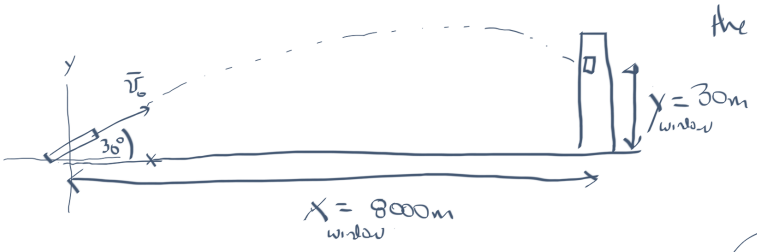
Trying to shoot a shell into the window of a tower.



$x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2 \Longrightarrow 8000 = 0 + v_0 \cos 30° \, t$ ← time at which shell travels 8000 meters horizontally

$y = y_0 + v_{0y}t + \frac{1}{2}a_y t^2 \Longrightarrow 30 = 0 + v_0 \sin 30° t - \frac{1}{2}10t^2$

I need to eliminate t and solve for v_0.

$\cos 30° = \sqrt{3}/2$, $\sin 30° = 1/2 \Longrightarrow 8000 = \frac{\sqrt{3}\, v_0 t}{2} \Longrightarrow t = \frac{2 \cdot 8000}{\sqrt{3} v_0}$

$30 = v_0 \frac{t}{2} - 5t^2$ Now I need to plug in this for t in the previous equation and solve for v_0. I did this on my computer (using the wolfram.com website.

$\boxed{v_0 = 305 \text{ m/s}}$