

Department of Bioengineering

BE3-HMIB – Modelling in Biology (MiB), Prof Guy-Bart Stan & Dr Tom Ouldrige

Each week a set of training exercises will be posted. We do not collect nor mark them. It is highly recommended you do all problems each week as it will prepare you well for the assessed coursework. If you are stuck, ask the GTAs during the Matlab training sessions to get help. All the training exercises have a computer component, which requires Matlab. You can download this from College, if you don't have it already. Matlab is installed on all cluster computers.

Training coursework 1

1D ODEs: simple numerics on the exponential

1. Consider a one-dimensional linear ODE $\dot{x} = -kx$, with $k = \frac{3}{5}$. Take as initial condition $x_0 = 4$ and use Matlab to find the solution of this equation numerically for $0 \leq t \leq 10$. Plot x as a function of time.
2. Obtain the analytical solution to this equation and plot it on the same figure. Use Matlab to obtain the *mean squared error* of the numerical solution with respect to the true analytical solution.
3. By default, `ode45` does not give the solution at fixed points in time. Confirm this in the numerical solution obtained in 1 by plotting integration step size vs time. Can you deduce why/when `ode45` takes smaller or larger steps?

In this coursework you may need to use the following Matlab commands: `ode45`, `function`, `plot`, `hold`, (`dsolve`, `subs`, `eval`). You can check the Matlab help by using `help COMMAND`.