A ball is launched from ground level with a particular launch angle, measured from the horizontal. The launch speed is 16.0 m/s. The ball reaches a particular maximum height. It continues to follow a parabolic trajectory until it lands at the same level from which it was launched, thus achieving a particular range and a particular time of flight. Note that air resistance can be neglected in this problem.

If the ball is fired again from the same place, with the same launch angle, but with the launch speed doubled to 32.0 m/s,...

(a) the time of flight increases by a factor of \(2\). 
(b) the ball’s maximum height increases by a factor of \(4\). 
(c) the range increases by a factor of \(4\).

(a) \(t_f = 2v_i \sin \theta / g\). If \(v_i\) is doubled, \(t_f\) is also doubled.

(b) \(h_{\text{max}} = (v_i^2 \sin^2 \theta) / (2g)\). If \(v_i\) is doubled, \(h_{\text{max}}\) is increased by a factor of \(2^2 = 4\).

(c) \(R = (2v_i^2 \sin \theta \cos \theta) / g\). If \(v_i\) is doubled, \(R\) is increased by a factor of \(2^2 = 4\).