

# ECE-210-A HW9

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In this (final) problem set, you will review the symbolic toolbox and create a simple app using the app designer.

1. Consider the system of differential equations:

$$\begin{aligned}\frac{dx}{dt} &= y \\ \frac{dy}{dt} &= -x - y\end{aligned}$$

Solve the system using the symbolic toolbox's `dsolve` function using four different initial conditions (so you should have four sets of solutions):

$$\begin{aligned}x(0) &= -1, \quad y(0) = 1 \\ x(0) &= 1, \quad y(0) = 1 \\ x(0) &= -1, \quad y(0) = -1 \\ x(0) &= 1, \quad y(0) = -1\end{aligned}$$

Then plot all four parametric curves  $(x(t), y(t))$  on the same plot on  $t = [0 \ 100]$  using `fplot`. This should generate four spirals. Use a legend.

2. Consider the following experiment: You roll  $M$   $D$ -sided fair die, and count the sum of all the die values.

You are going to build an app using `appdesigner` that displays a histogram of the resulting sums. There should be input boxes to control the simulation, a button to run the simulation, and a plot plane (`UIAxes`) to plot the histogram. You will need three input boxes: one for  $M$ , one for  $D$ , and one for the number of simulations to run,  $N$ . Make each bin width 1, and normalize the counts (see the histogram `"BinWidth"` and `"Normalization"` options). (You can assume that the input is valid.)

For submission, export the app to a `.m` file by clicking "Save & Export to `.m` File," and make sure you can run it like you would a normal function. (E.g., if you export your app to `dice_sim.m`, you should be able to call it by running `dice_sim`.)

(As  $M$  increases, the distribution becomes more normal – this is a demonstration of the Central Limit Theorem.)