Practice with Scilab/Python

Numerical resolution of ODE's : Second-order Runge-Kutta method

We aim to solve numerically the ODE :

$$\begin{cases} y' & = f(y) \\ y(0) & = y_0 \end{cases}$$

We want to use the second order Runge-Kutta method to solve numerically this problem from the time $t = 0$ to the time $t = 1$. We decompose the interval $[0, 1]$ into n sub-intervals $[k/n, (k + 1)/n]$, each of them having the size $\Delta t = 1/n$. The approximate value of y at the time k/n is denoted y_k.

1. Write a Scilab/Python function `rk2` similar to the function `euler_ex` seen in the previous exercise sheet, but using the second order Runge-Kutta method instead of the explicit Euler method.
2. Plot on the same figure the exact solution the results obtained with the explicit Euler method and the second order Runge-Kutta method.
   What do you observe ?