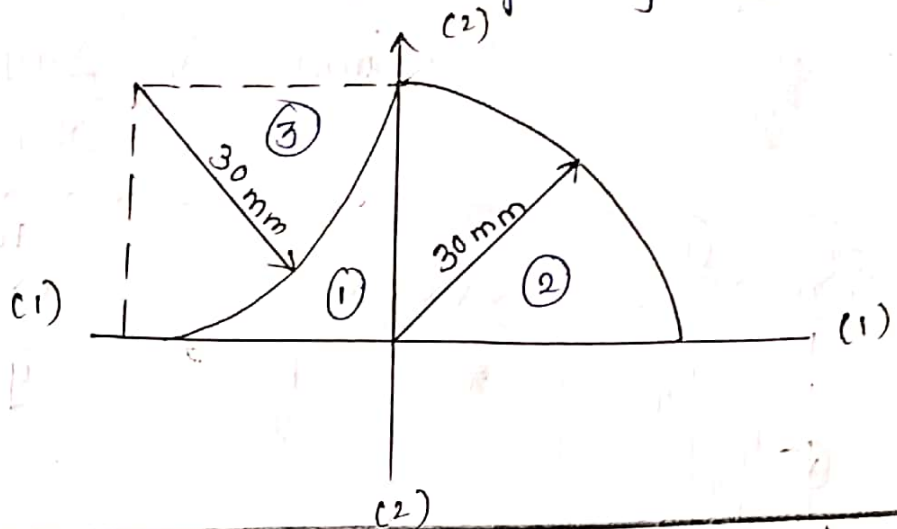


③ Locate the centroids of the following area.



| Component | area 'a' mm ² | \bar{x} distance from (2)-(2) mm | \bar{y} distance from (1)-(1) mm | $a\bar{x}$ mm ³ | $a\bar{y}$ mm ³ |
|--|---|--|--|--------------------------------|---------------------------------|
| ① Square (in 2nd quadrant) | 30×30 $= 900$ | $-\frac{b}{2}$ $= -\frac{30}{2}$ $= -15$ (2nd quadrant x is -ve) | $d/2$ $= \frac{30}{2}$ $= 15$ | -13500 | 13500 |
| ② Quarter circle | $\frac{\pi r^2}{4}$ $= \frac{\pi (30)^2}{4}$ $= 706.86$ | $\frac{4r}{3\pi}$ $= \frac{4(30)}{3\pi}$ $= 12.73$ | $\frac{4r}{3\pi}$ $= \frac{4(30)}{3\pi}$ $= 12.73$ | 8998.33 | 8998.33 |
| ③ Quarter circle in 2nd quadrant dotted line | $-\frac{\pi (30)^2}{4}$ $= -706.86$ | $-\left(30 - \frac{4(r)}{3\pi}\right)$ $= 130 - 12.73$ | $30 - \frac{4(r)}{3\pi}$ $= 30 - 12.73$ | +12207.47 | -12207.47 |
| indicates its cutout so area is -ve | $\Sigma a =$ 900 | $= -17.27$ x -ve in II quadrant | $= 17.27$ | $\Sigma a\bar{x} =$ 7705.75 | $\Sigma a\bar{y} =$ 10290.86 |

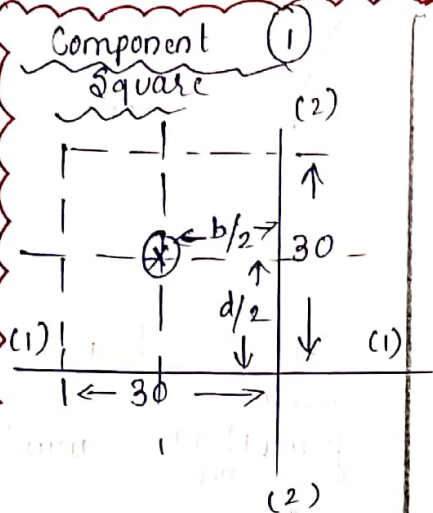
Centroid of the whole section $Q(\bar{x}, \bar{y})$

$$\bar{x} = \frac{\sum a \bar{x}}{\sum a}$$

$$= 8.562 \text{ mm}$$

$$\bar{y} = \frac{\sum a \bar{y}}{\sum a}$$

$$= 11.438 \text{ mm}$$



For \bar{x}

$$\bar{x} = -\frac{b}{2}$$

$$= -\frac{30}{2}$$

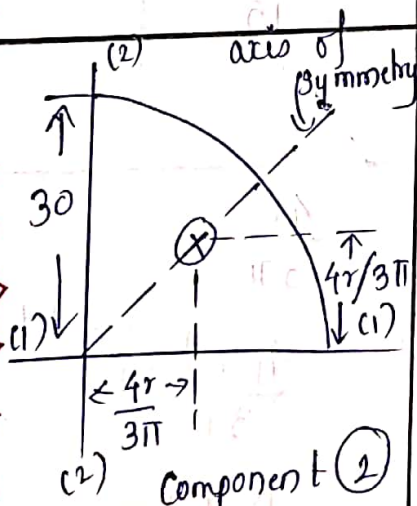
$$\bar{x} = -15 \text{ mm}$$

-ve sign because square is in II quadrant & \bar{x} is negative

For \bar{y}

$$\bar{y} = \frac{d}{2}$$

$$\bar{y} = 15 \text{ mm}$$



$$\bar{x} = \frac{4r}{3\pi}$$

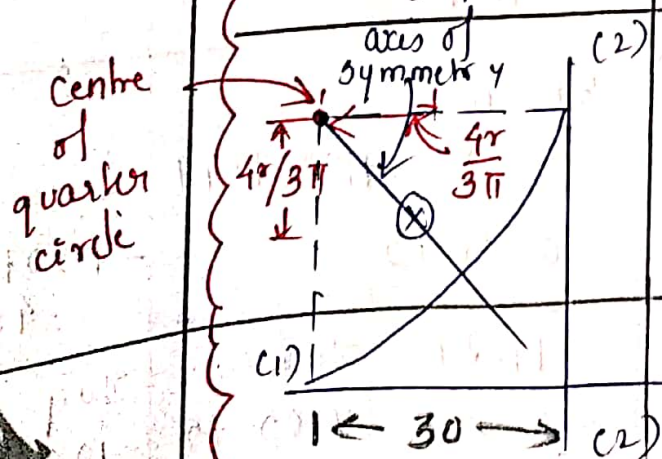
$$= \frac{4(30)}{3\pi}$$

$$\bar{x} = 12.73 \text{ mm}$$

$$\bar{y} = \frac{4r}{3\pi}$$

$$= \frac{4(30)}{3\pi}$$

$$= 12.73$$



$$\bar{x} = -\left(30 - \frac{4r}{3\pi}\right)$$

$$= -17.27$$

(1) \bar{x} is -ve as it is II quadrant

$$\bar{y} = 30 - \frac{4r}{3\pi}$$

$$= 17.27$$