Rotational motion continued!

A force is 4 N; it is applied a distance of 6.2 m from the pivot, 27° counterclockwise. Calculate the torque.

Relationship between force and torque

- $\vec{\tau} = \vec{r} \times \vec{F} = I\vec{\alpha}$

Reminder, $\vec{F} = m\vec{a}$

Moment of Inertia

- This is a way to talk about how mass is distributed, and how that affects rotational motion.

The triceps muscle in the back of the upper arm extends the forearm. This muscle in a professional boxer exerts a force of 2.00×10^3 N with an effective perpendicular lever arm of 3.00 cm, producing an angular acceleration of the forearm of 120 rad/s^2 . What is the moment of inertia of the boxer's forearm?

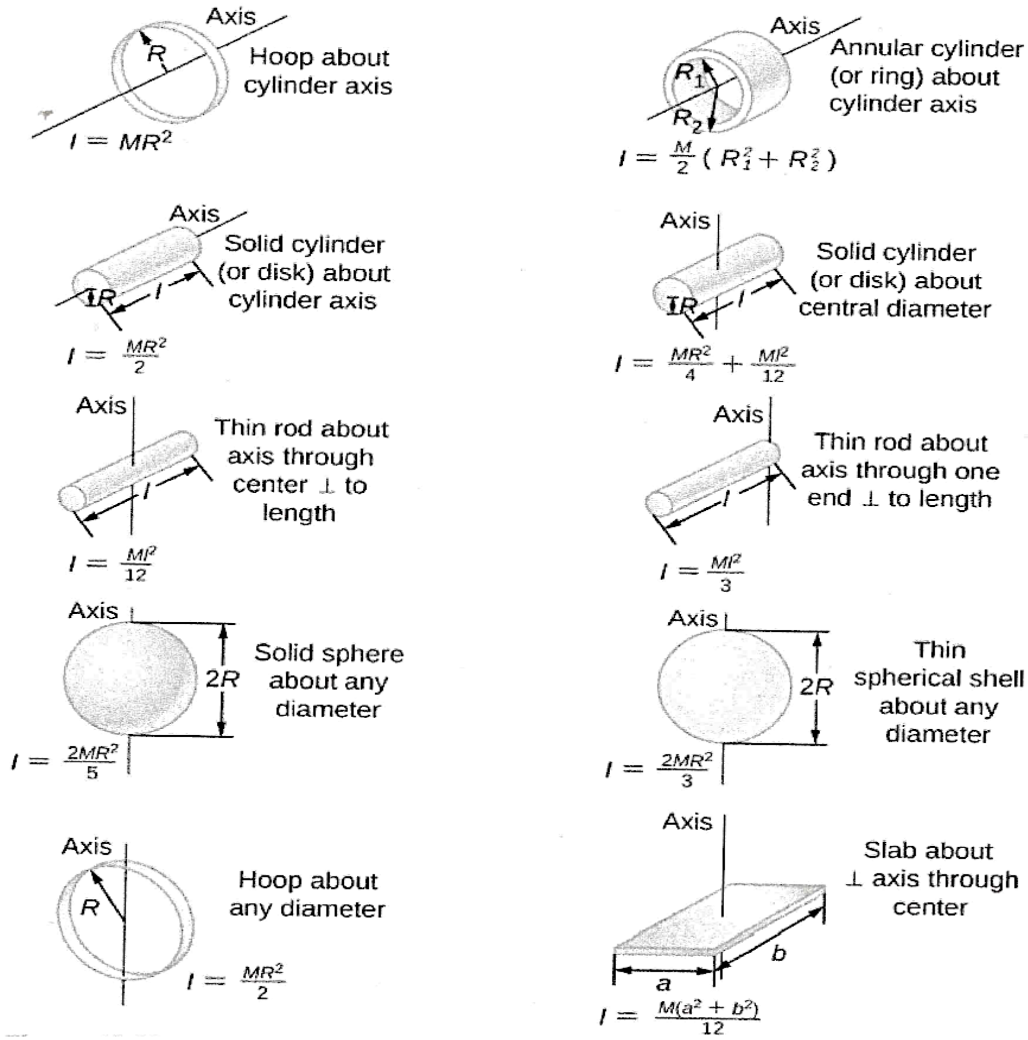
- Qualitative representation

- Variables (knowns and unknowns) and Equations

The triceps muscle in the back of the upper arm extends the forearm. This muscle in a professional boxer exerts a force of 2.00×10^3 N with an effective perpendicular lever arm of 3.00 cm, producing an angular acceleration of the forearm of 120 rad/s^2 . What is the moment of inertia of the boxer's forearm?

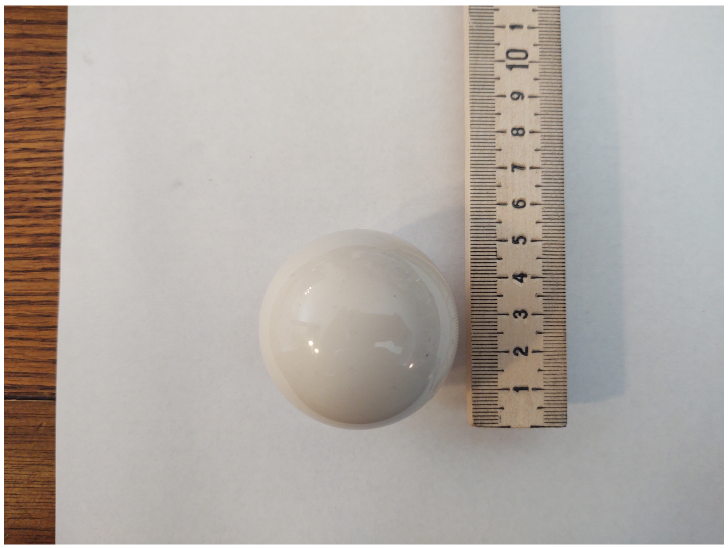
- Solution

- Reasonability Check?



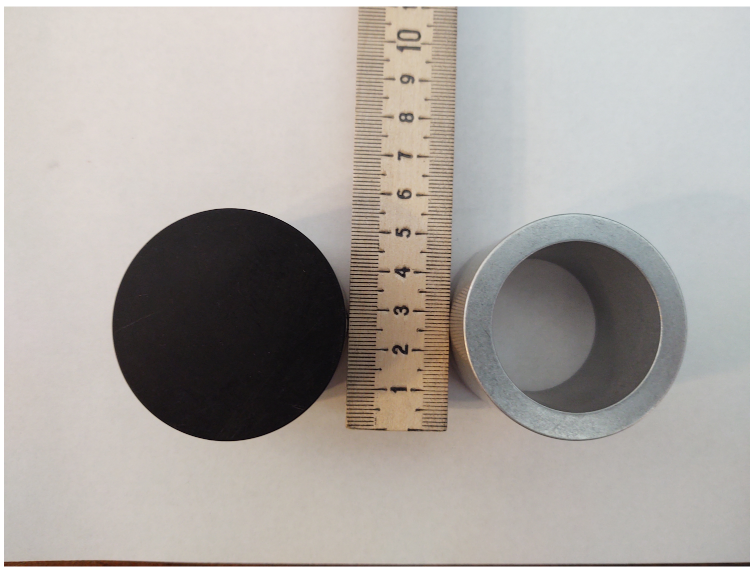
Formulae for common mass distributions and their moment of inertia around different axes of rotation

Let’s calculate some moments of inertia for real objects…..



Solid ball
Mass is 120 g
Diameter is 5 cm

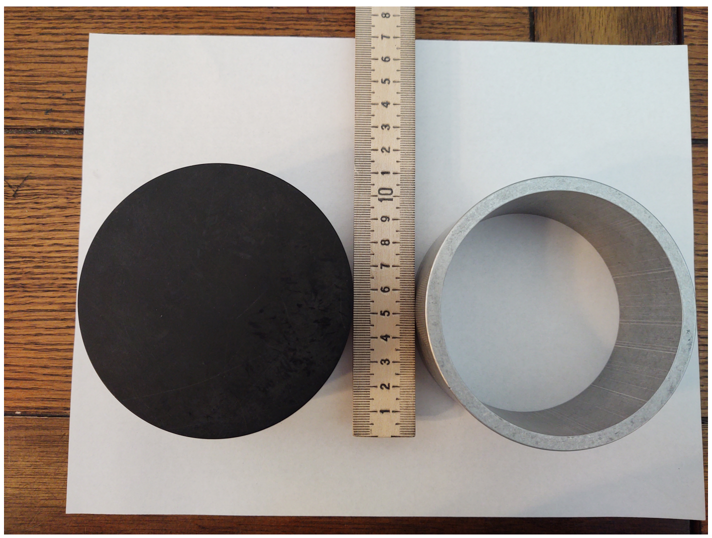
Calculating moment of inertia for real objects: solid disk and cylinder



Mass of small metal cylindrical ring 91.4 g
outer diameter 5.0 cm
Inner diameter 3.8 cm

Mass of black small solid cylinder 109.2 g
diameter 5 cm

Calculating moment of inertia for real objects: large solid disk and cylinder



Mass of large metal cylindrical ring 219 g
outer diameter 10.0 cm
Inner diameter 9.0 cm

Mass of large black solid cylinder 525 g
diameter 10 cm