



A ceremonial cannon is being fired across a field.

The cannon's barrel is level with the ground, and after it is fired, the cannon ball follows a parabolic trajectory.

If the cannon ball travels for t seconds before landing in the grass d m away, what is its initial velocity?

What angle was the cannon fired at?

given
 d
+
find
 V
 θ

$g = -9.81 \text{ m/s}^2$

$$y = y_0 + v_{y0}t + \frac{1}{2}gt^2$$

$$x = x_0 + v_{x0}t + \frac{1}{2}at^2$$

$$(y - y_0) = v_{y0}t + \frac{1}{2}gt^2$$

$$d = x = v_{x0}t$$

$$0 = v_{y0}t + \frac{1}{2}gt^2$$

$$v_{x0} = d/t$$

$$v_{y0} = -\frac{1}{2}gt$$

$$V = \sqrt{v_{y0}^2 + v_{x0}^2}$$

$$\theta = \tan^{-1}\left(\frac{v_{y0}}{v_{x0}}\right)$$