Name:_____ Date:_____

Mr. Croom's Physics Chapter 3: Two Dimensional Motion

Projectile Motion Variable Notes

2D Projectile Motion variables, their meanings, and their functions.

$\mathbf{v_o}$ = initial velocity at the beginning of the problem. (answers how fast and in what direction.)

θ = the launch angle (answers in what direction was the projectile launched.)

$\mathbf{v_{ox}}$ = initial velocity in the x-direction at the beginning of the problem
(answers how fast in the x- direction at t = 0 sec.)

$\mathbf{v_{oy}}$ = initial velocity in the y-direction at the beginning of the problem.
(answers how fast in the y- direction at t = 0 sec.)

$\Delta\mathbf{x}$ = horizontal displacement at any moment in time.
(answers how far in the x- direction at any moment in time.)

$\Delta\mathbf{y}$ = vertical displacement at any moment in time.
(answers how far in the y- direction at any moment in time.)

$\mathbf{y_{MAX}}$ = **maximum** height or altitude of the projectile (use Δy in your equations.)
(This is a special value of Δy.)

R = range of the projectile, which is the **maximum** horizontal displacement of the projectile.
(This is a special value of Δx.)

$\mathbf{t_{TOT}}$ = total air time of the projectile. (answers how long the event took to occur.)

$\mathbf{t_r}$ = time it takes the projectile to reach y_{MAX}.

$\mathbf{v_f}$ = final impact velocity of the projectile. (find vector components v_{fx} and v_{fy})
(answers how fast the projectile is traveling upon impact.)

$\mathbf{v_{fx}}$ = final impact velocity in the x-direction of the projectile. (numerically equal to v_{ox})

$\mathbf{v_{fy}}$ = final impact velocity in the y-direction of the projectile. (changes in time due to gravity)

2D Projectile Motion Equations:

x-direction: $\Delta x = v_{ox}\, t$

y-direction:
$v_y = v_{oy} - gt$
$\Delta y = v_{oy}t - \frac{1}{2}\, gt^2$
$v_y^2 = v_{oy}^2 - 2g\Delta y$

NOTES:

• When a projectile is thrown horizontally, initially it is moving horizontally, **NOT** vertically… therefore, $v_{oy} = 0$ for these types of problems.

• When the problem states that the projectile *starts and stops on the same level*, assume $\Delta y = 0$ (Symmetrical!!).

• In the absence of drag, maximum range is achieved at a 45° angle and maximum altitude is achieved at a 90° angle.

• The launch angle θ and the initial velocity v_o are the *most important variables* to have. If you do not have these variables at the start of the problem, **FINDING THEM IS OF THE UTMOST IMPORTANCE**!!