1. **(20 points)** A dynamical system is given by its step response:

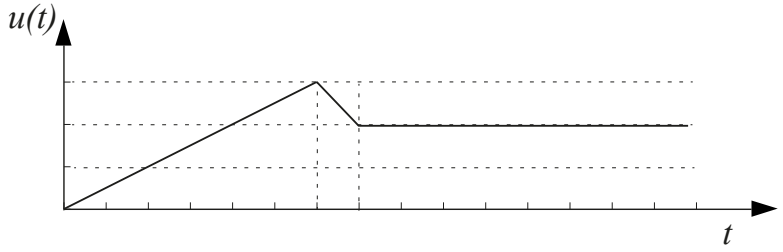
$$y(t) = 0.25 - 0.25e^{-t}\cos\sqrt{3}\,t + 0.25\sqrt{3}e^{-t}\sin\sqrt{3}\,t, \quad t \geq 0$$

   a) Calculate the transfer function of the system.
   b) Calculate the static gain, the natural frequency, the damping factor and the time constant(s) of the system.
   c) Calculate and sketch the impulse response of this system.

2. **(20 points)** Consider the following dynamical system

$$y^{(i)}(t) + 2y(t) = u(t)$$

   with $y(t)$ being the output and $u(t)$ the input of the system. If $u(t)$ given in the figure below (one tick represents one unit) is applied to the system:



   a) Calculate the Laplace transform of the input signal.
   b) Calculate the time response of the system.
   c) What is the final value of the response obtained in b)?
   d) Calculate and sketch the *step response* of this system for the initial condition $y(0) = -0.5$.