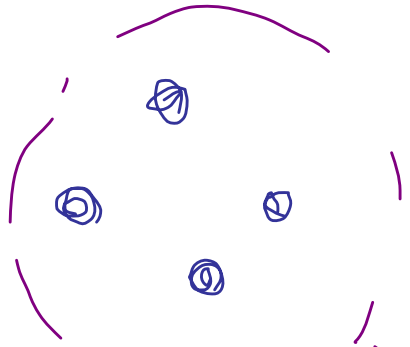
Phys 2110-4 3/20/13

Note Title 3/20/2013

Conservation of momentum



outside world exerts no net force

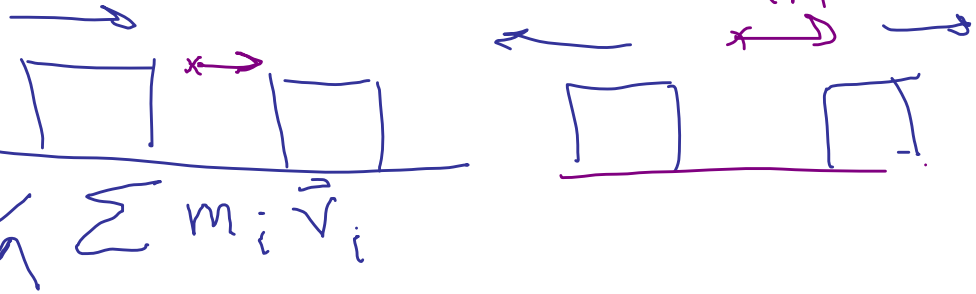
isolated system

$\Sigma p_i = \vec{P}$ is const

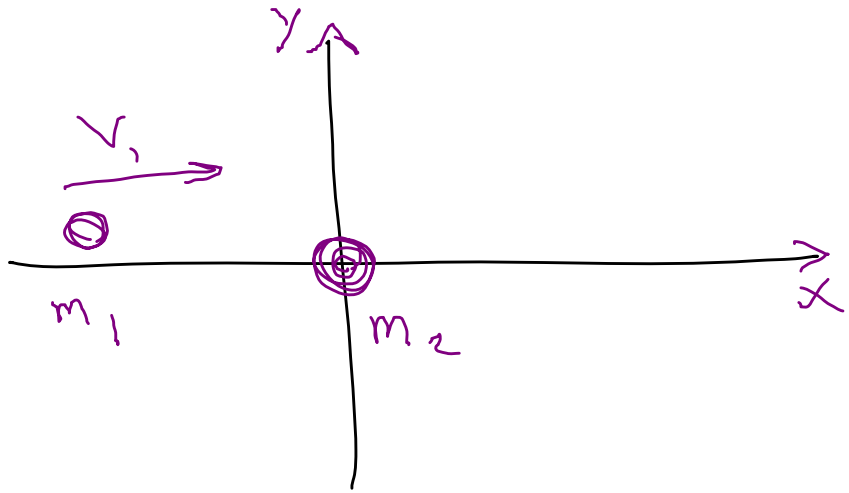
$\vec{P} = M \vec{v}_{cm}$

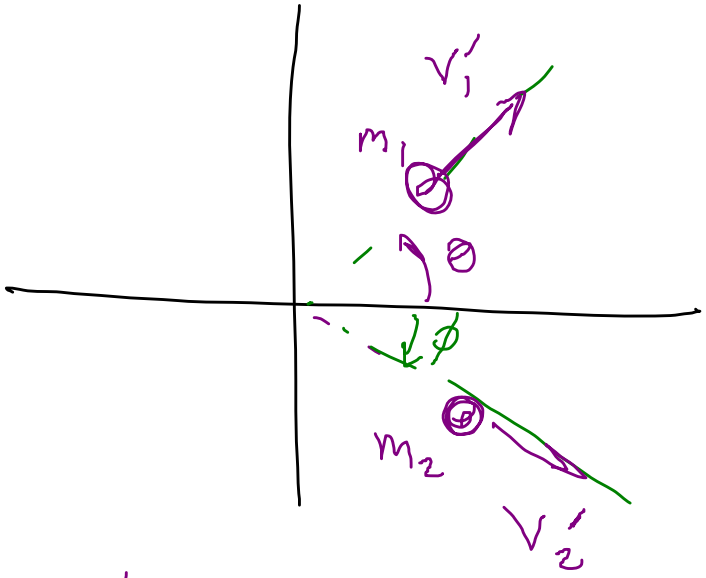
and vel. of cm is constant

$\vec{v}_{cm} = \frac{1}{M} \Sigma m_i \vec{v}_i$



Collisions:





P_x is cons'd:

$$m_1 v_1 = m_1 v_1' \cos\theta + m_2 v_2' \cos\phi$$

P_y is cons'd

$$0 = m_1 v_1' \sin\theta - m_2 v_2' \sin\phi$$

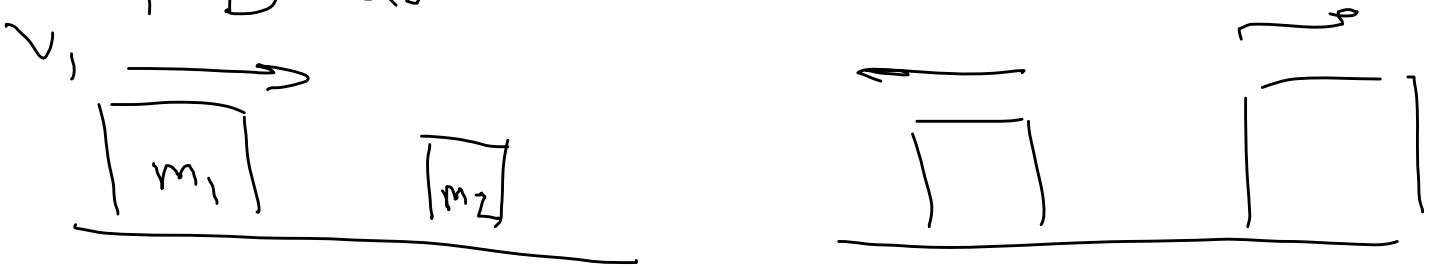
2 eqns
2 unk's.

If this was also elastic

$$\frac{1}{2}m_1v_1^2 = \frac{1}{2}m_1v_1'^2 + \frac{1}{2}m_2v_2'^2$$

Last time

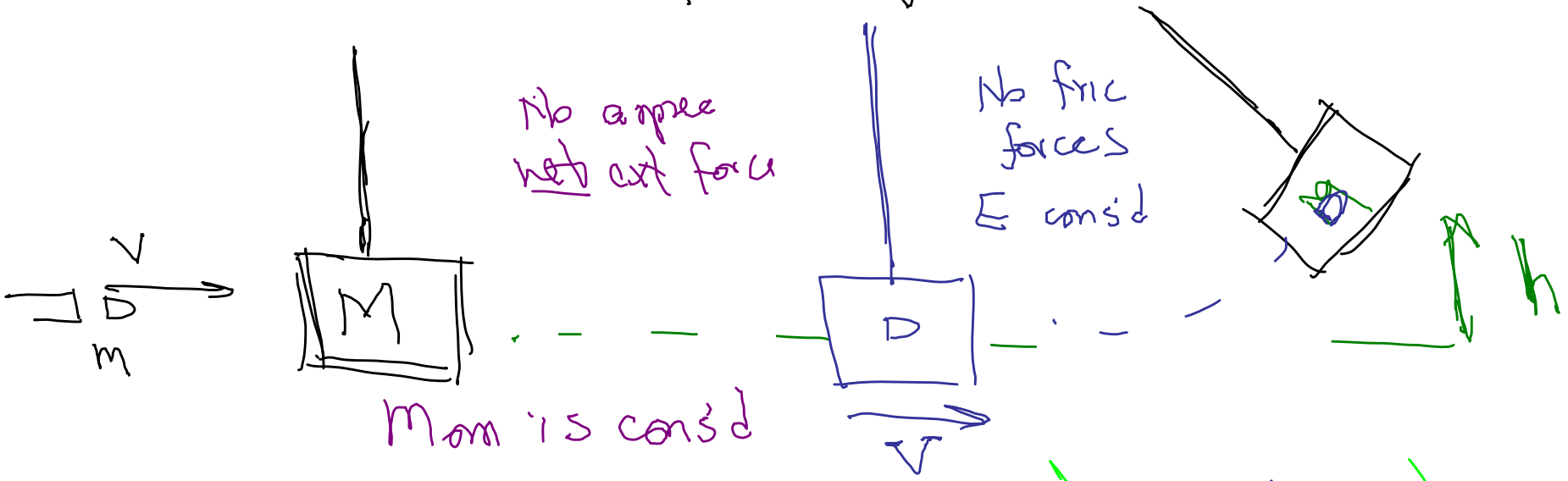
1-D elastic collision



Famous example: p. 145

Ballistic Pendulum.

Find speed of bullet. ~400 m/s

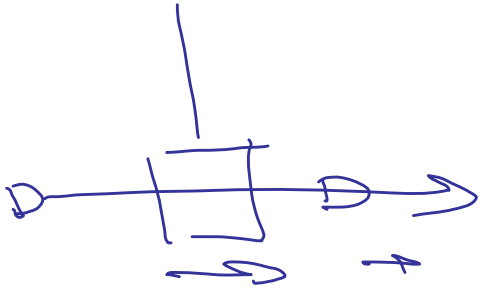


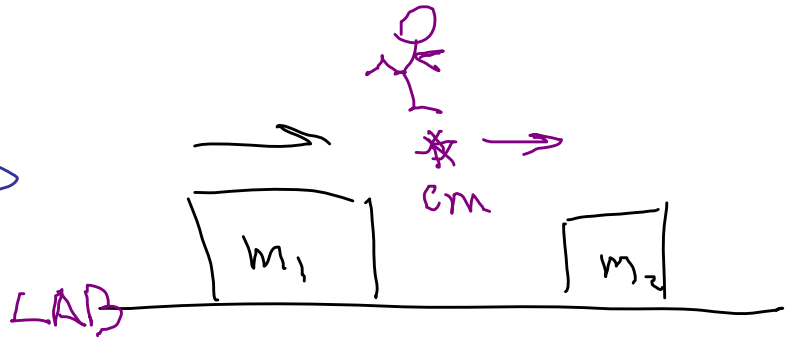
$mv = (M+m)V$

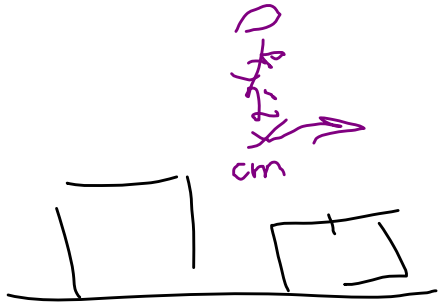
$\frac{1}{2}(M+m)V^2 = (M+m)gh$

$V = \sqrt{2gh}$

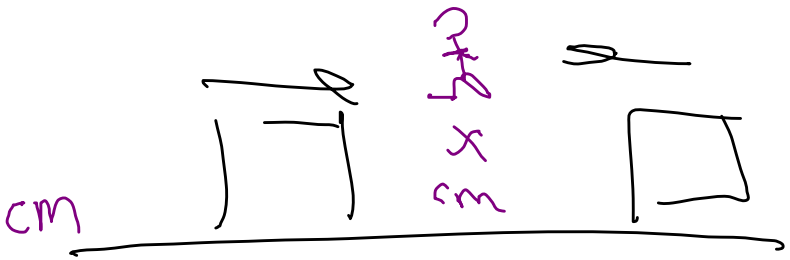
$$v = \frac{(M+m)}{m} V = \frac{(M+m)}{m} \sqrt{2gh}$$

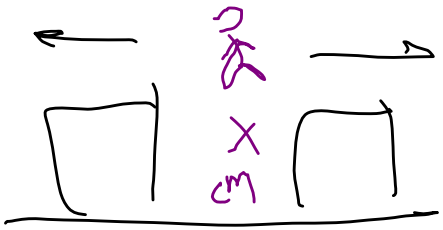






Ref frames





cm frame can make analysis easier.

In cm frame $P = M v_{cm} = 0$

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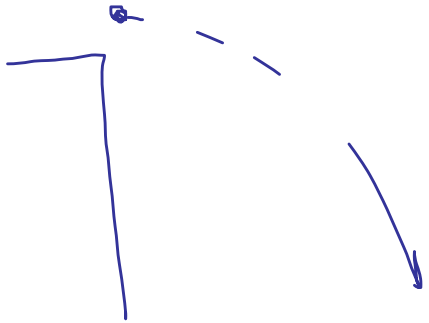
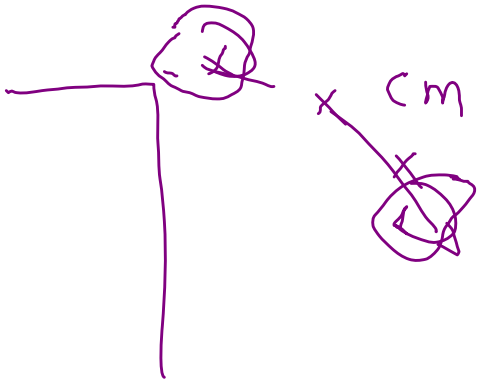
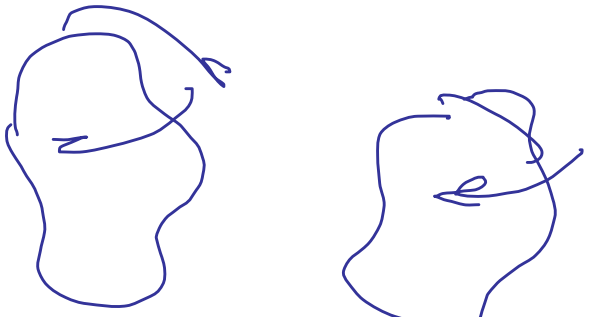
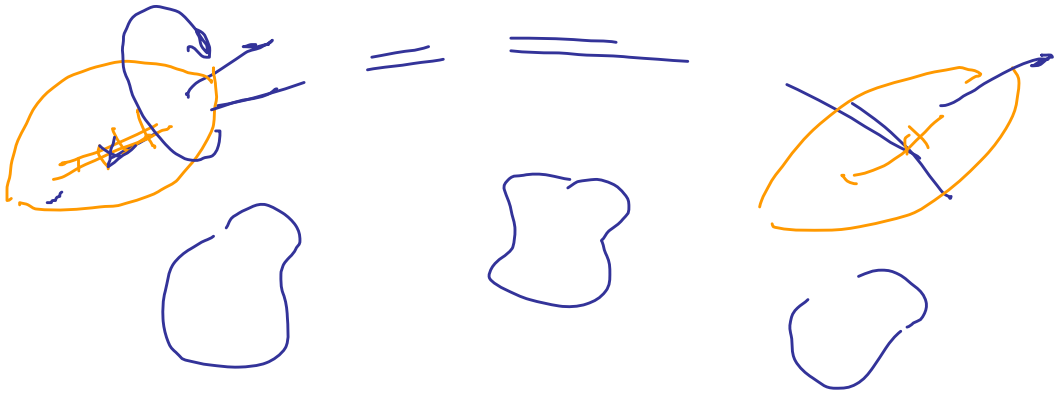






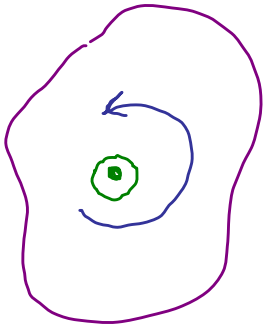


Rigid body motion.

In general, complicated subject

Greatly simplified:

One fixed axis.



Rotating object

Angle θ gives orientation.

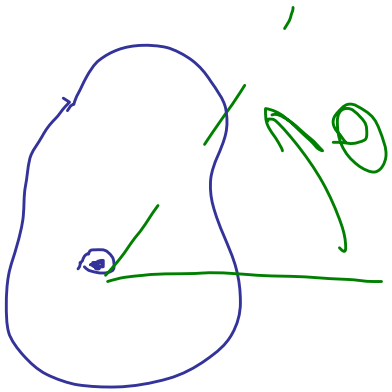
Angles meas'd ccw.

Angles are in radians.

π rad = 180 deg

1 rev = 360 deg
= 2π rad.

Radian can be omitted (prob shouldn't)



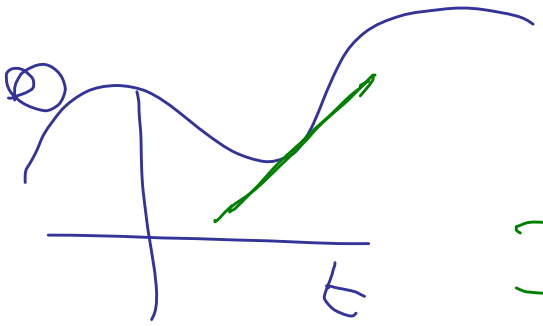
$\theta(t)$

How fast is θ changing w/ time?

$\frac{\Delta x}{\Delta t} \Longrightarrow \frac{\Delta\theta}{\Delta t}$ = avg. ang. velocity

$= \overline{\omega}$ (omega)

over a certain interval of time, Δt



Instantaneous ang vel

$$\omega = \frac{d\theta}{dt}$$