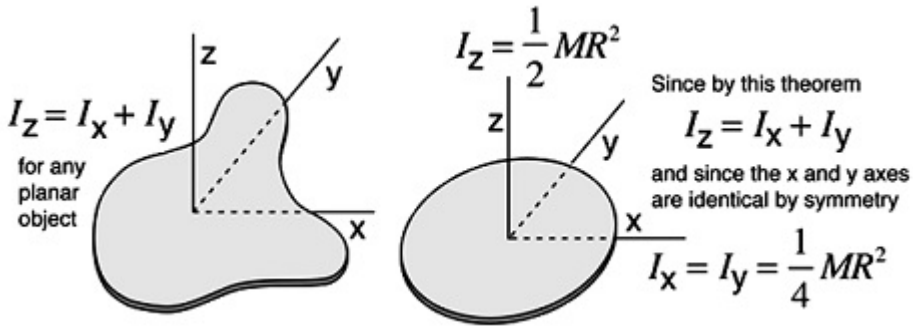
Circular Motion

Basics

Angular Momentum $= L = mvr = m\omega r^2$
Centripetal Force $= \frac{mv^2}{r} = m\omega^2 r$

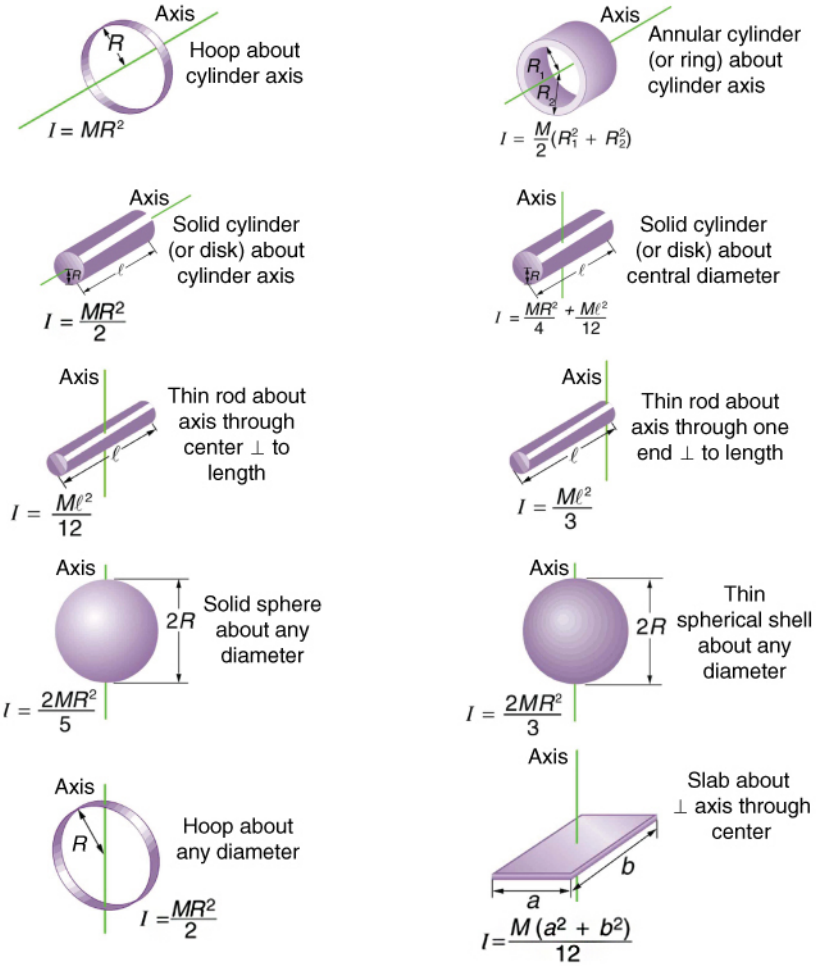
Perpendicular Axis Theorem



Parallel Axis Theorem

$I_f = I_i + mr^2$

Common Moment of Inertias



Simple Harmonic Motion

$d = a\sin(\omega t)$
$f = 1/T$
$f = \frac{\omega}{2\pi}$

Spring $T = 2\pi\sqrt{\frac{m}{k}}$
$\omega = \sqrt{\frac{k}{m}}$

Error Propagation

Collisions

Gravity

Energy

Kinematics

1. $v = v_0 + at$
2. $\Delta x = \frac{(v+v_0)}{2}t$
3. $\Delta x = v_0 t + \frac{1}{2}at^2$
4. $v = v_0 + at$
5. $v^2 = v_0^2 + 2a\Delta x$

Launching Ball from Ground

$Range = \frac{2v^2 \sin\theta\cos\theta}{g} = \frac{v^2\sin(2\theta)}{g}$

Launching ball from cliff

Range

Optimal angle $h = \frac{v^2}{g}\left(\frac{1}{2\sin^2\theta} - 1\right)$
$\Rightarrow \sin\theta = \left(2\left(\frac{gh}{v^2} + 1\right)\right)^{-1/2}$