## Lab 01: Introduction to MATLAB and LATEX

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## 1 Output

```
beep off
 2
   help log
 3
    <strong>log</strong>
                             Natural logarithm.
 4
        <strong>log</strong>(X) is the natural logarithm of the elements of X.
 5
       Complex results are produced if X is not positive.
 6
 7
        See also <a href="matlab:help log1p">log1p</a>, <a href="matlab:help log2">log2</a>, <
           a href="matlab:help log10">log10</a>, <a href="matlab:help exp">exp</a>, <a href="
           matlab:help logm">logm</a>, <a href="matlab:help reallog">reallog</a>.
 8
       <a href="matlab:doc log">Reference page for log</a>
 9
10
        <a href="matlab:matlab.internal.language.introspective.overloads.displayOverloads('log</pre>
            ')">Other functions named log</a>
11
12
   help sin
13
    <strong>sin</strong>
                             Sine of argument in radians.
14
        <strong>sin</strong>(X) is the sine of the elements of X.
15
16
       See also <a href="matlab:help asin">asin</a>, <a href="matlab:help sind">sind">sind</a>.
17
18
        <a href="matlab:doc sin">Reference page for sin</a>
19
        <a href="matlab:matlab.internal.language.introspective.overloads.displayOverloads('sin</pre>
            ')">Other functions named sin</a>
20
21
   help tan
22
    <strong>tan</strong>
                             Tangent of argument in radians.
23
        <strong>tan</strong>(X) is the tangent of the elements of X.
24
25
        See also <a href="matlab:help atan">atan</a>, <a href="matlab:help atan2">atan2</a>, <
           a href="matlab:help tand">tand</a>, <a href="matlab:help atan2d">atan2d</a>.
26
27
        <a href="matlab:doc tan">Reference page for tan</a>
28
        <a href="matlab:matlab.internal.language.introspective.overloads.displayOverloads('tan</pre>
            ')">Other functions named tan</a>
29
```

```
30 2 + 5
31
32 ans =
33
   7
34
35
36 4 ^ 5
37
38 ans =
39
40
         1024
41
42 7 * 6
43
44 ans =
45
46
     42
47
48 3 / 8
49
50 ans =
51
52
     0.3750
53
54 | 54460 - 2342
55
56 ans =
57
58
   52118
59
60 cos(50 / 180 * pi)
61
62 ans =
63
64
     0.6428
65
66 | sqrt(4)
67
68 ans =
69
70
     2
71
72 log(3)
73
74 ans =
75
76
      1.0986
77
```

```
sin(pi / 2)
 78
 79
 80
    ans =
 81
 82
          1
 83
    e ^ 34
 84
 85
    {Undefined function or variable 'e'.
 86
 87
    exp(34)
 88
 89
    ans =
 90
 91
       5.8346e+14
 92
93
    plus(2, 5)
 94
95
    ans =
 96
 97
         7
 98
99
    power(4, 5)
100
101
    ans =
102
103
             1024
104
105
    times(7, 6)
106
107
    ans =
108
109
         42
110
111
    rdivide(3, 8)
112
113
    ans =
114
115
         0.3750
116
117
    minus(54460, 2342)
118
119
    ans =
120
121
            52118
122
123 help plus
124
         Plus.
125
        X + Y adds matrices X and Y. X and Y must have compatible sizes. In the
```

```
126
         simplest cases, they can be the same size or one can be a scalar. Two
127
         inputs have compatible sizes if, for every dimension, the dimension
128
         sizes of the inputs are either the same or one of them is 1.
129
130
         C = \langle strong \rangle plus \langle strong \rangle (A,B) is called for the syntax 'A + B' when A or B is an
131
         object.
132
133
         <a href="matlab:doc plus">Reference page for plus</a>
134
         <a href="matlab:matlab.internal.language.introspective.overloads.displayOverloads('</pre>
             plus')">Other functions named plus</a>
135
136
     help power
137
      .^ Array power.
138
         Z = X.^Y denotes element-by-element powers. X and Y must have
139
         compatible sizes. In the simplest cases, they can be the same size or
140
         one can be a scalar. Two inputs have compatible sizes if, for every
141
         dimension, the dimension sizes of the inputs are either the same or one
142
         of them is 1.
143
144
         C = \langle strong \rangle power \langle strong \rangle (A,B) is called for the syntax 'A .^ B' when A or B is an
145
         object.
146
147
         See also <a href="matlab:help mpower">mpower</a>, <a href="matlab:help nthroot">
             nthroot</a>, <a href="matlab:help realpow">realpow</a>.
148
149
         <a href="matlab:doc power">Reference page for power</a>
150
         <a href="matlab:matlab.internal.language.introspective.overloads.displayOverloads('</pre>
             power')">Other functions named power</a>
151
152
     help times
153
     .* Array multiply.
154
         X.*Y denotes element-by-element multiplication. X and Y must have
155
         compatible sizes. In the simplest cases, they can be the same size or
156
         one can be a scalar. Two inputs have compatible sizes if, for every
157
         dimension, the dimension sizes of the inputs are either the same or one
         of them is 1.
158
159
160
         C = \langle strong \rangle = \langle A,B \rangle is called for the syntax 'A .* B' when A or B is an
161
         object.
162
163
         See also <a href="matlab:help mtimes">mtimes</a>.
164
165
         <a href="matlab:doc times">Reference page for times</a>
166
         <a href="matlab:matlab.internal.language.introspective.overloads.displayOverloads('</pre>
             times')">Other functions named times</a>
167
168
    help rdivide
169
     ./ Right array divide.
```

196

diary off

170	A./B denotes element-by-element division. X and Y must have compatible
171	sizes. In the simplest cases, they can be the same size or one can be a
172	scalar. Two inputs have compatible sizes if, for every dimension, the
173	dimension sizes of the inputs are either the same or one of them is 1.
174	
175	C = <strong>rdivide</strong> (A,B) is called for the syntax 'A ./ B' when A or B is an
176	object.
177	
178	See also <a href="matlab:help ldivide">ldivide</a> , <a href="matlab:help mldivide"> mldivide</a> , <a href="matlab:help mrdivide">mrdivide</a> .
179	
180	<a href="matlab:doc rdivide">Reference page for rdivide</a>
181	<pre><a href="matlab:matlab.internal.language.introspective.overloads.display0verloads('&lt;/pre&gt;&lt;/td&gt;&lt;/tr&gt;&lt;tr&gt;&lt;td&gt;rdivide')">0ther functions named rdivide</a></pre>
	182
183	help minus
184	- Minus.
185	X - Y subtracts matrix Y from X. X and Y must have compatible sizes. In
186	the simplest cases, they can be the same size or one can be a scalar.
187	Two inputs have compatible sizes if, for every dimension, the dimension
188	sizes of the inputs are either the same or one of them is 1.
189	
190	C = <strong>minus</strong> (A,B) is called for the syntax 'A - B' when A or B is an
191	object.
192	
193	<a href="matlab:doc minus">Reference page for minus</a>
194	<a href="matlab:matlab.internal.language.introspective.overloads.displayOverloads('minus')">Other functions named minus</a>
195	

```
\section{Basics of \LaTeX{}}
\subsection{Simplifying Fractions}
Consider the function
$$
f(x) = \frac{x^2 - 1}{x + 1}.
To simplify this funciton we can factor the numerator and cancel like terms
\begin{align*}
   f(x)
      & = \frac{x^2 - 1}{x + 1}
   \end{align*}
\subsection{Matrix}
A general $3 \times 3$ matrix $A$ has the form
$$
A =
\begin{bmatrix}
   1 & 2 & 3 \\
   4 & 5 & 6 \\
   7 & 8 & 9 \\
\end{bmatrix}.
$$
\subsection{The Millennium Prize Problems}
\emph{The Millennium Prize Problems} are seven problems in mathematics that were stated by
the \textbf{Clay Mathematics Institute} on May 24, 2000. The problems are
\begin{enumerate}[(1)]
  \item Birch and Swinnerton-Dyer conjecture,
  \item Hodge conjecture,
  \item Navier-Stokes existence and smoothness,
  \item P versus NP problem,
  \item Poincar\'{e} conjecture,
  \item Riemann hypothesis,
  \item Yang-Mills existence and mass gap.
\end{enumerate}
\textsc{The Riemann zeta function} is defined for complex $s$ with real part greater than $1$
by the absolutely convergent infinite series
$$
\zeta(s) = \sum_{n=1}^{\sin\{1\}} \frac{1}{n^s} = \frac{1}{1^s} + \frac{1}{2^s} + \frac{1}{3^s} + \cdots
The practical uses of the Riemann hypothesis include many propositions known true under the
Riemann hypothesis, and some that can be shown to be equivalent to the Riemann hypothesis:
\begin{itemize}
  \item Distribution of prime numbers,
  \item Growth of arithemtic functions,
```

\item Large prime gap conjecture,
\item Criteria equivalent to the Riemann hypothesis.
\end{itemize}