Phys171 – Mon 4/16

HW 13 DUE April 20 – THIS IS **LONG**

3rd midterm on Mon Apr 23

FINAL EXAM:
PHY 0405 Fri, May 18 8:00 am - 10:00 am

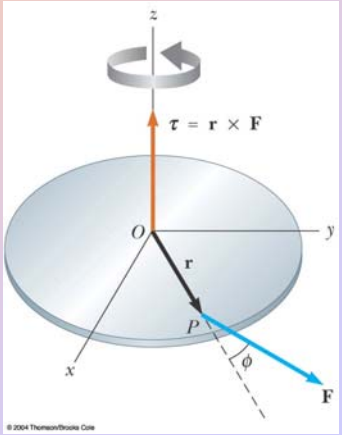
Chapter 13 - Rotation

Torque: tendency of a force to generate rotation an object about some axis

Torque vector $\tau = \mathbf{r} \times \mathbf{F}$
(vector product)

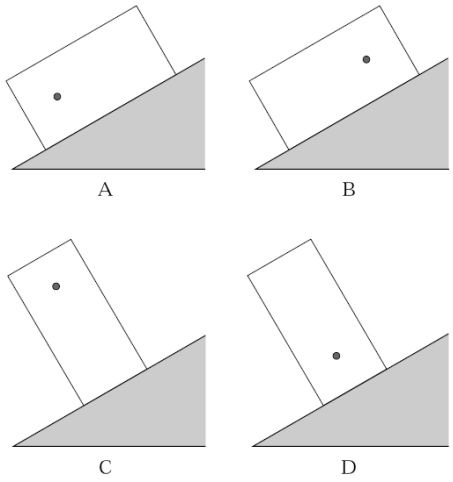
Direction: perpendicular to the plane formed by the position vector and the force vector (right-hand rule)

Magnitude: $r F \sin(\theta)$



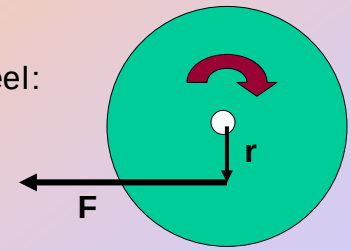
A box, with its center-of-mass off center as indicated by the dot, is placed on an inclined plane. In which of the four orientations shown, if any, does the box tip over? © Mazur

1. A
2. B
3. C
4. D
5. None
6. More than one

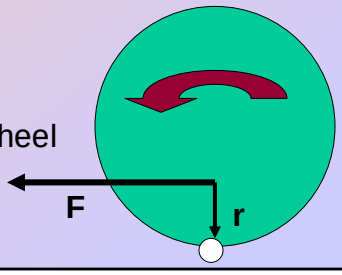


It is important to know the point around which an object rotates. The direction vector from that point **r** influences the AMOUNT and DIRECTION of torque.

1) Rotate around center of wheel:
-> clockwise rotation of wheel



2) Rotate around wheel surface:
-> counterclockwise rotation of wheel



In which direction will the tricycle move when I pull the string?

1. Forward
2. Backward
3. The tricycle will not move

With the pedal extender, in which direction will the tricycle move when I pull the string?

1. Forward
2. Backward
3. The tricycle will not move

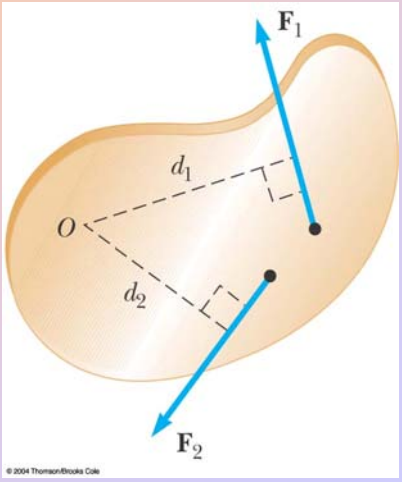
Net Torque

$\mathbf{F}_1$ would cause counter-clockwise rotation about *O*

$\mathbf{F}_2$ would cause clockwise rotation about *O*

Total (net) torque = sum of torques

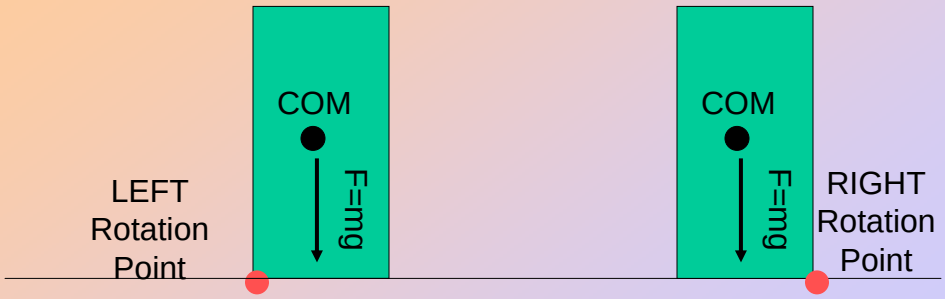
$$\Sigma\tau = \tau_1 + \tau_2 = F_1 d_1 - F_2 d_2$$



Does an object tip over?

Tip over to LEFT?

Tip over to RIGHT?



Clockwise torque around LEFT rotation point
-> No rotation

Counterclockwise torque around RIGHT rotation point
-> No rotation