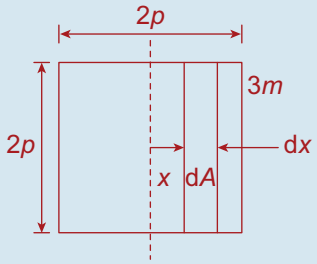
Q. 8.



$\rho = \frac{3m}{4p^2}$, $dA = 2p\ dx$

$dm = \rho\ dA$

$\Rightarrow dm = \frac{3m}{4p^2} 2p(dx)$

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

now $dI = x^2\ dm$

$\Rightarrow I = \frac{3m}{2p}\int_{-p}^{p} x^2\ dx$

$= \frac{3m}{2(2p)}\left[x^3\right]_{-p}^{p}$

$= \frac{m}{2p}[p^3 + p^3]$

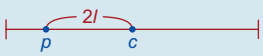
$= mp^2$ **QED**

Exercise 14B

Q. 1. (i) $I = \frac{1}{3}(m)(3l)^2 = 3ml^2$

(ii) $I = \frac{4}{3}(m)(3l)^2 = 12ml^2$

(iii) $I_p = I_c + md^2$



$= 3ml + m(2l)^2$

$= 7ml^2$

Q. 2. (a) (i) $I_A = \frac{1}{3}(m)l^2 = \frac{1}{3}ml^2$

(ii) $I_B = \frac{1}{3}(m)(2l)^2 = \frac{4}{3}ml^2$

(iii) $I_C = I_A + I_B$ (by perpendicular axis theorem)

$= \frac{5}{3}ml^2$

(iv) $I_p = I_c + md^2$

$= \frac{5}{3}ml^2 + m(2l)^2$

$= \frac{17}{3}ml^2$

(b) Only (iv) and by $mr^2 = (3m)(2l)^2 = 12ml^2$

Q. 3. (i)

Rod: I_X: $\frac{4}{3}ml^2$

Disc: I_o: $\frac{1}{2}ml^2$

Parallel Axes:

$(I_X = I_o + mr^2)$

$\Rightarrow I_X = \frac{ml^2}{2} + m(3l)^2$

$\Rightarrow I_X = \frac{19ml^2}{2}$

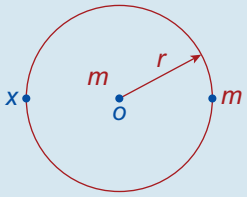
$I_{Total} = I_{Rod} + I_{Disc}$

$= \frac{19ml^2}{2} + \frac{4ml^2}{3}$

$= \frac{(57 + 8)}{6}ml^2$

$\Rightarrow I = \frac{65}{6}ml^2$

(ii)



Parallel Axes: $(I_X = I_o + mr^2)$

Disc:

$I_X = \frac{mr^2}{2} + mr^2$

$\Rightarrow I_X = \frac{3mr^2}{2}$

Pt Mass:

$I_X = m(2r)^2$

$\Rightarrow I_X = 4mr^2$

$I_{Total} = \frac{3mr^2}{2} + 4mr^2$

$= \frac{11mr^2}{2}$

(iii)