PROJECTILE MOTION

$$\boxed{T = \frac{2u\sin\theta}{g} = \frac{2u_y}{g}}$$

$$\boxed{H = \frac{u^2\sin^2\theta}{2g} = \frac{(u_y)^2}{2g}}$$

$$R = \frac{2u^2\sin\theta\cos\theta}{g} = \frac{u^2\sin 2\theta}{g}$$

$$R = \frac{2u_x u_y}{g}$$

$$\boxed{\frac{H}{T^2} = \frac{g}{8} \Rightarrow H = \frac{1}{8}gT^2}$$

$$\boxed{R\tan\theta = 4H = \frac{1}{2}gT^2}$$

Horizontal ~~velocity~~ component of velocity doesn't not change in projectile motion

Maximum Range

For maximum range, $\theta = 45^\circ$

$\therefore$ $\boxed{R_{max} = \frac{v^2}{g}}$ ☆

$\boxed{H_{max} = \frac{v^2}{2g}}$ ☆

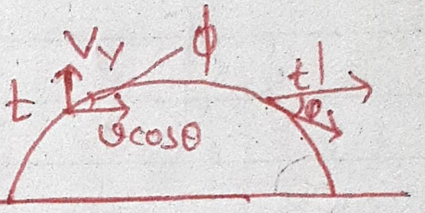
$\boxed{R_{max} = 2H_{max}}$ ☆

Equation of Trajectory

$\boxed{y = x \tan\theta \left[1 - \frac{x}{R}\right]}$

Parabola

After time t angle made by particle with horizontal is same after t' time at same height :—



$$\boxed{\tan\phi = \frac{v\sin\theta - gt}{v\cos\theta}}$$

$$\boxed{-\tan\phi = \frac{v\sin\theta - gt'}{v\cos\theta}}$$

—x—x—x—

Complementary Angles

1) $R_\theta = R_{90-\theta}$

2) $\dfrac{T_\theta}{T_{90-\theta}} = \tan\theta$

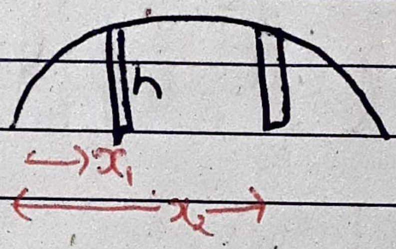
3) $\dfrac{H_\theta}{H_{90-\theta}} = \tan^2\theta$

$$\boxed{R_\theta = 4\sqrt{H_\theta H_{90-\theta}}}$$

$$\boxed{R_\theta = 4\sqrt{H_\theta H_{90-\theta}} = \frac{1}{2} g T_\theta T_{90-\theta}}$$

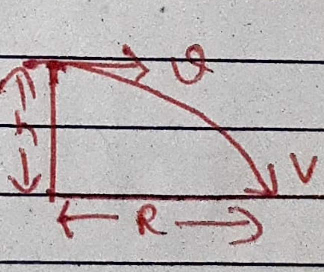
PROJECTILE B/W SAME Height

$$\boxed{x_2 - x_1 = \sqrt{R^2 - 4\left(\frac{hR}{\tan\theta}\right)}}$$



* PROJECTILE FROM A TOWER

$$\boxed{T = \sqrt{\frac{2H}{g}}}$$

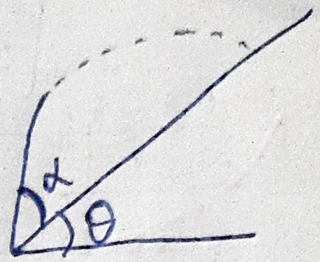


$$\boxed{R = v_x T = v\sqrt{\frac{2H}{g}}}$$

$$\boxed{V_{net} = \sqrt{v^2 + 2gh}}$$

PROJECTILE ON INCLINED PLANE [OF ANGLE θ]

$$\boxed{T = \frac{2u \sin\alpha}{g\cos\theta}}$$



$$\boxed{H = \frac{u^2 \sin^2\alpha}{2g\cos\theta}} = \frac{-u_y^2}{2a_y}$$

$$R = \frac{2u^2 \sin\alpha\cos\alpha}{g\cos\theta} - \frac{2(g\sin\theta)u^2\sin^2\alpha}{g^2\cos^2\theta}$$

Learn it

$$\boxed{R = \frac{2u^2\sin\alpha}{g\cos\theta}\left[\cos\alpha - \tan\theta\sin\alpha\right]}$$

$$\boxed{R_{max} = \frac{u^2}{g(1+\sin\theta)}}$$

bottom to top if ball is thrown

Circular Motion

$\omega = \frac{d\theta}{dt}$ → Angular Velocity

$\alpha = \frac{d\omega}{dt}$ → Angular Acch.

$\Delta\theta$ = displacement

θ = Angular position

———x———x———

$$\boxed{V = R\omega}$$

$$\boxed{a_t = R\alpha}$$

for Uniform Circular motion:

$a_t = 0$, $a_c = \frac{V^2}{R} = \omega^2 R$