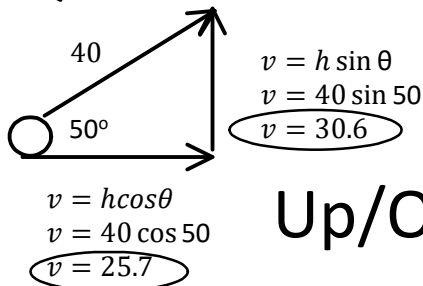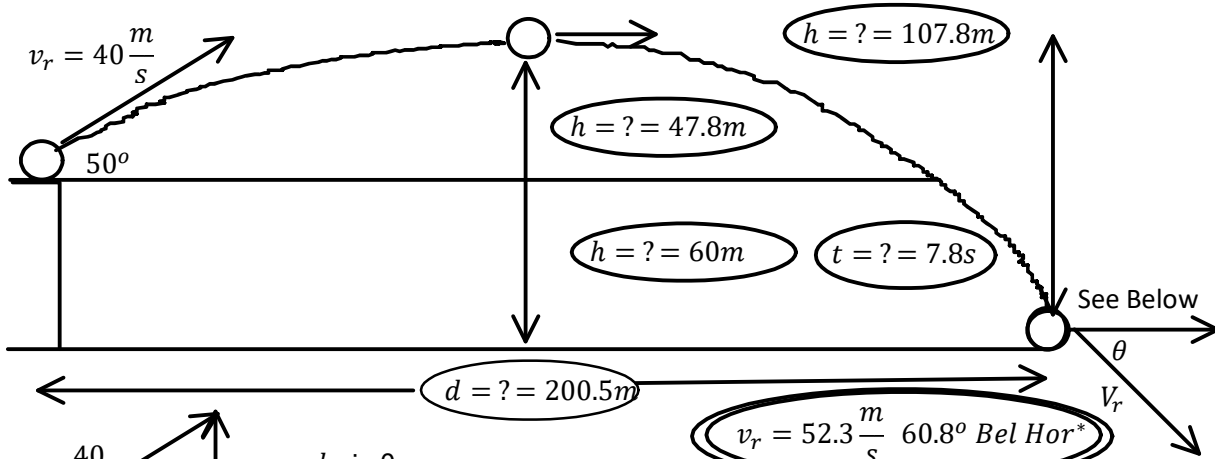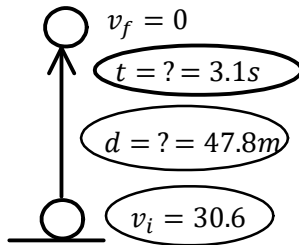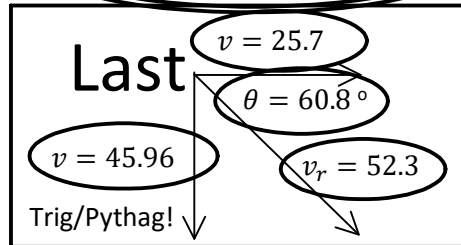# P12 - 2.10 - Projectile Motion Cliff Angle Notes
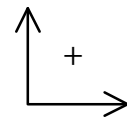
A ball is shot off a $60m$ cliff at $40\frac{m}{s}$ at an angle of 50° from the horizontal. What is its max height? What is its time time in flight? What is the horizontal distance the ball travels? What is the velocity and angle at impact?

$v_r = 40\frac{m}{s}$

50°

$h = ? = 107.8m$

$h = ? = 47.8m$

$h = ? = 60m$ $t = ? = 7.8s$

See Below

θ

V_r

$d = ? = 200.5m$

$v_r = 52.3\frac{m}{s}$ $60.8^o \; Bel \; Hor^*$

40

$50°$

$v = h\sin\theta$
$v = 40\sin 50$
$v = 30.6$

$v = h\cos\theta$
$v = 40\cos 50$
$v = 25.7$

Up/Over

Last

$v = 25.7$

$v = 45.96$ $\theta = 60.8°$ $v_r = 52.3$

Trig/Pythag!

$v_f = 0$

$t = ? = 3.1s$

$d = ? = 47.8m$ **Up**

$v_i = 30.6$

$v_f^2 = v_i^2 + 2ad$

$d = \dfrac{-v_i^2}{2a}$
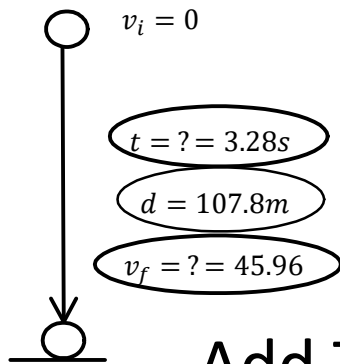
$d = \dfrac{-(30.6)^2}{2(-9.8)}$

$d = 47.8m$

Add Cliff

Max height $= 47.8 + 60$
$= 107.8m$

$v_f = v_i + at$

$t = \dfrac{-v_i}{a}$

$t = \dfrac{-30.6}{-9.8}$

$t = 3.1s$

Time to Max Height $= 3.1s$

$v_i = 0$

$t = ? = 3.28s$

$d = 107.8m$

$v_f = ? = 45.96$

$\Delta d = v_i t + \dfrac{1}{2}at^2$

$t = \sqrt{\dfrac{2d}{a}}$

$t = \sqrt{\dfrac{2(-107.8)}{-9.8}}$

$t = 4.69s$

$v_f^2 = (0)^2 + 2a\Delta d$

$v_f = \sqrt{2(-9.8)(-107.8)}$

$v_f = 45.96\frac{m}{s}$

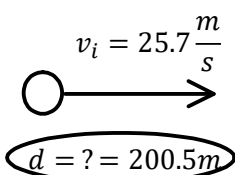## Or

$\Delta d = v_i t + \dfrac{1}{2}at^2$

$-60 = 30.6t + \dfrac{1}{2}(-9.8)t^2$

$0 = -4.9t^2 + 30.6t + 60$

$t = 7.8s$ | Quadform

Add Times

$t = 4.69 + 3.1$
$t = 7.8s$

Total time in flight:

Up/Down

$v_i = 25.7\frac{m}{s}$

Over

$v = \dfrac{d}{t}$
$d = vt$
$d = 25.7(7.8)$
$d = 200.5m$

$d = ? = 200.5m$

Or Or Or Or Or Or Or Or !!!