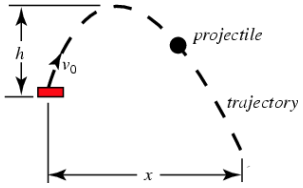
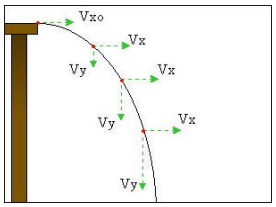
PROJECTILE MOTION: NEGLECTING AIR RESISTANCE

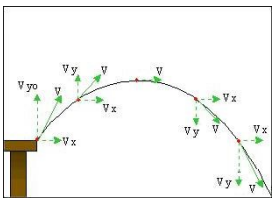


- The path of a projectile is its trajectory
  - The horizontal & vertical velocities of a projectile are independent
  - If 2 unknowns in a eqn – must substitute one eqn into another



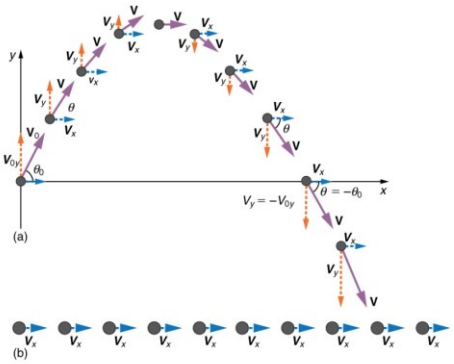
2 types of projectile problems

1. Projectiles launched horizontally
   - Viy = 0 & Vix = Some constant velocity
2. Projectiles launched at an angle Ø



PROJECTILE MOTION

(a) Analyze two-dimensional projectile motion by breaking it into 2 independent one-dimensional motions along the vertical & horizontal axes

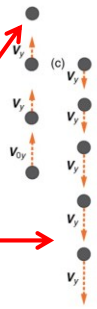


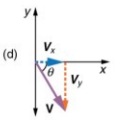
(b) The horizontal motion is simple

$a_x = 0$ and v_x is thus constant

(c) The velocity in the vertical direction begins to decrease as the object rises;

- At its highest point, the vertical velocity is zero.
- As the object falls, the vertical velocity increases again in magnitude but points in the opposite direction to the initial vertical velocity.





Notice – the vector arrow lengths change!

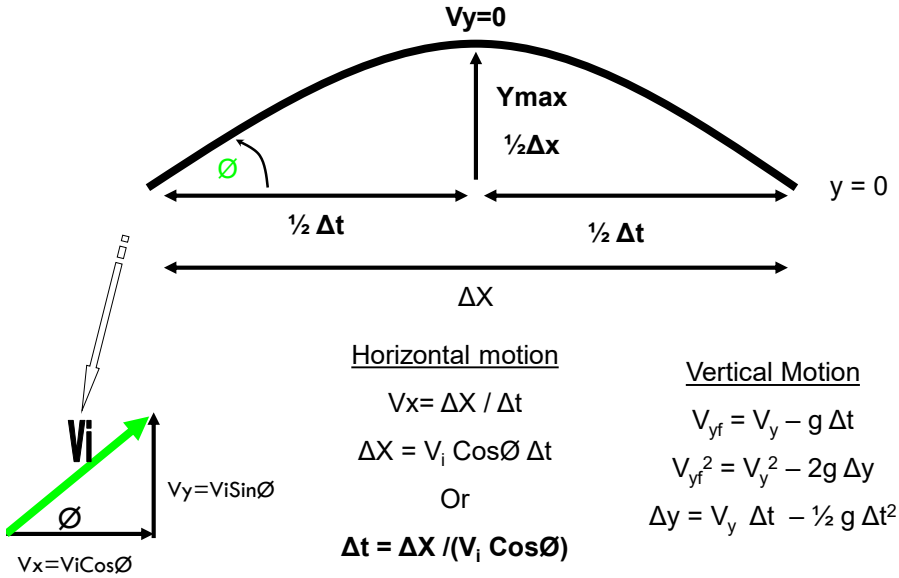
Kinematic Equations

X	Y
I. $v_x = v_{0x} + a_x t$	I. $v_y = v_{0y} + a_y t$
II. $x = x_0 + v_{0x} t + \frac{a_x}{2} t^2$	II. $y = y_0 + v_{0y} t + \frac{a_y}{2} t^2$
III. $v_x^2 = v_{0x}^2 + 2a_x (x - x_0)$	III. $v_y^2 = v_{0y}^2 + 2a_y (y - y_0)$

The AP physics 1 equations sheet has the constant acceleration equations for the x direction, with the subscript x, the the same three equations can be used just as well for the y or x direction. Just make sure to **use them independently in each direction.**

The only thing that is common about the three directions is time.

PROJECTILES LAUNCHED AT ANGLE



Horizontal motion

$V_x = \Delta X / \Delta t$

$\Delta X = V_i \cos\emptyset \, \Delta t$

Or

$\Delta t = \Delta X / (V_i \cos\emptyset)$

Vertical Motion

$V_{yf} = V_y - g \Delta t$

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

$\Delta y = V_y \Delta t - \frac{1}{2} g \Delta t^2$