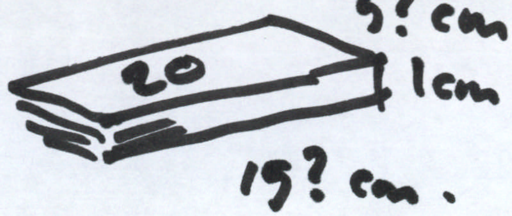
① $\frac{\$2000}{\sim 100\,cm^2}$ ~ density of money: $\frac{\$20}{cm^3} = \frac{\$2\times10^7}{m^3}$ woah.



truck: maybe $10\ m^3$ so $\boxed{\$\,2\times10^8\ !}$

$\frac{\$2000}{30g}$ ~ density of gold. > density of money if paper is $1\ g/cm^3$.

So gold is LESS massive @ fixed value.

---

② $F = ma \rightarrow kg\ m\ s^{-2}$

$\rho \rightarrow kg\ m^{-3}$

need a v^2

$F = \rho A v^2$ $\boxed{P = Fv = \rho A v^3}$

$F = mg$ $\boxed{P = Fv = mgV}$

---

③ $\mu \rightarrow kg\ m^{-1} s^{-1}$

need a v^1

$\cancel{v = \rho v}$ $\cancel{F = \rho v}$ $\overbrace{F_\mu = \mu v R}^{\text{viscous force}}$

$\underbrace{mg = \rho R^3 g}_{\text{grav. force.}} = F_g$

$\boxed{v = \frac{\rho R^2 g}{\mu}}$

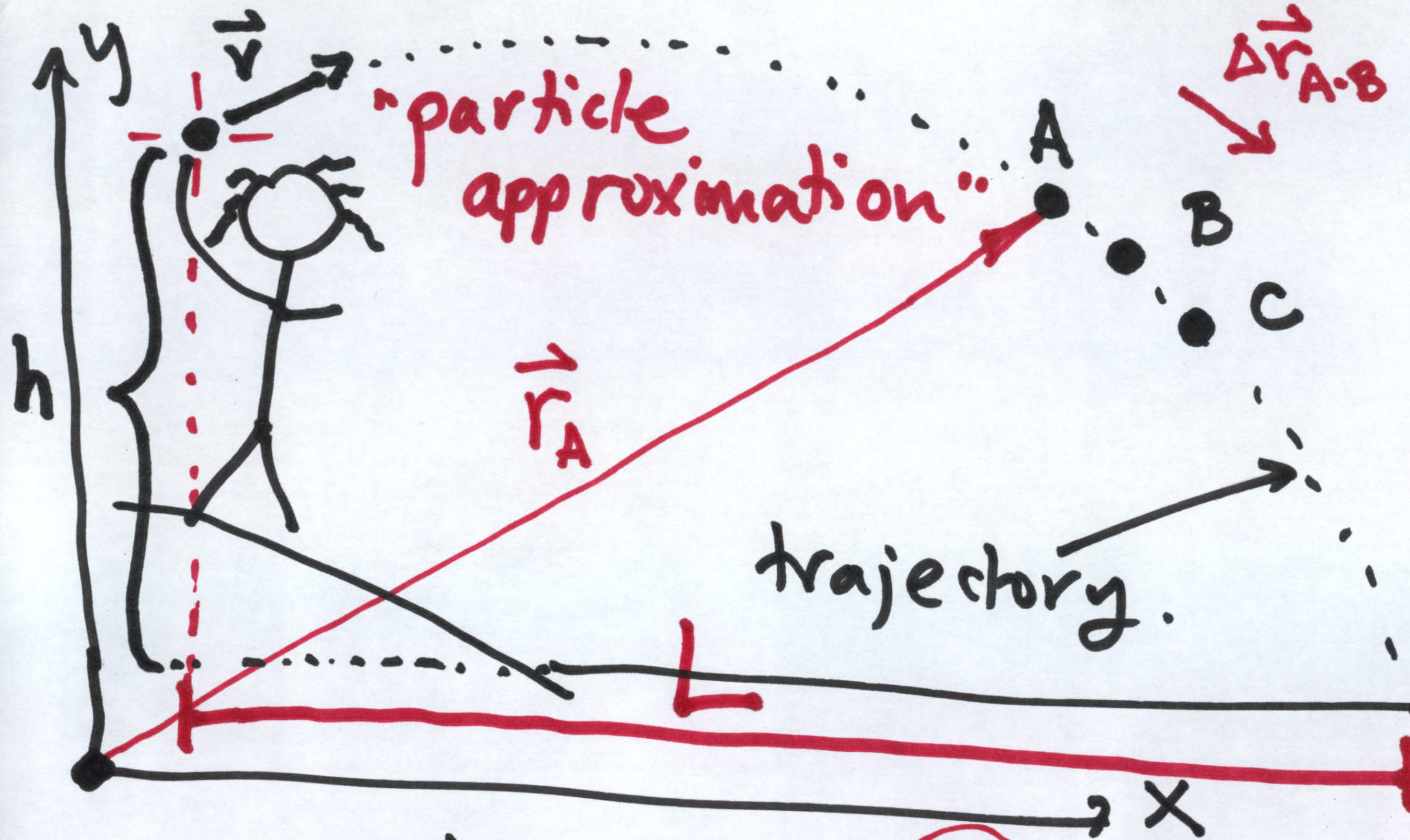
2011-09-13

$F_{air} \sim \rho A v^2$ air

R^2

$F_g \sim mg$

R^3



How far did she throw?

$$\vec{V}_A = \frac{d\vec{r}}{dt}\bigg|_A = \lim_{\Delta t \to 0} \frac{\Delta\vec{r}}{\Delta t}$$

vector difference (m)

scalar difference (s)

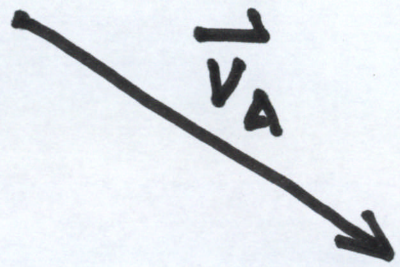
$$\vec{V} = \frac{d}{dt}\vec{r}$$

vector

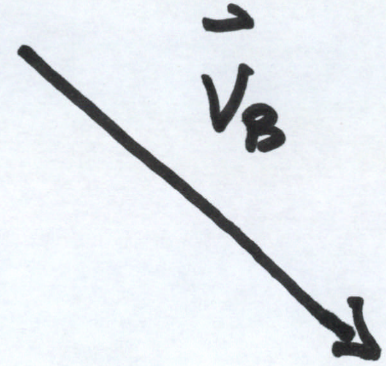
operator.

$$\vec{V} = \lim_{\Delta t \to 0} \frac{1}{\Delta t} \cdot \Delta\vec{r}$$

@ A:

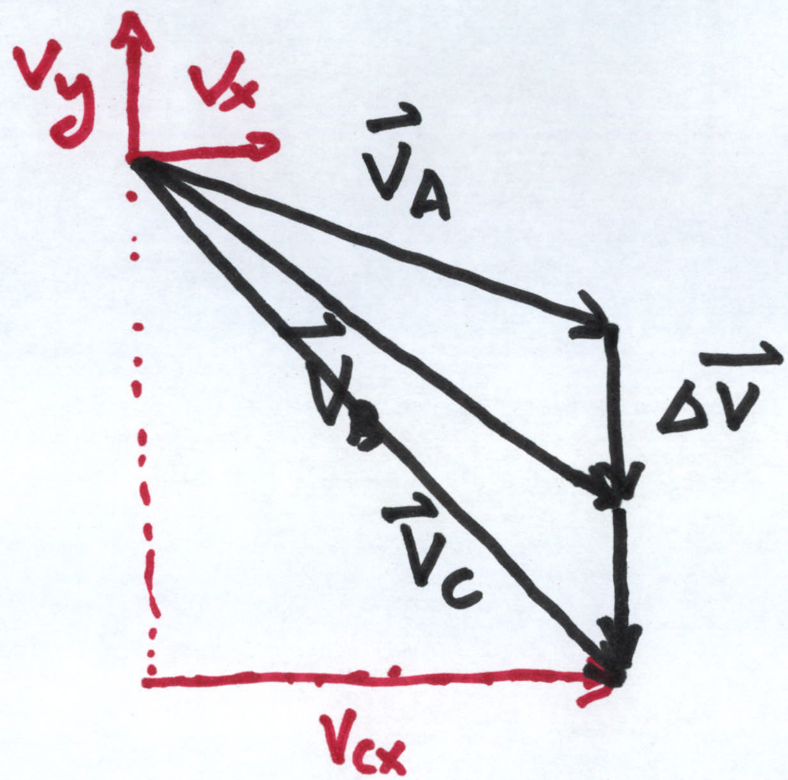


@ B:



$$\vec{a} = \lim_{\Delta t \to 0} \frac{1}{\Delta t} \Delta\vec{V}$$

$$\vec{V}_B - \vec{V}_A \equiv \Delta\vec{V}$$



x-component : $a_x = 0$

$v_x = \int 0 \, dt = 0 + v_{x0}$ velocity @ $t=0$

$x = \int v_{x0} \, dt = v_{x0} t + x_0$ position @ $t=0$

$\cancel{\vec{v} = d}$ $\vec{a} = \frac{d\vec{v}}{dt}$

$\vec{v} = \int \vec{a} \, dt$

$\vec{v} = \frac{d\vec{r}}{dt}$

$\vec{r} = \int \vec{v} \, dt$

y-component: $a_y = -g = -9.8 \, ms^{-2}$

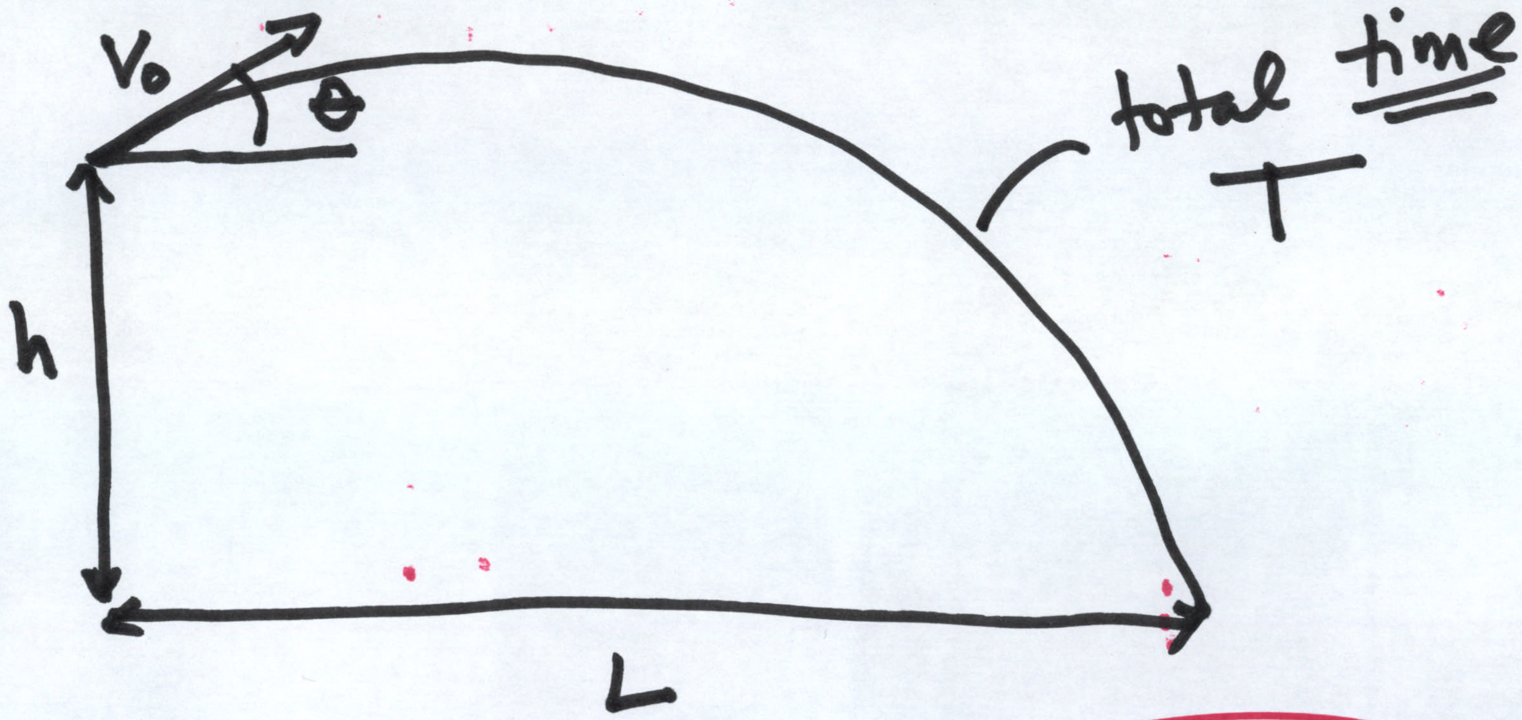
$v_y = \int a_y \, dt = \int -g \, dt = -gt + v_{y0}$ velocity @ $t=0$

$y = \int v_y \, dt = \int -gt \, dt + \int v_{y0} \, dt = -\frac{1}{2}gt^2 + v_{y0}t + y_0$

$\vec{r} = x\hat{i} + y\hat{j} = [x_0 + v_{x0}t]\hat{i} + [y_0 + v_{y0}t - \frac{1}{2}gt^2]\hat{j}$

$\vec{v} = [v_{x0}]\hat{i} + [v_{y0} - gt]\hat{j}$

$$\vec{a} = [0]\,\hat{i} + [-g]\,\hat{j} = -g\hat{j}$$



$L = v_{x_0} T$

this will get L.

$y(T) = y_0 - h$

this will get T