# 10.1: Moment of Inertia

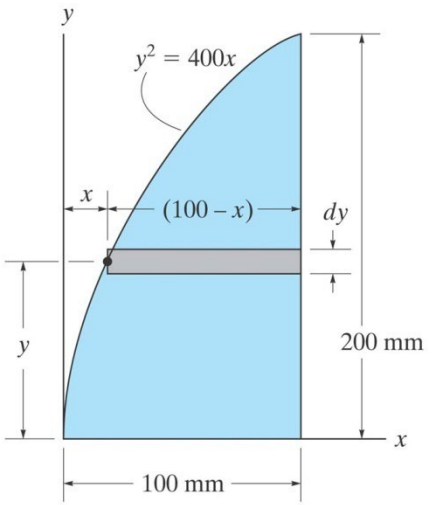
Finding the *moment of inertia* of a shape depends on the orientation of the differential slice used.

For *Moment of Inertia* about x-axis:

When slice is taken parallel to the *x*-axis:

Use the basic equation:

$$I_x = \int_A y^2 \, dA$$




where,

$I_x$ = *Moment of Inertia* of shape about the *x* axis

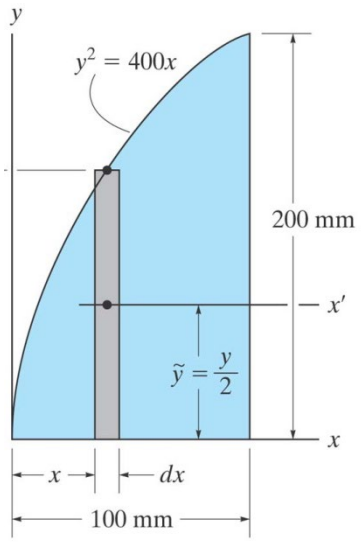
$y$ = Distance from *x* axis to centroid of slice

$dA$ = Area of differential slice

For *Moment of Inertia* about x-axis:

When slice is taken perpendicular to the *x*-axis:

Use the *Parallel-Axis Theorem* eqn:




$$I_x = \int dI_x$$

*where,*

$$dI_x = d\bar{I}_{x'} + dAy^2$$

$d\bar{I}_{x'}$ = *moment of inertia* of differential slice about its centroid

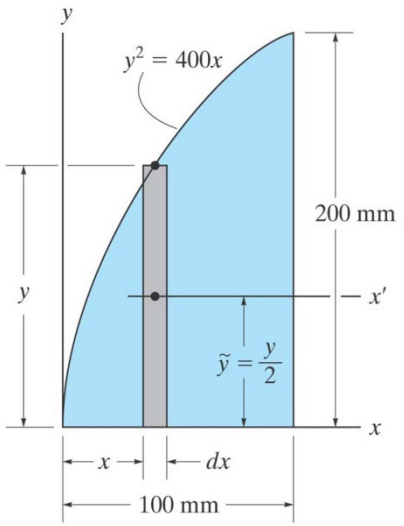
$$= \frac{dx\, y^3}{12}$$

$dA$ = area of differential slice

$y$ = distance from *x*-axis to centroid of slice

## Procedures for determining *Moment of Inertia*:

1. Choose a differential slice to use - Horiz. or Vert.:
   a) If differential slice is taken parallel to the axis, use the basic eqn.
   b) If slice is taken perpendicular to the axis, use the *Parallel-Axis* eqn.
2. Define slice size & moment arm to use. Draw these on the sketch for reference.




3. Apply eqns previously derived and perform integration. *Integrate in the direction perpendicular to the slice.*
4. Does the answer make sense?