Phys 2110-4 2/29/12

Note Title 2/29/2012

Main point No non-cons. forces

$$\Delta E = 0$$

$$\Delta E = W_{\text{non cons}}$$

Potential energy (1-D)

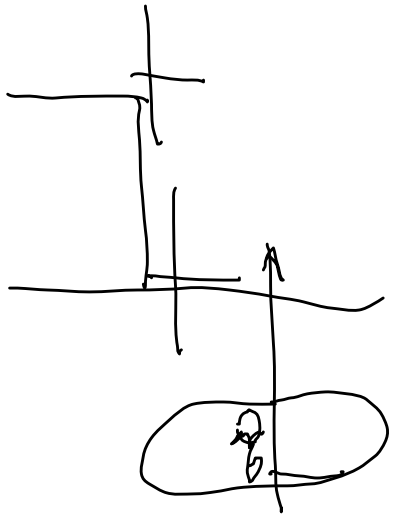
$$W_{a \to b} = \int_a^b F_x \, dx = -\Delta U$$

$$\Delta U = -\int_a^b F\,dx$$

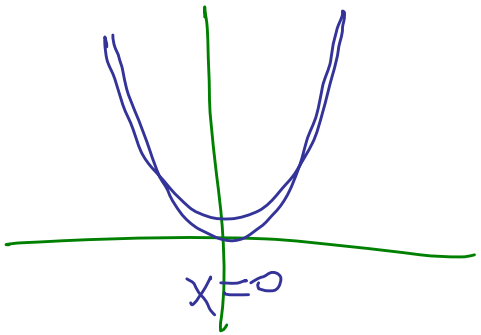
$$U(x) = -\int_0^x F(x')\,dx'$$

$$F_x = -\frac{dU}{dx}$$

Agree on point $x = 0$



$U = mgy$

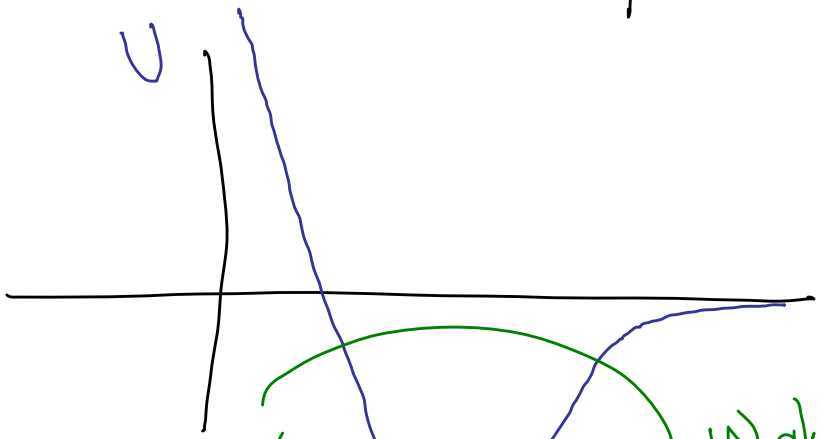


$U = \frac{1}{2}kx^2$

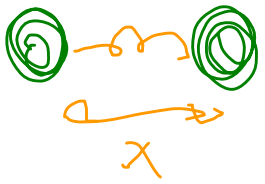
$F = -kx$

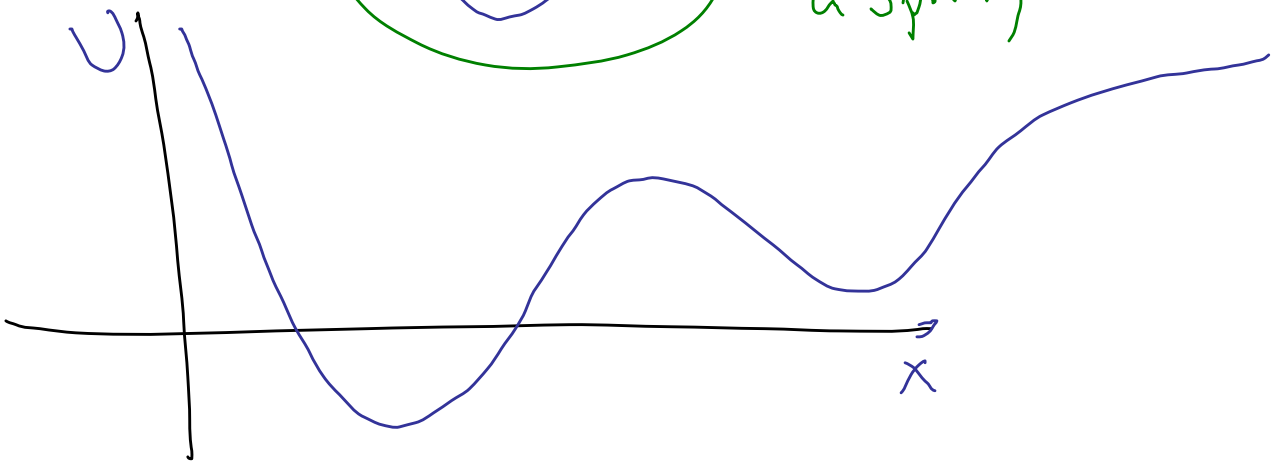
and Linear Restoring Force.

Potential Energy.



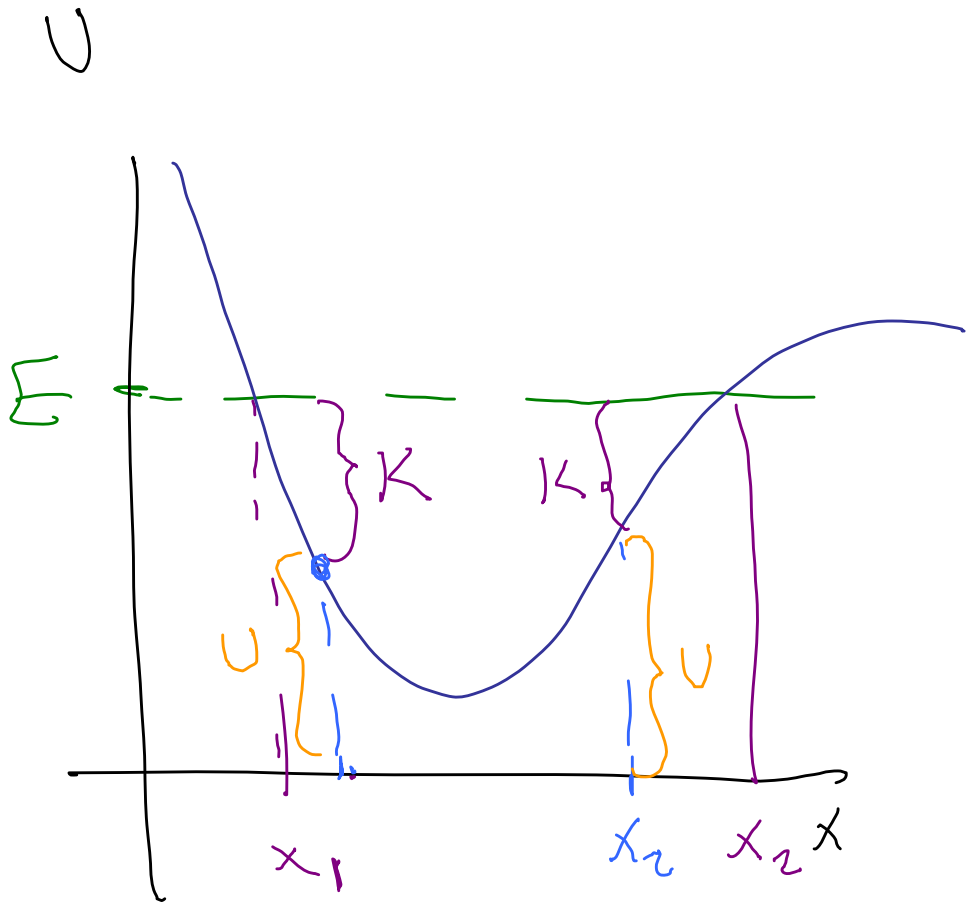
Looks like a spring





Cons. of Energy

$K+U = \text{const}$



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Trapped in a potential well

E = total energy

$E = K + V$

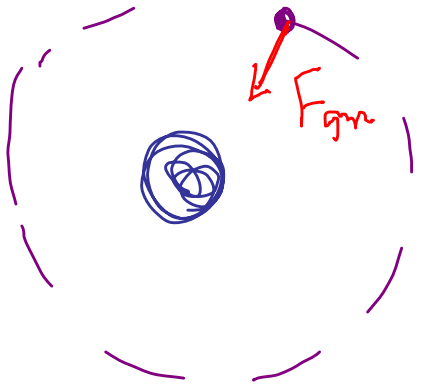
K has to be positive!

Particle must turn around at x_1, x_2

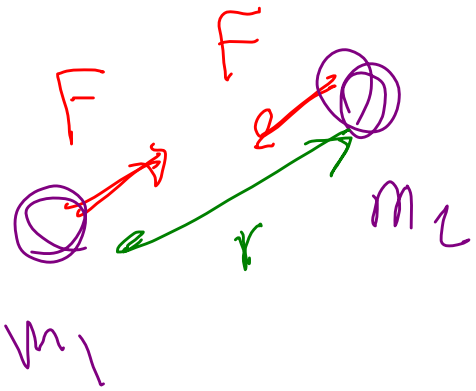
Turning points

Chap 8 Gravity

$$F_{grav} = G\frac{m_1 m_2}{r^2}$$

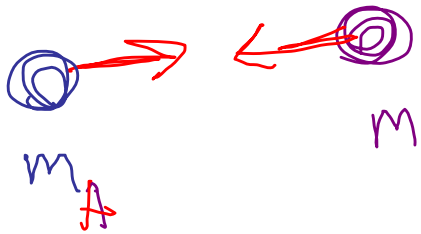


$$G = 6.67 \times 10^{-11} \frac{N m^2}{kg^2}$$



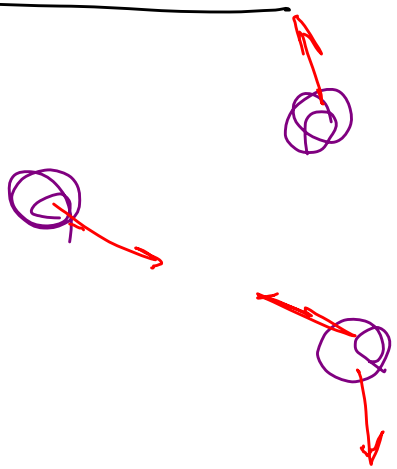
Chap 9

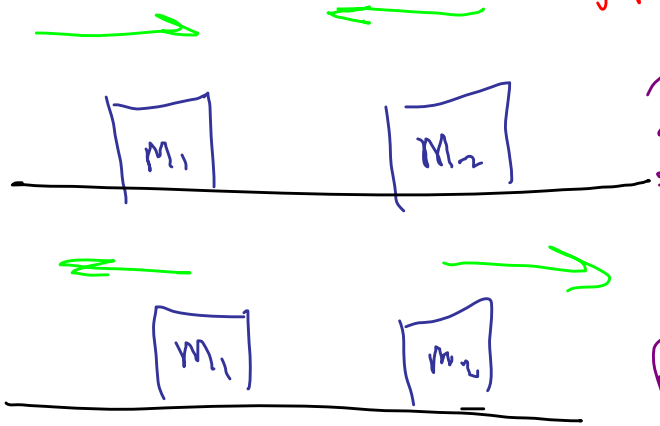
Systems of Particles



$$F_{B \text{ on } A} = F_{A \text{ on } B}$$

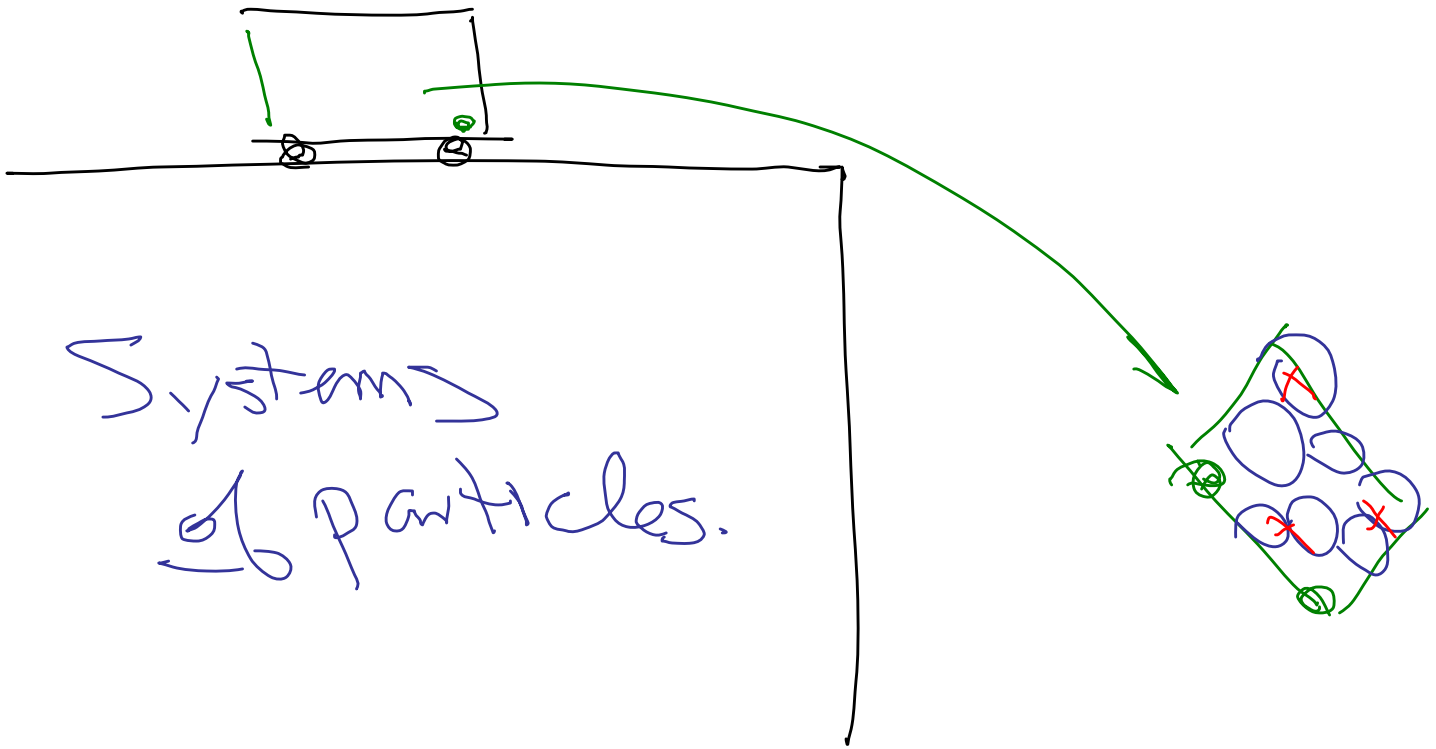
N's 3rd Law

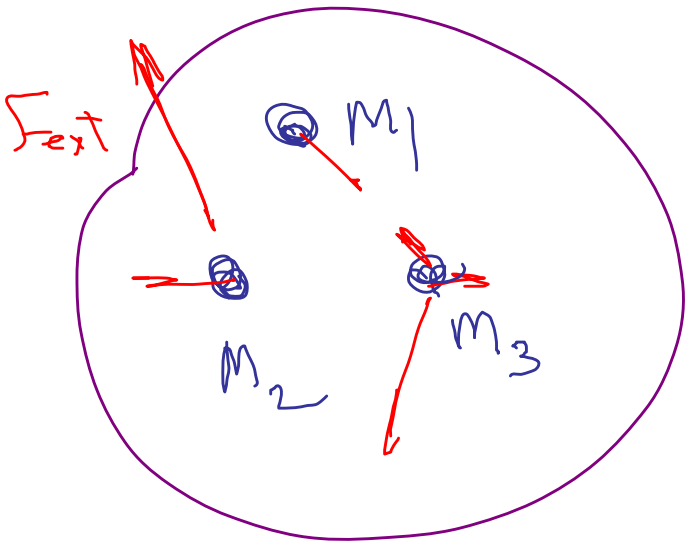




Interactions is complicated

We can figure out something.


Systems
of particles.



$$\vec{F}_{net,i} = m_i \vec{a}_i$$

$$= m_i \, d\vec{v}_i / dt$$

$$= m_i \, d^2\vec{r}_i / dt^2$$

$$\sum_i \vec{F}_{net,i} = \sum_i m_i \, d^2\vec{r}_i / dt^2 = \frac{d^2}{dt^2} \sum m_i \vec{r}_i$$

Def: Total mass $\sum_i m_i = M$

$$\sum_i \vec{F}_{i\,net} = M \frac{d^2}{dt^2}\left\{\frac{\sum m_i \vec{r}_i}{M}\right\}$$

$$= M \frac{d^2}{dt^2}\left\{\vec{R}\right\}$$

$$\vec{a}_{cm} = \frac{d^2\vec{R}}{dt^2}$$

$\vec{R}$ = center of mass

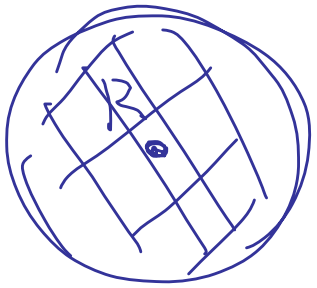
$$\sum \vec{F}_{Total} = M\vec{a}_{cm}$$

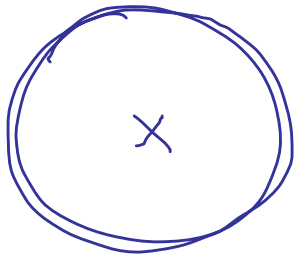
$$= \vec{R}$$

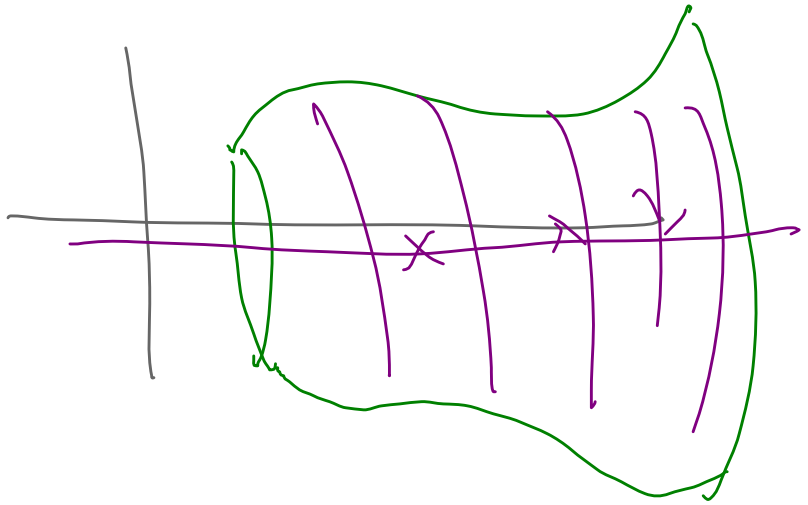
Weighted avg. of locations of masses

$$\vec{R} = \frac{\sum m_i \vec{r}_i}{M}$$

$$x_{cm} = \frac{\sum m_i x_i}{M} \qquad y_{cm} = \frac{\sum m_i y_i}{M} \quad .-$$

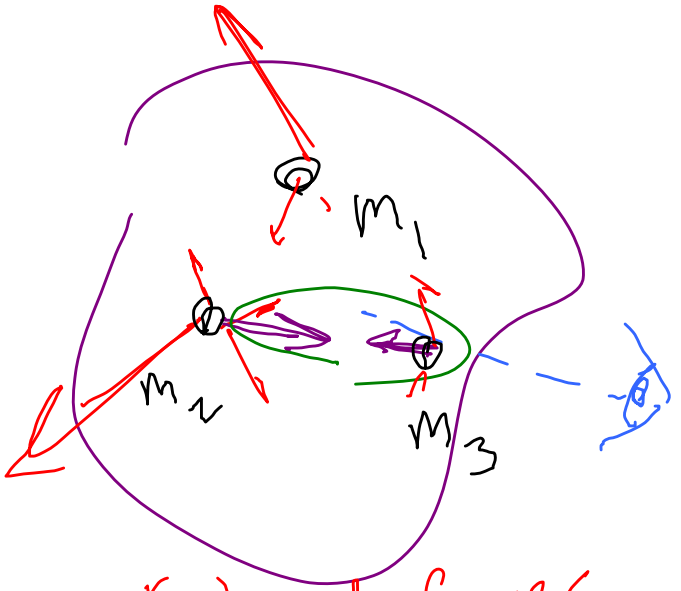




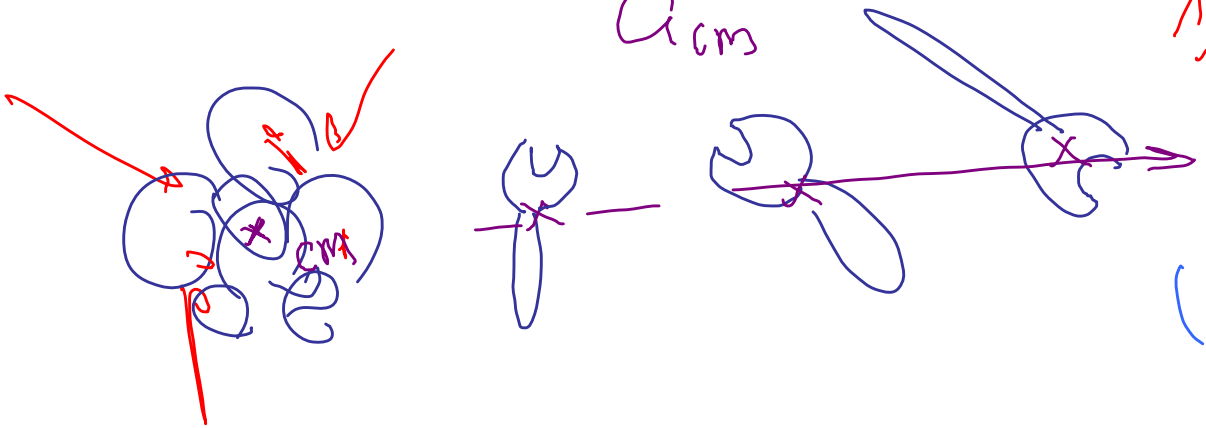


$$\vec{F}_{Total} = M\vec{a}_{cm}$$

$$\vec{F}_{Total\ ext} = M\vec{a}_{cm}$$



Internal forces all cancel



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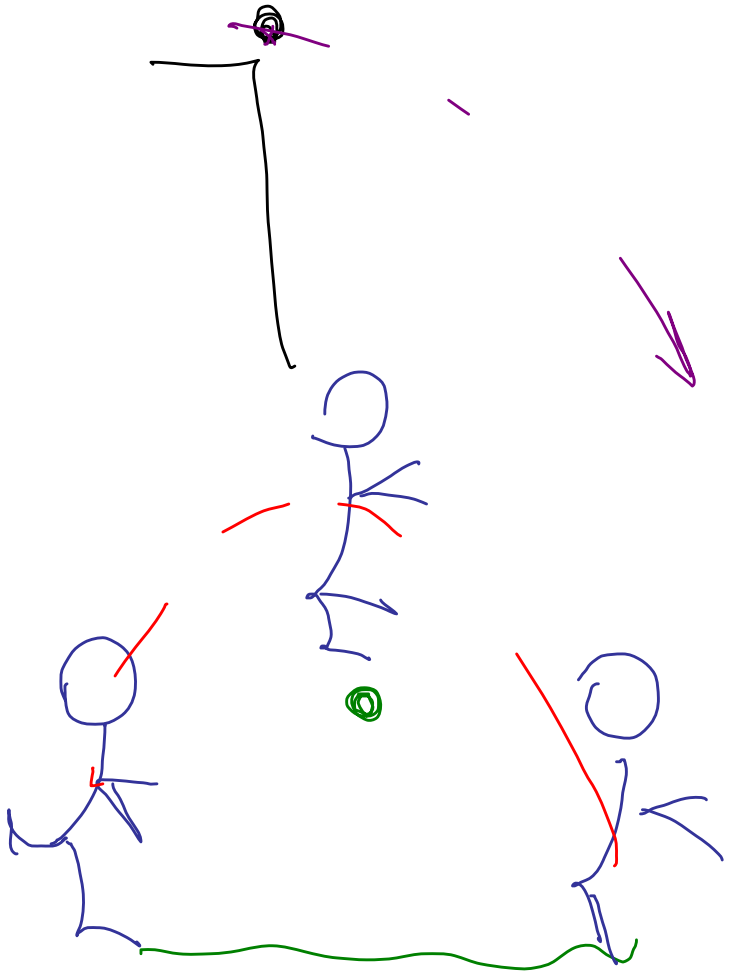
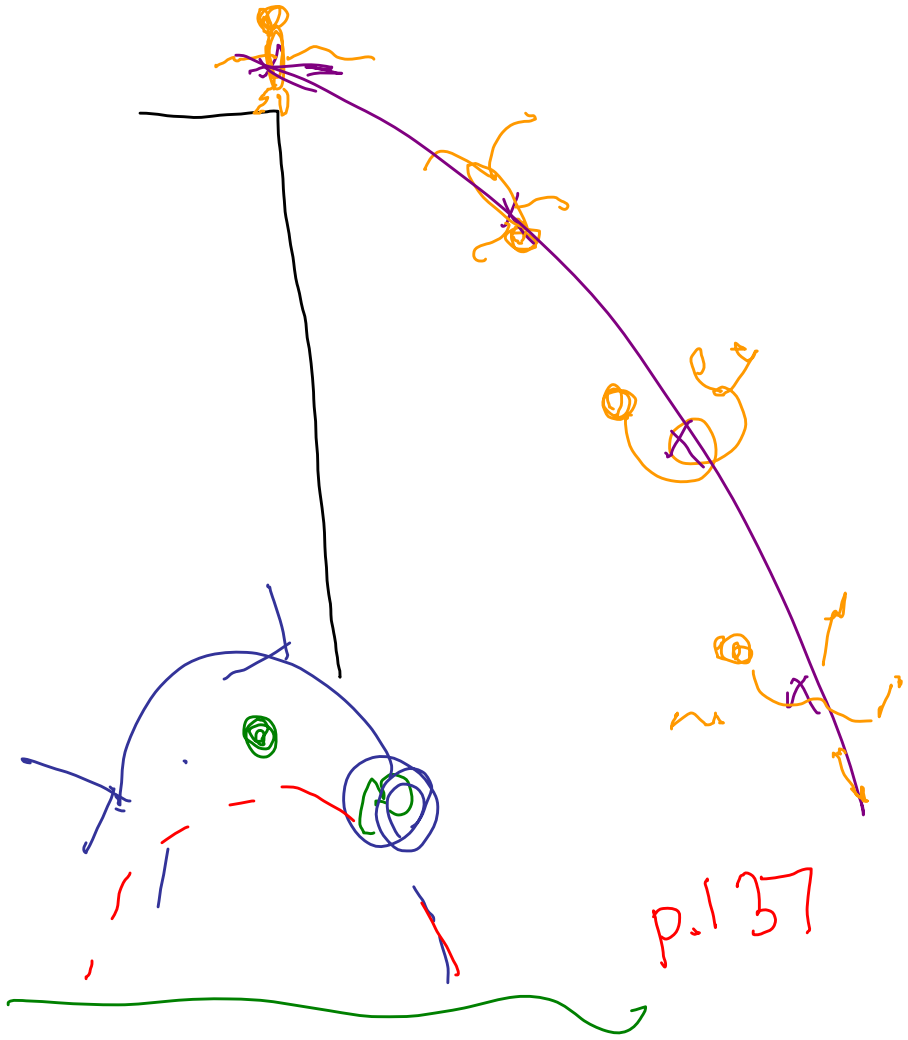




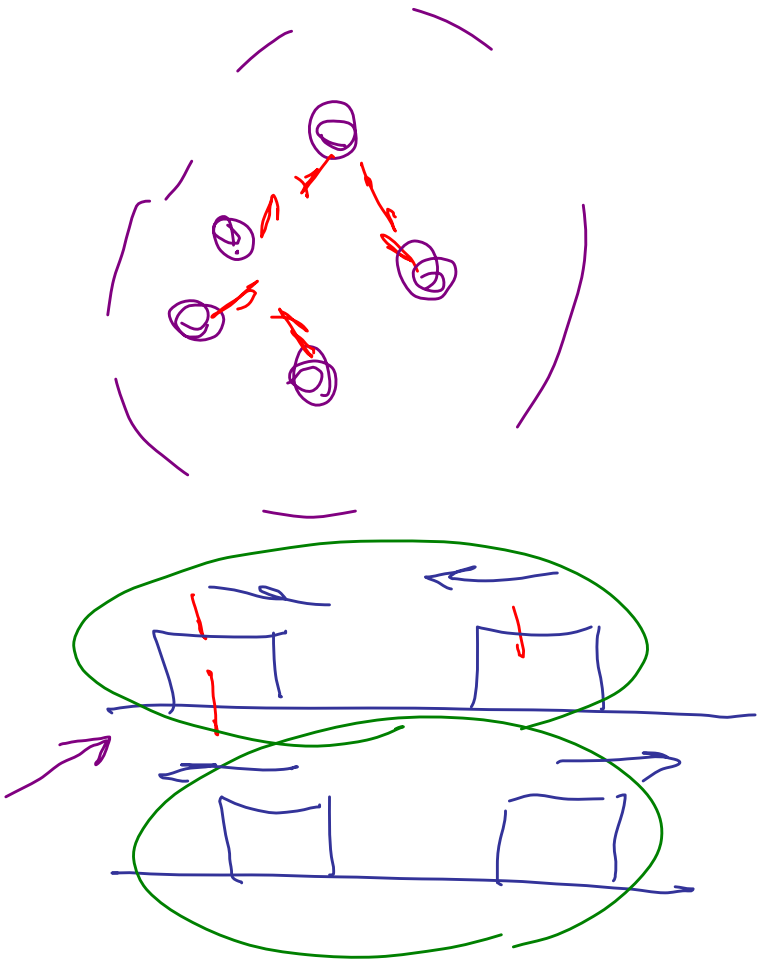
$$\vec{F}_{\text{total ext}} = M \vec{a}_{cm}$$

No external

Isolated system

No net external forces.

$$0 = M \vec{a}_{cm}$$



Momentum

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

Vector Units $\frac{kg \cdot m}{s}$