

Why don't racing motorcycles fall over more often?



Centre of mass

L

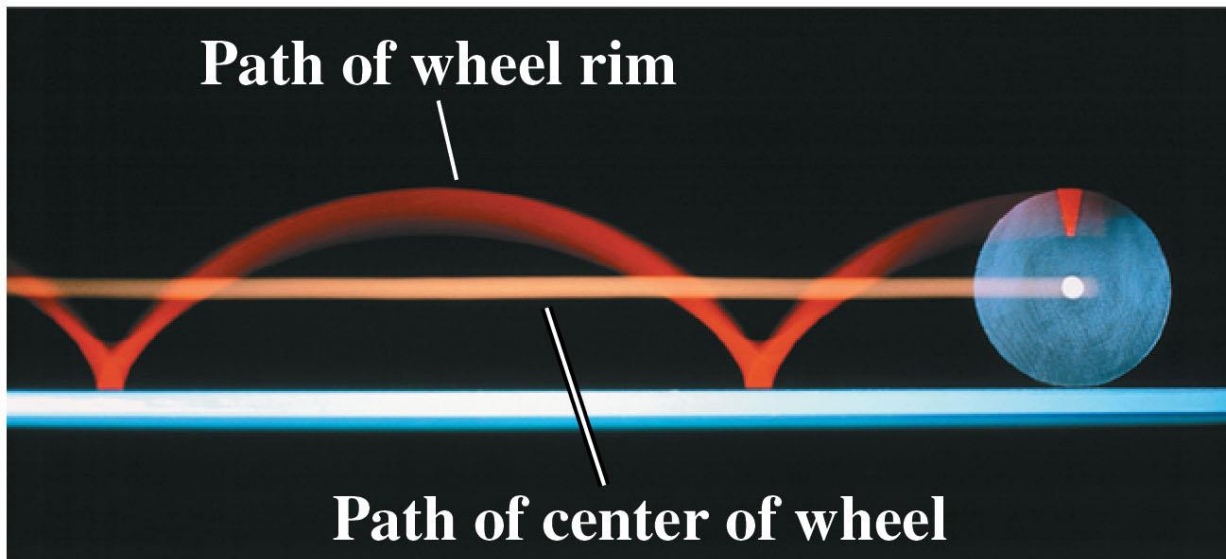
τ

pivot point

Chapter 12 – Rotation of a Rigid Body

- Centre of mass and moment of inertia
- Torque and cross product
- Rolling motion and rotational energy
- Angular momentum





$$v_{cm} \Delta t = \omega R \Delta t = 2\pi R$$

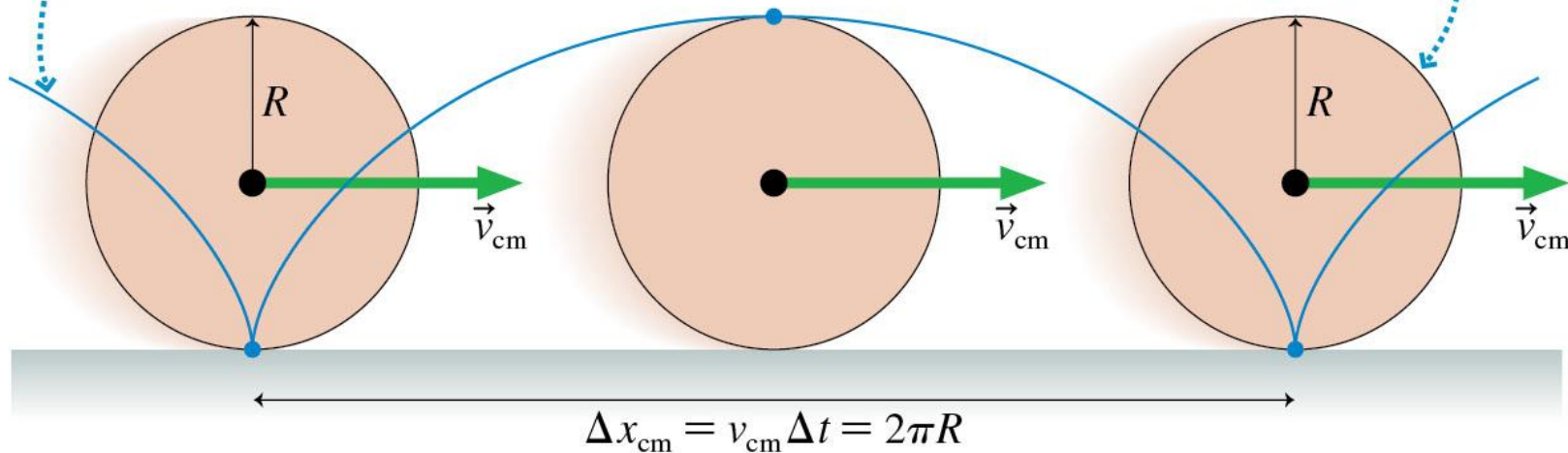
$$\omega \Delta t = 2\pi$$

Period $T \rightarrow \boxed{\omega = \frac{2\pi}{T}}$

PHY 152

Path followed by the point on the rim

Object rolls one revolution without slipping.



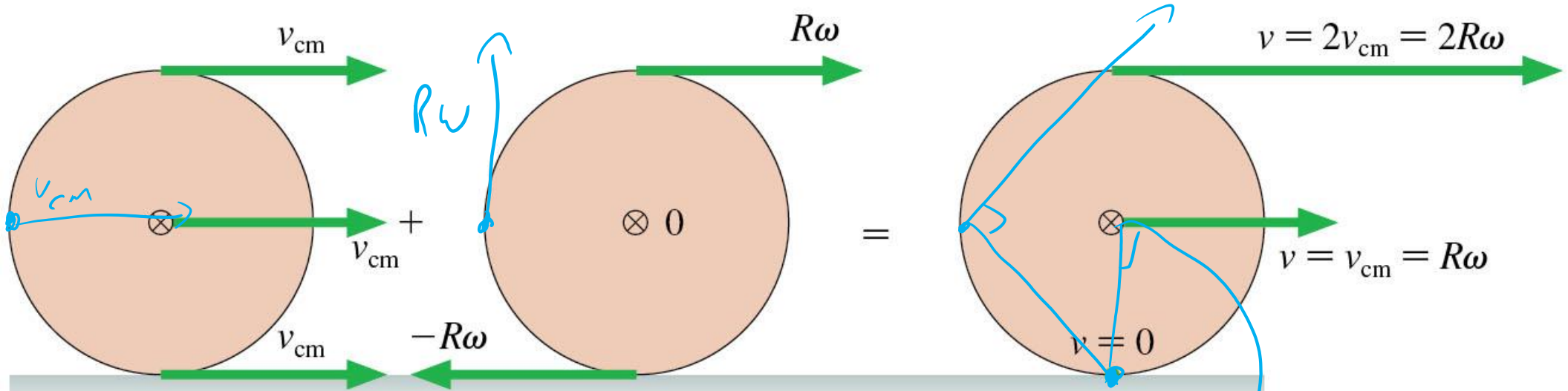
Translation

+

Rotation

=

Rolling

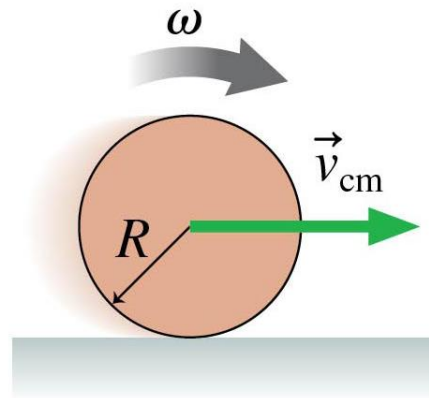


© 2022 Pearson Education, Inc.

For an object that rolls
without slipping

$$v_{cm} = R\omega$$

$$K = K_{rot} + K_{cm}$$



what if $R\omega > v_{cm}$

© 2022 Pearson Education, Inc.

Angular velocity $\vec{\omega}$ points along the rotation axis in the direction of the right-hand rule.

For a rigid body rotating about a fixed axle, the angular momentum is $\vec{L} = I\vec{\omega}$.

Newton's second law is $\frac{d\vec{L}}{dt} = \vec{\tau}_{\text{net}}$.

© 2022 Pearson Education, Inc.

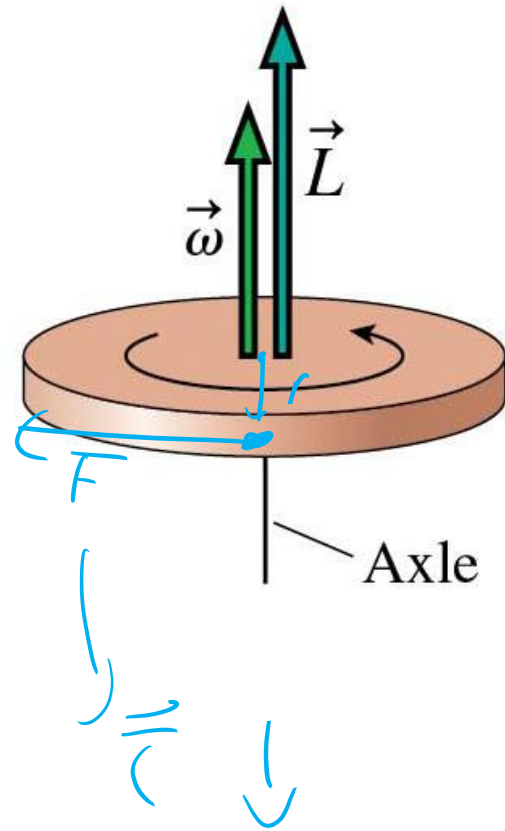
$$\frac{d\vec{p}}{dt} = \vec{F}$$

$$\vec{p} = m\vec{v}$$

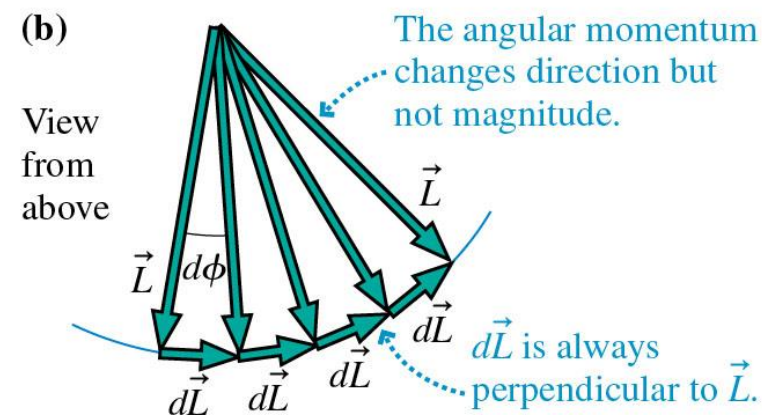
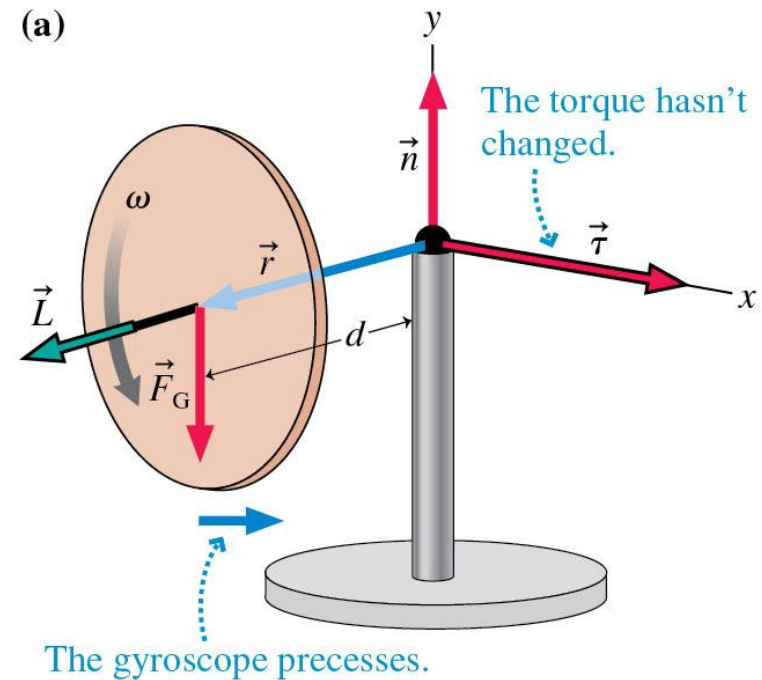
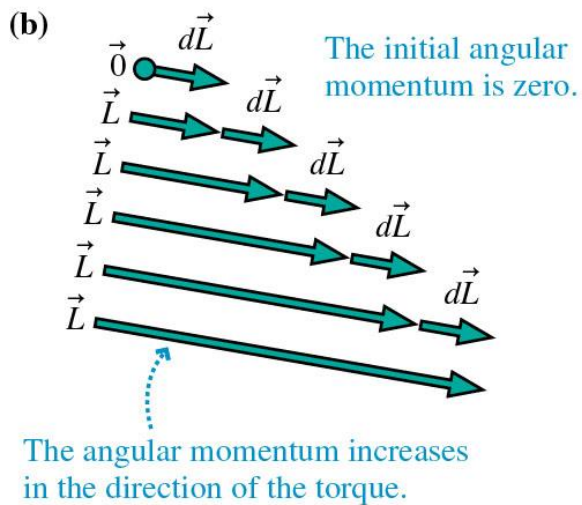
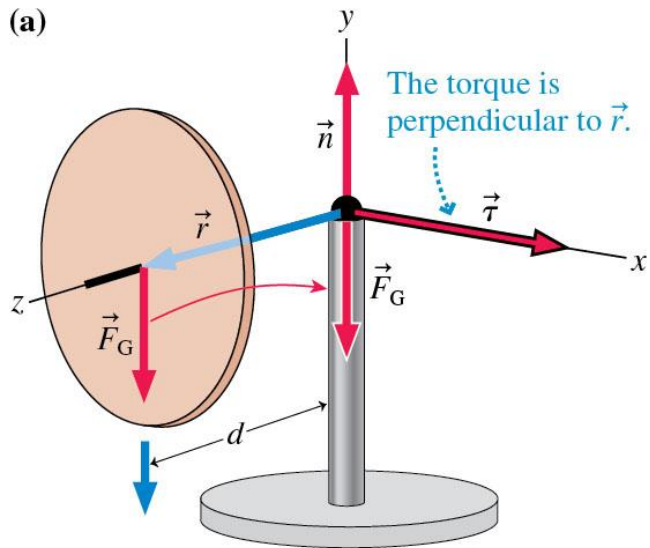
$$\vec{p} \leftrightarrow \vec{L}$$

$$m \leftrightarrow I$$

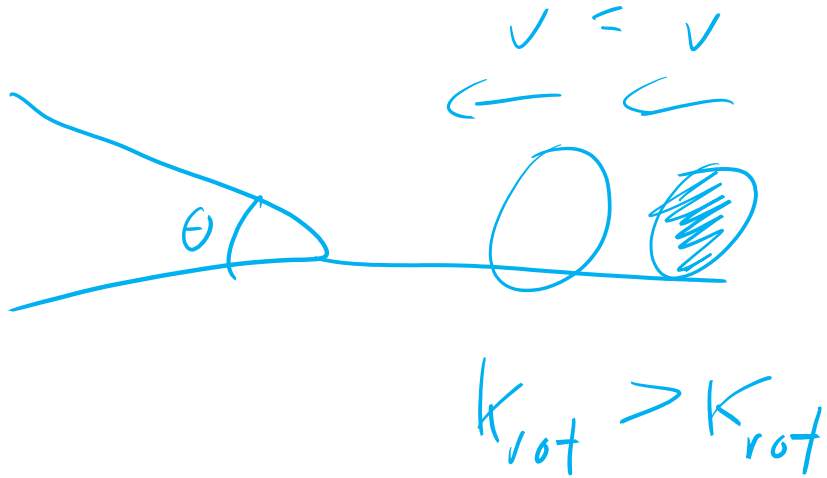
$$\vec{v} \leftrightarrow \vec{\omega}$$



$$\frac{d\vec{L}}{dt} = \vec{\tau}$$



Team Up Questions



$$K \rightarrow 0$$

$$u_g \rightarrow \text{increased}$$

Motorcycle physics

