

Subject n°39: Functions

Please do not write on this document, and do not forget to hand it back at the end of the test.

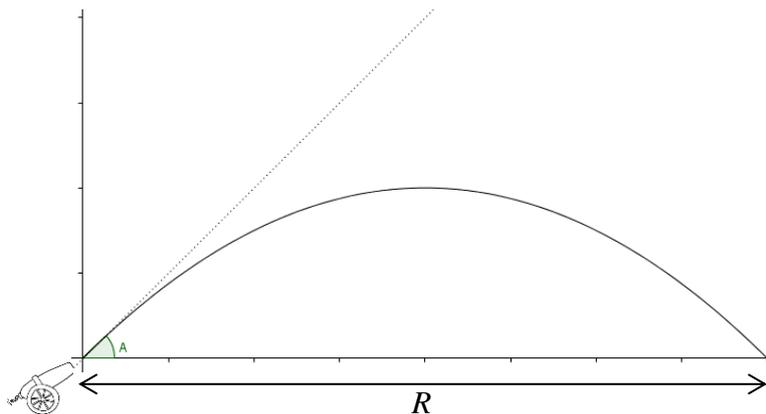
Galileo Galilei (1564-1642) discovered that the movement of a projectile is parabolic and could be separated into vertical and horizontal movement.

This led to the formula to calculate  $R$ , the range of a cannon or other artillery weapon:

$$R = \frac{V_0^2 \sin(2A)}{g}$$

Where:

- $g$  is the acceleration due to gravity (about 9.81 metre/second<sup>2</sup>),
- $V_0$  is the velocity at which the cannonball leaves the cannon, or the bullet leaves the gun,
- $A$  is the angle of elevation of the cannon.



1. a) For which value of  $A$  is the maximum range achieved?  
b) When  $A=45^\circ$ , determine the velocity of the cannonball leaving the cannon, in order to reach a target located 700 metres away.
2. The trajectory of the cannonball is modeled in the Cartesian plane by part of the parabola representing the function  $f$  defined by  $f(x) = -\frac{1}{800}x^2 + x$ 
  - a) Compute the range of the cannon.
  - b) How high will the cannonball go?