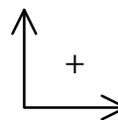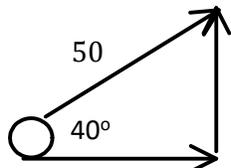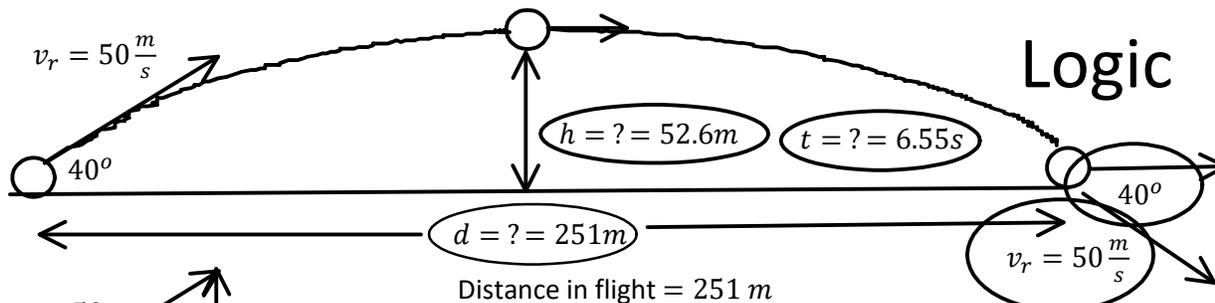# P12 - 2.9 - Projectile Motion Ground Angle Notes

A ball is shot at $50 \frac{m}{s}$ at an angle of 40° above the horizontal. What is its max "h"? What is its "t" in flight? What is the "d" the ball travels? Find v_r.

$v_r = 50\frac{m}{s}$

40°

Logic

$h = ? = 52.6m$ $t = ? = 6.55s$

40°

$v_r = 50\frac{m}{s}$

$d = ? = 251m$

Distance in flight $= 251\ m$

50

40°

$v = h\sin\theta$
$v = 50\sin 40$
$v = 32.1$

$v = h\cos\theta$
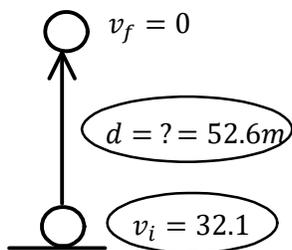$v = 50\cos 40$
$v = 38.3$

Up/Over

Final Check

Over

$R^* = \dfrac{v^2 \sin 2\theta}{g}$

$R^* = \dfrac{(50)^2 \sin 2(40)}{9.8}$

$R^* = 251m$

$R^* = \dfrac{v^2 \sin 2\theta}{g}$; $\Delta h = 0$

$v_f = 0$

$d = ? = 52.6m$

$v_i = 32.1$

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

$d = \dfrac{-v_i^2}{2a}$

$d = \dfrac{-(32.1)^2}{2(-9.8)}$

$d = 52.6m$

Up

Max height $= 52.6m$

$v_f = v_i + at$

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

$t = \dfrac{-32.1}{-9.8}$

$t = 3.28s$

$v_i = 0$

$t = ? = 3.28s$

$d = 52.6m$

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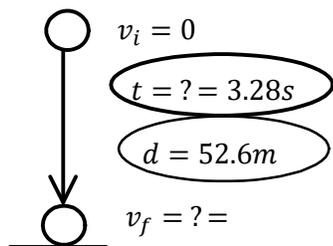
$\Delta d = v_i t + \dfrac{1}{2}at^2$

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

$t = \sqrt{\dfrac{2(-52.6)}{(-9.8)}}$

$t = 3.28s$
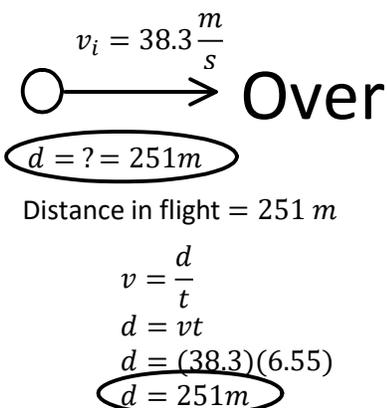
Down

$\Delta d = d_f - d_i$
$\Delta d = 0 - 52.6$
$\Delta d = -52.6m$

Or

Total time in flight:

$t = 3.28 \times 2$

$t = 6.55s$

Double Time

$v_i = 38.3\frac{m}{s}$

Over

$d = ? = 251m$

Distance in flight $= 251\ m$

$v = \dfrac{d}{t}$
$d = vt$
$d = (38.3)(6.55)$
$d = 251m$

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

$0 = 32.1t + \dfrac{1}{2}(-9.8)t^2$

$0 = -32.1t - 4.9t^2$

$0 = -4.9t(t - 6.55)$

$-4.9t = 0$ $t - 6.55 = 0$
$t = 0s$ $t = 6.55s$

$Total\ Time = 6.55s$

Or Quadform/Square Root Method

Or

Up/Down