

Bisection

There will be no worked-out solutions posted. **Post your solutions and questions on the dedicated Slack channel.** Working solutions should emerge from the discussion with the aid of the lecturer and the TAs.

Consider the ballistic problem from lecture 2. The question is the following: “Given the air friction coefficient and initial velocity, under what angle should we launch a cannon ball to land a certain distance away?”. In the tutorial folder on GitHub (https://github.com/2072U/Tutorial_01/) you will find the Python function that gives horizontal distance travelled as a function of the elevation angle.

Task 1 Using the function in the tutorial repo, write a script that uses bisection to solve the cannonball problem. Assume the following values of the parameters: $g = 9.81 \text{ (m/s}^2\text{)}$, $c = 0.01 \text{ (kg/m)}$, $v_0 = 100 \text{ (m/s)}$. The target distance is $R = 85 \text{ (m)}$.

Task 2 This is a bit more challenging, complete this task only if you have time left and want to dig a bit deeper.

Repeat task 1 for a range of values of R and plot the result (the angle of elevation) as a function of R . Keep the following in mind:

- for most values of R there are two solutions – a fast, low shot and a high, looping shot. Try to find and plot both.
- Do a few values by hand and then try to make the whole procedure automatic. You will need to include the call to the bisection function in a loop over values for R .