

Centroid and Moment of Inertia:-

Centroid of plane, curve, area, volume and composite bodies, moment of Inertia of plane area, parallel axis theorem, perpendicular axis theorem, principle moment of Inertia, mass moment of Inertia of circular ring, disc, cylinder, sphere, cone about their axis of symmetry.

Centroid of plane:-

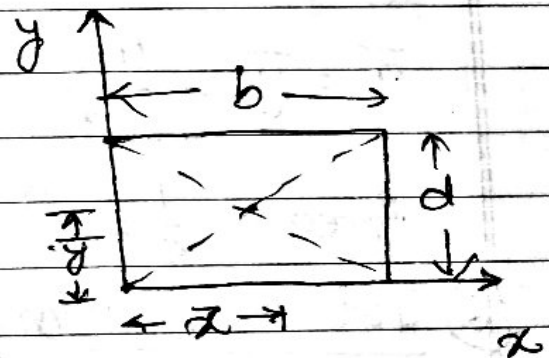
Plane ~ centroid ~ Area ~ volume ~ curve

①

Rectangle

$$\bar{x} = \frac{b}{2} \quad \bar{y} = \frac{d}{2}$$

$$\text{area} = b \cdot d$$



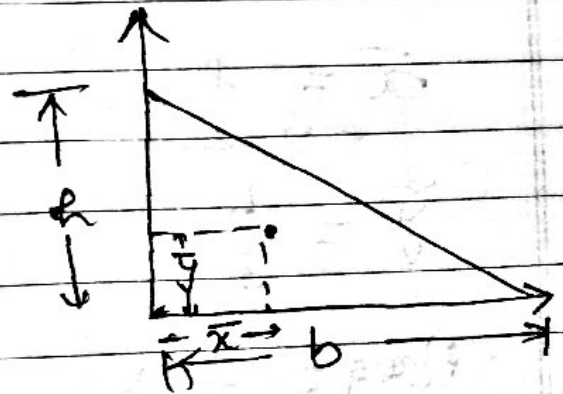
②

Triangular (Triangle)

$$\bar{x} = \frac{b}{3}$$

$$\bar{y} = \frac{h}{3}$$

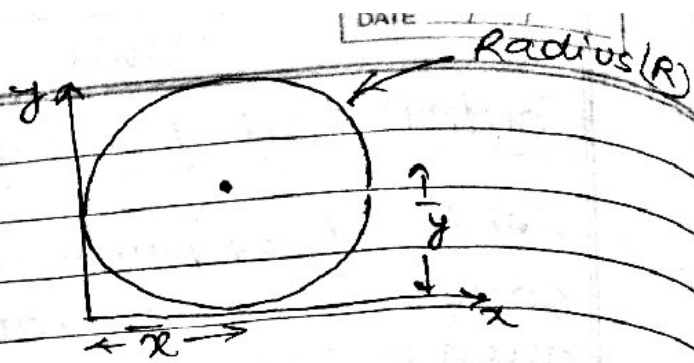
$$\text{Area} = \frac{1}{2} b \cdot h$$



③ Circle:

$$\bar{x} = \bar{y} = R$$

$$\text{Area} = \pi R^2$$

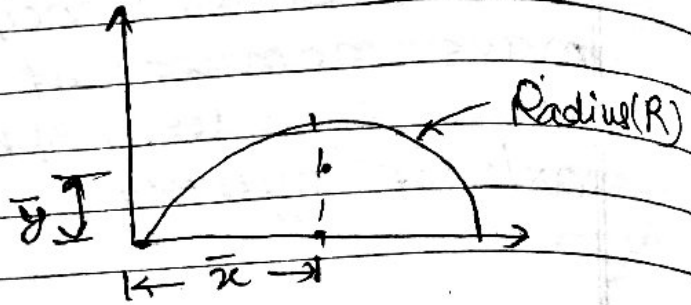


④ Semi-circle:

$$\bar{x} = R$$

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

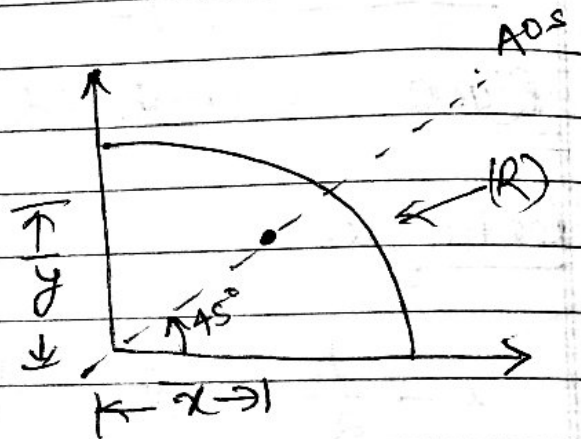
$$\text{Area} = \frac{1}{2} \pi R^2$$



⑤ Quarter circle:

$$\bar{x} = \bar{y} = \frac{4R}{3\pi}$$

$$\text{Area} = \frac{1}{4} \pi R^2$$

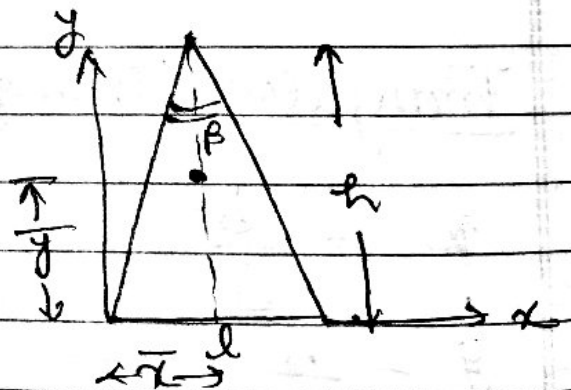


⑥ Isosceles - Triangle

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

$$\bar{y} = \frac{h}{3}$$

$$\text{Area} = \frac{1}{2} bh$$

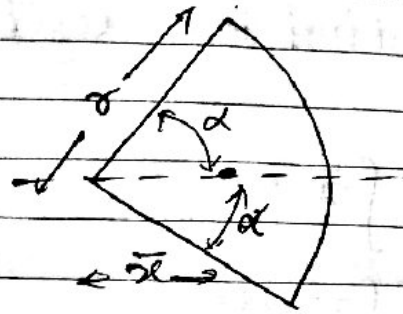


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⑦ Circular sector :-

$$\bar{x} = \frac{2r \sin \alpha}{3\alpha}$$

$$\text{Area} = \alpha r^2$$

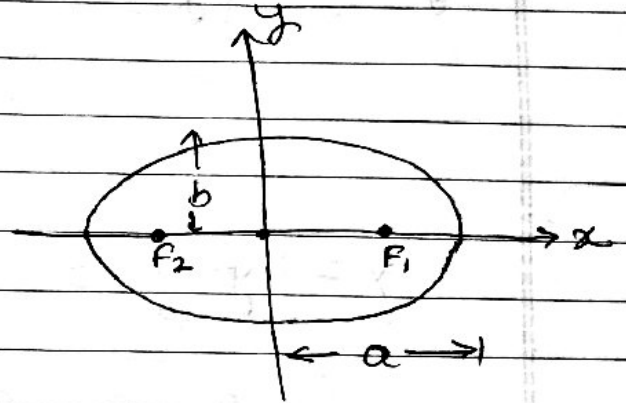


α in radian

⑧ elliptical area

$$\bar{x} = \bar{y} = 0$$

$$\text{Area} = \pi ab$$



#1. Determination of centroid

→ Direct Integration

→ Method of Composite Bodies.

① Direct Integration

$$\bar{y} = \int \bar{y} \cdot \frac{dA}{A}$$

$$\bar{x} = \int \bar{x} \cdot \frac{dA}{A}$$

