

# MATH 3341 — Fall 2021

## Lab 04: Plotting Data

If you haven't downloaded and unzipped [Math.3341.zip](#). Download and unzip it under H: (H Drive if you are working on the Remote Lab). Change the current working directory by typing `cd H:\Math.3341\Math.3341.Lab.04` in the Command Window, and type `edit lab_04_script` in the Command Window to edit `lab_04_script.m`.

### 1 BASICS OF PLOTTING FUNCTIONS

- (a) Plot  $y = x^3$ . Define a vector `x`, of which the range is from  $-10$  to  $10$  with step size  $4$ , then define `y` by aforementioned  $y$ . Plot in `subplot(2, 2, 1)`. Add labels `$x$`, `$y$` to  $x$ ,  $y$  axis, respectively, and add title `$y = x^{\{3\}}$` (step size =  $4$ ).
- (b) Repeat (a) but change the step size of vector `x` to  $0.1$ , and put the plot in `subplot(2, 2, 2)`. Observe the difference between two plots.
- (c) Plot the curve  $(x(t), y(t))$  whose parametrization is

$$\begin{cases} x(t) = 13 \sin^3 t, \\ y(t) = 13 \cos t - 5 \cos 2t - 2 \cos 3t - \cos 4t, \end{cases} \quad t \in [0, 2\pi]. \quad (1.1)$$

First, define a vector `t` using `linspace`, then define `x`, `y` by (1.1). Plot in `subplot(2, 2, 3)` with *red dash-dot* line. Add labels, title as shown in the third plot of Figure 1.

- (d) Plot the curve  $(x(t), y(t))$  whose parametrization is

$$\begin{cases} x(t) = 4 \sin \frac{24t}{25}, \\ y(t) = 3 \sin t, \end{cases} \quad t \in [-25\pi, 25\pi]. \quad (1.2)$$

First, define a vector `t` using `linspace` with 5000 entries, then define `x`, `y` by (1.2). Plot in `subplot(2, 2, 4)`. Add labels, title as shown in the fourth plot of Figure 1.

### 2 SET PROPERTIES FOR PLOTTING

- (a) Define `x`, which ranges from  $0$  to  $2\pi$  with 1000 points, and define `y1`, `y2`, and `y3` as follows

$$y_1 = \sin(x/2), \quad y_2 = \sin(x), \quad y_3 = \sin(2x).$$

- (b) Plot `y1`, `y2`, `y3` versus `x` in the same figure window with line style (`'LineWidth', 2`), legend, labels, grid, and title in Figure 2. Change the range of  $x$ -axis to  $[0, 2\pi]$ , and that of  $y$ -axis to  $[-1, 1]$ .
- (c) Use `set` to set the following properties:
- `XTick` to `[0, pi / 2, pi, 3 * pi / 2, 2 * pi]`;
  - `XTickLabel` to `{'0', '$\pi/2$', '$\pi$', '$3 \pi/2$', '$2\pi$'}`;
  - `GridLineStyle` to `'--'`;
  - `Box` to `'on'`;
  - `BoxStyle` to `'full'`.

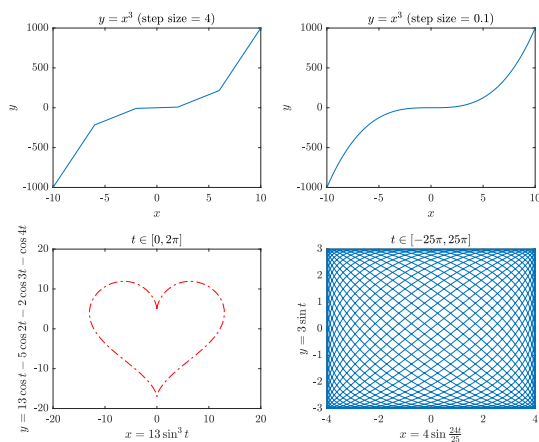


Figure 1: Expected Result for Part 1

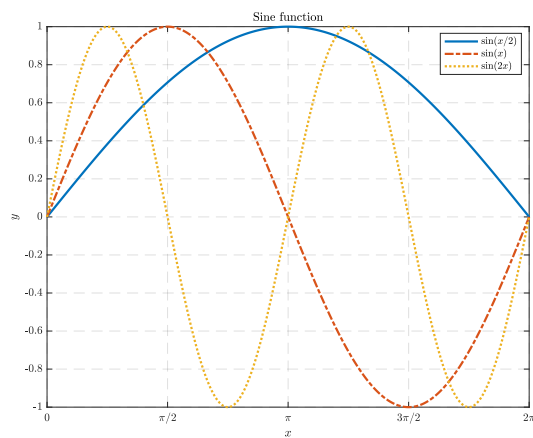


Figure 2: Expected Result for Part 2

### 3 PLOTTING PIECEWISE FUNCTION ON DIFFERENT SCALES

(a) Define  $x$  to be a vector from 0 to 10 with step size 0.01, and the piecewise function  $y$  as below

$$y = \begin{cases} \frac{e^8}{8}x & x \leq 8, \\ e^x & 8 < x. \end{cases}$$

(b) In `subplot(2, 2, 1)`, use `plot` to plot  $y$  versus  $x$ . Set `grid minor`, add labels and title as shown in the first plot in Figure 3.

(c) Repeat (b), then set  $y$ -axis to log scale using `set(gca, 'YScale', 'log');`.

(d) Repeat (b), but use `semilogy` to plot  $y$  versus  $x$  instead.

(e) Combine the first and the third figure in `subplot(2, 2, 4)` using `plotyy`, then add labels, title, etc. as shown in the fourth plot in Figure 3.

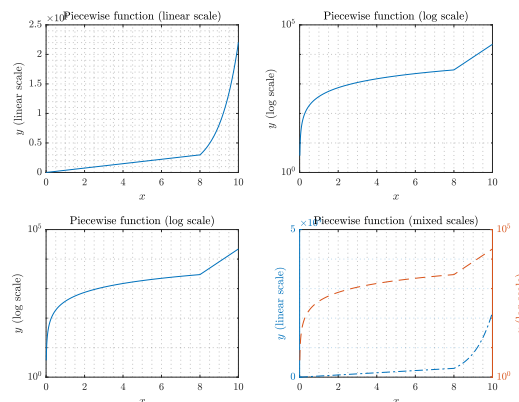


Figure 3: Expected Result for Part 3

### 4 SAVE PLOTS

Use the following script to save the figures.

```

1 prefix = 'lab_04_plot_';
2 for i = 1:3
3     name = strcat(prefix, num2str(i)); % Set filename for figure i
4     fig = figure(i); % Set figure i as current figure window
5     set(fig, 'PaperPositionMode', 'auto'); % Set paper position mode to 'auto'
6     pos = get(fig, 'PaperPosition'); % Get figure window paper position
7     set(fig, 'PaperSize', [pos(3) pos(4)]); % Set figure paper size
8     print(fig, '-dpdf', name); % Save figure
9 end

```

Once you finish, upload the script file `lab_04_script.m` to the folder `src`, figure files `lab_04_plot_1.pdf`, `lab_04_plot_2.pdf`, and `lab_04_plot_3.pdf` to the folder `figure` on Overleaf. Recompile, and submit the generated `.pdf` file to WyoCourses.