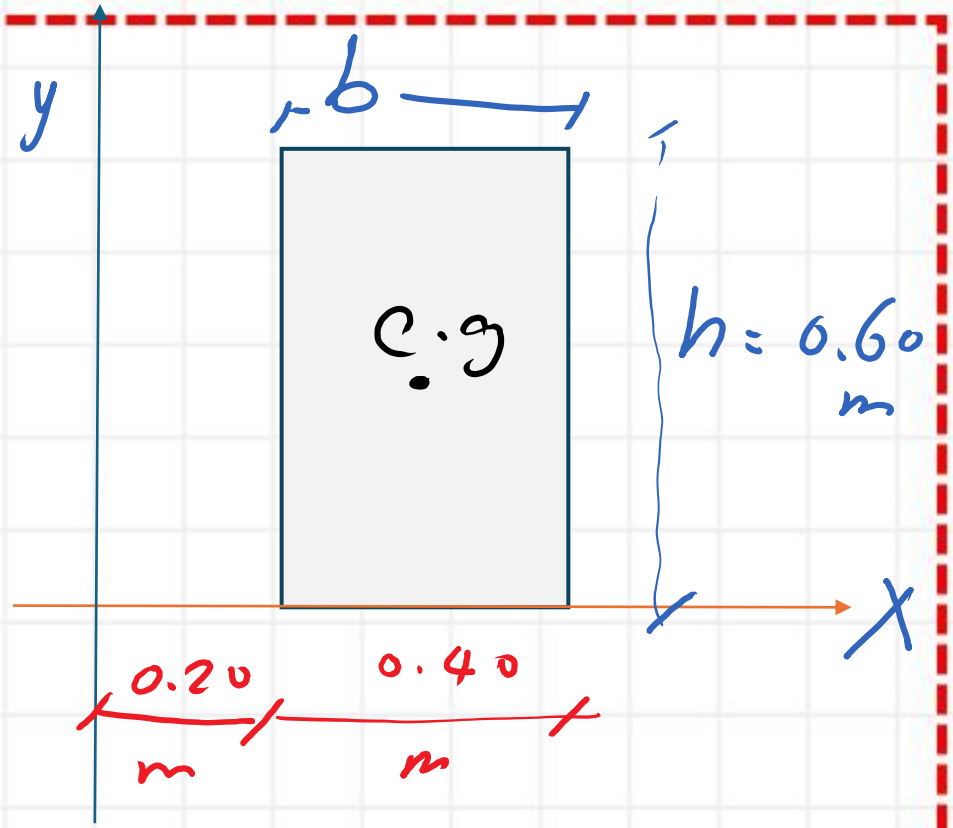
Example # 1

Estimate the Following

For the given Rectangle

(a) I_x, k_x

(b) I_y, k_y



Solution : $I_x = I_{xG} + A\bar{y}^2$

$I_{xG} = \frac{bh^3}{12} = \frac{0.4}{12}(0.60)^2 = 0.0072\ m^4$, $A = 0.4(0.60) = 0.24\ m^2$

$A\bar{y}^2 = bh(\frac{h}{2})^2 = 0.4(0.60)(\frac{0.60}{4})^2 = 0.0216\ m^4$

$I_x = 0.0072 + 0.0216 = 0.0288\ m^4 = 2880 \times 10^4\ cm^4$

$k^2_x = [0.0288 / 0.24] = 3/25$

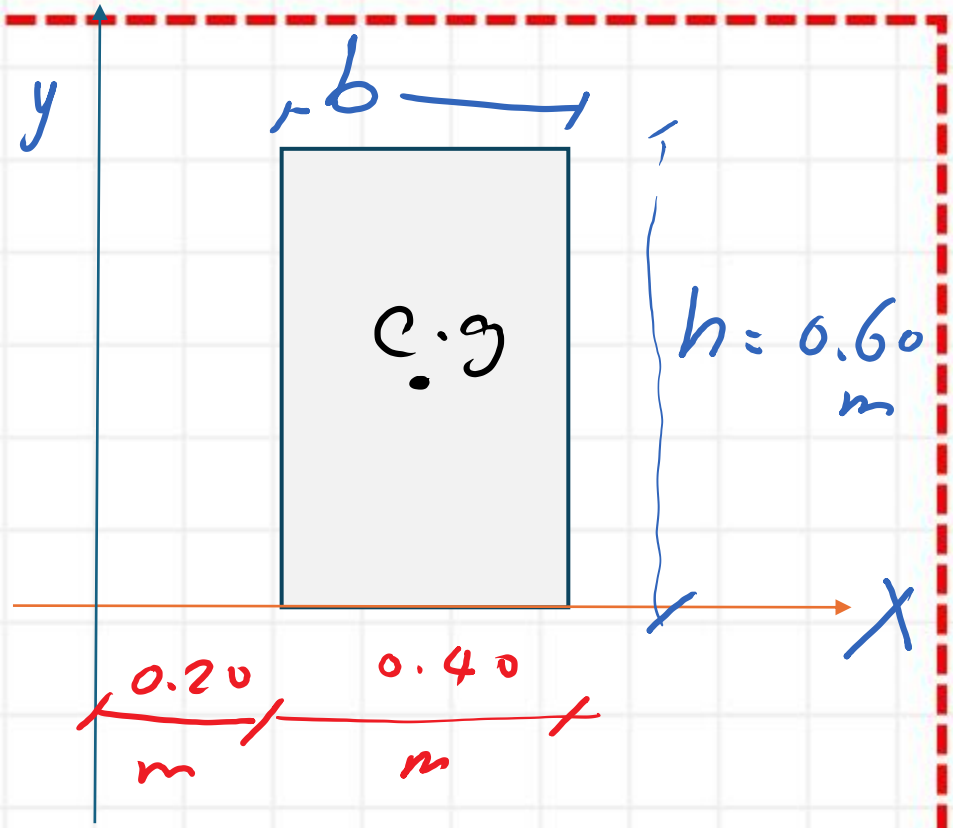
Prepared by Eng.Maged Kamel.

Example # 1 - Contd

Estimate the Following For the given Rectangle

(a) I_x, K_x

(b) I_y, K_y



Solution : $I_x = I_{xG} + A\bar{y}^2$

$A = 0.4(0.60) = 0.24\ m^2$

$I_x = 0.0072 + 0.0216 = 0.0288\ m^4 = 2880 \times 10^4\ cm^4$

$K^2_x = [0.0288 / 0.24] = 3/25$, $K_x = \frac{\sqrt{3}}{5} = 0.3464\ m$

Prepared by Eng.Maged Kamel.

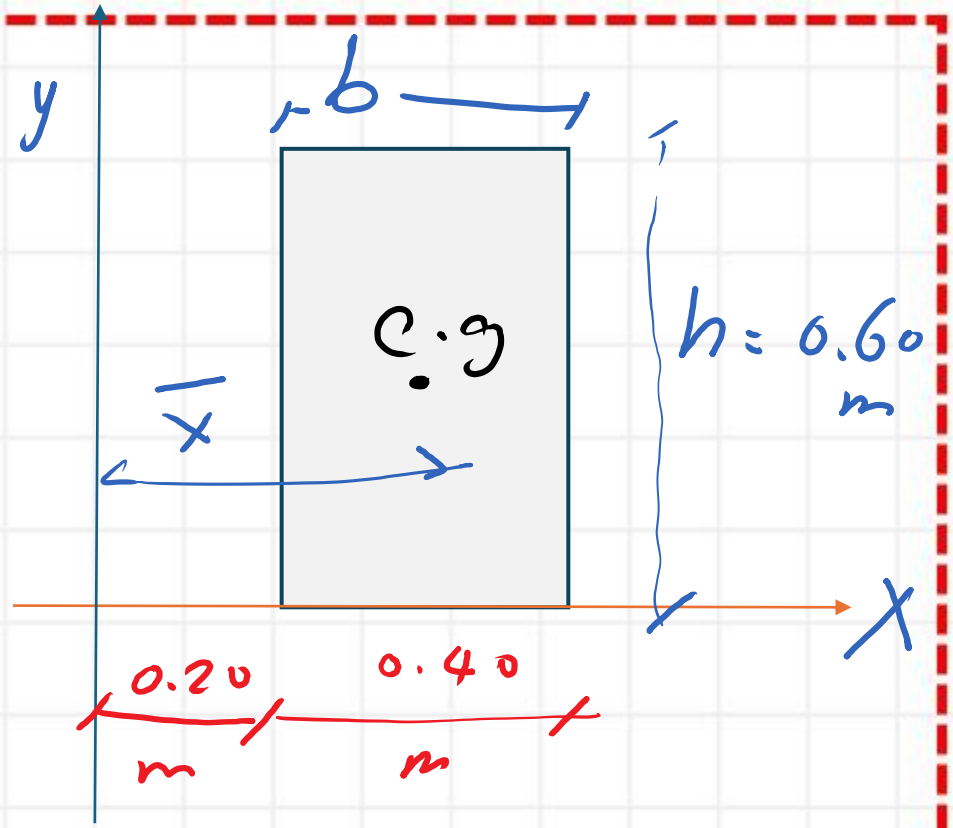
Example # 1 - Contd

Estimate the Following

For the given Rectangle

(a) I_x, k_x

(b) I_y, k_y



Solution

Part (b) $\Rightarrow I_y = I_{yG} + A\bar{x}^2$

$I_{yG} = \frac{hb^3}{12} = \frac{0.6(0.40)^3}{12} = 0.0032\ m^4$ & $A = 0.4(0.60) = 0.24\ m^2$

$A\bar{x}^2 = bh(0.40)^2 = 0.40(0.60) = 0.0384\ m^4$

$I_y = 0.0032 + 0.0384 = 0.0416\ m^4$ $\Rightarrow k_y = [0.0416/0.24]^{1/2} = 0.416$ m

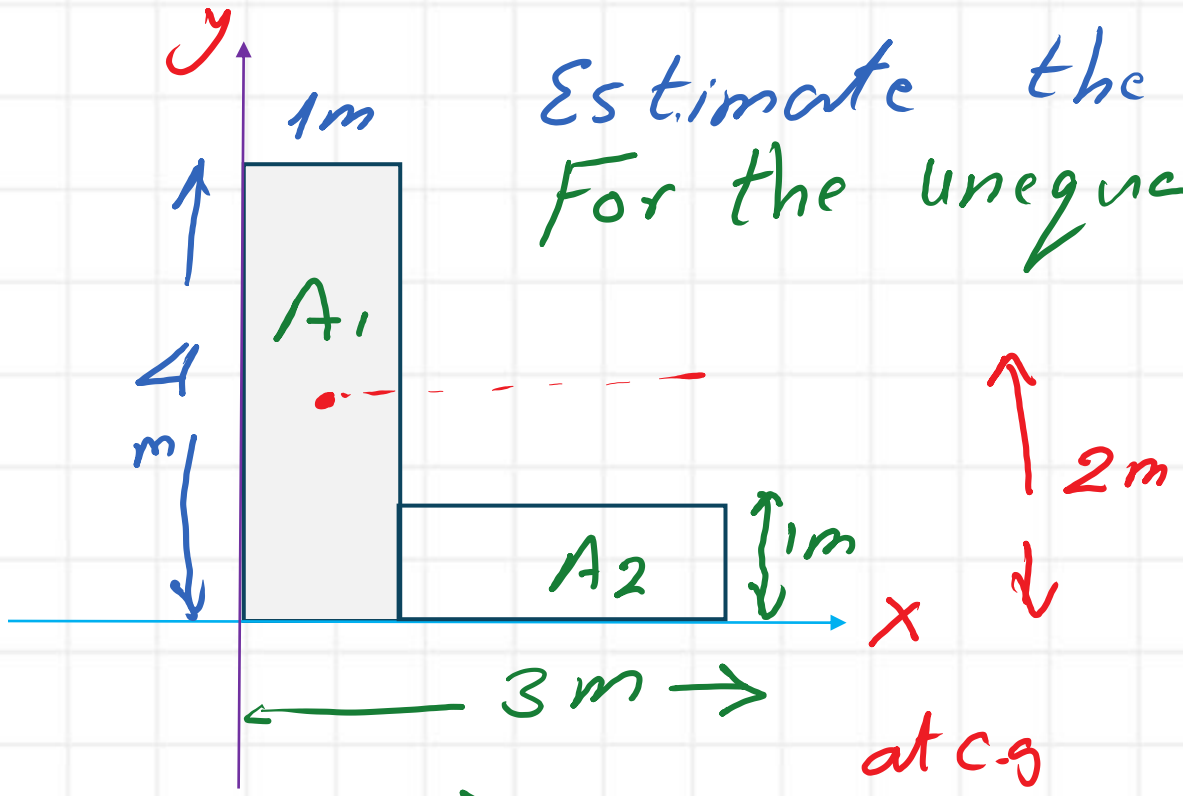
Prepared by Eng.Maged Kamel.

Example # 2

Estimate the following For the unequal angle

(A) I_x

(b) Product of inertia



Solution

$A_1 = (1)(4) = 4.00\ m^2$

$A_2 = (1)(3-1) = 2.00\ m^2$

$I_x = I_{x1} + I_{x2}$

at c.g

$$I_{x1} = \frac{(1)(4)^3}{12} + (1)(4)(2)^2$$

$$= 21.33\ m^4$$

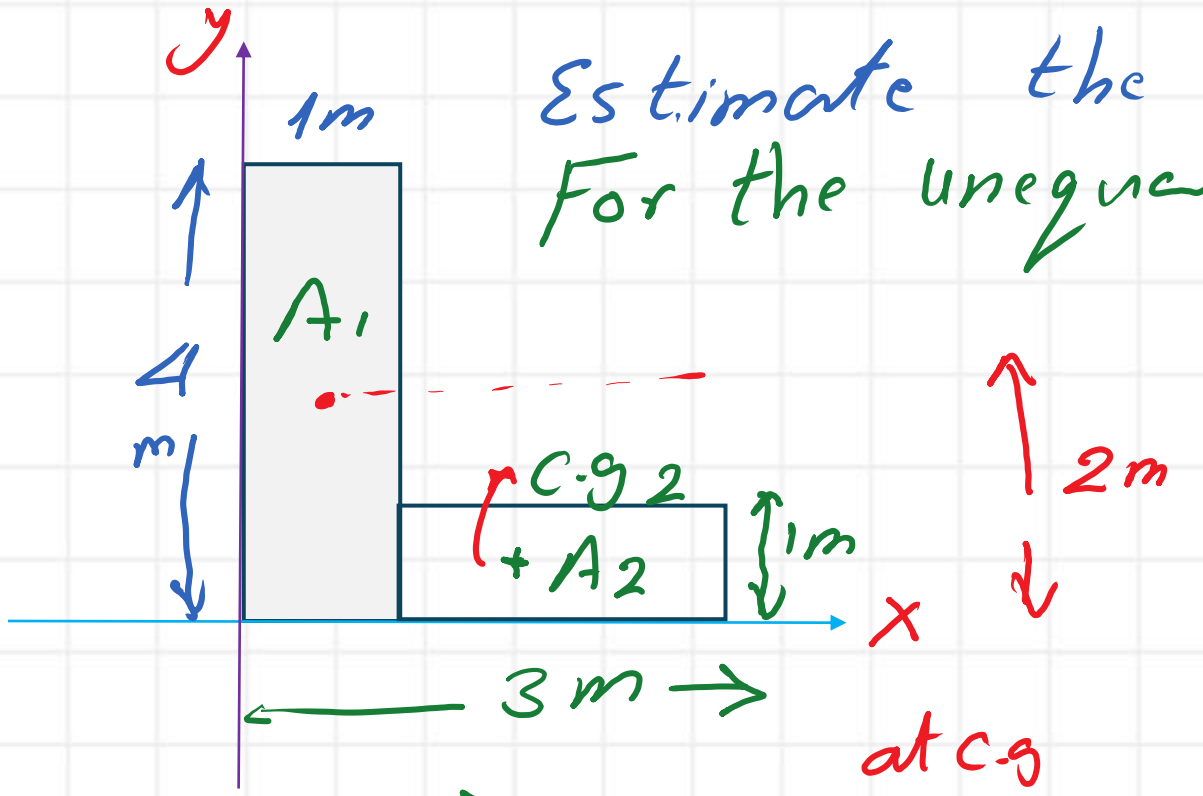
Prepared by Eng.Maged Kamel.

Example # 2

Estimate the following For the unequal angle

(A) I_x

(b) Product of inertia



Solution

$A_1 = (1)(4) = 4.00\ m^2$

$A_2 = (1)(3-1) = 2.00\ m^2$

$I_x = I_{x1} + I_{x2}$

at c.g

$I_{x_2} = \frac{(2)(1)^3}{12} + (2)(1)\left(\frac{1}{2}\right)^2$

$= 0.666\ m^4$

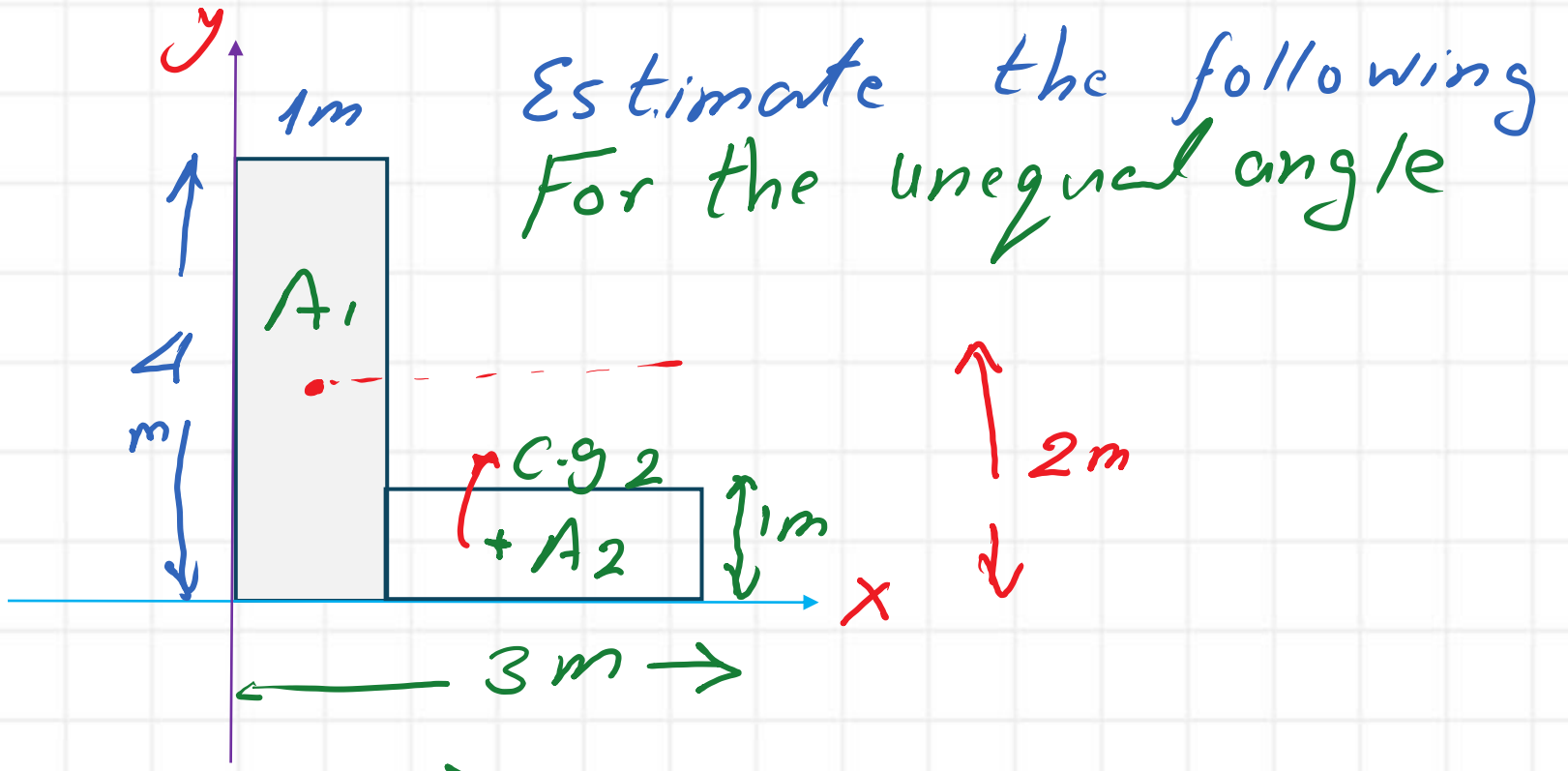
Prepared by Eng.Maged Kamel.

Example # 2

Estimate the following For the unequal angle

(A) I_x

(b) Product of inertia



Solution

$A_1 = (1)(4) = 4.00\ m^2$ →

$A_2 = (1)(3-1) = 2.00\ m^2$ → $I_{x_1} = 21.33\ m^4$

$I_{x_2} = 0.666\ m^4$

$I_x = I_{x_1} + I_{x_2}$

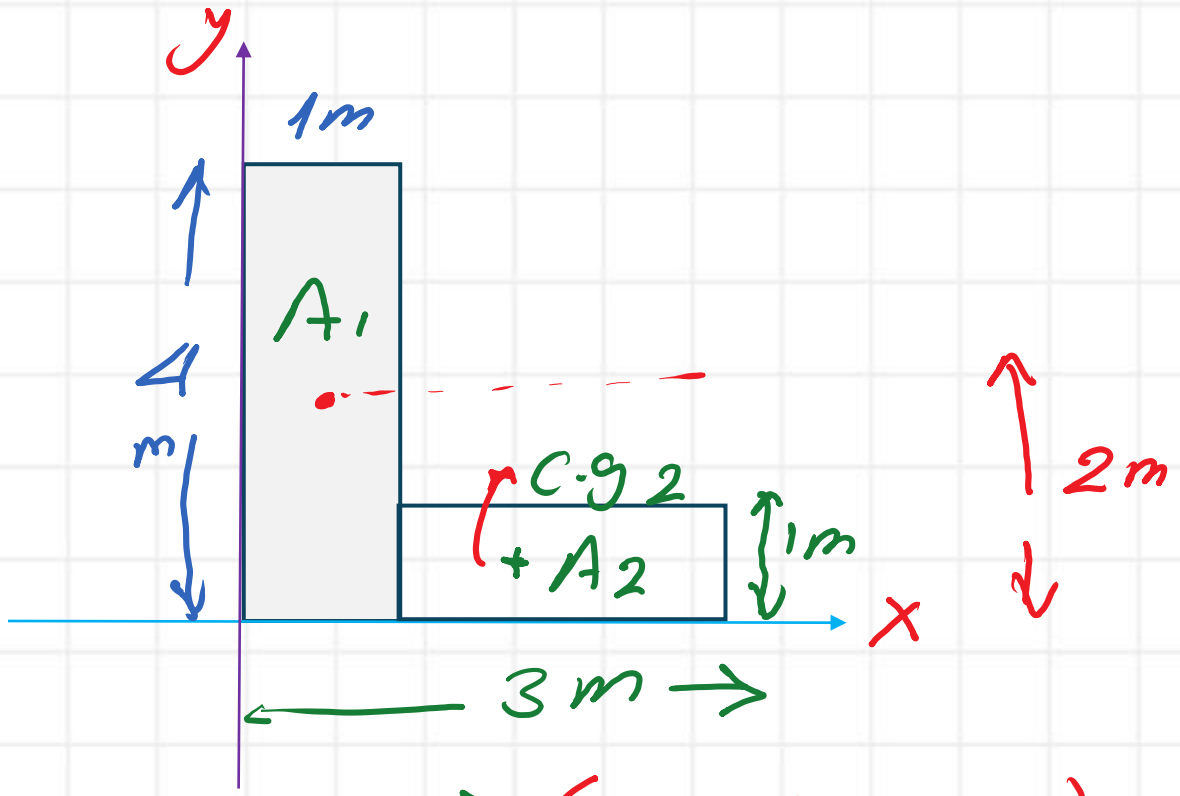
$I_x = (21.33) + (0.666) = 22.00\ m^4$ → Part (a)

Prepared by Eng.Maged Kamel.

Example # 2

Part (b)

Product of Inertia



$A_1 = (1)(4) = 4.00\ m^2 \rightarrow (x_1 = 0.50\ m)$, $y_1 = 2.00\ m$

$A_2 = (1)(3-1) = 2.00\ m^2 \rightarrow (x_2) = 2.00\ m$, $y_2 = 0.50\ m$

$I_{(xy)_1} = 0 + (4)(1)(2)0.50 = 4.00\ m^4$

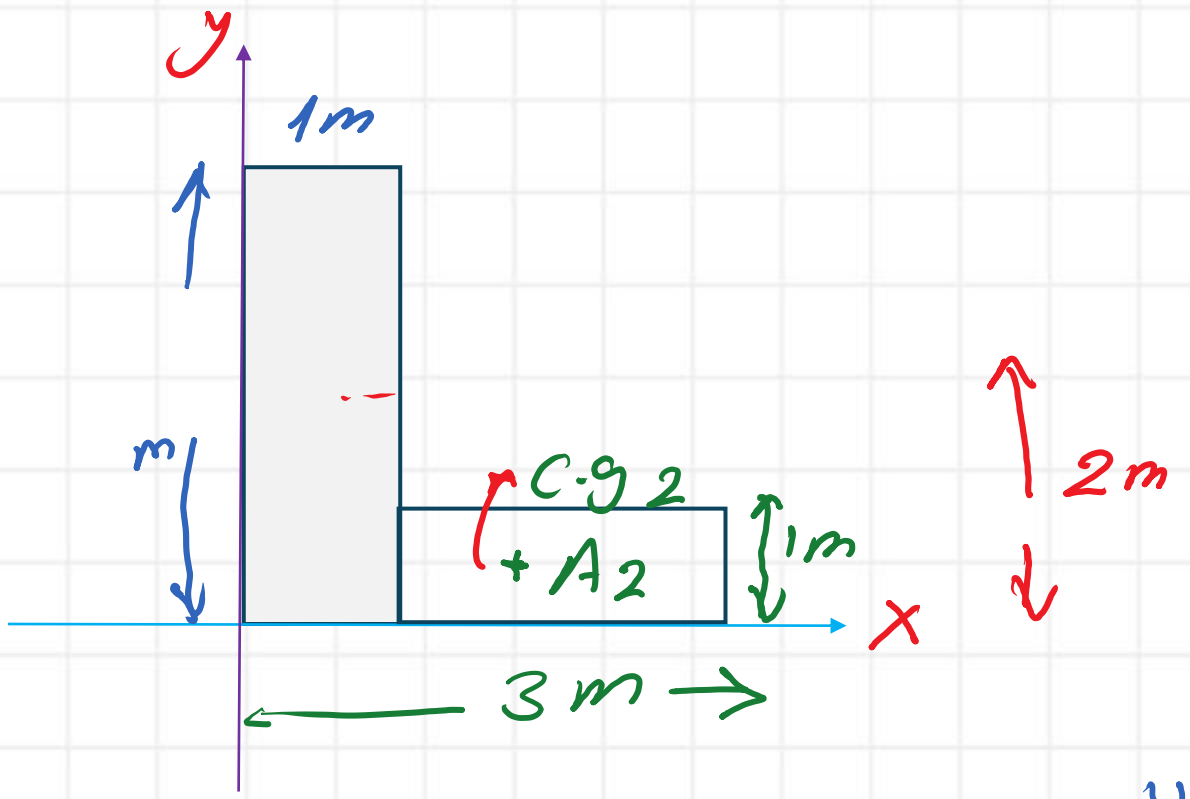
$I_{(xy)_2} = 0 + (2)(2)(0.50) = 2.00\ m^4$

Prepared by Eng.Maged Kamel.

Example # 2

Part (b)

Product of Inertia



$$I_{(xy)_1} = 0 + (4)(1)(2)0.50 = 4.00\ m^4$$

$$I_{(xy)_2} = 0 + (2)(2)(0.50) = 2.00\ m^4$$

$$I_{xy} = (I_{xy})_1 + (I_{xy})_2 = 4.00 + 2.00 = 6.00\ m^4$$

Prepared by Eng.Maged Kamel.