Physics 113 - September 18, 2012

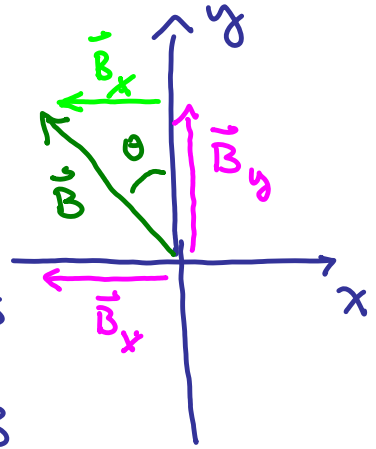
- Possible issue w/ "late" P.S. 1 - Will get back to you...
- Next week (sept. 25 and 27)
  - No lecture in Hoyt either day
  - Slides (w/ more details than usual) and audio will be posted
  - I will assume you went thru both lectures
  - P.S. 4 - Hand in at locker + B+L
  - Workshops run normally
  - Email w/ questions

- Exam I two weeks from Thursday (8 am here)
  - Material covered thru next week's P.S. (4) and workshop
  - Will tell you lectures covered next week
  - Past exams available online (w/ + w/out solns)
  - Calculator
  - 1 side 8.5 x 11 inch paper + EXAM comes w/ formsheet
  - Will set up Q + A session day or two before Exam.

Last Time

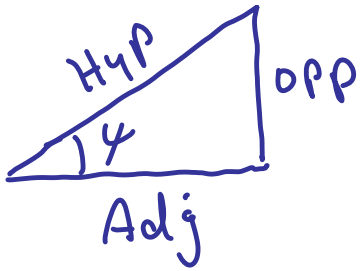
Breaking vector $\vec{B}$ into components

"Resolving" vector B



$B_y = B\cos\theta$

$B_x = B\sin\theta$

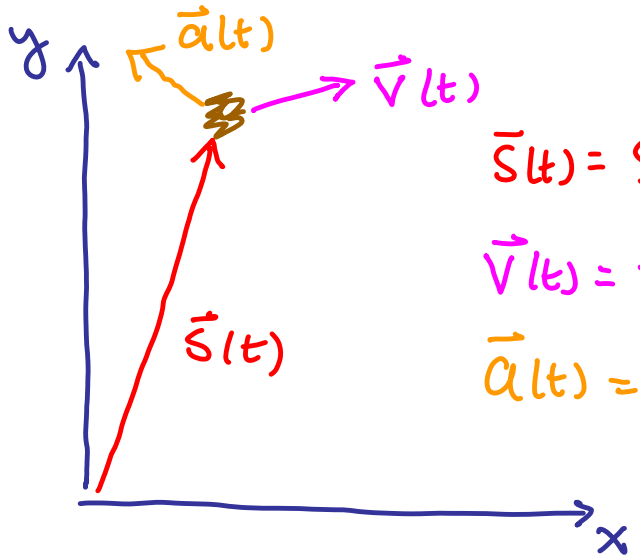


$$\sin\psi = \frac{opp}{hyp}$$

$$\cos\psi = \frac{Adj}{hyp}$$

$$\tan\psi = \frac{opp}{Adj}$$

For multidimensional problems, resolve vectors along axes, combine along each dimension (TAKE sign/direction into account), recombine



$$\vec{s}(t) = s_x\hat{i} + s_y\hat{j} + s_z\hat{k}$$

$$\vec{v}(t) = v_x\hat{i} + v_y\hat{j} + v_z\hat{k}$$

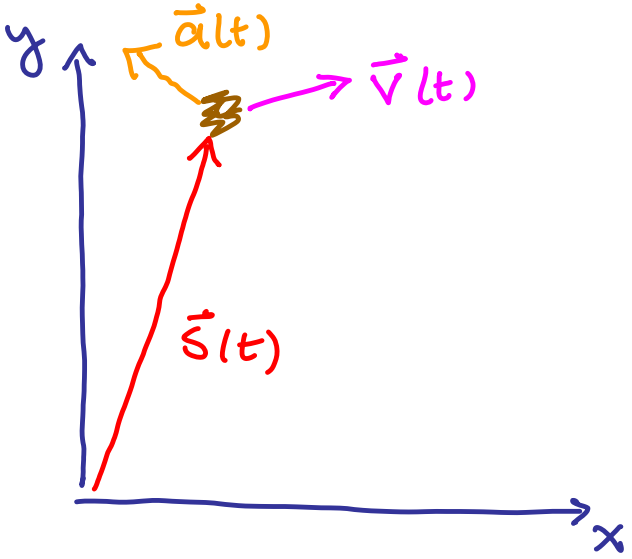
$$\vec{a}(t) = a_x\hat{i} + a_y\hat{j} + a_z\hat{k}$$

General 3-d motion:

$\vec{s}(t), \vec{v}(t), \vec{a}(t)$ are related

Resove components of vectors along chosen axes

Solve 3 1-d problems simultaneously



$$\vec{s}(t) = s_x \hat{i} + s_y \hat{j} + s_z \hat{k}$$

$$\vec{v}(t) = \frac{ds_x}{dt}\hat{i} + \frac{ds_y}{dt}\hat{j} + \frac{ds_z}{dt}\hat{k}$$

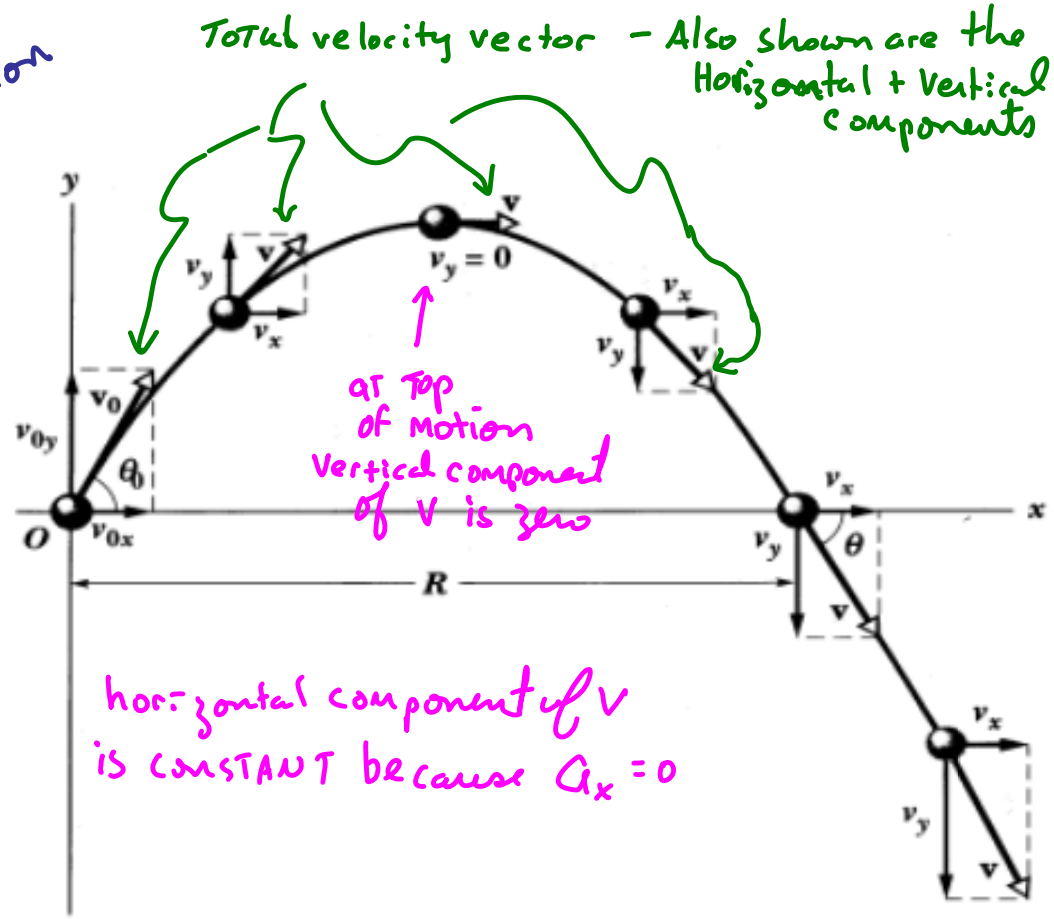
$$v_x \qquad v_y \qquad v_z$$

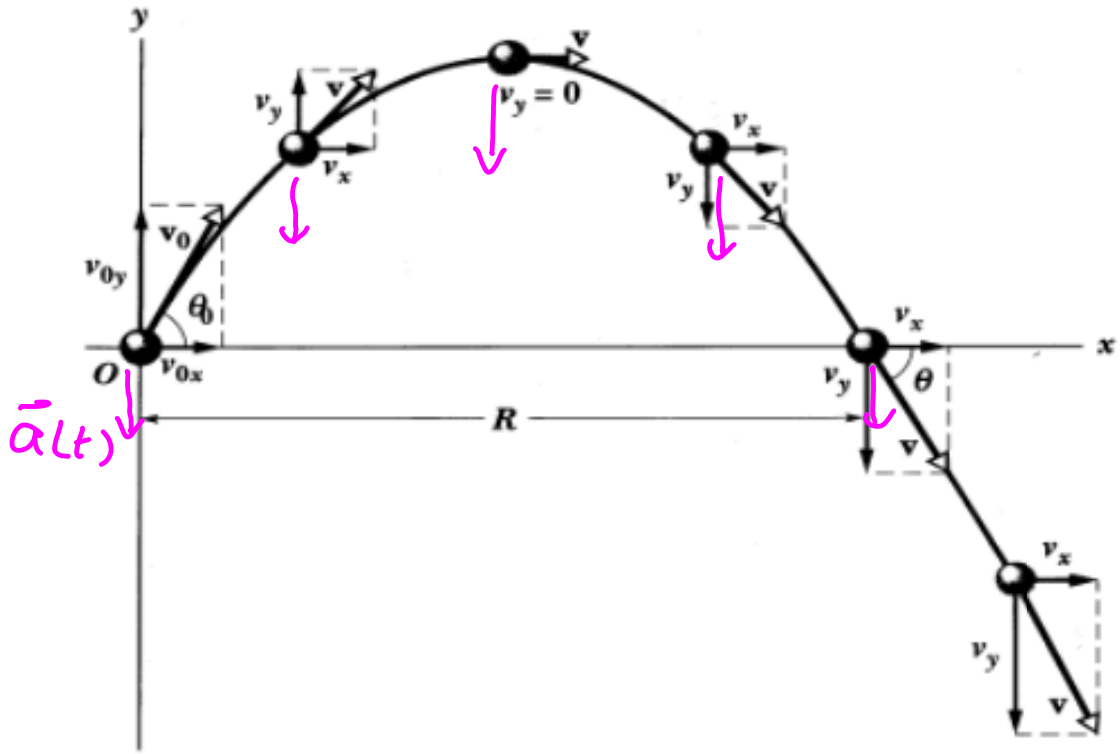
$$\vec{a}(t) = \frac{d^2 s_x}{dt^2}\hat{i} + \frac{d^2 s_y}{dt^2}\hat{j} + \frac{d^2 s_z}{dt^2}\hat{k}$$

$$\overset{\text{or}}{=}$$

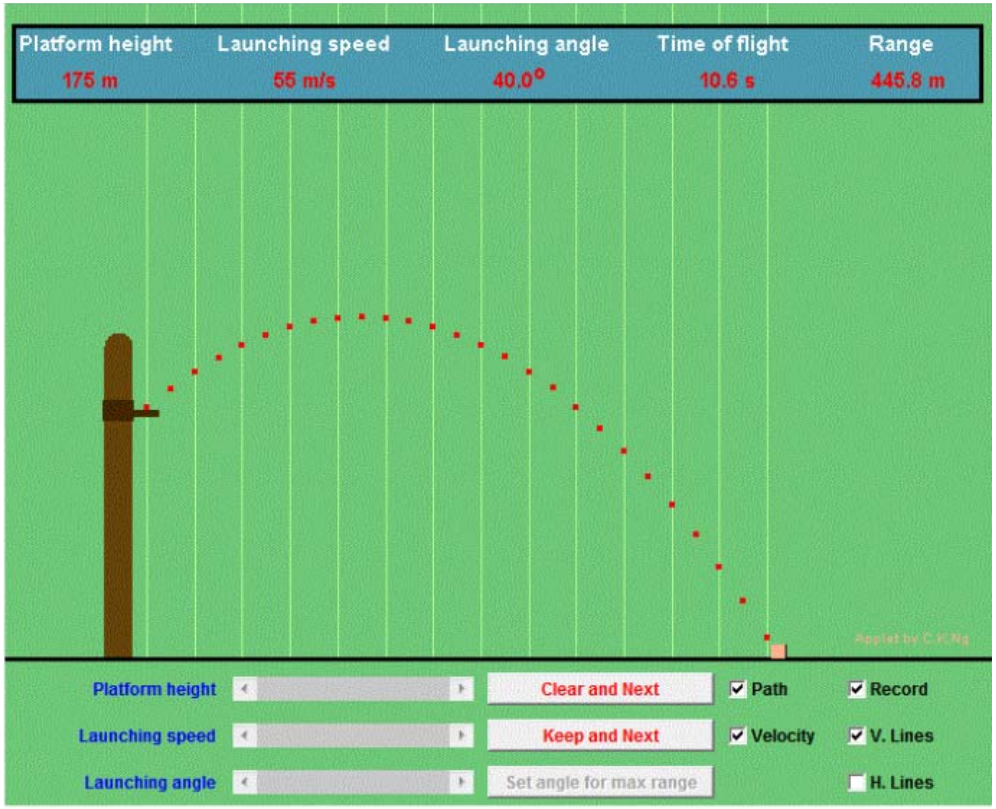
$$\vec{a}(t) = \frac{dv_x}{dt}\hat{i} + \frac{dv_y}{dt}\hat{j} + \frac{dv_z}{dt}\hat{k}$$

Projectile Motion




y
x
O
$\mathbf{v}_0$
v_{0y}
v_{0x}
θ_0
θ
R
$\vec{a}(t)$
$v_y = 0$
v_x
v_y
$\mathbf{v}$

http://ngsir.netfirms.com/englishhtm/ThrowABall.htm



Projectile motion

Monkey hangs from branch. It drops at the moment you pull the trigger. Where should you aim.

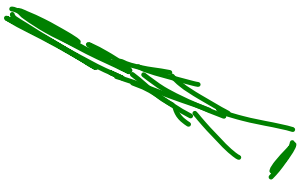
MONKEY
NOT
ANATOMICALLY
CORRECT

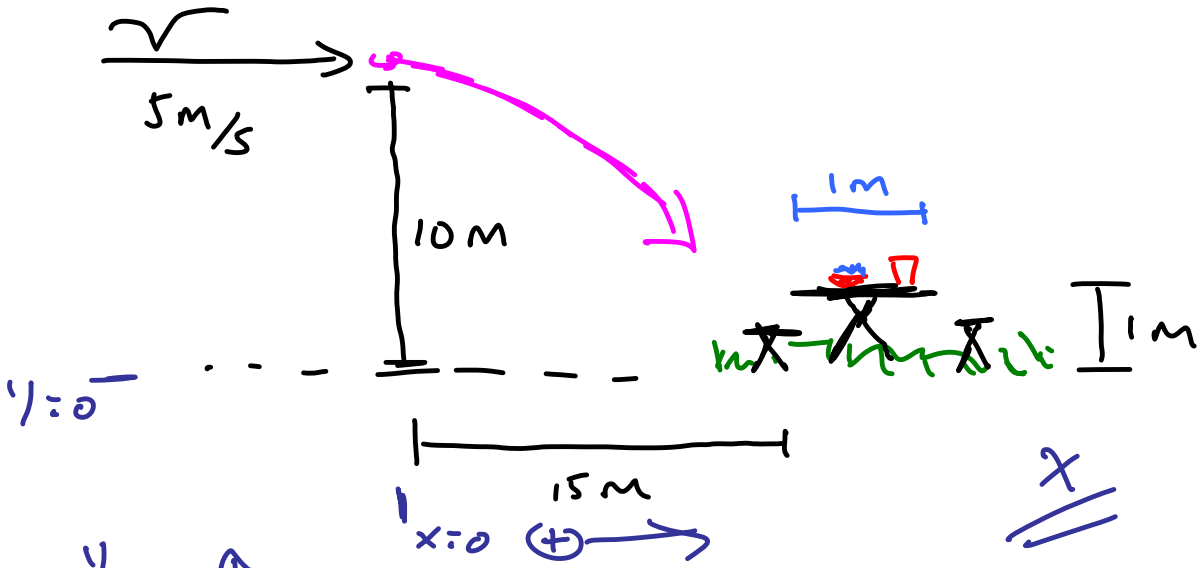
X A III

X B II

X C I

X D IV





Does bird ruin Picnic

y ⊕↑

$a_y = -9.8\ m/s^2$

$V_{oy} = 0$

$y_o = +10\ m$

$y = +1\ m$

x =

$a_x = 0$

$V_{ox} = 5\ m/s$

$x_o = 0$

x ?

if x bel 15 + 16 m the table gets hit

$y = y_0 + v_{0y} t + \frac{1}{2} a t^2$

$1\,m = 10\,m + 0 - \frac{1}{2}\, 9.8\, t^2$

$t = \sqrt{\frac{18}{9.8}}$ $\quad t = 1.4\,s$

$x = x_0 + v_{0x} t + \frac{1}{2} a_x t^2$ ($x_0 \to 0$, $\frac{1}{2} a_x t^2 \to 0$)

$x = v_{0x} t$

$x = (5\,m/s)(1.4\,s)$

$x = 7\,m$

TABLE IS NOT HIT

in units of Newtons

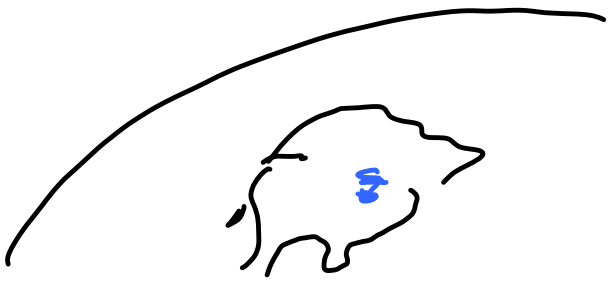
$\vec{F} = m\vec{a}$ Newton's 2ND Law

m = inertial mass

Force of Gravitation

CONSTANT

$$|\vec{F}| = G\frac{m_1 m_2}{r^2}$$

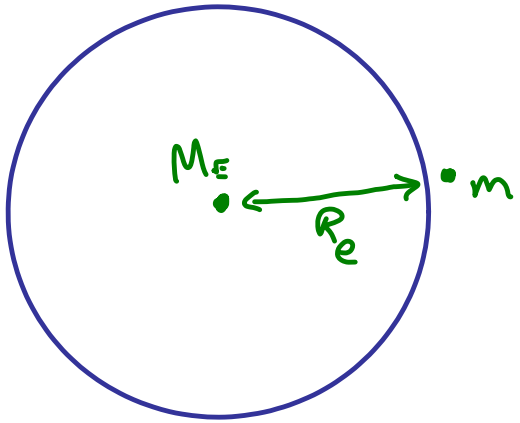


Special case — near surface of earth

$R_{earth} = 6.38 \times 10^6 \text{ m}$

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

$M_{earth} = 5.97 \times 10^{24} \text{ kg}$



$|\vec{F}| = \frac{G M_E m}{R_E^2}$

$|\vec{F}| = m|\vec{a}|$

$g = 9.8 \text{ m/s}^2$

Weight $\equiv$ magnitude of force of grav. due to Earth's gravitational attraction near surface of earth

$= |\vec{F}| = mg$

on Moon Weight $= m\left(\frac{GM_{moon}}{r_{moon}^2}\right)$

$\sim m\left(\frac{1}{6}g\right)$

Systems (of units)	Force	Mass	Accel
MKS	Newton	kg	m/s^2
cgs	dynes	gram	cm/s^2
English	pound	Slugs	ft/s^2

$g = 32\ ft/s^2$