MATH 3341 — Fall 2020

Lab 04: Plotting Data

Download `Math.3341.Lab.04.zip`, unzip it and replace the files under `H:\Math.3341\Math.3341.Lab.04`. 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

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

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

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

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.

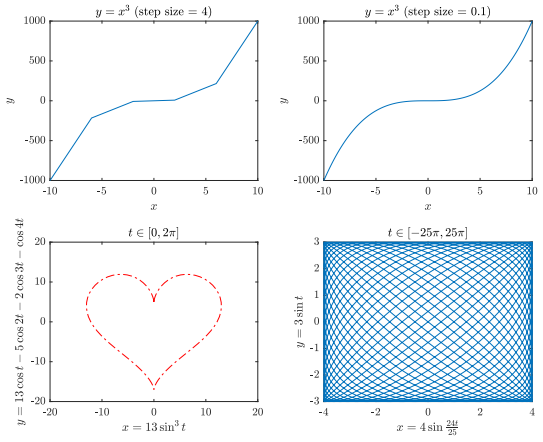

Figure 1: Expected Result for Part 1

2 Set Properties for Plotting

(a) Define `x`, which ranges from 0 to 2π 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'`.

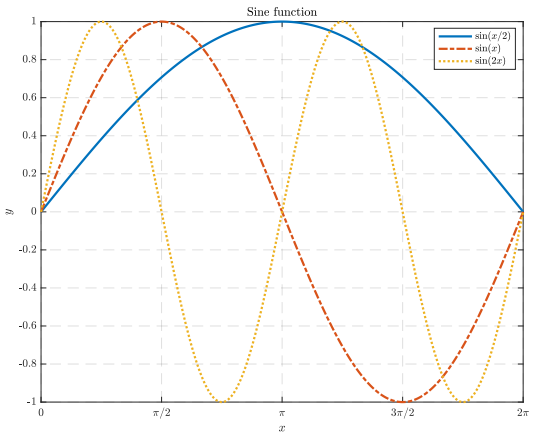

Figure 2: Expected Result for Part 2

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

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

(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.

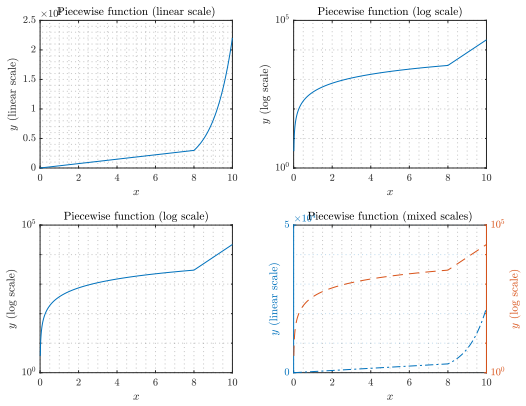

Figure 3: Expected Result for Part 3

4 Save Plots

Use the following script to save the figures.

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