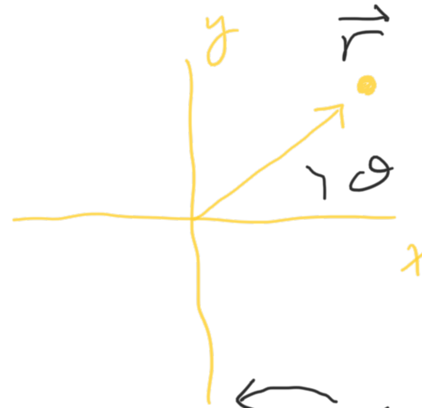
Rotations

2D for now



linear

v

$\frac{1}{2} m v^2$

angular

$r\omega$

$\frac{1}{2} \underbrace{m r^2}_{\downarrow} \omega^2$

I = moment of inertia

$a \iff r\alpha$

$F \qquad \vec{\tau} = \text{"torque"}$

$\equiv \vec{r} \times \vec{F}$

in 3D

$F = m a \iff \tau = r(m r \alpha)$

$\tau = I \alpha$

$p = m v \qquad \vec{L} = \text{"angular moment"}$

$\equiv \vec{r} \times p$

$= r(m r \omega)$ if 2D, $r_\perp$

$= m r^2 \omega$

$p = mv \iff L = I\omega$

m mass $\qquad I = mr^2$ "moment of inertia"

$$F = \frac{\Delta p}{\Delta t} \iff \tau = \frac{\Delta L}{\Delta t}$$

So there are analogous equations for linear and rotational motion.

And new conserved quantities

no torque $\Rightarrow$ L is conserved

E = linear + rotational motion

often done as

1. motion <u>of</u> center of mass
2. motion <u>around</u> c.o.m.

Torque is