Hand in 4, part 1 of 2 - Higher order methods

1. Consider the same problem as in the last hand in $y'(t) = f(y,t) = -0.5y$ with initial condition $y(0) = 1$. Construct a python-function for solving the problem using RK2 until time T.

2. Solve the problem until time $T = 10$ with $h = 0.1$. Plot the result together with the exact solution, which is $e^{-0.5y}$, the numerical solution should be very close to the exact one. You don't need to save this plot for the hand in, it is just for you to sanity-check your code.

3. Compare the error at time T between Euler forward (use the code from the last lab) and RK2. Half the step size and compare again. Does the error for RK2 and Euler behave as expected?

4. Redo exercise 3 for the equation $y'(t) = y - t^2$ with initial condition $y(0) = 1$ for $t \in [0,3]$. The exact solution is $y = 2 + 2t + t^2 - e^t$. Also include a plot of your Euler forward solution and your RK2 solution for $h = 0.1$.

This should be included in this part of the hand in: Your RK2 python code, the error measurements you did in task 3 and 4, together with some comment on how this relate to what you know about the order of accuracy of these methods, and lastly the plot from task 4. Deadline is Monday the 24th, 19:00.