Lab 05: Formatting Output and LaTeX

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1 OUTPUT

```
 1  lab_05_script
 2
 3  x =
 4
 5      6086/263
 6
 7
 8  x =
 9
10      23.1406926327793e+000
11
12
13  x =
14
15              23.1406926327793
16
17
18  x =
19
20       2.314069263277927e+01
21
22
23  x =
24
25    23.140692632779267
26
27
28  x =
29
30      23.1407e+000
31
32
33  x =
34
35          23.141
```

```
36
37
38  x =
39
40      2.3141e+01
41
42
43  x =
44
45      23.1407
46
47  x          sin(x/2)  sin(x)   sin(2x)
48  0.000000   0.000000  0.000000  0.000000
49  0.261799   0.130526  0.258819  0.500000
50  0.523599   0.258819  0.500000  0.866025
51  0.785398   0.382683  0.707107  1.000000
52  1.047198   0.500000  0.866025  0.866025
53  1.308997   0.608761  0.965926  0.500000
54  1.570796   0.707107  1.000000  0.000000
55  1.832596   0.793353  0.965926  -0.500000
56  2.094395   0.866025  0.866025  -0.866025
57  2.356194   0.923880  0.707107  -1.000000
58  2.617994   0.965926  0.500000  -0.866025
59  2.879793   0.991445  0.258819  -0.500000
60  3.141593   1.000000  0.000000  -0.000000
61  3.403392   0.991445  -0.258819 0.500000
62  3.665191   0.965926  -0.500000 0.866025
63  3.926991   0.923880  -0.707107 1.000000
64  4.188790   0.866025  -0.866025 0.866025
65  4.450590   0.793353  -0.965926 0.500000
66  4.712389   0.707107  -1.000000 0.000000
67  4.974188   0.608761  -0.965926 -0.500000
68  5.235988   0.500000  -0.866025 -0.866025
69  5.497787   0.382683  -0.707107 -1.000000
70  5.759587   0.258819  -0.500000 -0.866025
71  6.021386   0.130526  -0.258819 -0.500000
72  6.283185   0.000000  -0.000000 -0.000000
73
74  \begin{table}[!hbtp]
75  \centering
76  \caption{Sine functions}
77  \label{tab:sine}
78  \begin{tabular}{lcrr}
79  \toprule
80          $x$ & $\sin(x/2)$ &   $\sin(x)$ &  $\sin(2x)$ \\
81  \midrule
82  $ 0.000000$ & $ 0.000000$ & $ 0.000000$ & $ 0.000000$ \\
83  $ 0.261799$ & $ 0.130526$ & $ 0.258819$ & $ 0.500000$ \\
```

```
 84  $ 0.523599$ & $ 0.258819$ & $ 0.500000$ & $ 0.866025$ \\
 85  $ 0.785398$ & $ 0.382683$ & $ 0.707107$ & $ 1.000000$ \\
 86  $ 1.047198$ & $ 0.500000$ & $ 0.866025$ & $ 0.866025$ \\
 87  $ 1.308997$ & $ 0.608761$ & $ 0.965926$ & $ 0.500000$ \\
 88  $ 1.570796$ & $ 0.707107$ & $ 1.000000$ & $ 0.000000$ \\
 89  $ 1.832596$ & $ 0.793353$ & $ 0.965926$ & $-0.500000$ \\
 90  $ 2.094395$ & $ 0.866025$ & $ 0.866025$ & $-0.866025$ \\
 91  $ 2.356194$ & $ 0.923880$ & $ 0.707107$ & $-1.000000$ \\
 92  $ 2.617994$ & $ 0.965926$ & $ 0.500000$ & $-0.866025$ \\
 93  $ 2.879793$ & $ 0.991445$ & $ 0.258819$ & $-0.500000$ \\
 94  $ 3.141593$ & $ 1.000000$ & $ 0.000000$ & $-0.000000$ \\
 95  $ 3.403392$ & $ 0.991445$ & $-0.258819$ & $ 0.500000$ \\
 96  $ 3.665191$ & $ 0.965926$ & $-0.500000$ & $ 0.866025$ \\
 97  $ 3.926991$ & $ 0.923880$ & $-0.707107$ & $ 1.000000$ \\
 98  $ 4.188790$ & $ 0.866025$ & $-0.866025$ & $ 0.866025$ \\
 99  $ 4.450590$ & $ 0.793353$ & $-0.965926$ & $ 0.500000$ \\
100  $ 4.712389$ & $ 0.707107$ & $-1.000000$ & $ 0.000000$ \\
101  $ 4.974188$ & $ 0.608761$ & $-0.965926$ & $-0.500000$ \\
102  $ 5.235988$ & $ 0.500000$ & $-0.866025$ & $-0.866025$ \\
103  $ 5.497787$ & $ 0.382683$ & $-0.707107$ & $-1.000000$ \\
104  $ 5.759587$ & $ 0.258819$ & $-0.500000$ & $-0.866025$ \\
105  $ 6.021386$ & $ 0.130526$ & $-0.258819$ & $-0.500000$ \\
106  $ 6.283185$ & $ 0.000000$ & $-0.000000$ & $-0.000000$ \\
107  \bottomrule
108  \end{tabular}
109  \end{table}
110  diary off
```

2 SCRIPT

```matlab
1   % Math 3341, Fall 2021
2   % Lab 05: Formatting Output and LaTeX
3   % Author: Melissa Butler
4   % Date: 09/20/2021
5
6   clear; close all; clc;
7   % Change default text interpreter to LaTeX
8   set(groot, 'defaultTextInterpreter','latex');
9   set(groot, 'defaultAxesTickLabelInterpreter','latex');
10  set(groot, 'defaultLegendInterpreter','latex')
11
12  %% 1 Formatting Numerical Values
13  % 1(a)
14  x = exp(pi);
15  % 1(b)
16  format_types = {'rat', ...
17          'longeng', 'longg', 'longe', 'long', ...
18          'shorteng', 'shortg', 'shorte', 'short'};
19  % 1(c)
20  for i = 1:length(format_types)
21      format(format_types{i}); x
22  end
23
24  %% 2 Formatting Numerical Values using fprintf
25  % 2(a)
26  x = linspace(0, 2 * pi, 25)';
27  y1 = sin(x / 2);
28  y2 = sin(x);
29  y3 = sin(2 * x);
30  % 2(b)
31  data = [x y1 y2 y3];
32  data_size = size(data);
33  % 2(c)
34  fprintf('%-9s %-9s %-9s %-9s\n', 'x', 'sin(x/2)', 'sin(x)', 'sin(2x)');
35  % 2(d)
36  for i = 1:data_size(1)
37      fprintf('%-9.6f %-9.6f %-9.6f %-9.6f\n', data(i, 1), data(i, 2), data(i, 3), data(i, 4));
38  end
39
40  % fprintf('%9.6f %9.6f %9.6f %9.6f\n', data');
41
42  % 3(a)
43  file_handle = fopen('sin.tex', 'w');
44  % 3(b)(c)(d)
45  fprintf(file_handle, '\\begin{table}[!hbtp]\n');
46  fprintf(file_handle, '\\centering\n');
47  fprintf(file_handle, '\\caption{Sine functions}\n');
48  fprintf(file_handle, '\\label{tab:sine}\n');
49  fprintf(file_handle, '\\begin{tabular}{lcrr}\n');
50  fprintf(file_handle, '\\toprule\n');
```

```matlab
51  fprintf(file_handle, '%11s & %11s & %11s & %11s \\\\\n', '$x$', '$\sin(x/2)$', '$\sin(x)$', '$\sin
        (2x)$');
52  fprintf(file_handle, '\\midrule\n');
53  % fprintf(file_handle, '$%9.6f$ & $%9.6f$ & $%9.6f$ & $%9.6f$ \\\\\n', data');
54  for i = 1:data_size(1)
55      fprintf(file_handle, '$%9.6f$ & $%9.6f$ & $%9.6f$ & $%9.6f$ \\\\\n', data(i, 1), data(i, 2),
            data(i, 3), data(i, 4));
56  end
57  fprintf(file_handle, '\\bottomrule\n');
58  fprintf(file_handle, '\\end{tabular}\n');
59  fprintf(file_handle, '\\end{table}\n');
60  fclose(file_handle);
61  type('sin.tex');
62
63  %% 4 Plotting Multiple Functions using for-loop
64  figure(1); hold on;
65  % 4(a)
66  styles = {'o-', 'd-.', '^--'};
67  % 4(b)
68  y = {y1, y2, y3};
69  % 4(c)
70  for i = 1:3
71      plot(x, y{i}, styles{i});
72  end
73  % 4(d)
74  legend({'$\sin(x/2)$', '$\sin(x)$', '$\sin(2x)$'}, 'Location', 'best');
75  grid on;
76  xlabel('$x$');
77  ylabel('$y$')
78  axis([0, 2*pi, -1, 1]);
79  title('Sine functions');
80  set(gca, 'XTick', [0, pi / 2, pi, 3 * pi / 2, 2 * pi]);
81  set(gca, 'XTickLabel', {'0', '$\pi/2$', '$\pi$', '$3 \pi / 2$', '$2\pi$'});
82  set(gca, 'GridLineStyle', '--');
83  set(gca, 'Box', 'on');
84  set(gca, 'BoxStyle', 'full');
85
86  % 4(e)
87  name = 'lab_05_plot';
88  fig = figure(1);                      % Set figure i as current figure window
89  set(fig, 'PaperPositionMode', 'auto');  % Set paper position mode to 'auto'
90  pos = get(fig, 'PaperPosition');      % Get figure window paper position
91  set(fig, 'PaperSize', [pos(3) pos(4)]); % Set figure paper size
92  print(fig, '-dpdf', name);            % Save figure
```

3   BASICS OF LaTeX

```
\subsection{Sine functions}
For given $x \in [0, 2\pi]$ with step size $\pi/12$, we can obtain the
evaluations of \eqref{eq:y1}, \eqref{eq:y2}, \eqref{eq:y3} at $x$
(see Table \ref{tab:sin}), and the corresponding plot (see Figure \ref{fig:sin}).
\begin{align}
y_1 & = \sin(x/2) \label{eq:y1}
y_2 & = \sin(x)   \label{eq:y2}
y_3 & = \sin(2x)  \label{eq:y3}
\end{align}
\input{../src/sin.tex}
\begin{figure}[!hbtp]
    \centering
    \includegraphics[width=0.75\textwidth]{../src/lab_05_plot.pdf}
    \caption{Sine functions}
    \label{fig:sin}
\end{figure}
```