Reminders 03-16-10:

-Quiz 7 on Power Work-Kinetic Energy Thm and Conservation of Energy in Recitation Next Week.

-POW 7 Due Today

-Short Quiz Thursday on Energy Level Diagrams.

-Exam 3 Ch 7,8, and 9 March 25. No Makeups.

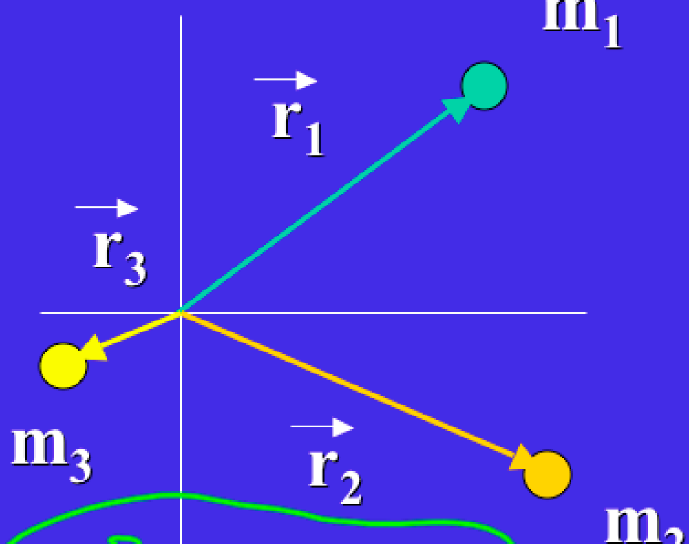
Objectives:

-Systems of Particles

-Center of Mass

-Conservation of Momentum

Now let's write $\vec{a}$ as a second derivat



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

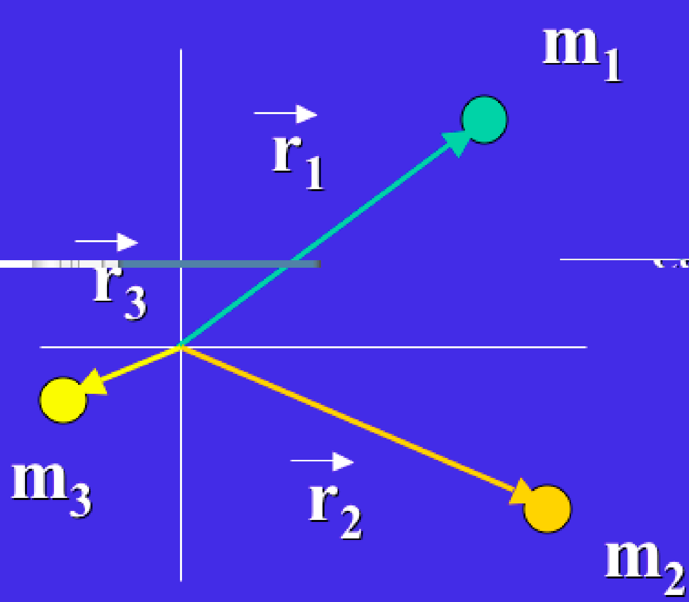
$$\vec{F}_{EXT} = \sum \frac{d\vec{p}_i}{dt} = \sum m_i \vec{a}_i$$

$$\vec{F}_{EXT} = M \frac{d^2\vec{R}}{dt^2} = \sum m$$

only **if**

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

Now let's write $\vec{a}$ as a second derivat



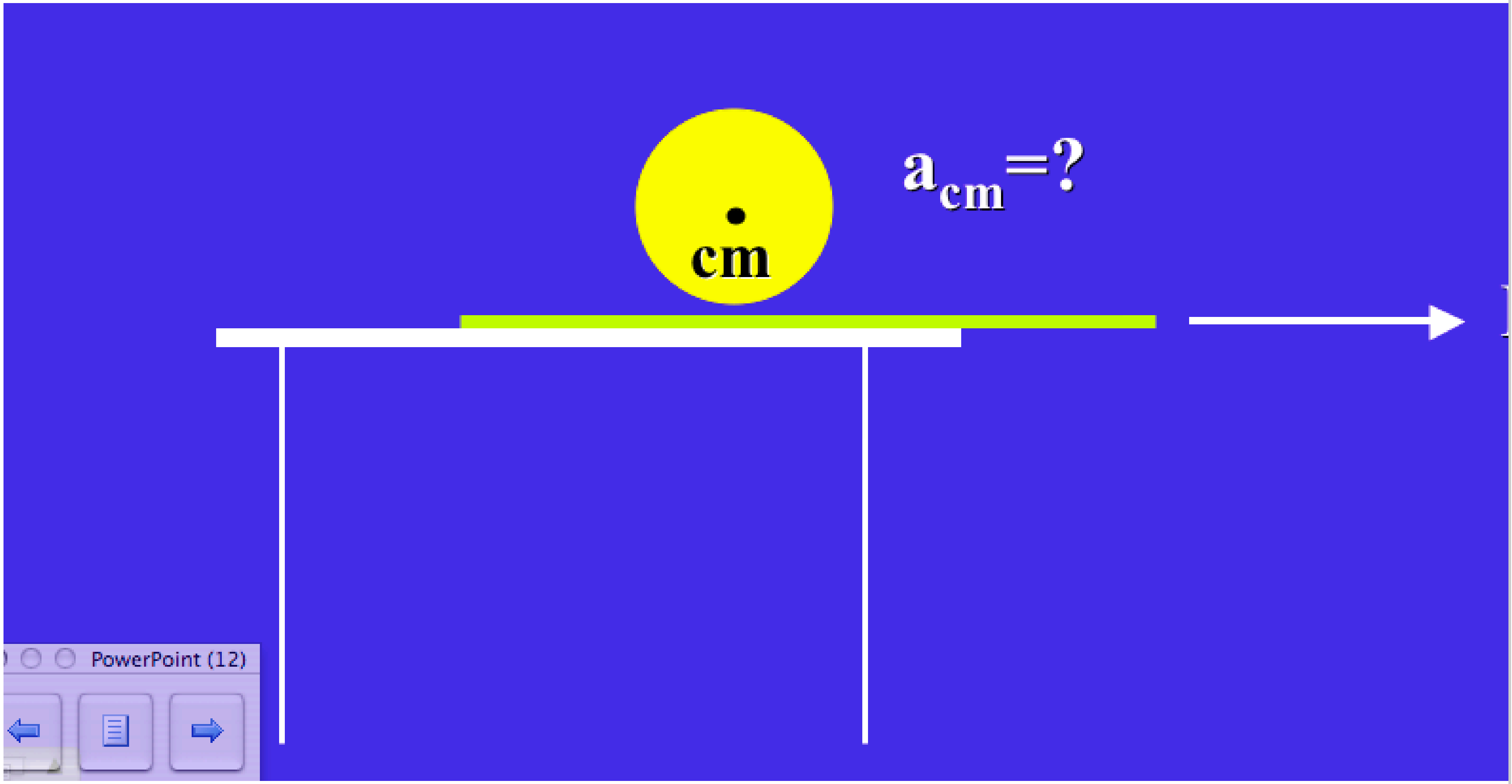
$$\vec{F}_{EXT} = \sum \frac{d\vec{p}_i}{dt} = \sum m_i \vec{a}_i$$

$$\vec{F}_{EXT} = M \frac{d^2\vec{R}}{dt^2} = \sum m$$

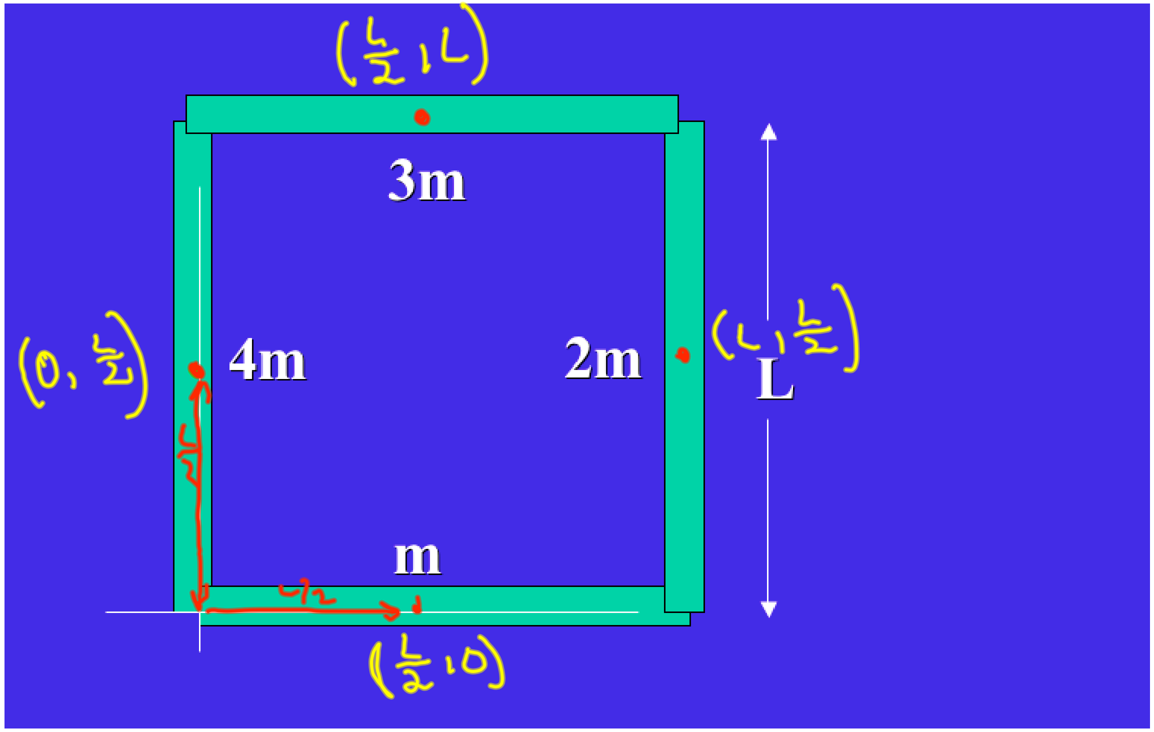
only if

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

$\vec{R}$ is called the center of mass of system
think of it as the average position of a m
system of particles.



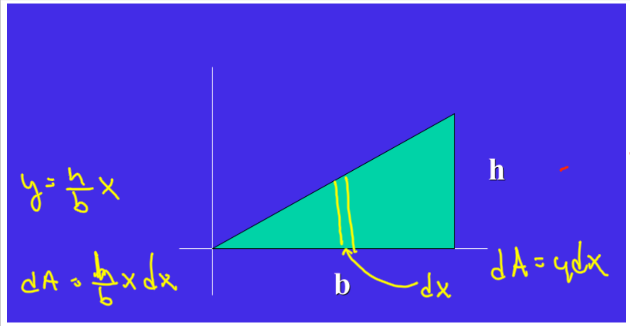
a_{cm} to Right



$$X_{cm} = \frac{m(\frac{L}{2}) + 2m(L) + 3m(\frac{L}{2}) + 0}{10m} = .4L$$

$$Y_{cm} = \frac{0 + 2m(\frac{L}{2}) + 3m(L) + 4m(\frac{L}{2})}{10m} = .6L$$

$$\vec{r}_{cm} = (.4\hat{i} + .6\hat{j})L$$



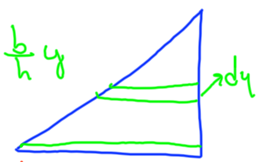
$$\vec{r}_{cm} = \frac{\int \vec{r}\,dm}{\int dm}$$

$$X_{cm} = \frac{\int x\,dm}{\int dm} = \frac{\int x\sigma\,dA}{\int \sigma\,dA}$$

$$X_{cm} = \frac{\int x\,dA}{\int dA} = \frac{\int_0^b x\frac{h}{b}x\,dx}{\int_0^b \frac{h}{b}x\,dx} = \frac{\int_0^b x^2\,dx}{\int_0^b x\,dx}$$

$$X_{cm} = \frac{b^3/3}{b^2/2} = \frac{2}{3}b$$

$x = b - \frac{b}{h}y$



$$dA = x\,dy = b\left(1 - \frac{1}{h}y\right)dy$$

$$y_{cm} = \frac{\int_0^h y\sigma b\left(1-\frac{y}{h}\right)dy}{\int_0^h \sigma b\left(1-\frac{y}{h}\right)dy} = \frac{\int_0^h y\left(1-\frac{y}{h}\right)dy}{\int_0^h \left(1-\frac{y}{h}\right)dy}$$

$$y_{cm} = \frac{\left.\frac{y^2}{2} - \frac{y^3}{3h}\right|_0^h}{\left.y - \frac{y^2}{2h}\right|_0^h} = \frac{\frac{h^2}{2} - \frac{h^2}{3}}{h - \frac{h}{2}} = \frac{\frac{h^2}{6}}{\frac{h}{2}} = \frac{h}{3}$$

$$\vec{r}_{cm} = \frac{2}{3}b\,\hat{i} + \frac{h}{3}\hat{j}$$