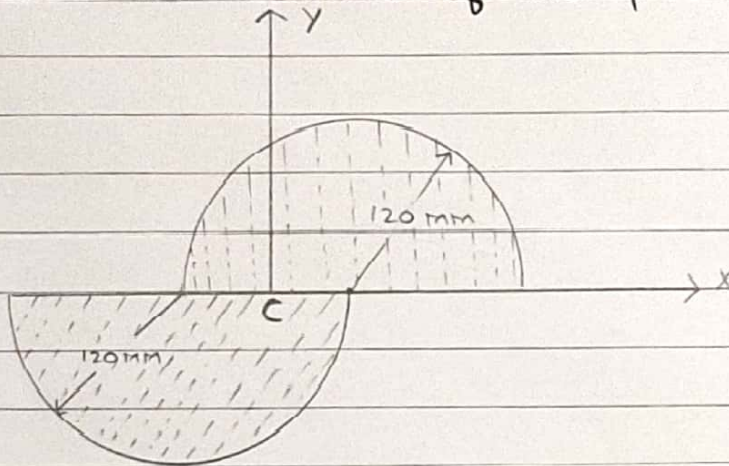
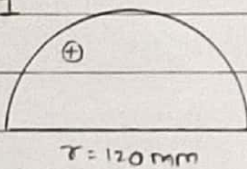
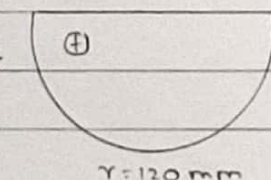
MechanicsAssignment no. 1-1 (centroid)

1-2-4) Locate the centroid of the plane area shown.



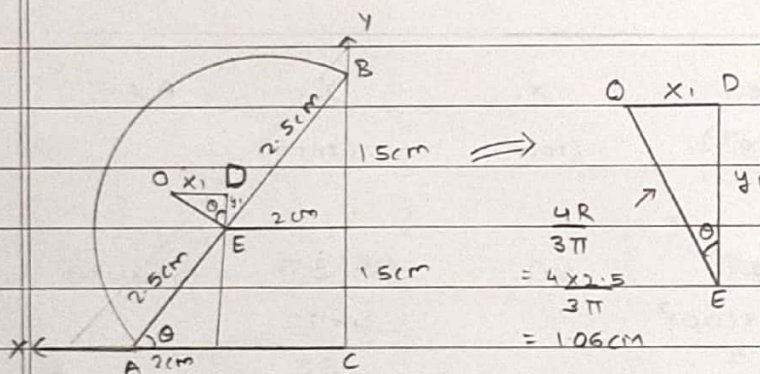
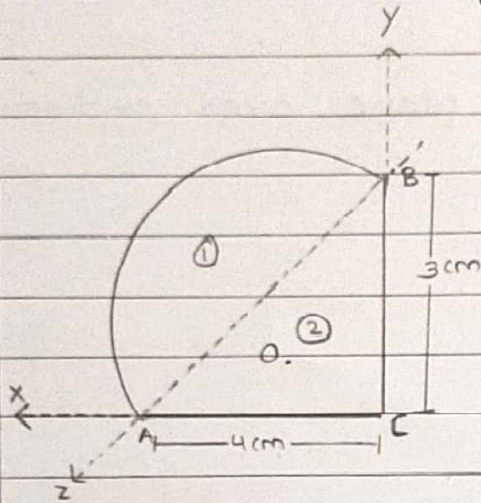
→	Component	Area (mm ²)	x (mm)	y (mm)	Ax	Ay
1		$\frac{\pi r^2}{2}$ $= \frac{3.14 \times (120)^2}{2}$ $= 22608$	60	$\frac{4R}{3\pi}$ $= \frac{4 \times 120}{3\pi}$ $= 50.96$	1356480	1152103.68
2		22608	-60	-50.96	-1356480	-1152103.68
		$\Sigma A = 45,216$			$\Sigma Ax = 0$	$\Sigma Ay = 0$

$$\therefore \bar{x} = \frac{\Sigma Ax}{\Sigma A} = 0, \quad \bar{y} = \frac{\Sigma Ay}{\Sigma A} = 0$$

\therefore Centroid C is at (0,0) mm



1.2.5) Find the centroid of area



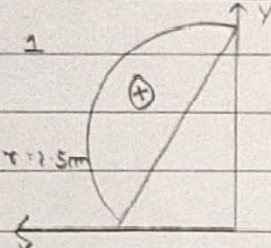
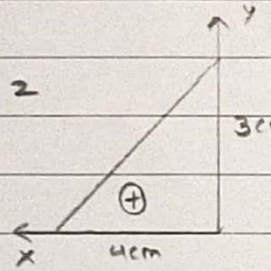
$$\theta = \tan^{-1}\left(\frac{3}{4}\right) = 36.87^\circ$$

$$\sin \theta = \frac{x_1}{1.06}, \quad \cos \theta = \frac{y_1}{1.06}$$

$$\therefore \sin 36.87 = \frac{x_1}{1.06} \quad \cos 36.87 = \frac{y_1}{1.06}$$

$$\therefore x_1 = 0.64 \text{ cm} \quad \therefore y_1 = 0.85 \text{ cm}$$

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Component	Area (cm ²)	x (cm)	y (cm)	Ax	Ay
	$\frac{\pi R^2}{2}$ $= \frac{\pi \times 2.5^2}{2}$ $= 9.82$	$2 + x_1$ $= 2 + 0.64$ $= 2.64$	$1.5 + y_1$ $= 1.5 + 0.85$ $= 2.35$	25.92	23.08
	$\frac{1}{2} \times 3 \times 4$ $= 6$	1.333	1	8	6
	$\Sigma A = 15.82$			$\Sigma Ax = 33.92$	$\Sigma Ay = 29.08$

$$\therefore \bar{x} = \frac{\Sigma Ax}{\Sigma A}$$

$$\bar{x} = \frac{33.92}{15.82}$$

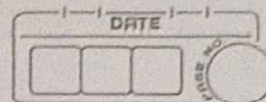
$$\bar{x} = 2.14 \text{ cm}$$

$$\therefore \bar{y} = \frac{\Sigma Ay}{\Sigma A}$$

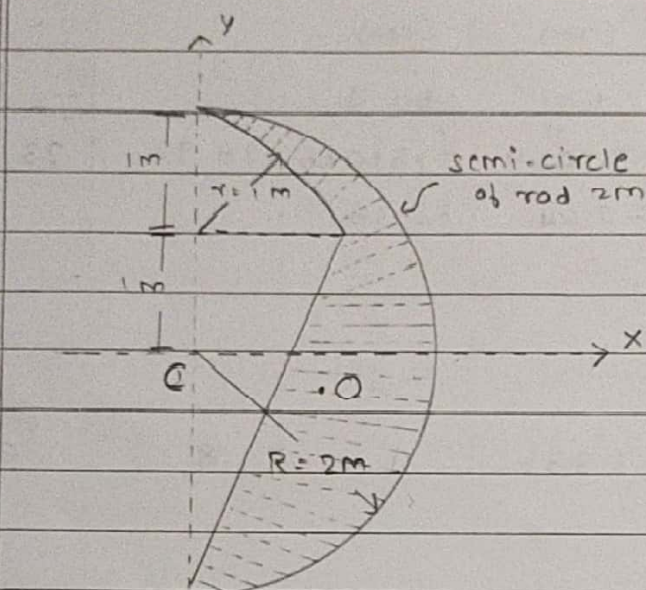
$$= \frac{29.08}{15.82}$$

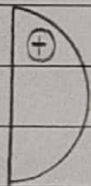
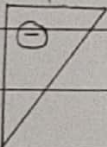
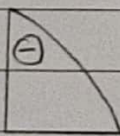
$$\bar{y} = 1.84 \text{ cm}$$

Centroid O is at (2.14, 1.84) cm



1.2.12) Find centroid.



Component	Area (m ²)	x (m)	y (m)	Ax	Ay
1) 	$\frac{\pi R^2}{2}$ $= \frac{\pi \times 2 \times 2}{2}$ $= 6.28$	$\frac{4R}{3\pi}$ $= \frac{4 \times 2}{3\pi}$ $= 0.849$	0	5.33172	0
2) 	$\frac{1 \times 1 \times 3}{2}$ $= -1.5$	0.333	0	-0.4995	0
3) 	$-\frac{\pi R^2}{4}$ $= -\frac{\pi \times 1^2}{4}$ $= -0.785$	0.424	1.424	-0.33284	-1.11784
$\Sigma A = 3.995$				$\Sigma Ax = 4.49938$	$\Sigma Ay = -1.11784$

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$$\begin{aligned}\therefore \bar{x} &= \frac{\sum Ax}{\sum A} \\ &= \frac{4.49938}{3.995} \\ &= 1.126 \text{ m}\end{aligned}$$

$$\begin{aligned}\therefore \bar{y} &= \frac{\sum Ay}{\sum A} \\ &= \frac{-1.11784}{3.995} \\ &= -0.28 \text{ m}\end{aligned}$$

\therefore Centroid O is at $(1.126, -0.28) \text{ m}$