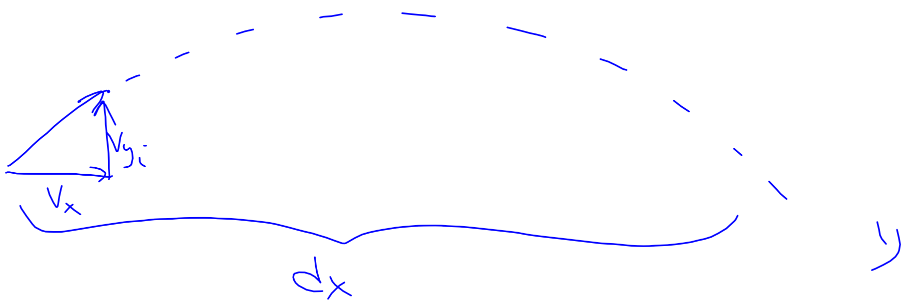
Symmetrical Projectiles Pt II



x

$d_x = v_x t$

$d = 0$

$v_i = v_{y_i}$ $v_f = -v_{y_i}$

$a = -g$

$d = v_i t + \frac{1}{2} a t^2$

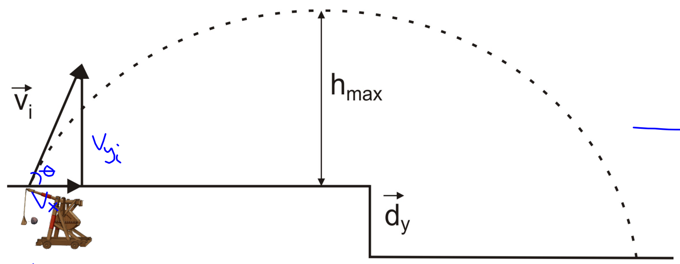
$0 = v_{y_i} t - \frac{1}{2} g t^2$

$0 = t\left(v_{y_i} - \frac{1}{2} g t\right)$

$t = 0$ OR $v_{y_i} - \frac{1}{2} g t = 0$

$t = \frac{2 v_{y_i}}{g}$

Asymmetrical Projectiles



$\uparrow \vec{d}_y$ is + here

$\leftarrow \vec{d}_y$ is − here

d_x

x

$d_x = V_x t$

$= V_x$ (big mess)

y

Going up

$V_i = V_{y_i}$
$a = -g$
$V_f = 0$

$V_f = V_i + at$
$0 = V_{y_i} - gt$
$\boxed{t_{up} = \frac{V_{y_i}}{g}}$

$V_f^2 = V_i^2 + 2ad$
$0 = V_{y_i}^2 - 2gh_{max}$
$\boxed{h_{max} = \frac{V_{y_i}^2}{2g}}$

y

Coming down

$V_i = 0$
$a = -g$
$d = -(h_{max} - \vec{d}_y)$

$d = \cancel{V_i t} + \frac{1}{2}at^2$
$\cancel{-}(h_{max} - d_y) = \cancel{-}\frac{1}{2}gt^2$
$t_{down} = \sqrt{\frac{2(h_{max} - d_y)}{g}}$

$V_f^2 = \cancel{V_i^2} + 2ad$
$V_f = -\sqrt{2g(h_{max} - d_y)}$

$t_T = t_{up} + t_{down}$
$= \frac{V_{y_i}}{g} + \sqrt{\frac{2(h_{max} - d_y)}{g}}$

If $d_y = 0 \Rightarrow$ symmetrical

$t = \frac{V_{y_i}}{g} + \sqrt{\frac{2h_{max}}{g}}$?

$= \sim + \sqrt{\frac{\cancel{2}\frac{V_{y_i}^2}{\cancel{2}g}}{g}} = \frac{V_{y_i}}{g} + \frac{V_{y_i}}{g}$

$= \frac{2V_{y_i}}{g}$:)

$V_i = V_{y_i}$

$a = -g$

$d = d_y$

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

$$d_y = V_{y_i} t - \frac{1}{2} g t^2$$

$$0 = \frac{1}{2} g t^2 - V_{y_i} t + d_y$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$t = \frac{V_{y_i} \pm \sqrt{V_{y_i}^2 - 4(\frac{1}{2}g)d_y}}{2(\frac{1}{2}g)}$$

$$= \frac{V_{y_i}}{g} \pm \frac{\sqrt{V_{y_i}^2 - 2g d_y}}{g}$$

$$V_{f_y} = V_{y_i} + at$$

$$= V_{y_i} - g\left(\frac{V_{y_i}}{g} + \frac{\sqrt{V_{y_i}^2 - 2g d_y}}{g}\right)$$

$$V_{f_y} = \sqrt{V_{y_i}^2 - 2g d_y}$$

:)

$$t = \frac{V_{y_i}}{g} + \sqrt{\frac{2(h_{max} - d_y)}{g}}$$

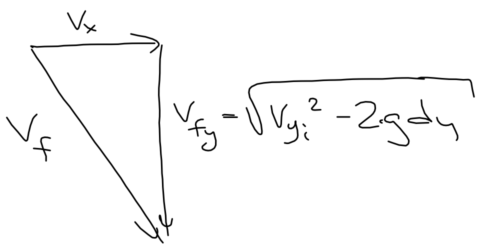
$$= \frac{V_{y_i}}{g} + \sqrt{\frac{2h_{max}}{g} - \frac{2d_y}{g}}$$

$$= \frac{V_{y_i}}{g} + \sqrt{\frac{V_{y_i}^2}{g^2} - \frac{2d_y}{g}}$$

$$t = \frac{V_{y_i}}{g} \pm \sqrt{\frac{V_{y_i}^2}{g^2} - \frac{2d_y}{g}}$$

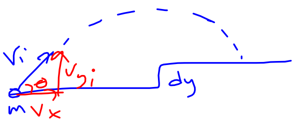
usually + root but need to check.

same :)



$$V_f^2 = \underbrace{V_x^2 + V_{y_i}^2} - 2g d_y$$

$$\boxed{V_f^2 = V_i^2 - 2g d_y}$$



Solving Projectiles Using Energy

	Beginning	Top	End
Kinetic Energy:	$\frac{1}{2}mv_i^2$	$\frac{1}{2}mv_x^2$	$\frac{1}{2}mv_f^2$
Potential Energy:		mgh_{max}	mgd_y
Total Energy:	$\frac{1}{2}mv_i^2$	$\frac{1}{2}mv_t^2$	$\frac{1}{2}mv_i^2$

$$\frac{1}{2}\cancel{m}v_i^2 = \cancel{m}gd_y + \frac{1}{2}\cancel{m}v_f^2$$

$$v_i^2 = 2gd_y + v_f^2$$

$$v_f^2 = v_i^2 - 2gd_y$$