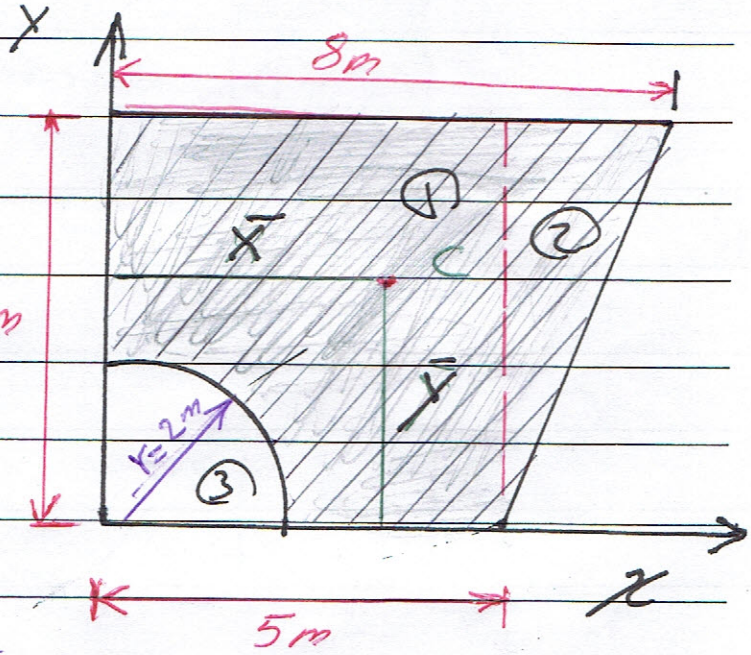
Moment of Inertia عزم القصور الذاتي

Ex:(1)

Find the Moment of Inertia about x-axis ?

Sol.



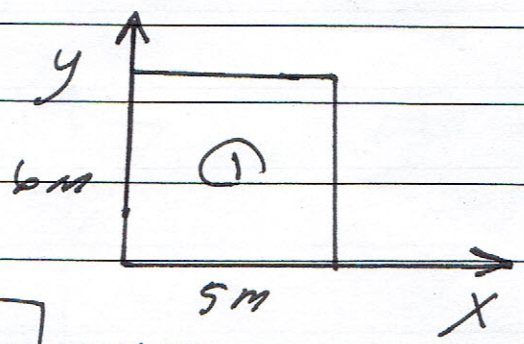
مستطيل ①

$$I_{X_1} = \frac{bh^3}{3} = \frac{5 \times 6^3}{3}$$

$$\boxed{I_{X_1} = 360}$$

$$A_2 = \frac{1}{2}bh = \frac{6 \times 3}{2} = 9\,m^2$$

مثلث ② نظرية المحاور المتوازية

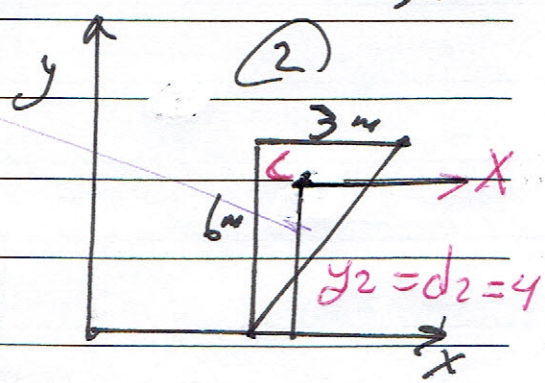


$$I_{X_2} = I_{X_{C_2}} + A_2 d_2^2$$

$$I_{X_2} = \frac{bh^3}{36} + A_2 d_2^2$$

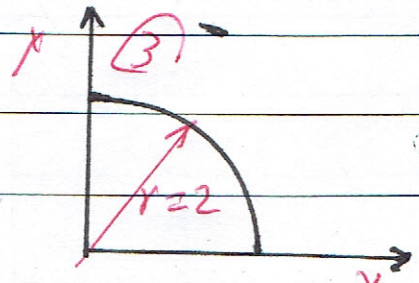
$$= \frac{3 \times 6^3}{36} + 9 * 4^2 = \boxed{162}$$

I_{X_2}



$$I_{X_3} = \frac{-\pi r^4}{16}$$ ③ دائرة

$$I_{X_3} = \frac{-\pi * (2)^4}{16} \Rightarrow \boxed{I_{X_3} = -3.14}$$



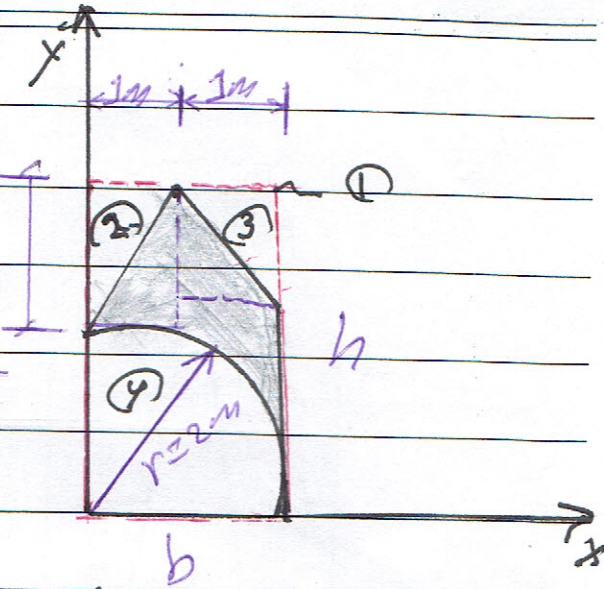
$$I_X = I_{X_1} + I_{X_2} + I_{X_3}$$

$$= 360 + 162 - 3.14$$

$$\boxed{I_X = 518.86}\ m^4$$

Ex(2)

Find the moment of inertia about X- axis ?



مثلث ①

$$I_{X_1} = \frac{bh^3}{3} = \frac{2*(3.5)^3}{3}$$

2+1.5

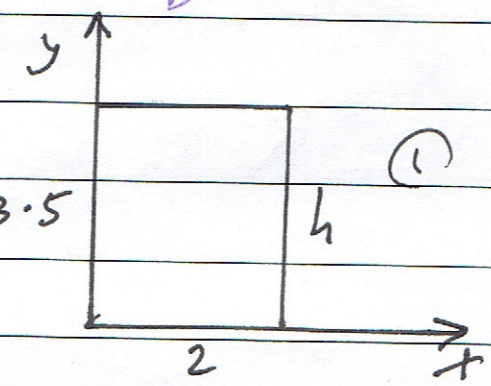
$$\boxed{I_{X_1} = 28.583}$$

مثلث ②

$$I_{X_2} = I_{XC_2} + A_2 d_2^2$$

$$I_{X_2} = \frac{bh^3}{36} + A_2 d_2^2$$

$$= \frac{-1*1.5^3}{36} + \underbrace{(-0.75)}_{\frac{1*1.5}{2}} * \underbrace{3^2}_{2+1}$$



$$\boxed{I_{X_2} = -6.843}$$

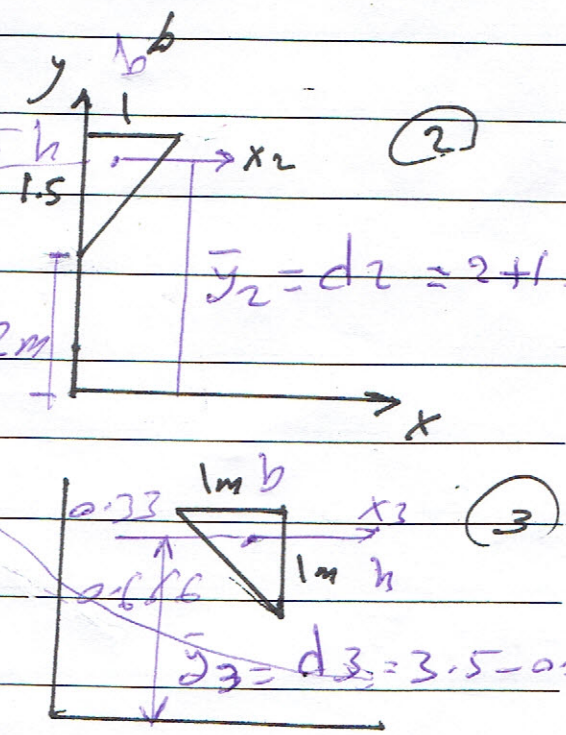
مثلث ③

$$I_{X_3} = I_{XC_3} + A_3 d_3^2$$

$$I_{X_3} = \frac{-bh^3}{36} + (-0.5) * (3.166)^2$$

$\frac{bh}{2} = \frac{1*1}{2}$

$$\boxed{I_{X_3} = -5.039}$$



ربع دائرة ④

$$I_{X_4} = -\frac{\pi r^4}{16}$$

$$I_{X_4} = \frac{-\pi (2)^4}{16} = \boxed{-3.14}$$

$$I_X = I_{X_1} + I_{X_2} + I_{X_3} + I_{X_4}$$

$$= 28.583 - 6.843 - 5.039 - 3.14$$

$$\boxed{I_X = 13.56 \text{ m}^4}$$