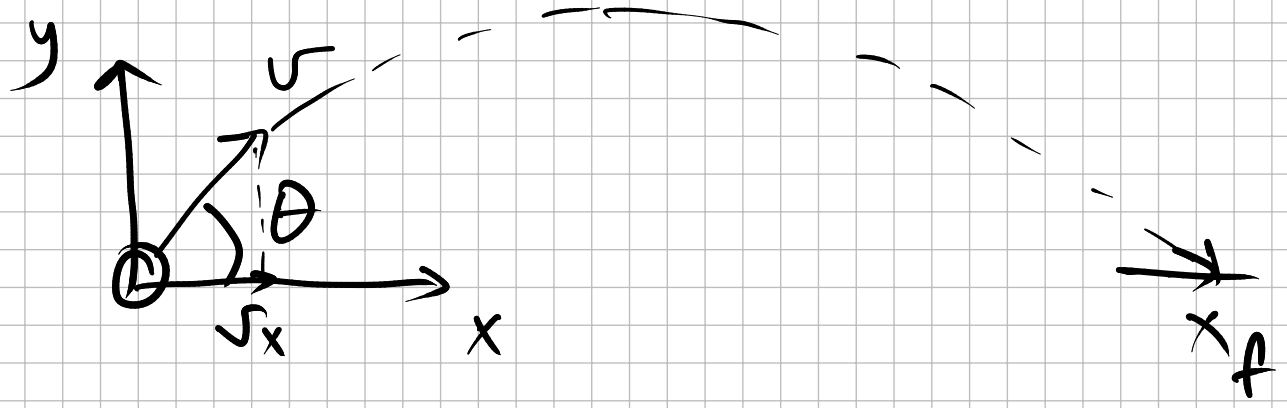


$$v_{x_0} = v \cdot \cos\theta$$

$$v_{y_0} = v \cdot \sin\theta$$

hit the ground time

$$0 = 0 + v_{y_0} t - \frac{g t^2}{2}$$

$$t = 0 \; ; \quad \frac{2 v_{0y}}{g} = \frac{2 v \sin\theta}{g}$$

$$x = \overset{0}{x_0} + v_{0x} \cdot t = v \cdot \cos\theta \cdot \frac{2 v \sin\theta}{g}$$

$$= \frac{v^2}{g} \cdot 2 \cos\theta \cdot \sin\theta = \frac{v^2}{g} \sin(2\theta)$$

if $v = 400 \frac{m}{s}$ $\quad x = \frac{400^2}{10} \cdot 1 = 16 \cdot 1000\ m$

$= 16\ km$

$= 10\ mi$

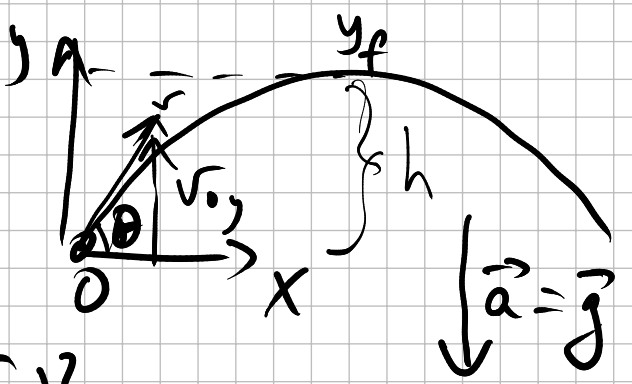
long jump

$v = 10\ m/s$

$$x_f = \frac{v^2}{g} \underbrace{\sin(2\theta)}_{1} \overset{45^\circ}{=} \frac{10^2 \left(\frac{m}{s}\right)^2}{10\ m/s^2} = 10\ m$$

$$\underbrace{y_f - y_0}_{h} = \frac{v_{fy}^2 - v_{0y}^2}{2a_y}$$

($v_{fy}^2 = 0$)



$$h = \frac{-v_{0y}^2}{2(-g)} = \frac{(v_0 \underbrace{\sin\theta}_{\theta = 90^\circ,\ = 1})^2}{2g}$$

$$h = \frac{(10\ m/s)^2}{2 \cdot 10\ \frac{m}{s^2}} = 5\ m$$

$$\vec{F}_{net} = m\vec{a} \quad - \quad [\,m/s^2\,]$$

mass - [kg]

$$\left[\frac{kg \cdot m}{s^2}\right] = [N_{ewton}]$$

Weight $\vec{w}$

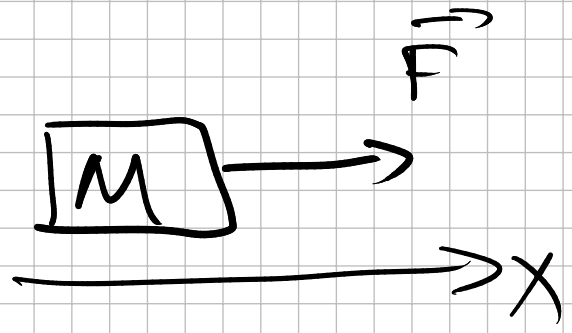
$$m\vec{g} = \vec{F}_g$$

Free fall

$$\vec{F}_{net} = \boxed{\vec{w} + \vec{F}_g = m\vec{a}} = m\vec{g}$$

$$\vec{w} + \cancel{m\vec{g}} = \cancel{m\vec{g}}$$

$$\vec{w} = 0$$



$$\vec{a} = \frac{\vec{F}}{M}$$

$$x: \quad a_x = \frac{F_x}{M} = \frac{F}{M}$$

$$\vec{v_f} = \vec{v_0} + \vec{a}t$$

$$x: \quad v_{x_f} = v_{0x} + a_x t$$

$$v_{x_f} = 25\frac{mi}{h} = 11\frac{m}{s} \qquad v_{0x} = 0 \qquad a_x = \frac{mg}{M}$$

$$t = \frac{v_{fx}}{mg} M = \frac{11\frac{m}{s}\, 10.70\,g}{100 \cdot 10}$$

$$\simeq 1.1\,\text{seg}$$