X Component Equation	*Equations Given on Test*	*Y Component Equations*
$x = x_o + v_o t + \frac{1}{2}at^2$ $\boxed{x = v_{ox}t}$	$x = x_o + v_o t + \frac{1}{2}at^2$	$y = y_o + v_{oy}t + \frac{1}{2}gt^2$ $\boxed{y = v_{oy}t - 4.9t^2}$
$v_x = v_{ox} + at$ $v_x = v_{ox}$	$v = v_o + at$	$\boxed{v_y = v_{oy} + gt}$
$v_x^{\,2} = v_{ox}^{\,2} + 2a(x - x_o)$ $v_x = v_{ox}$	$v^2 = v_o^{\,2} + 2a(x - x_o)$	$v_y^{\,2} = v_{oy}^{\,2} + 2g(y - y_o)$ $\boxed{v_y = \sqrt{v_{oy}^{\,2} - 19.6y}}$

X Variables	*Common to both X & Y*	*Y Variables*
$x_o = 0$	$v_o =$	$y_o = 0$
$x =$	$\theta =$	$y =$
$v_{ox} = v_o \cos\theta$	$t =$	$v_{oy} = v_o \sin\theta$
$v_x = v_{ox} = v_o \cos\theta$	$v = \sqrt{v_x^{\,2} + v_y^{\,2}}$	$v_y =$
$a_x = 0$		$g = -9.8$

Strategies that work most of the time.

* When no time is given. Finding time is the key to all falling body or projectile motion problems

  1st $v_y^{\,2} = v_{oy}^{\,2} + 2g(y - y_o)$ solve for v_y ***this can be +/- , but is usually minus***

  2nd $v_y = v_{oy} + gt$ use v_y from above to get t

  3rd $x = v_{ox}t$ use t from above to solve for range, x

  (Alternative: $y = y_o + v_{oy}t + \frac{1}{2}gt^2$, and the quadratic, followed by $x = v_{ox}t$)

* When time or range ***x*** is given. This makes the problem easy since velocity is constant in the ***x*** direction.

  1st $x = v_{ox}t$ Given time solve for x. Given x solve for time.

  2nd $y = y_o + v_{oy}t + \frac{1}{2}gt^2$ Once you have time this is easy, and you don't need the quadratic.

* When an object is dropped or fired horizontally $v_{oy} = 0$ and $y_o = 0$.

  $v_y = v_{oy} + gt$ becomes $v_y = gt$

  $y = y_o + v_{oy}t + \frac{1}{2}gt^2$ becomes $y = \frac{1}{2}gt^2$

  These versions are time savers, particularly the last one, since it now no longer requires the quadratic formula.

PROJECTILE MOTION

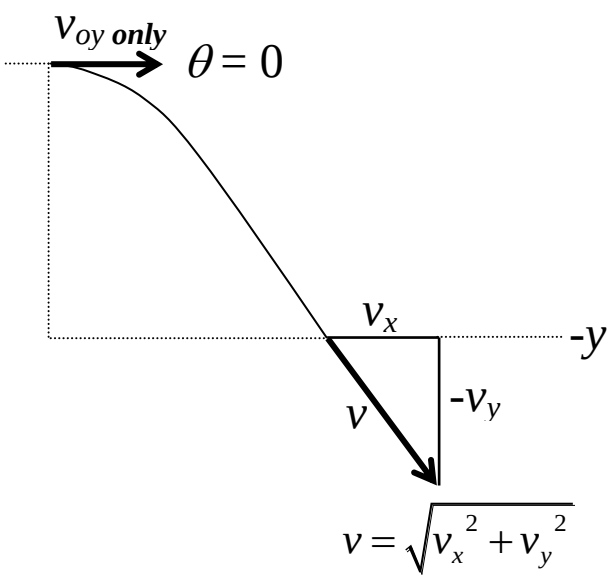
Time is ruled by gravity and height. Most problems require ***y*** variables and ***y*** equations to solve for time. From time distance in the ***x*** direction and the final ***v*** can be determined.

$v_{ox} = v_x$ ***holds true for all projectile motion problems***.

Horizontal

$v_{ox} = v_x = v_o$

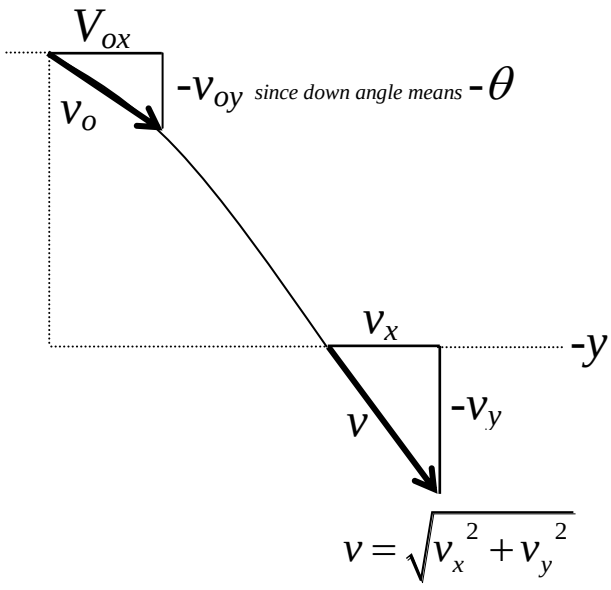
$v_{oy} = 0$



Downward

$v_{ox} = v_o \cos\theta$

$v_{oy} = v_o \sin\theta$



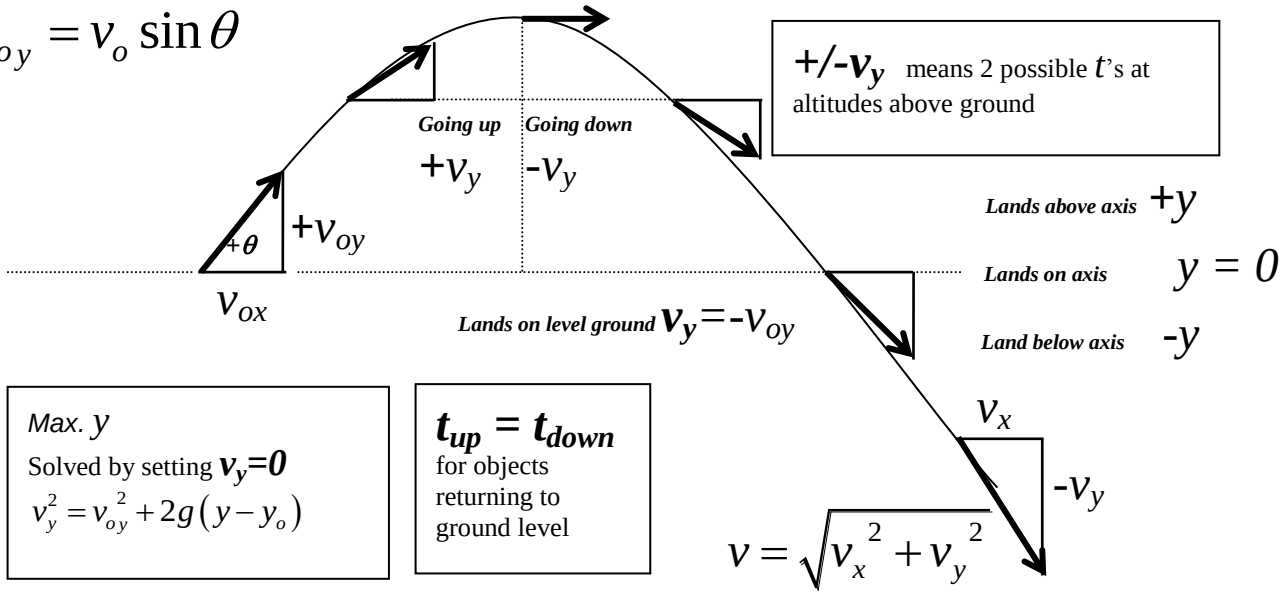
Upward

$v_{ox} = v_o \cos\theta$

$v_{oy} = v_o \sin\theta$

At top: $v_y = 0$, $v = v_x = v_{ox}$

$+/-v_y$ means 2 possible t's at altitudes above ground



Max. y

Solved by setting $v_y = 0$

$v_y^2 = v_{oy}^2 + 2g(y - y_o)$

$t_{up} = t_{down}$ for objects returning to ground level