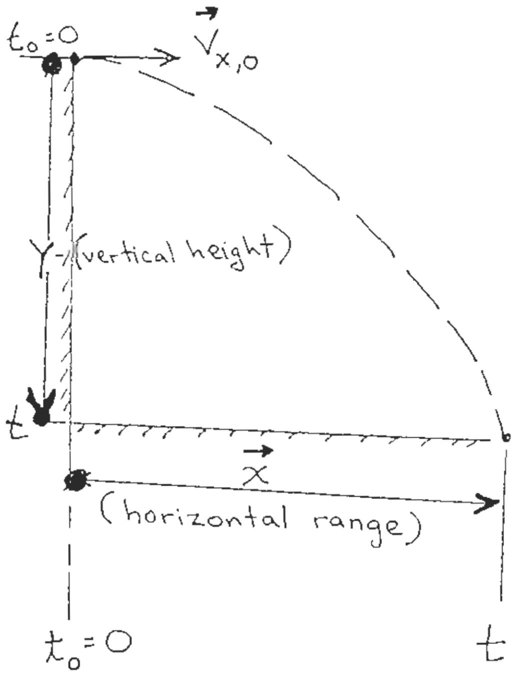
[illegible]

Projectile launched

horizontally



- Horizontally $\vec{V} = \text{const}$, i.e. $\vec{V}_{x,0} = \vec{V}_x$ and $\boxed{\vec{V}_x = \frac{\vec{X}}{t}}$; (assume: $\xrightarrow{+}$)
- Vertically there is acceleration (assume: $\downarrow +$)

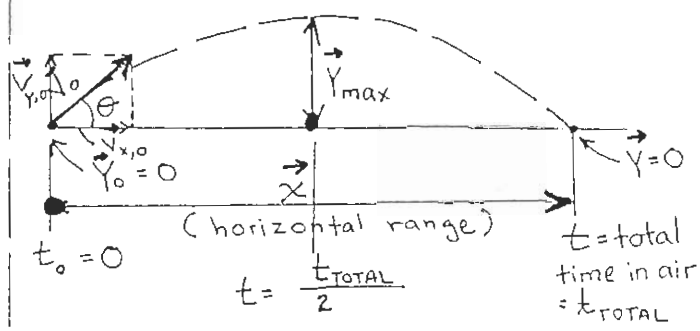
Known even if not given in problem: $\vec{V}_{Y,0} = 0$, $\vec{Y}_0 = 0$, $\vec{a} = \vec{g} = 9.8\,\frac{m}{s^2}$

$$\vec{V}_Y = \cancelto{0}{\vec{V}_{Y,0}} + \vec{g}t \Rightarrow \boxed{\vec{V}_Y = \vec{g}t}$$

$$\vec{Y} = \cancelto{0}{\vec{Y}_0} + \cancelto{0}{\vec{V}_{Y,0}}\,t + \tfrac{1}{2}\vec{g}t^2$$

$$\therefore \boxed{\vec{Y} = \tfrac{1}{2}\vec{g}t^2}$$

at an angle θ with the horizontal



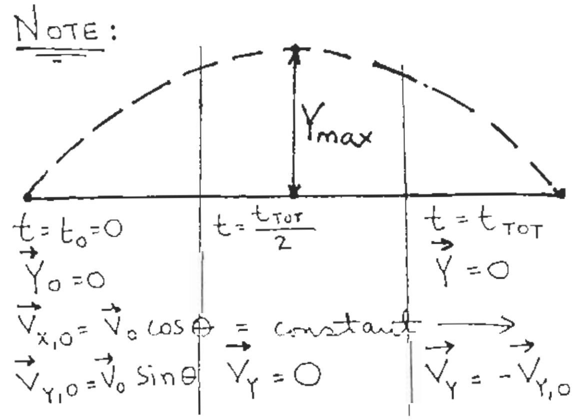
- horizontally $\vec{V} = \text{const.}$, i.e. $\vec{V}_{x,0} = \vec{V}_x$ and $\boxed{\vec{V}_x = \frac{\vec{X}}{t}}$ but $\boxed{\vec{V}_{x,0} = \vec{V}_0 \cos\theta}$ (assume $\xrightarrow{+}$)
- Vertically there is acceleration (assume $\uparrow +$) $\Rightarrow \vec{a} = \vec{g} = -9.8\,\frac{m}{s^2}$

$$\boxed{\vec{V}_Y = \vec{V}_{Y,0} + \vec{g}t} \quad \text{but} \quad \boxed{\vec{V}_{Y,0} = \vec{V}_0 \sin\theta}$$

$$\vec{Y} = \cancelto{0}{\vec{Y}_0} + \vec{V}_{Y,0}\,t + \tfrac{1}{2}\vec{g}t^2$$

$$\therefore \boxed{\vec{Y} = \vec{V}_{Y,0}\,t + \tfrac{1}{2}\vec{g}t^2}$$

NOTE:



i) Maximum height is reached at ½ the total flight time

ii) At the initial time and total time, the height is 0.