MOMENT OF INERTIA

① I_2 — I_1 circular ring

$I_1 = MR^2$

$I_2 = \frac{MR^2}{2}$

② Uniform Rod. I_1 I_2

$I_1 = \frac{ML^2}{12}$

$I_2 = \frac{ML^2}{3}$

③ I_1 I_2 Uniform Disc

$I_1 = \frac{MR^2}{2}$

$I_2 = \frac{MR^2}{4}$

④ H, L, I_1, I_2

$I_1 = \frac{MH^2}{6}$ $I_2 = \frac{ML^2}{6}$

⑤ Thin Cylinder shell

I_1 # Same as Ring

$I_1 = MR^2$

⑥ Solid Cylinder

I_1 # same as disc

$I_1 = \frac{MR^2}{2}$

⑦ I_1 shell

$I_1 = \frac{2}{3} \cdot MR^2$

I_2 Solid sphere

$I_2 = \frac{2}{5} \cdot MR^2$

⑧ I_1 Hollow cone I_2 Solid Cone.

$I_1 = \frac{MR^2}{2}$

$I_2 = \frac{3MR^2}{10}$

⑨ I_1 Hollow cylinder I_2 Solid cylinder

$I_1 = \frac{MR^2}{12} + \frac{ML^2}{12}$

$I_2 = \frac{MR^2}{4} + \frac{ML^2}{12}$

⑩ L, L, θ

I #θ can be anything

$I = \frac{ML^2}{12}$

⑪ I, a, b

$I = \frac{M}{12}(a^2+b^2)$

⑫ y, x, b, a

$I_x = \frac{Mb^2}{4}$

$I_y = \frac{Ma^2}{4}$

$I_z = \frac{M}{4}(a^2+b^2)$

③ MAIN LAWS –

1 Parallel axis theorem

$I' = I_{com} + md^2$.

(If axis shift is parallel)

2 ⊥ Axis Theorem.

(only 4 1D & 2D bodies)

I_z, I_y, I_x

$I_z = I_x + I_y$

3 MOI of object w/ cavity

$I_1 = I - I_2$

I_1 = Actual MOI of object w/ cavity

I = MOI of object w/o cavity

I_2 = MOI of cavity