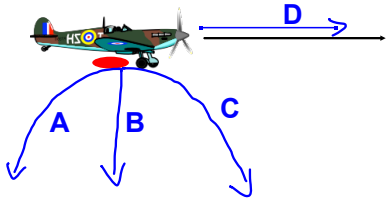
Chapter 3 - Kinematics in 2-D

If a plane drops a flare as it is flying at a constant velocity, what path will the flare follow?

1 Answer?



If a hunter aims at a monkey in a tree who is startled and drops when he hears the gun shoot, where should the hunter aim?

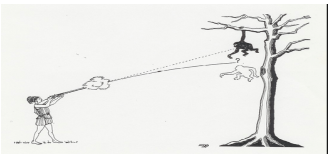
2 Answer?

A Below the monkey

B Above the monkey

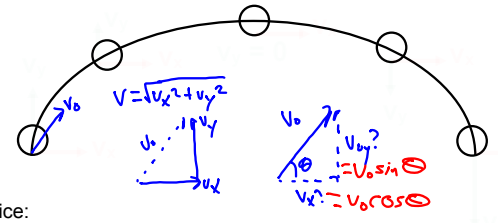
C At the monkey

D Depends on speed of bullet



Projectile -

An object that continues to move with only gravity acting upon it after given an initial velocity with a horizontal component



Notice:

v_x stays constant...NO acceleration in the horizontal direction

v_y changes because there is gravity acting downwards

at the top v IS NOT 0...there is still v in the x/horizontal direction

Projectile equations (slight modifications)

horizontal direction

$\bar{v} = x/t \longrightarrow x = v_x t$

vertical direction

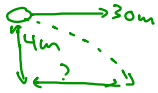
$x = 1/2at^2 + v_o t \longrightarrow y = 1/2gt^2 + v_{oy} t$

$v_f^2 = 2ax + v_o^2 \longrightarrow v_{fy}^2 = 2gy + v_{oy}^2$

$v_f = v_o + at \longrightarrow v_{fy} = v_{oy} + gt$

A football is thrown horizontally at 30 m/s, 4 m above the ground. How far does it travel in the horizontal direction before it hits the ground?

3 Answer? (use g = 10 m/s² and give answer in ~~m/s~~ m)



G: $V_x = 30m/s$, $y = 4m$, $g = 10m/s^2$, $V_{oy} = 0$

F: $x = ?$

E: $x = v_x t$, $y = \frac{1}{2}gt^2 + v_{oy}t$

M: $y = \frac{1}{2}gt^2$

$2y = gt^2$

$t^2 = 2y/g$

$t = \sqrt{2y/g}$

$= \sqrt{\frac{2(4)}{10}} = .89s$

$v_x = (30m/s)(.89s)$

$=$

How fast is it moving when it strikes the ground?

4 Answer? (give answer in m/s)

$t = .89s$

G: $V_x = 30m/s$, $g = 10m/s^2$

F: $V_f = ?$

E: $v_f = v_{oy} + gt$

M: $V_{fy} = (10m/s^2)(.89s)$

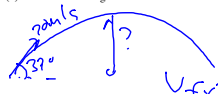
$= 8.9m/s$

$V_f = \sqrt{8.9^2 + 30^2}$

$= 31.3m/s$

A football is kicked at an angle to the horizontal of 37 degrees with a velocity of magnitude 20 m/s. Calculate

(a) the maximum height



$V_{fy} = 0$

G: $V_x = 20\cos 37° = 16m/s$

$V_{oy} = 20\sin 37° = 12m/s$

F: $y = ?$

E: ~~v_y^2~~ $= 2gy + v_{oy}^2$

M: $-2gy = v_{oy}^2$

$y = \frac{v_{oy}^2}{-2g} = \frac{(12m/s)^2}{-2(-10m/s^2)}$

$= 7.2m$

A football is kicked at an angle to the horizontal of 37 degrees with a velocity o

(b) the time of travel before it hits the ground

G: $v_x = 16\,m/s$, $v_{oy} = 12\,m/s$

$v_{fy} = -12\,m/s$, $y = 0$

F: $t = ?$

E: $v_{fy} = gt + v_{oy}$

M: $t = \dfrac{v_{fy} - v_{oy}}{g}$

$t = \dfrac{-12\,m/s - (12\,m/s)}{-10\,m/s^2}$

$= \dfrac{-24\,m/s}{-10\,m/s^2} = 2.4\,s$

A football is kicked at an angle to the horizontal of 37 degrees with a velocity

(c) how far way it hits the ground

G: $v_x = 16\,m/s$, $v_{oy} = 12\,m/s$

$y = 0$, $v_{fy} = -12\,m/s$

$t = 2.4\,s$

F $x = ?$

E: $x = v_x t$

M: $x = (16\,m/s)(2.4\,s)$

$= 38.4\,m$