

HW3-5 Soln)

Consider the y motion of the object. Let the launch point be the origin and up be positive.

$$y_i = 0$$

$$y_f = H$$

$$v_{yi} = v_o \sin \theta_o$$

$$v_{yf} = 0$$

$$a_y = a_g$$

Let's work with the range equation first:

$$R = \frac{v_o^2 \sin(2\theta_o)}{|a_g|} = \frac{v_o^2 2 \sin(\theta_o) \cos(\theta_o)}{|a_g|} = 2 \left(\frac{v_o^2 \sin(\theta_o)}{|a_g|} \right) \cos(\theta_o)$$
$$\left(\frac{v_o^2 \sin(\theta_o)}{|a_g|} \right) = \frac{R}{2 \cos(\theta_o)}$$

(4)

$$v_{yf}^2 = v_{yi}^2 + 2a(y - y_i)$$

$$y = \frac{v_{yf}^2 - v_{yi}^2}{2a} + y_i$$

$$H = \frac{0^2 - (v_o \sin \theta_o)^2}{2a_g} + 0 = \frac{1}{2} \left(\frac{v_o^2 \sin \theta_o}{2|a_g|} \right) \sin \theta_o = \frac{1}{2} \left(\frac{R}{2 \cos(\theta_o)} \right) \sin \theta_o = \frac{R}{4} \tan \theta_o$$