Some problems ask for the angle of the line of sight (LOS) from the "launch" position to the impact position. Consider the trajectory in the plot below. The range is

\[ R := \frac{v_0}{g} \cos(\theta) \left[ v_0 \sin(\theta) + \sqrt{(v_0 \sin(\theta))^2 + 2 g y_0} \right] \]

This is the x-coordinate of the impact point, whose y-coordinate is of course zero. The launch point is at (0, \(y_0\)), so that we have a right triangle with the LOS angle

\[ \phi = \tan^{-1}\left(\frac{-y_0}{R}\right) \]

made at the launch point, positive upward, as usual (counterclockwise).

For the case of hitting a target, at location (X,Y), we have from the same geometry as above

\[ \phi = \tan^{-1}\left(\frac{Y - y_0}{X}\right) \]

Also a special case is a launch from a zero angle, at a nonzero initial height (airplane). This leads to

\[ \phi = \tan^{-1}\left(\frac{g y_0}{2 v_0^2}\right) \]