

# Physics 113 - September 12, 2013

- ◆ P.S. 2 due tomorrow → noon
- ◆ Handing back Prob. Sets
- ◆ TA office hours
- ◆ Workshops Next week
  - ↳ • your expectations
  - What to do if your section does not work for you.
- ◆ SPS Tutoring M-Th 7-9 pm PAS Library Starts 9/15

Last time -

Always True

$$x - x_0 = \int_{t_0}^t v dt$$

$$v - v_0 = \int_{t_0}^t a dt$$

is F CONSTANT? F=ma

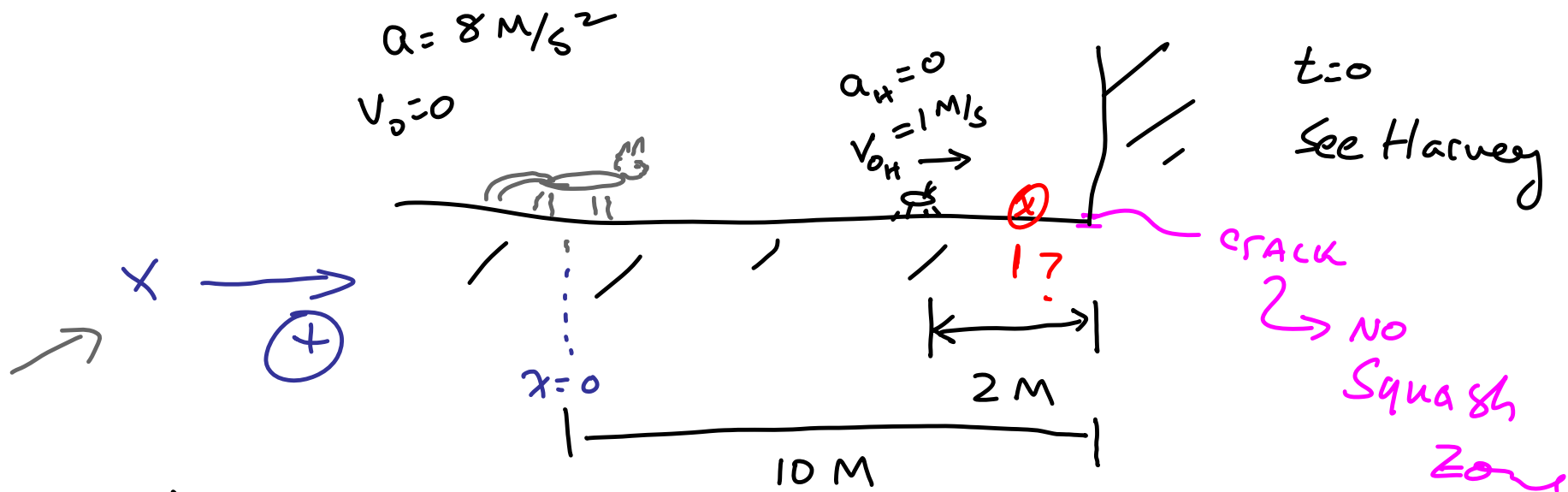
Assumes a=CONSTANT  
this form also Assumes  $t_0=0$

$$v = v_0 + at$$
$$x = x_0 + v_0 t + \frac{1}{2} at^2$$

Constant Acceleration Equations

$$x = x_0 + \left( \frac{v + v_0}{2} \right) t$$
$$v^2 = v_0^2 + 2a(x - x_0)$$

form may vary slightly ... easily understood if you take the trouble to understand the eqns and their origin



(a) does Harvey live to see another day?

Time of Harvey to wall

$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

$$+10 \text{ M} = +8 \text{ M} + (1 \text{ m/s}) t$$

$$t = \frac{10 - 8}{1} = 2 \text{ s}$$

Time of cat to wall

$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

$10 \text{ m}$        $0$        $0$        $8 \text{ m/s}^2$



$$10 = \frac{1}{2} 8 t^2$$

$$t = 1.6 \text{ s}$$

(b) where is the bug spot on rug?

$$x_H = x_{0H} + v_{0H} t_H + \frac{1}{2} a_H t_H^2$$

$8$        $1 \text{ m/s}$        $a=0$

$$x_H = 8 + t_H$$

$t_{\text{cat}} \equiv$  Time for cat to get to the spot

$$x_{\text{cat final}} = \cancel{x_0} + \cancel{V_0 t} + \frac{1}{2} a_{\text{cat}} t^2$$

$\downarrow$  0       $\downarrow$  0       $\uparrow$  ?       $\downarrow$   $8 \text{ m/s}^2$        $\uparrow$  (?)

Problem  $\rightarrow$

$$x_s = x_{\text{cat final}} \equiv x$$

$$t_{\text{horv}} = t_{\text{cat}} \equiv t$$

$$\left\{ \begin{array}{l} x = 8 + t \\ x = \frac{8}{2} t^2 \end{array} \right.$$

2 eqns

2 unknowns

$$\frac{8}{2} t^2 = 8 + t$$

$$t^2 - \frac{1}{4}t - 2 = 0$$

$$Ax^2 + Bx + C = 0 \rightsquigarrow$$

$$x = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}$$

$$t = 1.54 \text{ s} \quad \text{or} \quad t = -1.3 \text{ s}$$

obviously  
correct one

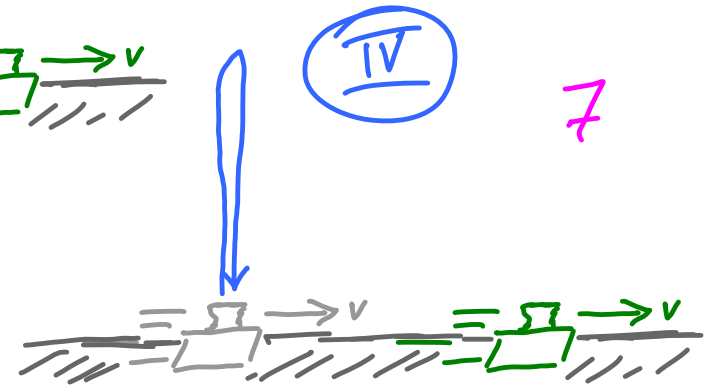
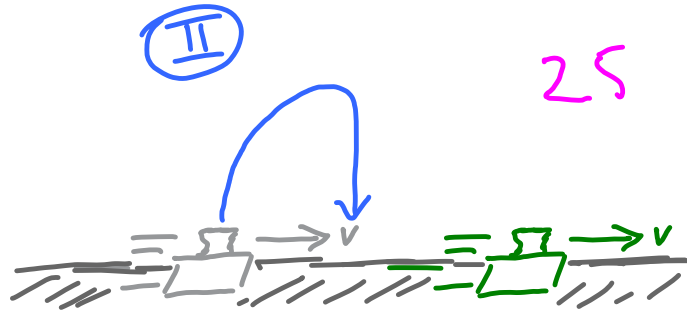
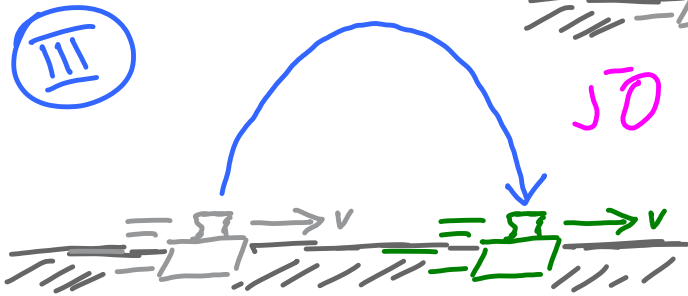
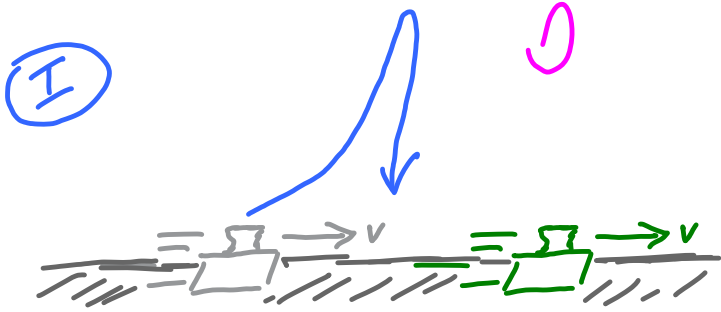
2<sup>ND</sup> root makes  
no physical  
sense

$$x = 8 + t = 8 + 1.54$$

$$x_{\text{Harvey is}} = 9.54 \text{ m}$$

sprayed

What path will ball take as  
Cart moves from "launch" point  
to "end" point (when ball returns  
to cart level)?



25

50

7

Scalar  $\rightsquigarrow$  #'s

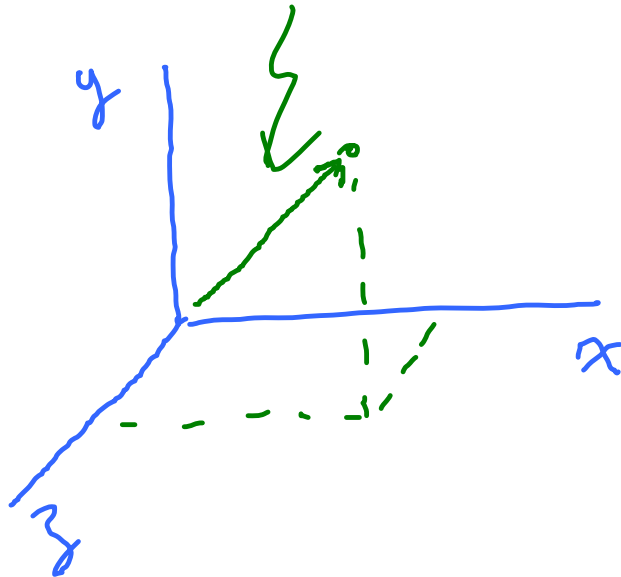
Magnitude

in 1d problem

direction given by

Algebraic sign

Vector



direction and magnitude

point  $(x, y, z)$



$\vec{A} \equiv \text{vector} \equiv (x, y, z)$