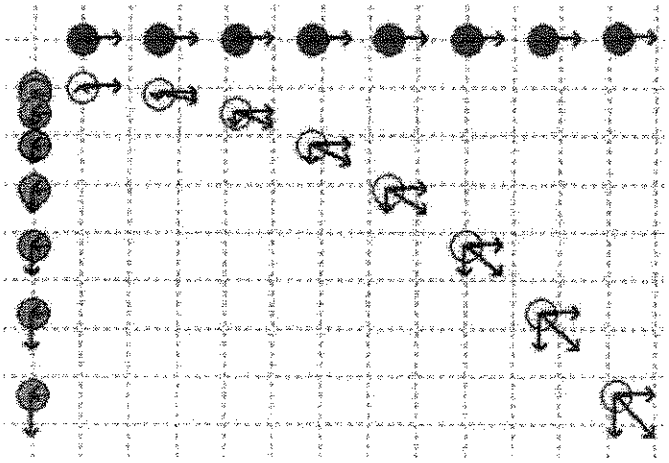
Topic 2C: PROJECTILES ON TWO AXES (2-Dimensional)

Skill 16 – Horizontal Projectiles

A projectile is an object that is only experiencing the force of gravity. In order to change from rest to motion an object undergoes a momentary force from a launching mechanism (device, person, etc). Once the launch mechanism disappears, the force disappears and the object remains in motion until something causes it to stop. **The time interval for analyzing the motion of a projectile starts as it leaves a launching device and ends just as it impacts the ground or other surface.** During this time interval the only force acting on the object is the due to the gravitational field which is aligned vertically. Therefore, acceleration is only present on the vertical "y" axis. The horizontal axis does not experience a force and therefore the object moves forward at equilibrium with constant velocity.

THE HORIZONTAL MOTION OF THE PROJECTILE IS INDEPENDENT OF THE VERTICAL MOTION EXCEPT FOR TIME. (An object can only experience a single time, but it can have different vertical and horizontal displacements, velocities and accelerations). **THEREFORE, ALL VARIABLES MUST BE IDENTIFIED AS HORIZONTAL (X) and VERTICAL (Y) BEFORE BEING USED IN CALCULATIONS.**

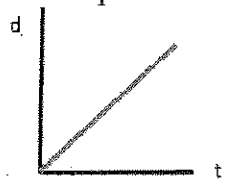


Notice that the horizontal position changes at a constant rate and therefore the horizontal velocity does not change. $\bar{v} = \frac{d}{t}$ applies to the horizontal axis.

Vertical position change is greater by the same amount each second and therefore the rate of change in velocity is uniform. (Since the initial velocity is all horizontal 0^0, the vertical component of initial velocity is zero). Since v_{iy} equals zero

$d = \frac{1}{2}at^2$ and $v_f = \sqrt{2ad}$ and $v_f = at$

apply to the vertical "y" axis.

Horizontal (Equilibrium) [Unit 1-Skill 9]	Vertical [Dropped Object (Skill 3)]
a = 0 v_i = launch velocity given or solve for d or t	a=g=9.81 $\frac{m}{s^2}$ v_i=0 given or solve for d, v_f, t
$\bar{v} = \frac{d}{t}$	$d = \frac{1}{2}at^2$ and $v_f = \sqrt{2ad}$ and $v_f = at$
REMEMBER TIME IS THE SAME FOR BOTH AXES	
Reference launch point: 	Reference launch point: