

# Computational Mathematics - Problem Sheet 3

MT 2022

Once you have completed the exercises, use the `publish` command to generate a `.pdf` file of your solutions.

1. Consider the initial value problem

$$(t + 1)^2 \frac{d^2 u}{dt^2} - 3(t + 1) \frac{du}{dt} + t = 1, \quad (1)$$

with initial conditions  $u(0) = 1$  and  $u'(0) = 1$ . Solve (1) in Matlab using `dsolve`.

2. Now (by hand) write (1) as a first-order system of ODEs by making the substitution  $v = \frac{du}{dt}$ . There is no need to show this in your solutions, but it will be necessary for the next question.
3. Download the files `ode_example.m` and `ode_template.m` from the course webpage. Using `ode_example.m` as a guide (and the Matlab help pages, if necessary), modify `ode_template.m` to numerically solve the ODE system from Q2 in the range  $t \in [0, 1]$ .
4. Plot the solutions of Q1 and Q3 on the same pair of labelled axes, and include a legend to distinguish between them. Ensure you include your name and college in the title.