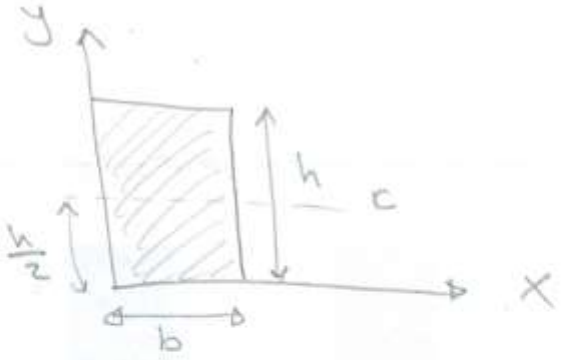
Moment of Inertia Examples

(1)

Example

find I_x



الحل

$\therefore I_c = \frac{bh^3}{12}$

المسافة من مركز المساحة الكلية الى المحور المطلوب

$\therefore I_x = \frac{bh^3}{12} + Ad^2$

$= \frac{bh^3}{12} + (bh) * \left(\frac{h}{2}\right)^2$

$= \frac{bh^3}{12} + \frac{bh^3}{4}$

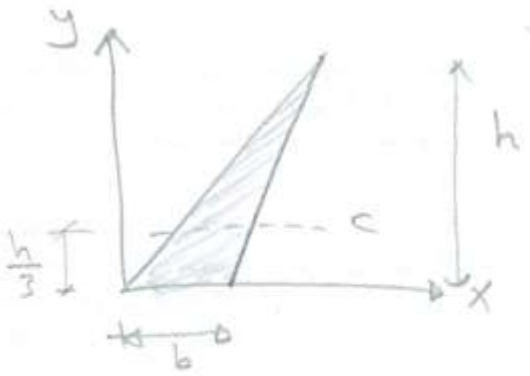
$= \frac{bh^3 + 3bh^3}{12}$

$= \frac{4bh^3}{12_3}$

$= \frac{bh^3}{3}$

(2)

Example Find I_x



$\because I_c = \frac{bh^3}{36}$

$\therefore I_x = \frac{bh^3}{36} + Ad^2$

$= \frac{bh^3}{36} + \left[\left(\frac{1}{2} * b * h\right) * \left(\frac{h}{3}\right)^2\right]$

$= \frac{bh^3}{36} + \left[\frac{1}{18} * b * h^3\right]$

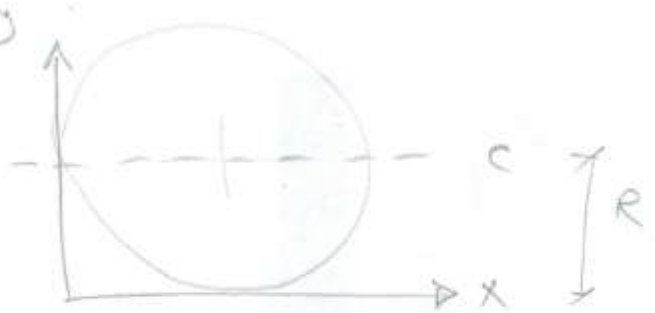
$= \frac{bh^3 + 2bh^3}{36}$

$= \frac{3bh^3}{36}$

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

(3) Example: find I_x

$\because I_c = \frac{\pi R^4}{4}$



$$I_x = \frac{\pi R^4}{4} + Ad^2$$

$$= \frac{\pi R^4}{4} + (\pi R^2 * R^2)$$

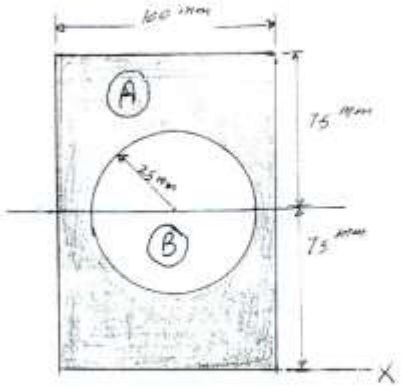
$$= \frac{\pi R^4}{4} + 4\frac{(\pi R^2 * R^2)}{4}$$

$$= \frac{\pi R^4 + 4\pi R^4}{4}$$

$$I_x = \frac{5\pi R^4}{4}$$

(4)

X Compute the moment of Inertia of the composite area shown in fig. about the X-axis.



Solution For Area A

$$I_x = I_c + A d^2$$

$$I_x = \frac{b h^3}{12} + (100 \times 150)(75)^2$$

$$I_x = \frac{100 \times (150)^3}{12} + (100 \times 150)(75)^2$$

$$I_x = 112.5 \times 10^6 \text{ mm}^4$$

For Area B

$$I_x = I_c + A d^2$$

$$= \frac{1}{4}\pi (25)^4 + \pi (25)^2 (75)^2 = 11.4 \times 10^6 \text{ mm}^4$$

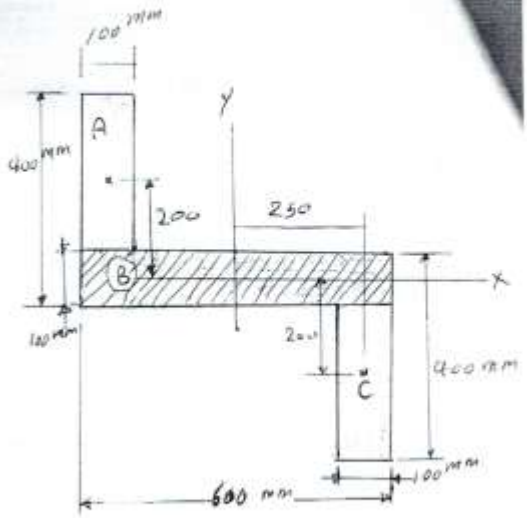
$$I_x = 112.5 \times 10^6 - 11.4 \times 10^6$$

$$= 101 \times 10^6 \text{ mm}^4$$

(5)

Ex Compute the moment of Inertia of the beam sectional area shown in fig. about the X-axis and Y-axis.

Solution



For Rectangle - A

$$I_X = \frac{100 \times 400^3}{12} + (100 \times 400)(200)^2$$

$$I_X = 1.425 \times 10^9 \text{ mm}^4$$

$$I_y = \frac{300 \times 100^3}{12} + (300 \times 100)(250)^2$$

$$= 1.9 \times 10^9 \text{ mm}^4$$

Rectangle B

$$I_X = \frac{600 \times 100^3}{12} = 0.05 \times 10^9 \text{ mm}^4$$

$$I_Y = \frac{100 \times 600^3}{12} = 1.8 \times 10^9 \text{ mm}^4$$

Rectangle C

$$I_X = \frac{100 \times 300^3}{12} + (100 \times 300)(200)^2 = 1.425 \times 10^9 \text{ mm}^4$$

$$I_Y = \frac{300 \times 100^3}{12} + (100 \times 300)(250)^2 = 1.9 \times 10^9 \text{ mm}^4$$

$$I_{X_{Cgl}} = 1.425 \times 10^9 + 0.05 \times 10^9 + 1.425 \times 10^9 = 2.9 \times 10^9 \text{ mm}^4$$

$$I_{y_{Cgl}} = 1.9 \times 10^9 + 1.8 \times 10^9 + 1.9 \times 10^9 = 5.6 \times 10^9 \text{ mm}^4$$

(6) The unit of moment of Inertia is

1. mm
2. mm^2
3. mm^3
4. mm^4
5. mm^5
6. mm^6

MCQ2 :- The unit of second moment of Area is

1- in
2- in^2
3- in^3
4- in^4
5- in^5

MCQ3 For the fig 1 the Ix =

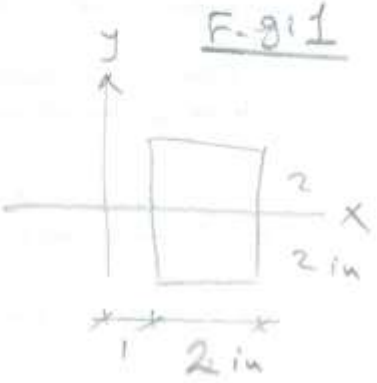
1- $\frac{2 * 4^3}{12}$

2- $\frac{2 * 4^3}{3}$

3- $\frac{\pi}{4} * 4^4$

4- Not of These Answers

Fig 1



MCQ4- For the Fig 1 shown the Iy is

1- 66.6 mm^4
2- 77.7 in^4
3- 80 ft^4
4- Not of these Answers