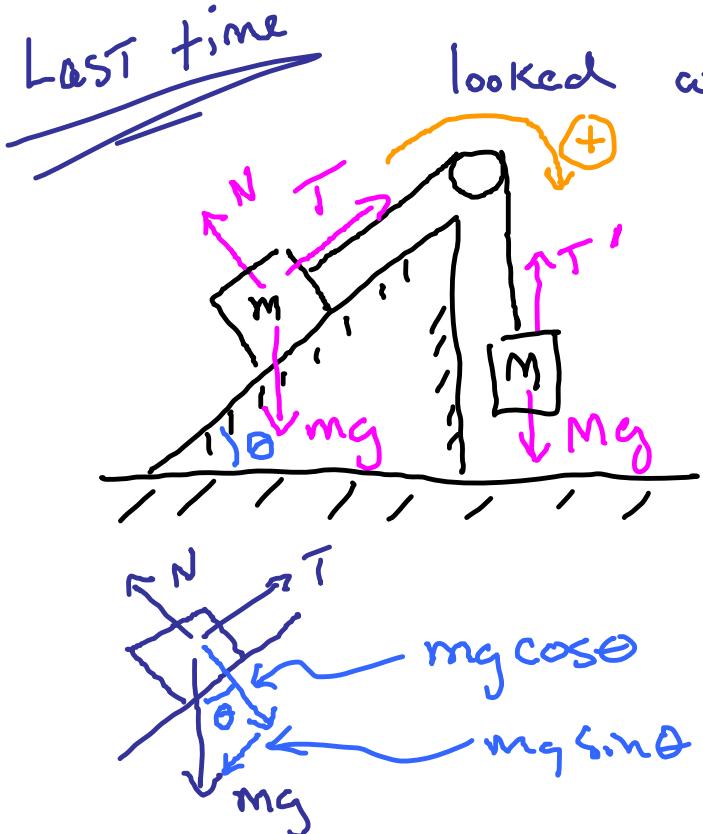


Physics 113 - November 7 2013

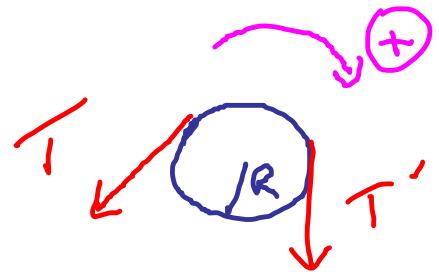
- EXAM 2 Tuesday 0800 Hubbell
- Still setting up Q+A session Room - Prob. Monday late afternoon
- We will have lecture on Tuesday as usual 
We will probably do the STRANGEST stuff of the term that day



\perp direction $\sum F_{\perp} = 0 = N - mg \cos \theta$

\parallel direction $\sum F_{\parallel} = ma = T - mg \sin \theta$

$$\sum F = Ma = Mg - T'$$



I, R

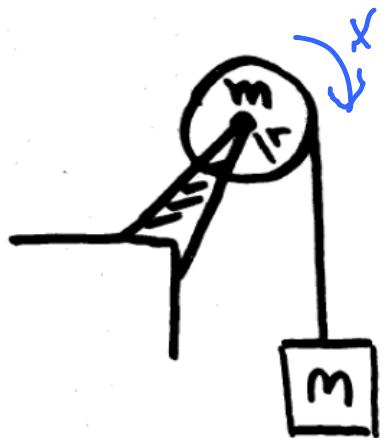
$$\sum I = I\alpha$$

$$s = R\theta$$
$$a = R\alpha$$

$$I\alpha = RT' - RT$$

$$I \frac{a}{R} = RT' - RT$$

$$\frac{1}{2} MR^2$$



$$I_{\text{Cylinder}} = \frac{1}{2}mr^2$$

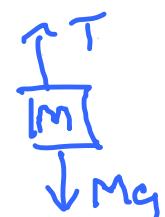
Find correct expression
for a of M

$$\sum F = I\alpha = Tr$$

$$I = \frac{1}{2}mr^2$$

$$\sum T = I\alpha = Tr$$

$$\frac{1}{2}mr^2 \frac{a}{r} = Tr$$



$$Ma = Mg - T$$

$$T = Mg - Ma$$

$$\textcircled{1} \quad g$$

$$\textcircled{2} \quad \left(\frac{M-m}{M+m}\right)g$$

$$\textcircled{3} \quad \left(\frac{1}{2}mr^2 + M\right)g$$

$$\textcircled{4} \quad \left(\frac{2M}{2M+m}\right)g$$

$$a = \frac{I_2 z}{m} = \frac{(Mg - Ma)z}{m} = z \frac{Mg}{m} - \frac{3M}{m} a$$

$$\left(1 + \frac{2M}{m}\right)a = \frac{2Mg}{m}$$

$$a = \frac{2Mg}{m} \cdot \frac{1}{\left(1 + \frac{2M}{m}\right)} = \frac{2Mg}{(m + 2M)}$$

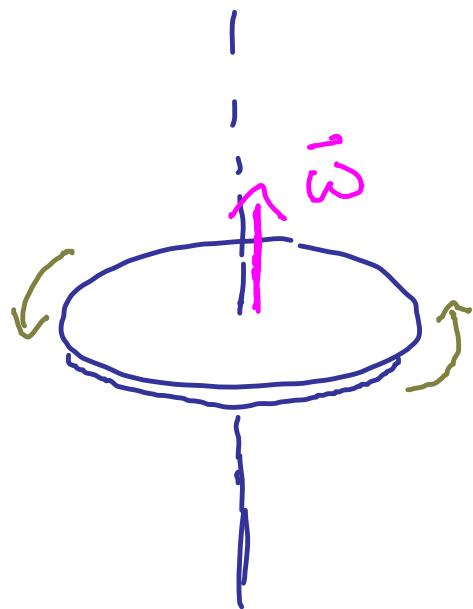
a few
Moments of
Reflection



Rotation
* You

Rotational Dynamics (chapt 11)

Right hand rule

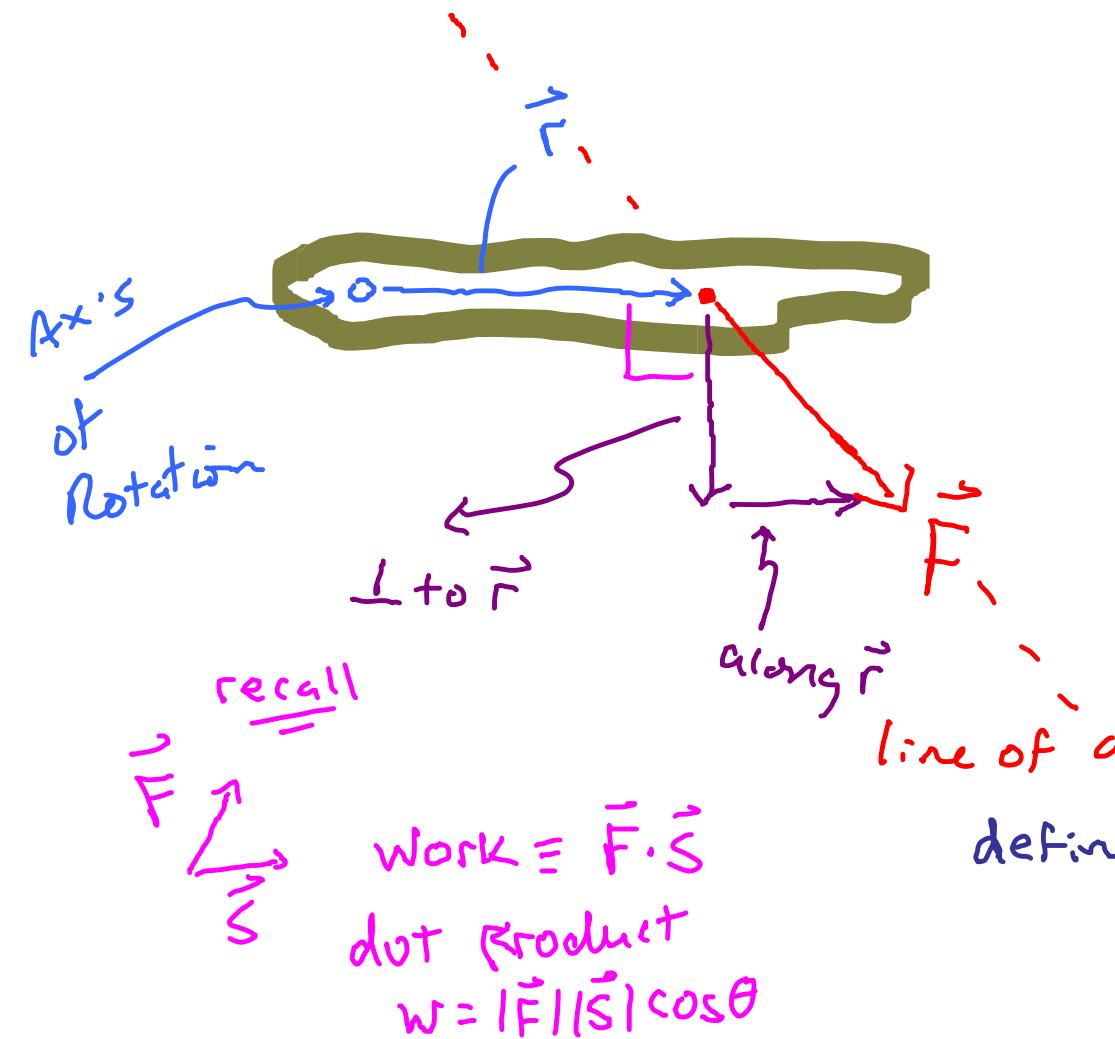


If $\vec{\omega}$ increasing w/t time

$\vec{\alpha}$ is a vector along $\vec{\omega}$

If $\vec{\omega}$ decreasing w/t time

$\vec{\alpha}$ is in the direction
opposite to $\vec{\omega}$

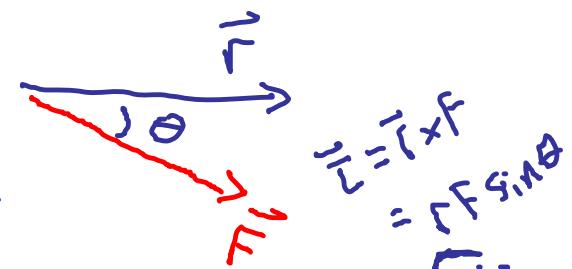


$$\vec{\tau} = I \vec{\alpha}$$

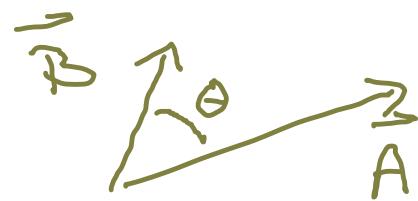
only part of \vec{F} important
for rotation (produce an $\vec{\alpha}$)
is part \perp to \vec{r}

define $\vec{r} \times \vec{F} \equiv$ cross product

$$\vec{\tau} \equiv \vec{r} \times \vec{F} \quad |\vec{r} \times \vec{F}| = |\vec{r}| |\vec{F}| \sin \theta$$



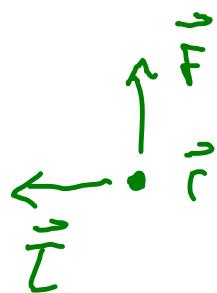
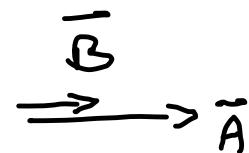
$$\vec{\tau} = \vec{r} \times \vec{F} \\ = |\vec{r}| |\vec{F}| \sin \theta$$



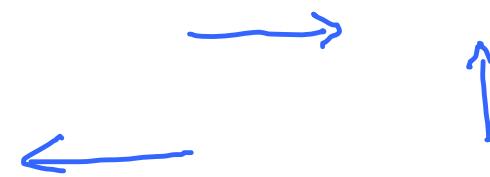
$$\vec{B} \times \vec{A} = (\vec{A}) |\vec{B}| \sin\theta$$

Dir. given by RHR

$$\vec{A} \times \vec{B} = - \vec{B} \times \vec{A}$$



\times into board



• out of board

Linear World

The diagram illustrates the relationship between linear and angular quantities for a rotating object. A central pink arrow points from left to right, representing the transition from linear to angular variables. To the left of this arrow, several blue lines represent linear quantities: s , \vec{v} , \vec{a} , M , and \vec{F} . To the right of the arrow, corresponding angular quantities are shown: θ , $\vec{\omega}$, $\vec{\alpha}$, $I = \int r^2 dm$, \vec{L} , $\frac{1}{2} I \omega^2$, and $\vec{L} \equiv I \vec{\omega}$.

$$s \rightarrow \theta$$
$$\vec{v} \rightarrow \vec{\omega}$$
$$\vec{a} \rightarrow \vec{\alpha}$$
$$M \rightarrow I = \int r^2 dm$$
$$\vec{F} \rightarrow \vec{L}$$
$$KE \rightarrow \frac{1}{2} I \omega^2$$
$$\vec{p} = m \vec{v} \rightarrow \vec{L} \equiv I \vec{\omega}$$

Angular Momentum $\equiv \vec{L} \equiv I\vec{\omega}$

$$\vec{F} = \frac{d\vec{P}}{dt} \sim m \frac{d\vec{V}}{dt} = \vec{ma}$$

$$\vec{\tau} = \frac{d\vec{L}}{dt} = I \frac{d\vec{\omega}}{dt} = I\vec{\alpha}$$

Conservation of Angular Momentum

$$\sum I\omega_{start} = \sum I\omega_{end}$$

$$\vec{L}_{start} = \vec{L}_{end}$$