73. (a) By symmetry, $y = H$ occurs at $x = R/2$ (taking the coordinate origin to be at the launch point). Substituting this into Eq. 4-25 gives

$$H = \frac{R}{2}\tan\theta_0 - \frac{gR^2/4}{2v_0^2\cos^2\theta_0}$$

which leads immediately to

$$\frac{H}{R} = \frac{1}{2}\left(\tan\theta_0 - \frac{gR}{4v_0^2\cos^2\theta_0}\right) .$$

In the far right term, we substitute from Eq. 4-26 for the range:

$$\frac{H}{R} = \frac{1}{2}\left(\tan\theta_0 - \frac{g\left(v_0^2\sin(2\theta_0)/g\right)}{4v_0^2\cos^2\theta_0}\right)$$

which, upon setting $\sin 2\theta_0 = 2\sin\theta_0\cos\theta_0$ and simplifying that last term, yields

$$\frac{H}{R} = \frac{1}{2}\left(\tan\theta_0 - \frac{\sin\theta_0}{2\cos\theta_0}\right)$$

which clearly leads to the relation we wish to prove.

(b) Setting $H/R = 1$ in that relation, we have $\theta_0 = \tan^{-1}(4) = 76°$.