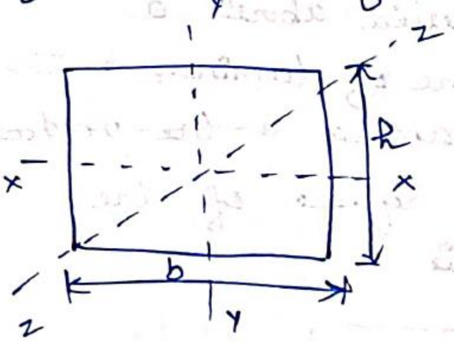
PERPENDICULAR AXIS THEOREM.

If I_{ox} & I_{oy} be MOI of a lamina about two mutually perpendicular axes OX & OY in the plane of lamina and I_{oz} be the MOI of lamina about an axis normal to the lamina & passing through the point of intersection of axis OX & OY Then,



$$I_{ox} = I_{ox} + I_{oy}$$

$$I_{xx} = \frac{bh^3}{12}$$

$$I_{yy} = \frac{hb^3}{12}$$

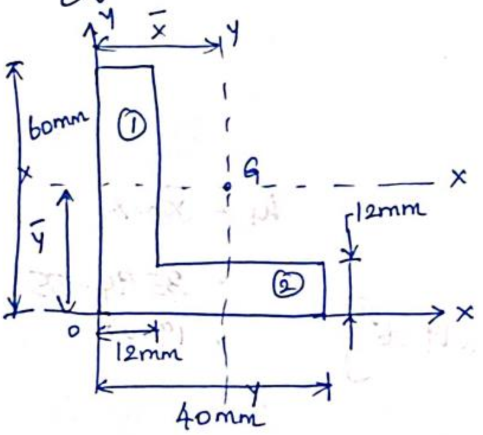
MOI of rectangle about axis ZZ, passing through the point of intersection of XX & YY axis and normal to the plane of rectangle

$$I_{zz} = I_{xx} + I_{yy}$$

$$= \frac{bh^3}{12} + \frac{hb^3}{12}$$

$$= \frac{1}{12}\left[bh^3 + hb^3\right]$$

4. Find the M.I of an angle section as shown in figure about its centroidal axes.



Not Symmetrical about any axes.

To Find $\bar{x}$ & $\bar{y}$

Portion ① (12×48mm)

$a_1 = 12 \times 48$

$= 576\ mm^2$

$x_1 = 12/2 = 6\ mm$

$y_1 = 12 + (48/2)$

$= 36mm.$

Portion ② (40mm × 12mm)

$a_2 = 40 \times 12 = 480 mm^2$

$x_2 = 40/2 = 20mm$

$y_2 = 12/2 = 6mm$

$$\bar{x} = \frac{a_1x_1 + a_2x_2}{a_1+a_2} = \frac{(576 \times 6) + (480 \times 20)}{576+480}$$

$= 12.36mm$

$$\bar{y} = \frac{a_1y_1 + a_2y_2}{a_1+a_2} = \frac{(576 \times 36) + (480 \times 6)}{576+480}$$

$= 22.36\ mm$

$I_{xx} = I_1 + I_2$

$I_1 = I_{G_1} + A_1 \bar{h}_1^2$

$= \frac{12 \times 48^3}{12} + \left[(12 \times 48) \times 13.64^2\right]$ $\quad \bar{h}_1 = 22.36 \sim 36$

$= 2.177 \times 10^5 \text{ mm}^4$

$I_2 = I_{G_2} + A_2 \bar{h}_2^2$ $\quad \bar{h}_2 = 22.36 \sim 6$

$= \frac{40 \times 12^3}{12} + \left[(40 \times 12) \times 16.36^2\right]$

$= 1.342 \times 10^5 \text{ mm}^4.$

$I_{xx} = (2.177 \times 10^5) + (1.342 \times 10^5)$

$= 3.519 \times 10^5 \text{ mm}^4.$

M.I about yy axis

$I_{yy} = I_1 + I_2$

$I_1 = I_{G_1} + A_1 h_1^2$ $\quad \bar{h}_1 = 12.36 \sim 6$

$= \frac{48 \times 12^3}{12} + \left[(48 \times 12) \times 6.36^2\right]$

$= 3.021 \times 10^4 \text{ mm}^4$

$I_2 = I_{G_2} + A_2 \bar{h}_2^2$ $\quad \bar{h}_2 = 12.36 \sim 20$

$= \frac{12 \times 40^3}{12} + \left[(12 \times 40) \times 7.64^2\right]$

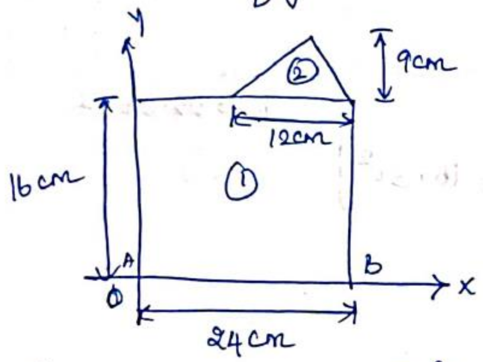
$= 9.201 \times 10^4 \text{ mm}^4$

$I_{yy} = I_1 + I_2$

$= (3.021 \times 10^4) + (9.201 \times 10^4)$

$= 1.222 \times 10^5 \, mm^4.$

5. Find the M.I of Composite plane figure as shown in figure about its bottom edge AB.



Location of centroid is not required.

$I_{AB} = (I_{AB})_1 + (I_{AB})_2$

$(I_{AB})_1 = I_{G_1} + A_1 \bar{h}_1^2$

$I_{G_1} = \frac{bd^3}{12} = \frac{24 \times 16^3}{12}$

$= 8192 \, cm^4$

$A_1 = 24 \times 16 = 384 \, cm^2$

$\bar{h}_1 = 16/2 = 8 \, cm$

$(I_{AB})_1 = 8192 + [384 \times 8^2]$

$= 32768 \, cm^4.$

$(I_{AB})_2 = I_{G_2} + A_2 \bar{h}_2^2$

$I_{G_2} = \frac{bh^3}{36} = \frac{12 \times 9^3}{36}$

$A_2 = bh/2 = \frac{12 \times 9}{2}$ | $\bar{h}_2 = \left(\frac{1}{3} \times 9\right) + 16$
$= 19 \, cm$

$$(I_{AB})_2 = \frac{12 \times 9^3}{36} + \left[\frac{12 \times 9}{2} \times 19^2\right]$$

$$= 19737 \text{ cm}^4.$$

$$I_{AB} = 32768 + 19737$$

$$= 52505 \text{ cm}^4.$$