ME1 Computing- Session 5: Functions

Learning outcomes:
- Being able to code user defined functions
- Being able to pass arguments to a function
- Being able to retrieve results from a function

:

Before you start
In your H drive create a folder *H:\ME1MCP\Session5* and work within it.

Task 1: Factorial, again
Write a function, *Factorial*, to compute the factorial of an integer number. The function receives an integer number *n* and returns the value of its factorial.

$$F = n! = n * (n-1) * (n-2) * (n-3) * \ldots \ldots * 3 * 2 * 1$$

Answer Question 1

Task B: Series expansion
The function $y(x) = e^x$ can be represented by the series expansion:

$$y(x) = \sum_{i=0}^{N} \frac{x^i}{i!} = 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \frac{x^4}{24} + \cdots$$

Write a function, *ExpSeries*, to approximate *y(x)* with *N* terms, in the range *x = [a:b]*.
The function *ExpSeries* receives a list of values *x* and the value of *N,* and returns a list *y* with the approximated values of $y(x) = e^x$.
(Recycle as much as you can from the script you have written in Tutorial 4, Task C. Also, make use of the function *MyFactorial* that you have created today).

Once the function *ExpSeries* is ready, write a script to plot *y(x)* in the range *x = [-4:2]* with points at intervals of 0.01, with *N = 2, 6, 10, 14*.

Answer Question 2

Task C: Sorting data
Write a function, *SortAscending*, that receives an array of numbers and returns the same array sorted in ascending order.
Test the function by generating an array of 50 integer random numbers between 1 and 100 and sorting them.

Answer Quiz 3

Task D: Warfare: the shooting videogame

Scope of the game is to fire a bullet from the ground and hit a circular target suspended in air (in a 2-dimensional space). The target is a circle of radius R, positioned at a random place, *(xt, yt)*, in the spatial unity quadrant. The bullet is a single size less point.

The user needs to guess and input the shooting angle, a_0, and the initial velocity, v_0, of the bullet, in order to hit the target.
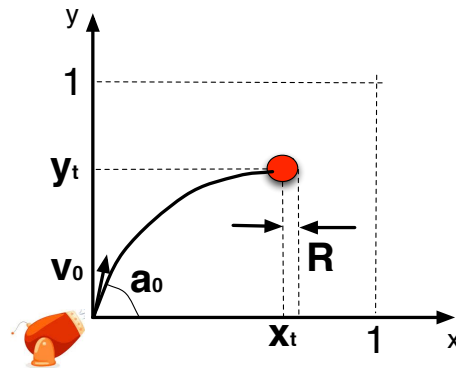
Write a function, *Shootbullet*, that receives the shooting angle, the initial velocity and the information about the target, i.e. *xt, yt* and *R*. The function must return the consequent shooting trajectory, i.e. two lists, *x* and *y*, coordinates of the trajectory, as described by:

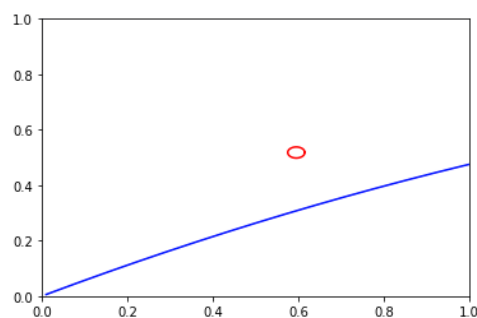$$y = xtan(a_0) - \frac{1}{2}\frac{x^2 g}{v_0^2}\frac{1}{cos^2(a_0)}$$

where *g = 9.81 m/s²* is the gravitational constant.
Set the step of the x-axis to *dx* = 0.01.
The function must also return a Boolean variable indicating whether the bullet has hit the target or reached the ground after missing the target.
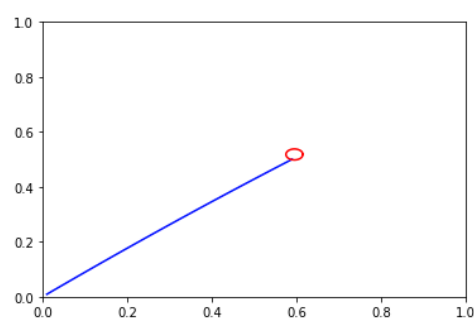
Now that you are ready to play, write a script that creates the target and asks the user to play until the target is hit. For every attempt, plot the war scenery (i.e. the trajectory and the target).

Answer Quiz 4