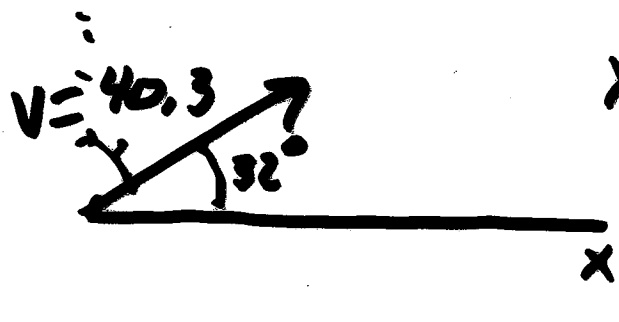


Golfer hits a ball with an initial speed of 40.3 m/s at an angle of  $32.0^\circ$  from the horizontal

a) How far does the ball go and how long is it in the air?

b) What is the speed when it hits the ground?



X:  $V_{ox}$   
 $= V \cos 32^\circ$   
 $= 40.3 \text{ m/s} \cdot \cos 32^\circ =$

Y:  $V_{oy} = V \sin 32^\circ$   
 $= 40.3 \text{ m/s} \cdot \sin 32^\circ$   
 $= \underline{21.4 \text{ m/s}}$

34.2 m/s

$$X = X_0 + V_{ox} t$$

$$V_y = V_{oy} - gt \quad V_y = 0 \text{ at peak}$$

$$0 = V_{oy} - gt \Rightarrow t = \frac{V_{oy}}{g} \quad t \uparrow + t \downarrow$$

$$t = \frac{2 \cdot 21.4 \text{ m/s}}{g} = \boxed{4.37 \text{ s}}$$

$$x = v_{0x}t = 34.2 \text{ m/s} \cdot 4.375 \\ = \underline{149 \text{ m}}$$

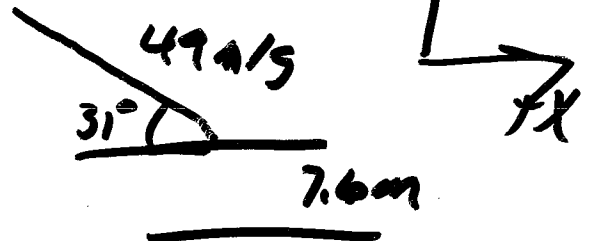
$$v_x = v_{0x} = 34.2 \text{ m/s}$$

$$v_y = v_{0y} - gt \\ = 21.4 \text{ m/s} - (9.8 \text{ m/s}^2)(4.375) \\ = \underline{-21.4 \text{ m/s}}$$

$$\text{speed} = \sqrt{(34.2 \text{ m/s})^2 + (-21.4 \text{ m/s})^2} \\ = \underline{40.3 \text{ m/s}}$$

Baseball player hits a ball and it lands in the seats 7.6 m above the point where ball was hit. It lands with a velocity of 49 m/s at an angle of  $31^\circ$  to the horizontal.

- a) what is initial velocity of ball when it leaves the bat?  $\uparrow$



$$V_x = V \cos 31^\circ = 49 \text{ m/s} \cdot \cos 31^\circ = 42 \text{ m/s}$$

$$V_y = V \sin 31^\circ = 49 \text{ m/s} \cdot \sin 31^\circ = -25 \text{ m/s}$$

$$\checkmark V_x = 42 \text{ m/s}$$

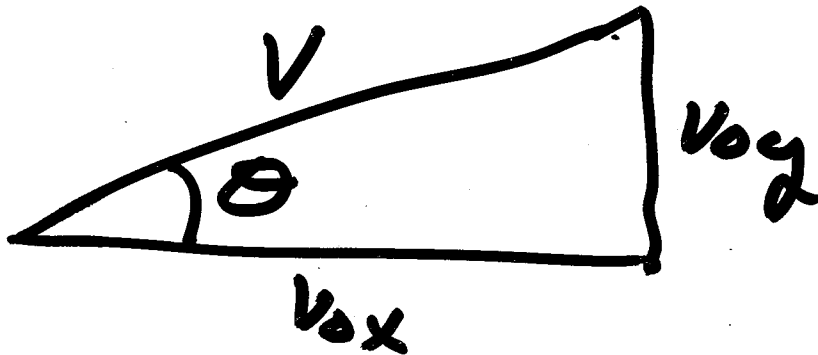
$$V_x^2 = V_y^2 + 2a(y - y_0)$$

$$= (-25 \text{ m/s})^2 - 2 \cdot 9.8 \text{ m/s}^2 (7.6 \text{ m} - 0)$$

$$= \underline{\underline{28 \text{ m/s}}}$$

$$v = \sqrt{v_{ox}^2 + v_{oy}^2}$$

$$= \sqrt{(42 \text{ m/s})^2 + (28 \text{ m/s})^2} = \underline{\underline{50 \text{ m/s}}}$$



$$\tan \theta = \frac{v_{oy}}{v_{ox}}$$

$$\theta = \tan^{-1} \frac{28 \text{ m/s}}{42 \text{ m/s}} = \boxed{34^\circ}$$

ex) A Golfer hits a ball 180 m on level ground at an angle of  $60^\circ$  above the horizontal. What is the initial speed of the ball?



$$V_{0x} = V \cos \theta$$

$$V_y = V_{0y} - gt$$

$$V_{0y} = V \sin \theta$$

$$0 = V_{0y} - gt$$

$$t = \frac{V_{0y}}{g} (2) \quad \text{Total}$$

$$x = x_0 + V_{0x}t$$

$$x = V \cos \theta \cdot t \quad t = \frac{2 \cdot V \sin \theta}{g}$$

$$x = \frac{V \cos \theta \cdot 2 V \sin \theta}{g}$$

$$x = \frac{2 V^2 \cos \theta \sin \theta}{g}$$

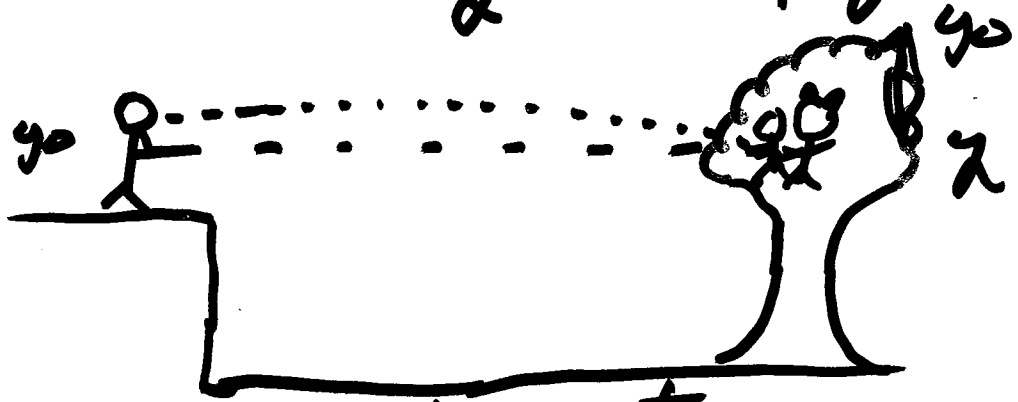
$$2 \cos \theta \sin \theta = \sin 2\theta$$

$$x = 180 \text{ m} \quad x = \frac{V^2 \sin 2\theta}{g} \Rightarrow \boxed{45 \text{ m/s}} = V$$

A hunter shoots at a monkey straight across. Just as hunter shoots, monkey lets go. Did monkey take physics?

A) yes

B) NO



where is monkey at time  $t$

$$y - y_0 = v_{y0} t - \frac{1}{2} g t^2$$

$$\Delta y = -\frac{1}{2} g t^2$$

Bullet at time  $t$

$$y - y_0 = v_{y0} t - \frac{1}{2} g t^2$$

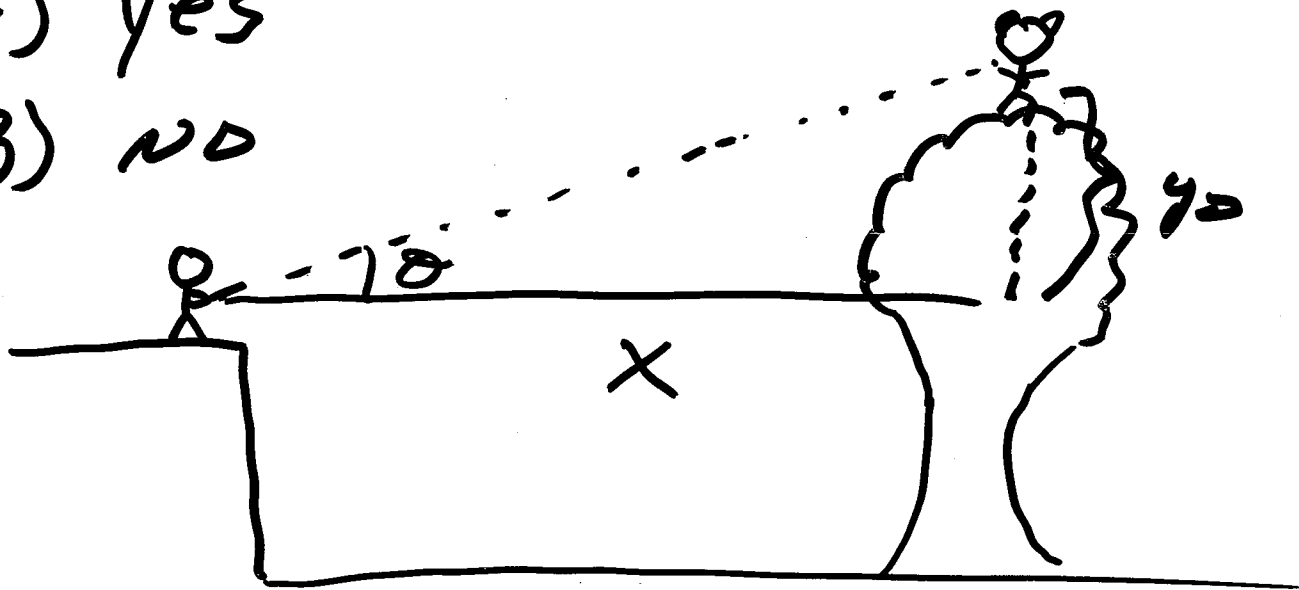
$$\Delta y = -\frac{1}{2} g t^2$$

monkey's uncle is higher up in tree. When hunter shoots, monkey lets go.

Did uncle take physics?

A) yes

B) no



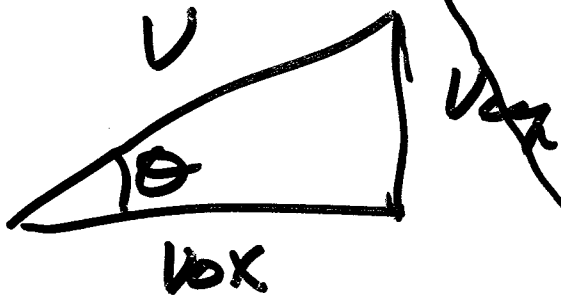
where will monkey be at time  $t$

$$y_m = y_0 - \frac{1}{2} g t^2$$

where is bullet at time  $t$

$$y_b = v_{0y} t - \frac{1}{2} g t^2$$

$$y_b = v \sin \theta \underset{\uparrow}{t} - \frac{1}{2} g t^2$$



$$V_{oy} = V \sin \theta$$

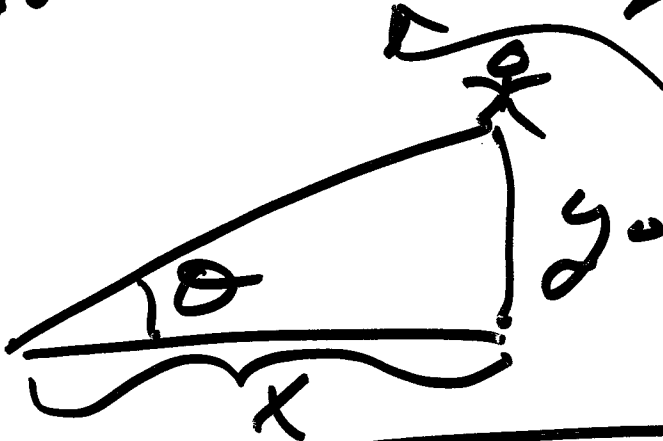
$$V_{ox} = V \cos \theta$$

$$x = V_x t \Rightarrow t = \frac{x}{V_x} = \frac{x}{V \cos \theta} = t$$

$$y_b = V \sin \theta \cdot t - \frac{1}{2} g t^2$$

$$y_b = \frac{V \sin \theta \cdot x}{V \cos \theta} - \frac{1}{2} g t^2$$

$$y_b = x \tan \theta - \frac{1}{2} g t^2$$



$$\tan \theta = \frac{y_0}{x}$$

$$y_0 = x \tan \theta$$

$$y_b = y_0 - \frac{1}{2} g t^2$$

# Exam

Monday in this room  
can begin at 8:00 AM if you  
wish

16 multiple choice questions

1 "FREE"

$\sim \frac{1}{2}$  calculational

$\sim \frac{1}{2}$  concept

mostly chp 2-3

if we talked about it, it  
could be on exam

Hw 3 solutions on class web  
page. Grp 3 solutions also available

★ H.W #2 prob 10

Race car

should be no surprises

vectors

graphs

velocity

acceleration (constant)

falling objects

projectile motion

⋮

Best way to prepare  
understand all notes  
H.W

Do extra problems in back of book

understand ideas

"change problem" slightly. Do you  
know answer?

practice Questions

\* Do not use solutions unless  
absolutely necessary \*

Bring a calculator &  
pen/pencil !!

no books, cell phones, etc...

wait outside room before  
8:00 A.M

each exam has a seat number  
and you should go to that  
seat

if any questions during exam

ASK!

P.S. H.W #3 Due Today