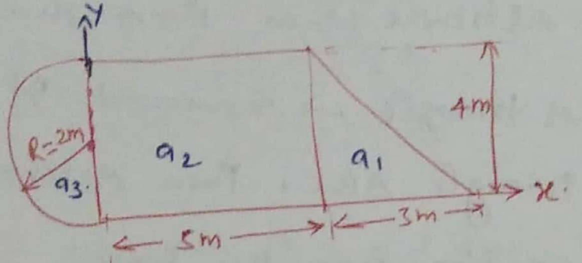
Locate the centroid of the area as shown in fig. with respect to the axes indicated in the fig. ①



Sol^n Triangular segment

$a_1 = \frac{1}{2} \times 3 \times 4 = 6\ m^2$, $x_1 = 5 + \frac{1}{3} \times 3 = 6\ m$, $y_1 = \frac{4}{3} = 1.33 m.$

Rectangular segment

$a_2 = 5 \times 4 = 20 m^2$, $x_2 = \frac{5}{2} = 2.5 m$, $y_2 = \frac{4}{2} = 2 m.$

Semi circular segment.

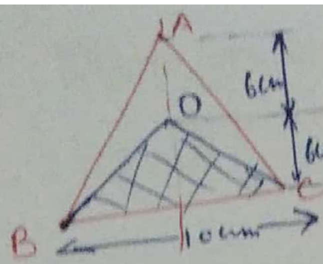
$a_3 = \frac{\pi\, 2^2}{2} = 6.28 m^2$, $x_3 = -\frac{4R}{3\pi} = \frac{-4 \times 2}{3\pi} = -.849 m.$

$y_3 = 2 m.$

$$\bar{x} = \frac{a_1x_1 + a_2x_2 + a_3x_3}{a_1 + a_2 + a_3} = \frac{6 \times 6 + 20 \times 2.5 + 6.28(-.849)}{6 + 20 + 6.28} = 2.5 m.$$

$$\bar{y} = \frac{a_1y_1 + a_2y_2 + a_3y_3}{a_1 + a_2 + a_3} = \frac{6 \times 1.33 + 20 \times 2 + 6.28 \times 2}{6 + 20 + 6.28} = 1.875 m.$$

Answer - $\bar{x} = 2.5 m$, $\bar{y} = 1.875 m$

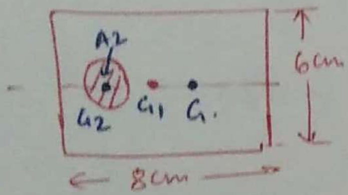
Q. 

A triangular plate in the form of Isosceles triangle ABC has base BC = 10cm and altitude 12cm. From this plate, a portion in the shape of an isosceles triangle is removed. If O is the mid point of the altitude of triangle ABC, Then determine the distance of C.G. of the remainder section from the base.

Solⁿ

$$\bar{y} = \frac{A_1 y_1 + A_2 y_2}{A_1 + A_2} = \frac{60 \times 4 + (-30) \times 2}{60 + (-30)} = 6 \text{ cm}$$

$A_1 = \frac{1}{2} \times 10 \times 12 = 60 cm^2$, $y_1 = \frac{12}{3} = 4cm$, $A_2 = \frac{1}{2} \times 10 \times 6 = 30 cm^2$, $y_2 = \frac{6}{3} = 2cm$

Q. 

From a rectangular plate whose cross-section is 8cm x 6cm, a circular disc of 3 cm² in area is removed. If C.G. of remainder is 1mm from C.G. of the rectangular plate. work out the distance of centre of disc from the centre of rectangular plate.

Solⁿ

G_1 → C.G. of rectangular plate

G_2 - C.G. of disc

G – C.G. of remainder

$A_2 = 3cm^2$,

$A_1 = 8 \times 6 = 48 cm^2$

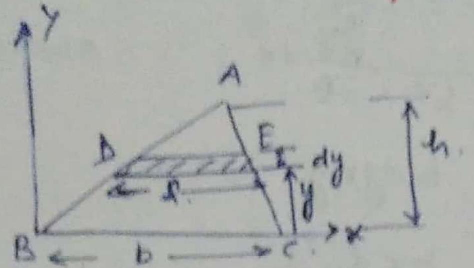
taking moment of area about G_1

$$A_1 \times 0 = A_2 \times G_1G_2 + (A_1 - A_2)\, G_1G$$

$$(8 \times 6) \times 0 = 3 \times G_1G_2 + (48-3) \times 0.1$$

$$G_1G_2 = -\left(\frac{45 \times 0.1}{3}\right) = -1.5 cm$$

...cak the centroid of the area of triangle with respect to its base.



Area of the elementry strip = $l\,dy$

Moment about x Axis = $l\,dy \times y$

from triangle ADE and ABC $\quad \frac{l}{b} = \frac{h-y}{h}$

$$l = b\left(1-\frac{y}{h}\right)$$

Moment about x Axis = $b\left(1-\frac{y}{h}\right) \cdot y \cdot dy$

area of triangle ABC = $\frac{1}{2} bh$

$$\frac{1}{2} \times bh \times \bar{y} = \int_0^h b\left(1-\frac{y}{h}\right) \cdot y\,dy$$

$$= b\left|\frac{y^2}{2} - \frac{y^3}{3h}\right|_0^h = b\left[\frac{h^2}{2} - \frac{h^2}{3}\right] = \frac{bh^2}{6}$$

$$\bar{y} = \frac{b \cdot h^2 \times 2}{6\, bh} = \frac{h}{3}$$ from the base

$\frac{2h}{3}$ from the apex.