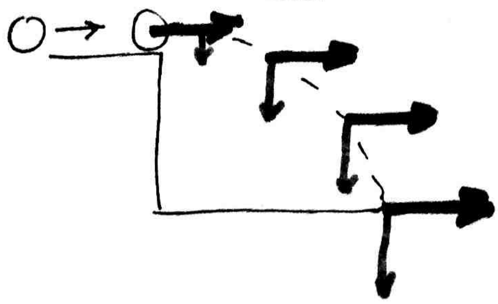
1. Horizontal Projectile
2. Ground-to-Ground
3. Ground-to-Not Ground

Horizontal

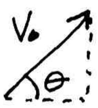


$V_{oy} = 0\ m/s$

$V_{ox} = V_x = \text{constant}$

x-direct.	y-direct.
$V_x = \frac{\Delta x}{\Delta t}$	$\Delta y = V_{oy}t + \frac{1}{2}gt^2$
	$V_y^2 = V_{oy}^2 + 2g\Delta y$
	$V_y = V_{oy} + gt$
	$\Delta y = \frac{1}{2}(V_y + V_{oy})t$

Ground to Ground



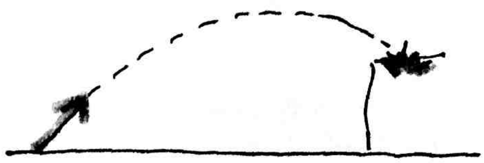
$V_{oy} = V_o \sin\theta$

$V_x = V_{ox} = V_o \cos\theta$

$\Delta y = 0$ at end

$t_{up} = t_{down}$

Ground to Not Ground



$\Delta y \neq 0$

$t_{up} \neq t_{down}$

Mirrors Guided Notes

r, inverted) and (larger,
mirrors since

Physics

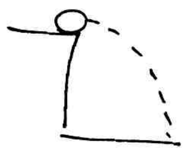
Projectile Motion Notes

A marble with a speed of 15 cm/s rolls off the edge of a table 65 cm high. How far horizontally from the table edge does the marble strike the floor?

$V_x = 15 \frac{cm}{s}$

$\frac{15cm}{} \cdot \frac{1}{100cm} = .15 m/s$

x	y
$V_x = .15 m/s$	$\Delta y = -0.65 m$
$\Delta x = ?$	$V_{oy} = 0 m/s$
$t = ?$	$g = -9.8 m/s^2$
	$t = ?$



$\Delta y = 65cm$

$\Delta y = -65cm = -0.65m$

$\Delta y = V_{oy}t + \frac{1}{2}gt^2$

$\sqrt{\frac{2\Delta y}{g}} = t$

$\sqrt{\frac{2(-0.65)}{-9.8}} = .365$ time

$V = \frac{x}{t}$

$Vt = x$

$.15(.36) = .054m$

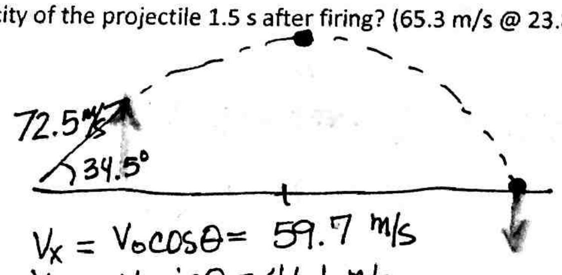
A projectile is fired with an initial speed of 72.5 m/s at an angle of 34.5° above the horizontal on a long flat firing range.

a. What is the maximum height reached by the projectile? (86.1 m)

b. What is the total time spent in the air? (8.4 s)

c. What is the range of the projectile? (501.5 m)

d. What is the velocity of the projectile 1.5 s after firing? (65.3 m/s @ 23.8°)



$V_x = V_o\cos\theta = 59.7$ m/s

$V_{y_o} = V_o\sin\theta = 41.1$ m/s

① $V_y = V_{oy} + gt$

$-V_o\sin\theta + (-V_o\sin\theta) = V_o\sin\theta + gt$

$-V_o\sin\theta$

$-2V_o\sin\theta = gt$

$\frac{-2V_o\sin\theta}{g} = 8.4$ s

$\Delta y_{max} = \frac{\text{total time}}{2}$

$V_y = 0$

$V_y^2 = V_{oy}^2 + 2g\Delta y$

$-2g\Delta y = V_{oy}^2$

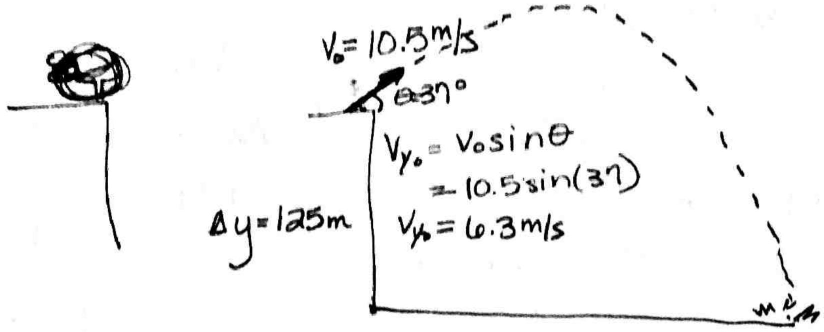
$\Delta y = \frac{V_{oy}^2}{-2g} = \frac{(V_o\sin\theta)^2}{-2g}$

$\Delta y = \frac{(41.1 m/s)^2}{-2(-9.8 m/s^2)}$

$\Delta y = 86m$

A chipmunk is shot from the edge of a 125 m tall cliff. It has an initial velocity of 10.5 m/s @37°.
a. Determine the time taken by the chipmunk to hit the ground. (5.5 s)
b. Determine where a cushion would need to be place to catch the chipmunk when it hits the ground. (46.4 m)
c. Determine the velocity of the chipmunk (magnitude AND direction) just before it lands. (48.6 m/s @ 80°)

$t_{up} \neq t_{down}$



$\Delta y = -125 m$

$\Delta y = V_{oy}t + \frac{1}{2}gt^2$

Quadratic

$-125 = 6.3 m/s\, t + \frac{1}{2}(9.8)t^2$

* set equal

$0 = 125 + 6.3t + \frac{1}{2}(-9.8)t^2$

A.) $t = 5.7 s$

$= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

b.) $\Delta x = V_x t = (V_o \cos\theta)t$

$= (8.4 m/s)(~~47.8~~ 5.7)$

$= 47.8 m$

c.) $V_x = 8.4 m/s$

$V_y = V_{oy} + gt = 6.3 m/s + (-9.8 m/s^2)(5.7 s)$ (8.4 m/s)

$V_y = -49.54 m/s$

θ, −49.56

$V = 50.3 m/s$

$\theta = \tan^{-1}\left(\frac{49.56}{8.4}\right)$

280°, below 80° the horizontal