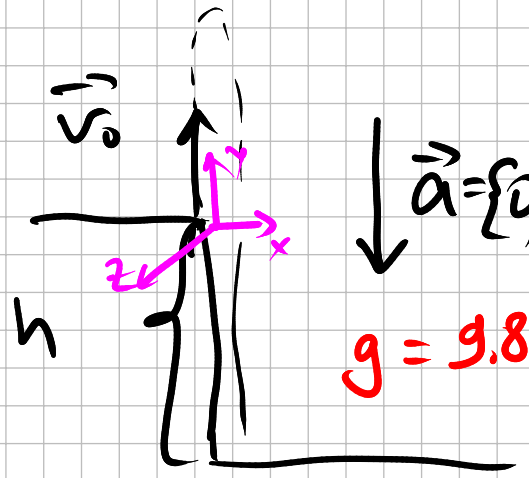


$$\vec{r}(t) = \vec{r}_0 + \vec{v}_0 t + \frac{\vec{a} t^2}{2}$$

$$z(t) = 0 + 0t + \frac{0 \cdot t^2}{2} = 0$$

$$x(t) = 0$$

$$y(t) = 0 + v_{0y} \cdot t + \frac{a_y t^2}{2} =$$

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

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

$$A t^2 + B t + C = 0$$

$$t = \frac{-B \pm \sqrt{B^2 - 4 \cdot A \cdot C}}{2A}$$

$$t = \frac{-v_{0y} \pm \sqrt{v_{0y}^2 - 4\left(-\frac{g}{2}\right)\cdot h}}{2\left(-g/2\right)}$$

$v_{0y} = 4\ m/s$

$h = 1\ m$

$g = 9.8\ \frac{m}{s^2} \approx 10\ \frac{m}{s^2}$

$$t = \frac{-4 \pm \sqrt{16 - 4\frac{-10}{2}\cdot 1}}{-10}$$

$$= \frac{-4 \pm \sqrt{36}}{-10} \quad (\sqrt{36} = 6) =$$

$$= -\frac{4 \pm 6}{-10} = 1s\ ;\ -0.2s$$

$$\vec{v}(t) = \vec{v}_0 + \vec{a} \cdot t$$

y: $v_y(t) = v_{0y} + a_y \cdot t$

$$v_y(t = 1\,s) = 4\,\frac{m}{s} + \left(-10\,\frac{m}{s^2}\right) \cdot 1\,s$$

hit the floor

$$= -6\ m/s$$

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

$$-1 = \underbrace{-h}_{-1} - 0 = \frac{v_{fy}^2 - (-4)^2}{2 \cdot (-10)}$$

$$-1 = \frac{v_{fy}^2 - 16}{-20} \Rightarrow v_{fy}^2 = 36$$

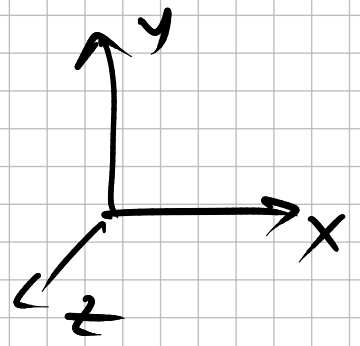
$$v_{fy} = \pm\sqrt{36} = \pm 6$$

-6 ← our choice

$$25\ \frac{mi}{h} = \frac{25\ mi \cdot 1600\ \frac{m}{mi}}{1\ h \cdot \frac{3600\ s}{h}} = 11.1\ \frac{m}{s}$$

$$-|h| = \frac{v_f^2}{-2g} = \frac{11^2}{-2 \cdot 10} = -\frac{121}{20} = -6.05\ m$$

$$\vec{r}(t) = \vec{r}_0 + \vec{v}_0 t + \frac{\vec{a} \cdot t^2}{2}$$



$$\vec{a} = \{0, -g, 0\}$$

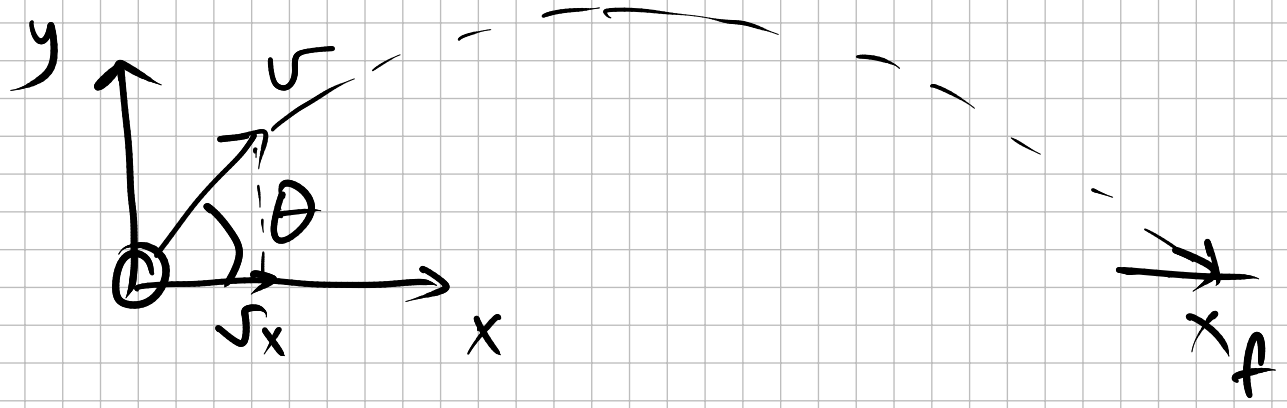
$$x(t) = x_0 + v_{0x} \cdot t + \frac{a_x t^2}{2} \quad (a_x \to 0)$$

$$y(t) = y_0 + v_{0y} t + \frac{a_y t^2}{2}$$

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

$$v_x(t) = \frac{dx(t)}{dt} = 0 + v_{0x} = v_{0x}$$

$$v_y(t) = \frac{dy(t)}{dt} = 0 + v_{0y} - a_y t$$



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

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

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

$= 16\ km$

$= 10\ mi$