Lab 04: Plotting Data

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1 BASICS OF PLOTTING FUNCTIONS
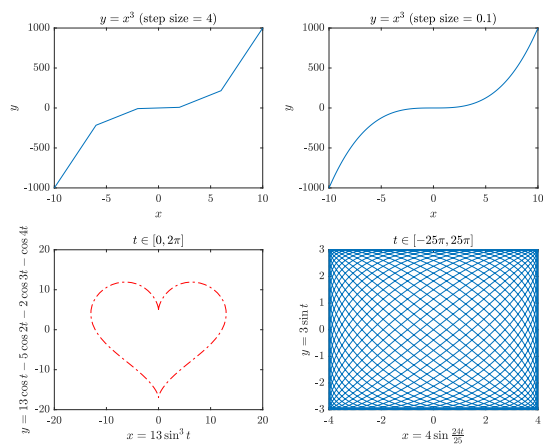

Figure 1: Plots of Special Curves

2 SET PROPERTIES FOR PLOTTING
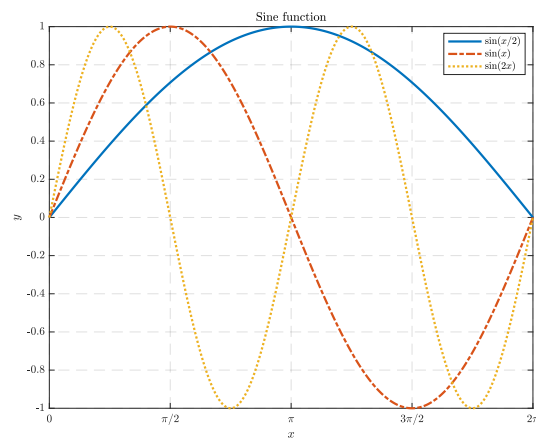

Figure 2: Plot of Sine Functions
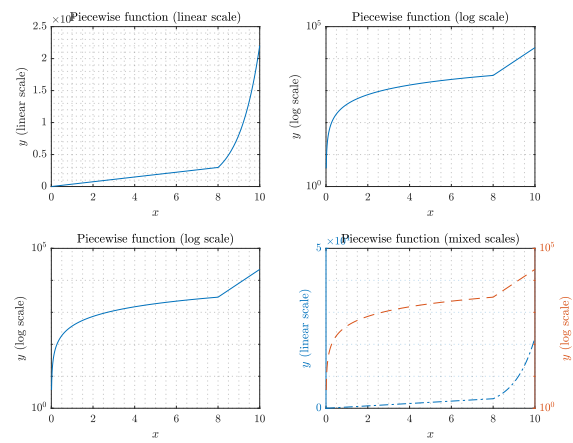
3   Plotting Piecewise Function on Different Scales

Figure 3: Plots of Piecewise Function on Different Scales

4 SCRIPT AND FUNCTION FILES

4.1 SCRIPT FILE

```matlab
% Math 3341, Fall 2021
% Lab 04: Plotting Data
% Author: Melissa Butler
% Date: 09/13/2021

clear  % clears all variables
close all; % closes all figure windows

% Change default text interpreter to LaTeX
set(groot,'defaultTextInterpreter','latex');
set(groot, 'defaultAxesTickLabelInterpreter','latex');
set(groot, 'defaultLegendInterpreter','latex')

%% 1 Basics of Plotting Functions
figure(1);

% 1(a)
x = -10:4:10;
y = x.^3;
subplot(2, 2, 1);
plot(x, y);
xlabel('$x$');
ylabel('$y$')
title('$y = x^3$ (step size = 4)');

% 1(b)
x = -10:0.1:10;
y = x.^3;
subplot(2, 2, 2);
plot(x, y);
xlabel('$x$');
ylabel('$y$')
title('$y = x^3$ (step size = 0.1)');

% 1(c)
t = linspace(0, 2 * pi);
x = 13 * (sin(t)).^3;
y = 13 * cos(t) - 5 * cos(2 * t) - 2 * cos(3 * t) - cos(4 * t);
subplot(2, 2, 3);
plot(x, y, 'r-.');
xlabel('$x = 13 \sin^3{t}$');
ylabel('$y = 13 \cos{t} - 5 \cos{2t} - 2 \cos{3t} - \cos{4t}$')
title('$t \in [0, 2 \pi]$');
axis([-20, 20, -20, 20])

% 1(d)
t = linspace(-25 * pi, 25 * pi, 5000);
x = 4 * sin(24 / 25 * t);
y = 3 * sin(t);
```

```matlab
50  subplot(2, 2, 4);
51  plot(x, y);
52  xlabel('$x = 4 \sin{\frac{24 t}{25}}$');
53  ylabel('$y = 3 \sin{t}$');
54  title('$t \in [-25\pi, 25\pi]$');
55  axis([-4, 4, -3, 3])
56
57  %% 2 Set Properties for Plots
58
59  % 2(a)
60  figure(2); hold on;
61  linestyles = {'-', '-.', ':'};
62  x = linspace(0, 2 * pi, 1000);
63  for i = -1:1
64      y = sin(2^i * x);
65      plot(x, y, 'LineStyle', linestyles{i + 2}, 'LineWidth', 2);
66  end
67
68  % 2(b)
69  legend({'$\sin(x/2)$', '$\sin(x)$', '$\sin(2x)$'}, 'Location', 'best');
70  grid on;
71  xlabel('$x$');
72  ylabel('$y$');
73  axis([0, 2*pi, -1, 1]);
74  title('Sine function');
75
76  % 2(c)
77  set(gca, 'XTick', [0, pi / 2, pi, 3 * pi / 2, 2 * pi]);
78  set(gca, 'XTickLabel', {'0', '$\pi/2$', '$\pi$', '$3 \pi / 2$', '$2\pi$'});
79  set(gca, 'GridLineStyle', '--');
80  set(gca, 'Box', 'on');
81  set(gca, 'BoxStyle', 'full');
82
83  %% 3 Piecewise Function on Different Scales
84  % 3(a)
85  x = 0:0.01:10;
86  y = (x <= 8) .* exp(8)/8 .* x +  (x > 8) .* exp(x);
87  figure(3);
88
89  % 3(b)
90  subplot(2, 2, 1);
91  plot(x, y);
92  grid minor;
93  xlabel('$x$');
94  ylabel('$y$ (linear scale)');
95  title('Piecewise function (linear scale)');
96
97  % 3(c)
98  subplot(2, 2, 2);
99  plot(x, y);
100 set(gca, 'YScale', 'log');
101 grid minor;
102 xlabel('$x$');
103 ylabel('$y$ (log scale)');
```

```matlab
104  title('Piecewise function (log scale)');
105
106  % 3(d)
107  subplot(2, 2, 3);
108  semilogy(x, y);
109  grid minor;
110  xlabel('$x$');
111  ylabel('$y$ (log scale)');
112  title('Piecewise function (log scale)');
113
114  % 3(e)
115  subplot(2, 2, 4);
116  [hAx, hLine1, hLine2] = plotyy(x, y, x, y, 'plot', 'semilogy');
117  set(hLine1, 'LineStyle', '-.');
118  set(hLine2, 'LineStyle', '--');
119  grid minor;
120  xlabel('$x$');
121  ylabel(hAx(1), '$y$ (linear scale)');
122  ylabel(hAx(2), '$y$ (log scale)');
123  title('Piecewise function (mixed scales)');
124
125  %% 4 Save Plots
126  prefix = 'lab_04_plot_';
127  for i = 1:3
128      name = strcat(prefix, num2str(i));        % Set filename for figure i
129      fig = figure(i);                          % Set figure i as current figure window
130      set(fig, 'PaperPositionMode', 'auto');    % Set paper position mode to 'auto'
131      pos = get(fig, 'PaperPosition');          % Get figure window paper position
132      set(fig, 'PaperSize', [pos(3) pos(4)]);   % Set figure paper size
133      print(fig, '-dpdf', name);                % Save figure
134  end
```