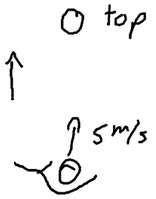
4) I throw a ball into the air at 5 m/s (straight up)
How long until it reaches the top of its flight?

$\Delta y =$
$V_{iy} = +5\ m/s$
$V_{fy} = 0\ m/s$
$a_y = -9.8\ m/s^2$
$\Delta t =$ NEED



initial: right after ball leaves my hand
final: top of its flight

$V_f = V_i + a\Delta t$
$\Delta t = \frac{V_f - V_i}{a}$
$= \frac{0-5}{-9.8} = 0.51s$

- How long does it take to hit your hand again?

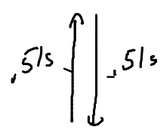
$\Delta y =$
$V_{iy} = 0\ m/s$
$V_{fy} =$
$a_y = -9.8\ m/s^2$
$\Delta t =$ NEED

initial: top of its flight
final: right before it hits my hand

Can't solve this yet, but I could go back & get Δy

Instead,
initial: when ball leaves my hand
$\Delta y = 0m$ ← back where it started
$V_{iy} = +5\ m/s$
$V_{fy} =$
$a_y = -9.8\ m/s^2$
$\Delta t =$ NEED

$\Delta y = V_i \Delta t + \frac{1}{2}a(\Delta t)^2$
$0 = 5\Delta t - 4.9(\Delta t)^2$
$= \Delta t[5 - 4.9\Delta t]$
$\Rightarrow \Delta t = 0,\ \frac{5}{4.9} = 1.02s$



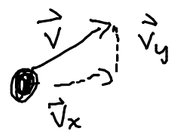
same time up as down

What is V_{fy}?

$V_{fy}^2 = V_{iy}^2 + 2a\Delta y$
$V_{fy}^2 = 25$
$V_{fy} = \pm 5\ m/s$
$V_{fy} = -5\ m/s$

speed is same coming down as going up

Two-Dimensional Motion w/ Constant Acceleration

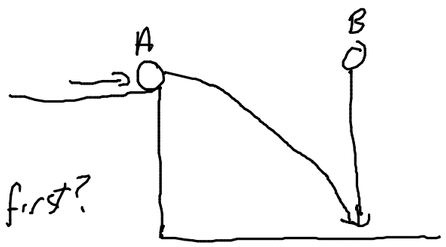


Δx	Δy
v_{ix}	v_{iy}
v_{fx}	v_{fy}
a_x	a_y
Δt	

- 9 unknowns
- 4 independent equations

need 5 of these values

Dimensions are independent



When A leaves the table, B is dropped

eg.

Which hits the ground first?

A) A B) B C) Both at same time

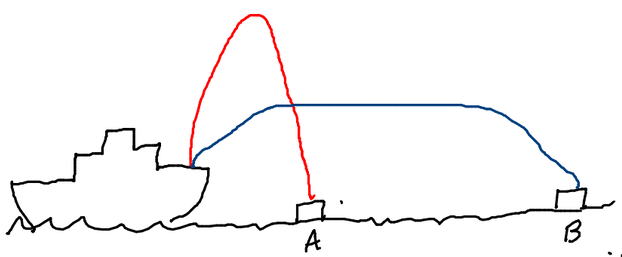
Looking at vertical components

Δy is same for both

$v_{iy} = 0$ is same for both (but A has additional x component)

$a = 9.8$ for both.

so you can solve for Δt

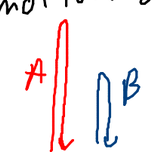


Cannon balls are not necessarily launched with same speed

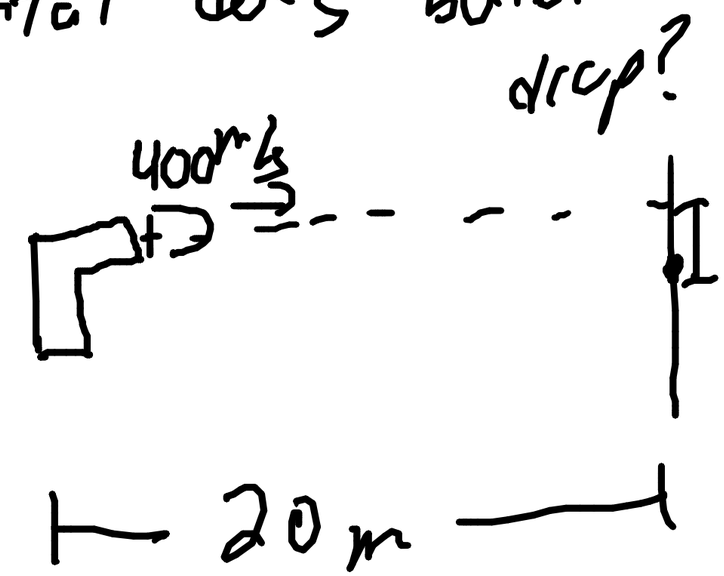
Which target is hit first?

A) A B) B C) Both the same

Look at vertical motion alone



Fire a bullet horizontally at 400 m/s at target 20 m away. How far below horizontal does bullet drop?



$\Delta x = 20m$ $\Delta y = NEED$

$V_{ix} = 400 m/s$ $V_{iy} = 0 m/s$

$V_{fx} =$ $V_{fy} =$

$a_x = 0$ $a_y = 9.8 m/s^2$

$\Delta t =$

Can't solve y right away, (only 2 given)

So solve x column for Δt first.