[mex139] Longest shot from the top of a hill

A gun is mounted on a hill of height h above a level plain. Assuming that the muzzle speed is v_0 and that the path of the projectile is parabolic, show that the angle of elevation α for greatest horizontal range depends on h and v_0 as follows:

$$\frac{1}{\sin^2 \alpha} = 2\left(1 + \frac{gh}{v_0^2}\right).$$

Solution: