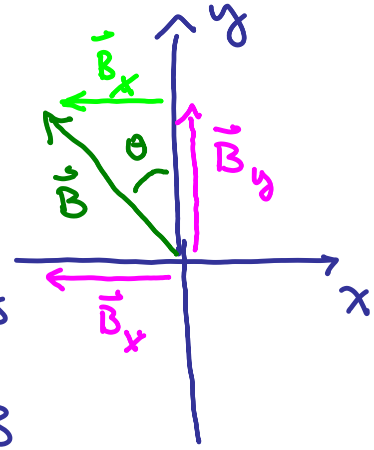
Physics 113 – September 19, 2013

Do Time interval of fall demo

Last Time

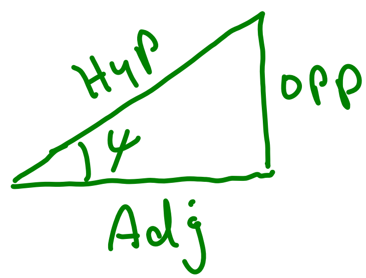
Breaking vector $\vec{B}$ into components

"Resolving" vector B



$B_y = B\cos\theta$

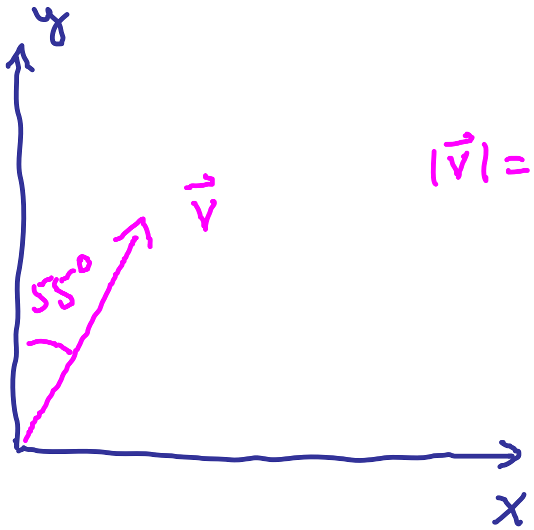
$B_x = B\sin\theta$



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

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

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



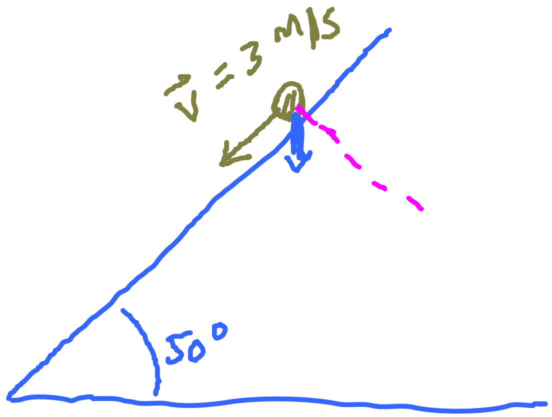
What is the horizontal component of the velocity?

I 3 m/s in +x direction

II 3 sin 55° in +x direction

III 0 m/s

IV 3 cos 55° in +x direction



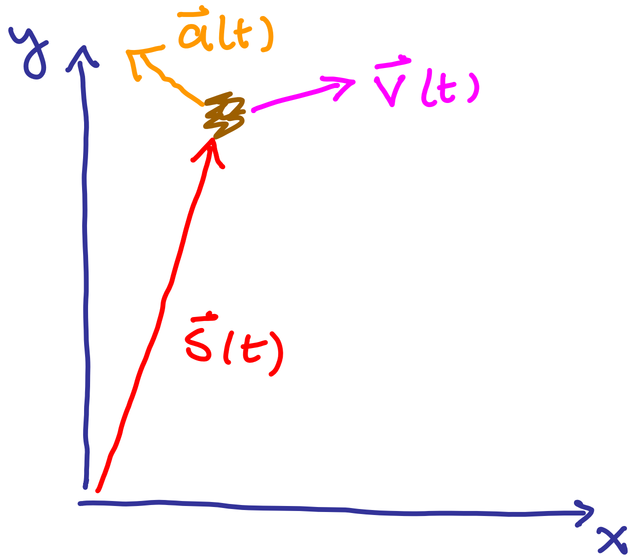
what is speed with which ball drops toward the ground?

I $3 \cos 50$ m/s 1

II 3 m/s 3

III $3 \sin 50$ m/s MOST

IV 0 m/s



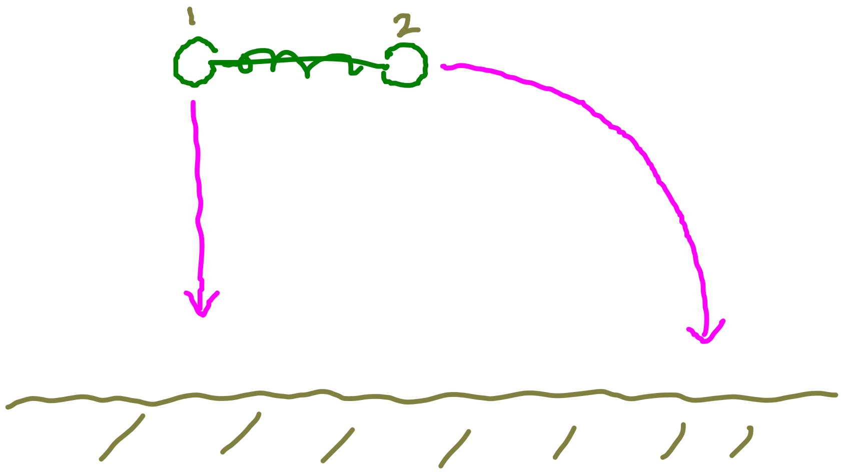
$$\vec{s}(t) = s_x\hat{i} + s_y\hat{j} + s_z\hat{k}$$

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

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

or

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

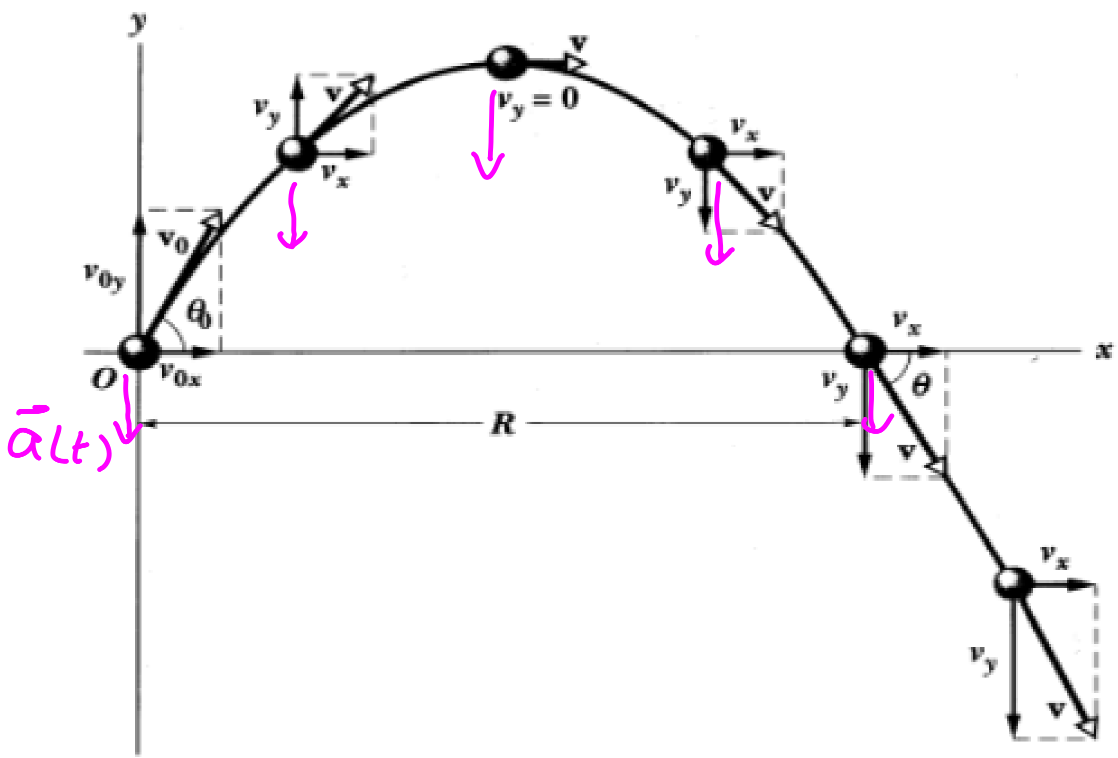


Which ball hits the ground 1ST ?

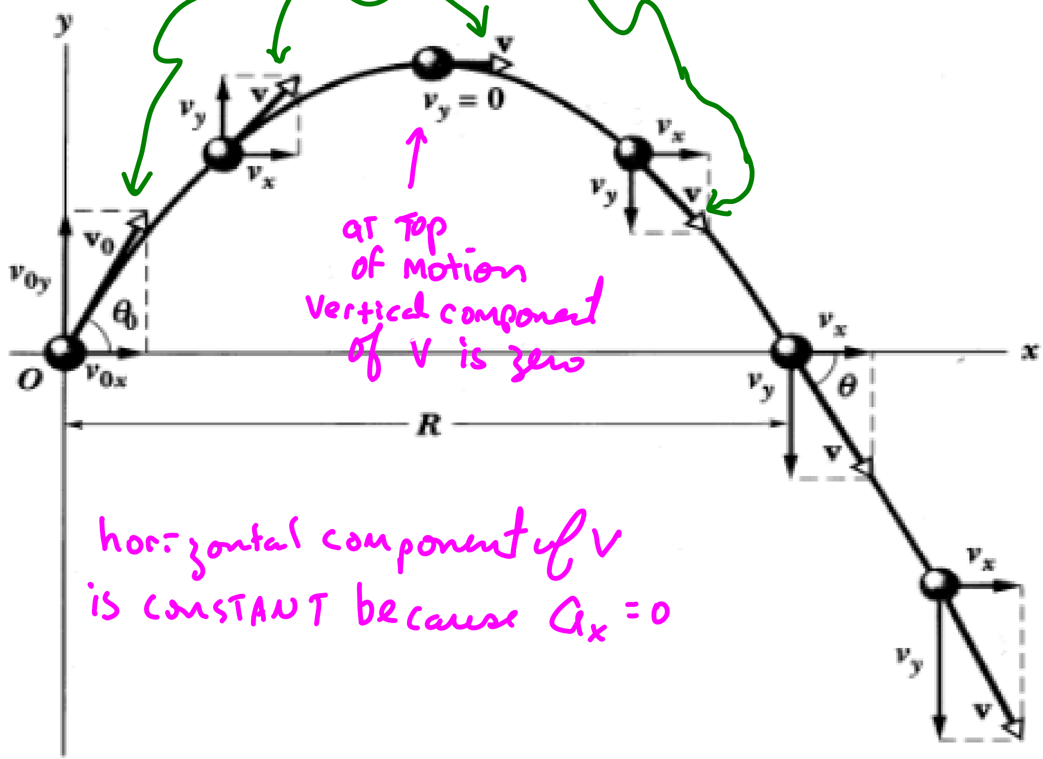
I 1 hits ground before 2

II 2 hits ground before 1

III 1 and 2 hit ground at same time


y
x
O
v
$v_y = 0$
v_y
v_x
v_0
v_{0y}
v_{0x}
θ_0
θ
R
$\vec{a}(t)$

Projectile Motion

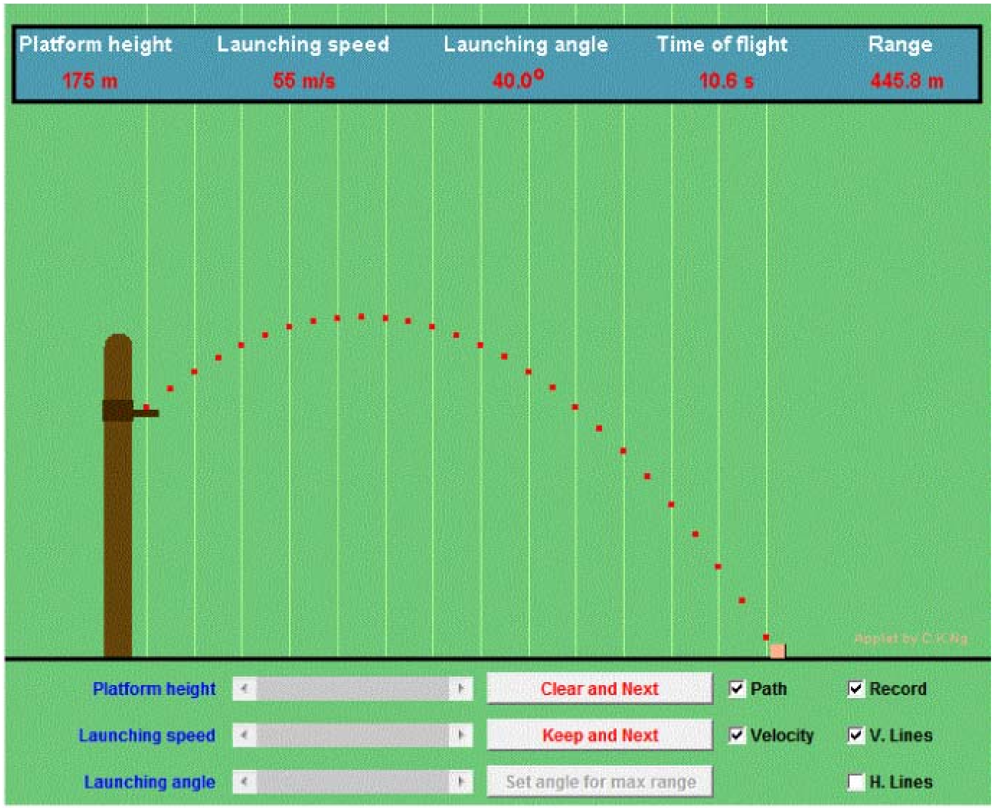


Total velocity vector - Also shown are the Horizontal + Vertical components

at top of motion vertical component of v is zero

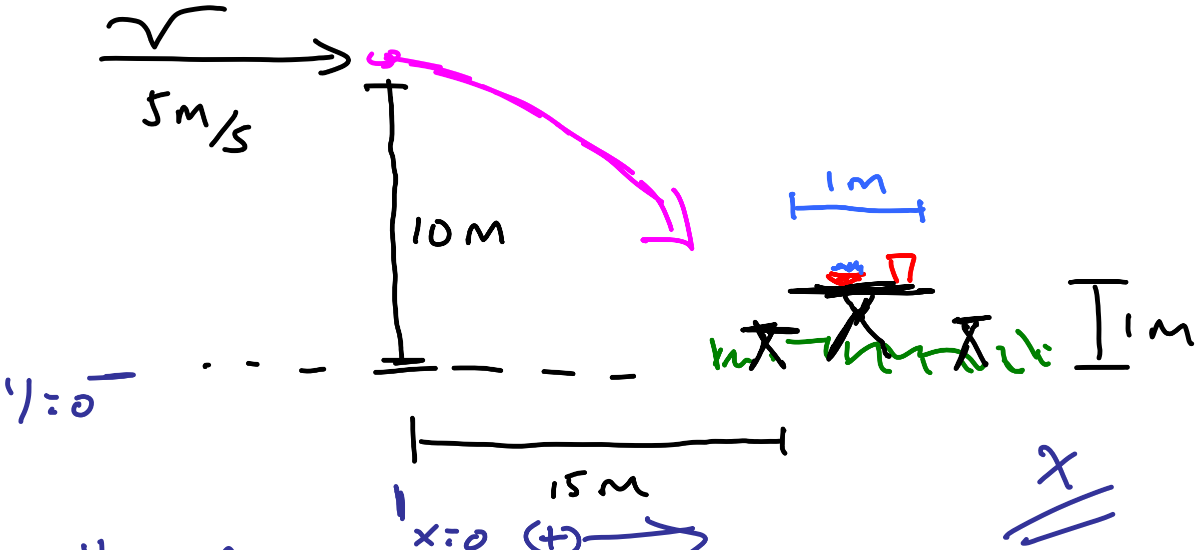
horizontal component of v is constant because $a_x = 0$

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



Projectile motion

Does bird ruin Picnic



y ⊕ ↑

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

$V_{oy} = 0$

$y_o = +10\ m$

$y = +1\ m$

x

$a_x = 0$

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

$x_o = 0$

$x \stackrel{?}{=}$

if x bel 15 + 16 m the table gets hit

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

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

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

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

$$x = 5\,m/s\; t = 7\,m$$

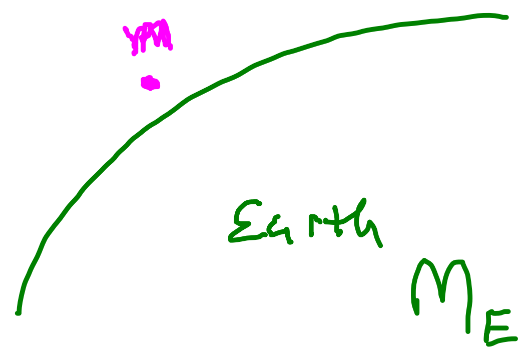
$1.4\,s$

Newton's 2^{ND} law

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

CONSTANT

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

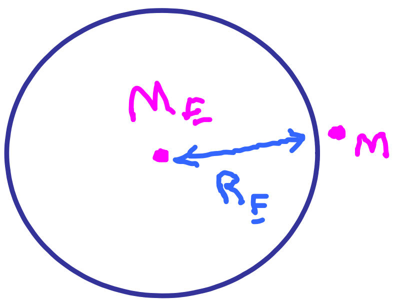


$R_E = 6.38 \times 10^6$ m

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

$M_E = 5.97 \times 10^{24}$ kg

$$|\vec{F}| = \frac{G M_1 M_2}{r^2}$$



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

acceleration due to grav at surf of Earth

$F = ma$

$\equiv g \equiv 9.8$ m/s²

Weight ≡ magnitude of force of grav. due to Earth's grav. attraction near surf. of Earth

$F = mg$ — weight — Force

units Newtons (MKS)

English

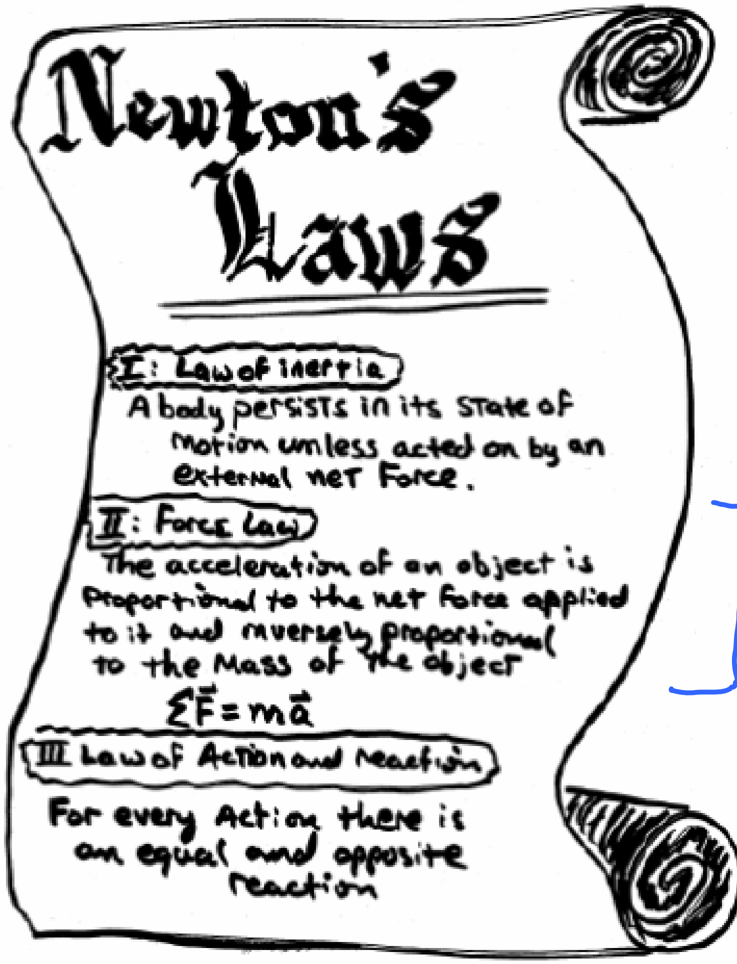
Force lb

mass slug

on Moon

$$\text{Weight} = m \frac{G M_{moon}}{R_{moon}^2}$$

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



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

$$\Sigma F_x = m a_x$$

$$\Sigma F_y = m a_y$$

$$\Sigma F_z = m a_z$$