This 1940 film was sponsored by Chevrolet to promote the use of the gasoline engine in automobiles. In this clip, the two men are showing that, when compressed and mixed with air, gasoline can fire a projectile a further distance than black powder can.

What are the initial velocities for the gas and gun powder projectiles?

First, ask your students what they can assume or estimate.

- Both projectiles are fired from the same angle ($\theta_1 = \theta_2$). Assume an angle of 30^o.
- The projectiles are not in the air for the same amount of time ($t_1 \neq t_2$).
- Estimate the horizontal range:
  - $x_1 = 50\ m$
  - $x_2 = 60\ m$
- The maximum y displacement occurs at a time of t/2.
- The velocity in the y-direction at maximum y displacement is 0 m/s.
- The acceleration due to gravity is $a_y = -9.8\,\frac{m}{s^2}$
- The initial x and y positions are zero.

Then, your students will need to solve a system of three equations:

$$\Delta x = v_{0,x} t$$

$$\Delta y = v_{0,y}\left(\frac{t}{2}\right) + \frac{1}{2}(a_y)t^2$$

$$v_{y,max}^2 = v_{0,y}^2 + 2a_y \Delta y$$

In these equations, there are three unknowns: v_0, y, and t.

Solving these equations might be beyond the ability of the average high school student. However, this is a great place to use the computer-based PHET simulators to "experimentally" determine the initial velocities of the two projectiles (phet.colorado.edu). The PHET simulation software for projectile motion is at:

http://phet.colorado.edu/simulations/sims.php?sim=Projectile_Motion

The initial velocities for the two projectiles are:

$$v_{gun\ powder} = 23.3\frac{m}{s}$$

$$v_{gasoline} = 25.6\frac{m}{s}$$