

Answer on Question #49632-Physics-Mechanics-Kinematics-Dynamics

A cannon ball has a range R on a horizontal plane. If h and h' are the greatest heights in the two paths for which this is possible, then

$$R = 4\sqrt{hh'}.$$

Solution

The two angles are complimentary.

$$h = \frac{u^2 \sin^2 \theta}{2g}; h' = \frac{u^2 \sin^2(90 - \theta)}{2g} = \frac{u^2 \cos^2 \theta}{2g}.$$

And

$$R = \frac{u^2 \sin 2\theta}{g} = \frac{2u^2 \sin \theta \cos \theta}{g}.$$

But

$$\sin \theta = \sqrt{\frac{2gh}{u^2}}, \cos \theta = \sqrt{\frac{2gh'}{u^2}}.$$

Therefore

$$R = \frac{2u^2}{g} \sqrt{\frac{2gh}{u^2}} \sqrt{\frac{2gh'}{u^2}} = 4\sqrt{hh'}.$$