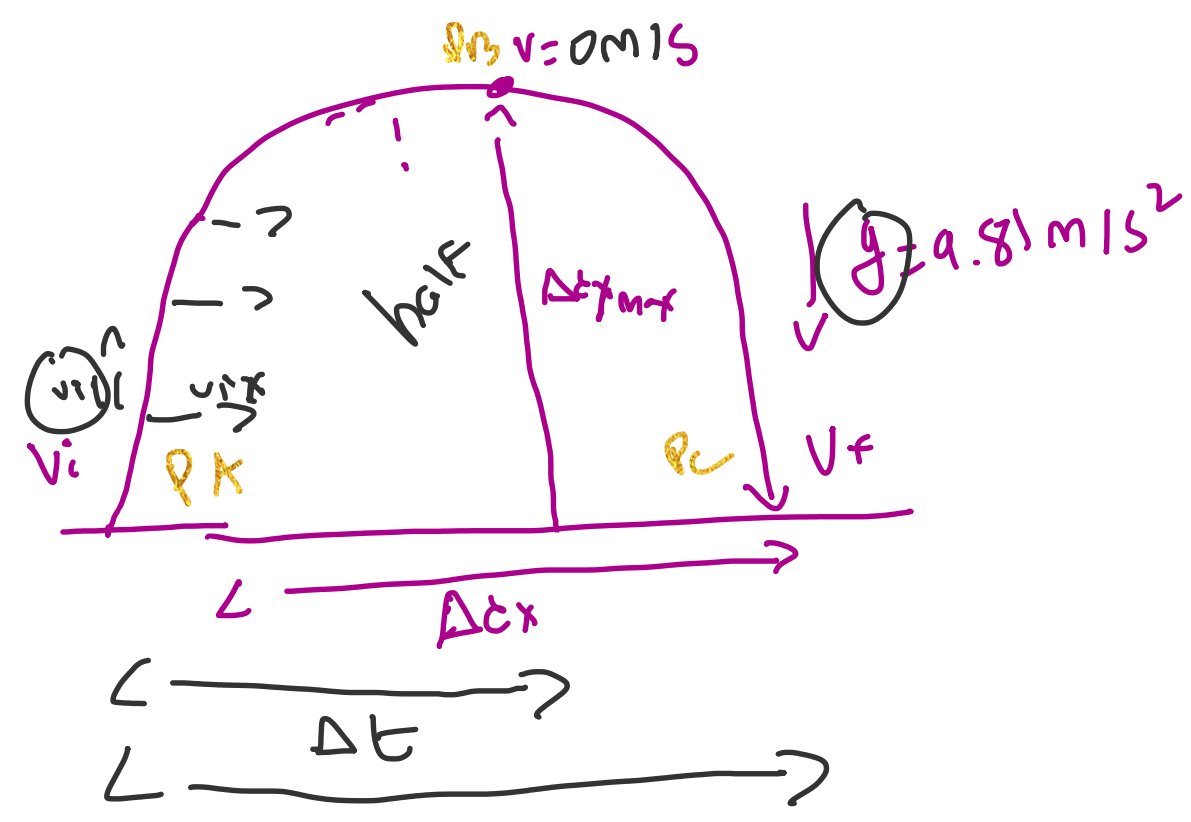


Case 1:



Case Basic Rules:

t to go from PA \rightarrow PB
 $= \frac{v \sin \theta}{g}$ $\leftarrow v_{iy} = \frac{v_{iy}}{g}$ 2
t to go from PA \rightarrow PC
 $= \frac{2v \sin \theta}{g}$

$\Delta y_{max} = \frac{v^2 \sin^2 \theta}{2g}$ \rightarrow Height max $\frac{(v \sin \theta)^2}{2g}$

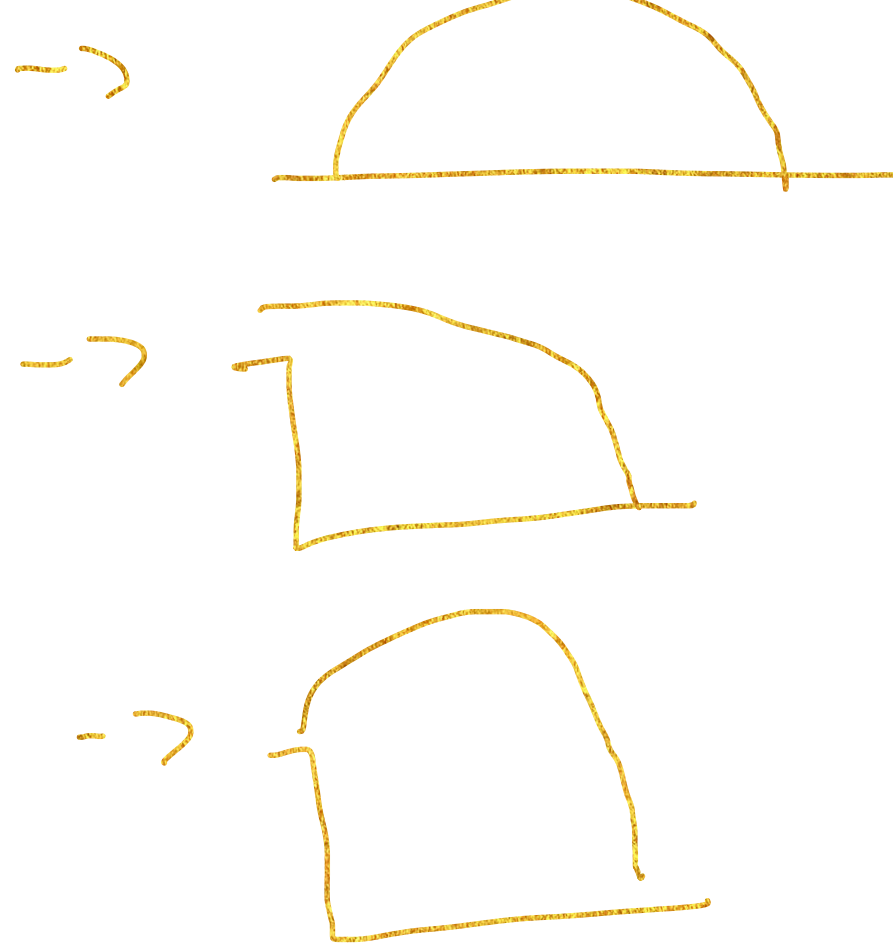
$\Delta x(P) = \frac{v^2 \sin(2\theta)}{g}$

General Rule:

- $\rightarrow v_x$ is constant
 $\therefore v_{ix} = v_{fx}$
- $\rightarrow a_y(g)$ changes v_y but there is no a_x so v_x is constant
- \rightarrow If there is an angle for v

 $\cos \theta = \frac{v_x}{v}$ $\sin \theta = \frac{v_y}{v}$
 $v_x = v \cos \theta$ $v_y = v \sin \theta$

\rightarrow 3 uses of trajectory



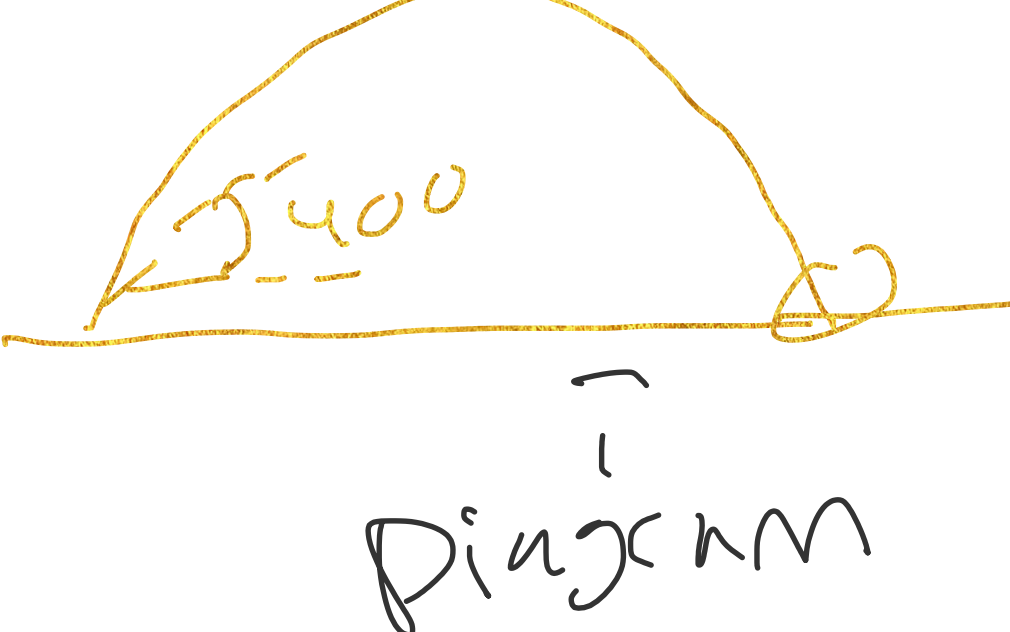
Ex: Soccer player kicks a ball with initial velocity of 25m/s at an angle of 40° above the horizontal. Calculate time of flight and Range

(1) Write Givens/unknowns

Givens: $v_i = 25 \text{ m/s}$ $a_y = 9.81 \text{ m/s}^2$
 $\theta = 40^\circ$

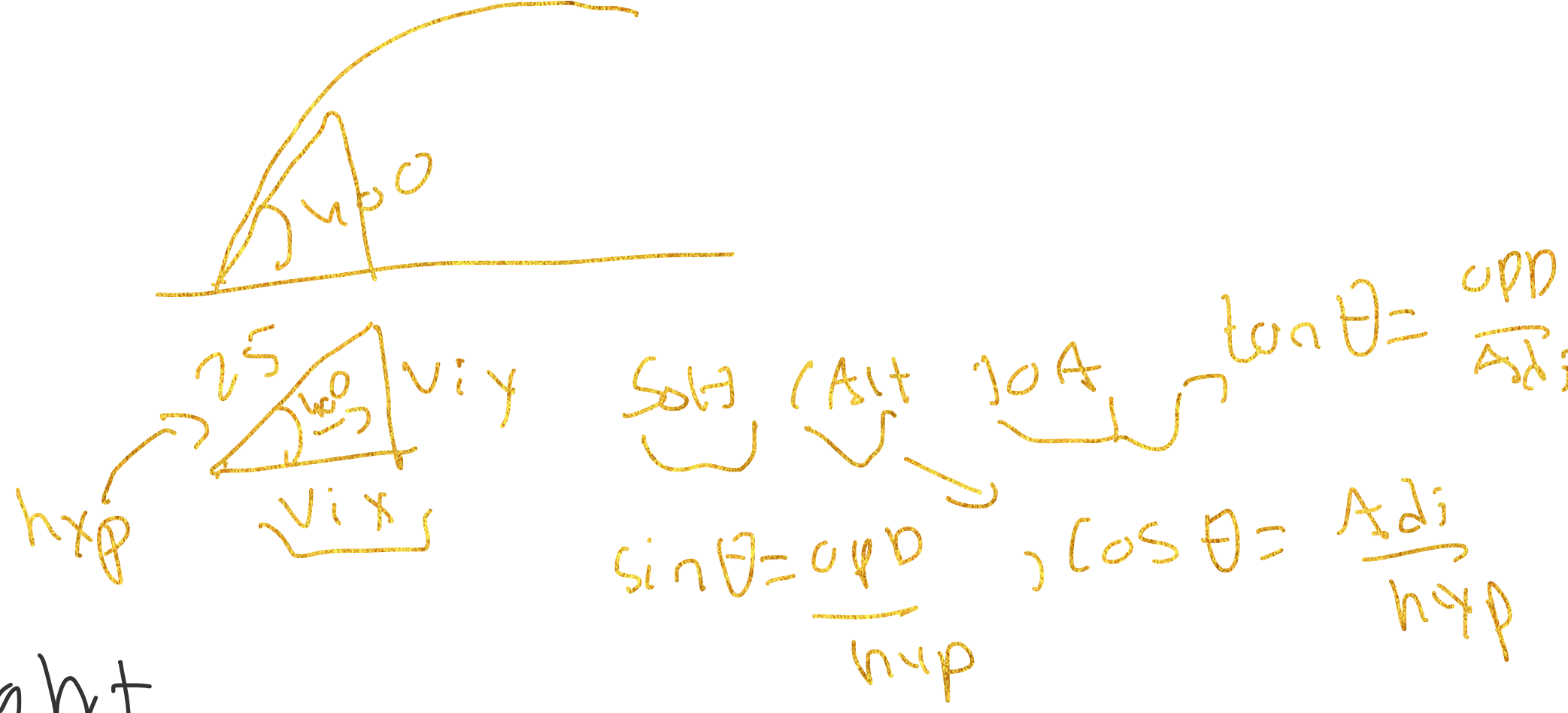
unknowns:

$v_{iy} = ?$ $\Delta t = ?$
 $v_{ix} = ?$ $\Delta x = ?$



(2) Determine Vertical/horizontal components of v_i

$v_{iy} = v \sin \theta \leftarrow$ $v_{ix} = v \cos \theta \leftarrow$
 $= 25 \sin 40$ $= 25 \cos 40$
 $= \underline{16.07 \text{ m/s}}$ $= \underline{19.15 \text{ m/s}}$



(3) Calculate Δt : \leftarrow tot w) time of flight

$\Delta t = \frac{2 v_i \sin \theta}{g}$
 $\Delta t = \frac{2 (25 \sin 40)}{9.81} \leftarrow \Delta t = 3.285 \checkmark$

(4) Calculate Range (Δx)

$\Delta x = \frac{v_i^2 \sin(2\theta)}{g}$
 $= \frac{25^2 \sin(2(40))}{9.81}$
 $= \underline{62.74 \text{ m}}$