

## Answer on Question #51294, Physics, Mechanics | Kinematics | Dynamics

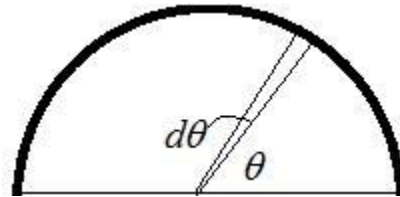
Find the moment of inertia of semicircular wire of mass 'M' and radius 'R' about an axis through the centre and perpendicular to the plane.

### Solution:

The definition of moment of inertia is

$$I = \int R^2 dm$$

where R is the distance of the mass element dm from the axis about which the moment is to be computed.



$$\pi R = l$$

Thus,

$$R = \frac{l}{\pi}$$

The mass element dm is

$$dm = \rho * dl$$

where rho is the linear density of the wire, and dl the element of length along the wire:

$$dl = R d\theta$$

$$dm = \rho(R d\theta)$$

$$I = \int_0^\pi R^2 \rho(R d\theta) = R^3 \rho \int_0^\pi d\theta = R^3 \rho \pi$$

To compare with the table value, the mass of the wire  $M = \pi R \rho$ , so

$$I = m R^2$$

**Answer:**  $I = m R^2$