Imperial College London
Department of mathematics
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Assignment 1

The project should be submitted as one zip- or tar-file to i.shevchenko@imperial.ac.uk by the due date. The file should contain all codes used to generate your results and a pdf-file of the report. The assignment must include a pledge that this is all your own work, your name and CID. Any marks received for the assignment are only indicative and may be subject to moderation and scaling.

Exercise 1 (The Euler method for scalar ODEs) — % of CW mark: 2.5

Solve the initial value problem

$$x' = 1 + t - x, \quad x(0) = 0, \quad t \in (0, 3.0] \tag{1}$$

with the Euler method.

a) Compute the numerical solution with the time steps $h = \{0.1, 0.05, 0.025\}$.

b) Compute the global error e_n and constant of proportionality for each h at $t = 3.0$.

c) Find the minimum number of time steps to get $e_n < 10^{-4}$ at $t = 3.0$.

d) Explain the results in **(a)–(c)**.

Exercise 2 (The Euler method for systems of ODEs) — % of CW mark: 2.5 Mastery Component

Solve the initial value problem

$$x'' + x' + 4x = t^2, \quad x(0) = 0, \quad x'(0) = 1, \quad t \in (0, 3.0] \tag{2}$$

with the Euler method.

a) Compute the numerical solution with the time steps $h = \{0.1, 0.05, 0.025\}$.

b) Compute the global error e_n and constant of proportionality for each h at $t = 3.0$.

c) Find the maximum h such that $e_n < 10^{-4}$ at $t = 3.0$.

d) Explain the results in **(a)–(c)**.