Assignment 1

Due Date: no more than 48 hours before the next lecture

1. Please use the built-in MATLAB function (dsolve: https://www.mathworks.com/help/symbolic/dsolve.html) to solve the 1st order differential equation: y'(x) = xy.
2. Please solve the initial value problem, which is y'(x) = xy with y(1) = 1.
3. Please solve the 2nd order differential equation: y''(x) + 8y'(x) + 2y(x) = cos(x) with y(0) = 0 and y'(0) = 1.
4. Please solve the numerical solution of the 1st ode: y'(x)=xy^2+y with y(0) = 1 and the x domain is [0, 0.5]. Try to use ode23 (https://www.mathworks.com/help/matlab/ref/ode23.html) and ode45 (https://www.mathworks.com/help/matlab/ref/ode45.html) respectively and compare the numerical results.
5. Solve the system of Lorenz equations (You may find this page very helpful with MATLAB/Python code: https://en.wikipedia.org/wiki/Lorenz_system). (1) Discuss the system behavior under the constant values: sigma, rho, and beta; (2) Comment the robustness of the dynamical system under different conditions.
6. Consider Lotka-Volterra equations (https://en.wikipedia.org/wiki/Lotka%E2%80%93Volterra_equations), which is known as predatory-prey equations: (1) Plot the phase portrait; (2) Compare the results using ode23 and ode45.
7. Consider Rossler attractor (https://en.wikipedia.org/wiki/R%C3%B6ssler_attractor) with the defining equations, use MATLAB to develop the code to solve the Rossler attractor problem.