1 Introduction

\LaTeX is a high-quality typesetting system; it includes features designed for the production of technical and scientific documentation. \LaTeX{} is the de facto standard for the communication and publication of scientific documents.

\LaTeX{} is also incredibly sophisticated and complex. Entire books have been written about it, and still more could be written. This short guide is not sufficient to cover any of it’s features in depth, but rather to provide a feel for what is possible, and so that you will understand what you are looking for when searching through the documentation.

2 Quickstart

While it is entirely possible for you to install \LaTeX{}\footnote{https://www.latex-project.org/} on your own computer, it is suggested that you use Overleaf\footnote{https://www.overleaf.com} which allows you to begin writing \LaTeX{} immediately, as well as easily collaborate with others on documents.

3 Syntax

Here are a few pointers. See the \LaTeX{} introduction\footnote{https://www.latex-project.org/about/} for more information.

• Commands begin with a \textbackslash{}.

• Commands may have arguments in square brackets ([]) and curly braces ({}).

• Curly braces can also group together a block of text.

• Blocks of text are also often denoted with \texttt{\begin{something}} and \texttt{\end{something}}. This is often referred to as an \texttt{environment}.

• Comments begin with a %.

• Whitespace at the beginning of a line does not matter. Whitespace at the end of a line matters \textit{a lot}, so you will often see \LaTeX{} code with % at the end of every line. Use this style if you want.

• \LaTeX{} is old. It has a staggering number of packages, and sometimes things aren’t as straightforward as we would like. The complexity, however, has the payoff that almost everything is customizable.

• You are probably not the only person who has faced whatever problem you are trying to solve. Search engines are your friend.

4 The Document

Every document input file has the following form (indentation is not required and is for clarity only in this example):

\begin{verbatim}
\documentstyle[opt-list]{doc-style}
preamble commands
\begin{document}
text
\end{document}
\end{verbatim}

The \texttt{preamble} is used to import packages (\texttt{\usepackage{something}}) and to perform any other setup required.

\footnote{https://www.latex-project.org/}
\footnote{https://www.overleaf.com}
\footnote{https://www.latex-project.org/about/}
5 Examples

A picture is worth a thousand words, and an example will (hopefully) answer your questions the quickest.

5.1 Math

\LaTeX{} creates beautiful formulas, but it can’t read your mind. You need to tell \LaTeX{} where the math is, and how it fits in with the surrounding text. This is usually in one of two forms, math mode, and display math. Forget the name similarity, and look at how it is used.

5.1.1 Math Mode

The solution to $\sqrt{x} = 5$ is $x = 5$.

5.1.2 Display Math

The solution to \[
\sqrt{x} = 5\] is \[x = 25.\]

5.1.3 Inline Display Math

\textbf{Inline:} Evaluate the sum $\sum_{i=0}^n i^3$.

\textbf{Combined:} Evaluate the sum $\sum_{i=0}^n i^3$.

Notice that the single newline did not affect the formula placement.

5.1.4 Breaking Out Of Math Mode

Sometimes you need to put “normal” text inside of a mathematical expression.

\begin{tabular}{rl}
Separate equations: & $a = b$ and $b = c$ \\
All in a single equation: & $a = b = c$ \\
Using \verb|\texttt|{}: & $a = b = c$ \\
Oops, we need spaces! & $a = b$ and $b = c$
\end{tabular}

\verb|\begin{tabular}|{r1}
Separate equations: & $a = b$ and $b = c$ \\
All in a single equation: & $a = b$ and $b = c$ \\
Using \verb|\texttt|{}: & $a = b \texttt{and} b = c$ \\
Oops, we need spaces! & $a = b \texttt{and} b = c$
\verb|\end{tabular}|

Obviously, the preceding example is contrived, and can be easily written as two separate equations, but sometimes the expression cannot be easily worked around. Consider the following example, in which words are being injected into a formula. Without \texttt{}, the letters are treated like variables as part of the mathematical expression, and spaces are ignored, the end result being that the equation might be misunderstood.

\[
\sum_{i=\text{the starting point}}^n i^3
\]

\[
\sum_{i=\text{the starting point}}^n i^3
\]

5.1.5 Aligned Equations

Equations can be aligned using the \texttt{align} environment. Equations must be separated with a linebreak (\texttt{\\}), and will be aligned along the \&. You must also include the \texttt{amsmath} package (\textit{i.e.}, put \texttt{\usepackage{amsmath}} in your preamble).

\begin{align*}
1 + 2 &= 3 \\
1 &= 3 - 2
\end{align*}
5.1.6 Other Math Necessities

Superscript: $x^2$ or $x^{hi}$ or $x^{x^x}$.
Subscript: $x_2$ or $x_{hi}$ or $x_{x_x}$.

See also https://en.wikibooks.org/wiki/LaTeX/Mathematics.

5.2 Text Formatting

5.2.1 Paragraphs

A new paragraph is denoted by leaving a blank line in your source file.

```
1 2
3
```

5.2.2 Punctuation

Quote marks are often a combination of back ticks and apostrophes.

```
"What do you want?"
'stuff'
Don't do 'this'. Or "this". It ain't right!
"This" might be ok.
```

5.2.3 Bold, Italics, etc.

There are two ways to type each two-letter formatting command. Note the \/, which is an "italic correction" and provides a space correction after italic text (see Italic A vs. Italic B). When in doubt, include it. It does not add extra space if the preceding text was not italicized.

```
\begin{tabular}{rl}
No Formatting: & This and this.\\
Bold: & \textbf{This and this}.\\
Italic A: & \textit{This and this}.\\
Italic B: & \textit{This and this}.\\
Roman: & \texttt{This and this}.\\
Small Capitals: & \textsc{This and this}.\\
Sans Serif: & \textsf{This and this}.\\
Slanted: & \textsl{This and this}.\\
Typewriter: & \texttt{This and this}.\\
\end{tabular}
```

There is also an "emphasis" command, whose behavior changed depending on the environment in which it is used.

```
1a: I love this class!\\
1b: I love this class!\\
2: I love this class!\\
3: I love this class!\\
4: I love THIS CLASS!\\
5: I love this class!\\
6: I love this class!\\
7: I love this class!\\
```

```
1a: {\bf I \{em love\}/ this class!\\
1b: {\bf I \{em love\}/ this class!\\
2: {\it I}/ \{em love\}/ this class!\\
3: {\rm I \{em love\}/ this class!\\
4: {\sc I \{em love\}/ this class!\\
5: {\sf I \{em love\}/ this class!\\
6: {\sl I}/ \{em love\}/ this class!\\
7: {\tt I \{em love\}/ this class!\\
```
5.2.4 Text alignment

Four score and seven years ago our fathers brought forth on this continent, a new nation, conceived in Liberty, and dedicated to the proposition that all men are created equal.

\begin{flushright}
Four score and seven years ago our fathers brought forth on this continent, a new nation, conceived in Liberty, and dedicated to the proposition that all men are created equal.
\end{flushright}

\begin{flushleft}
Four score and seven years ago our fathers brought forth on this continent, a new nation, conceived in Liberty, and dedicated to the proposition that all men are created equal.
\end{flushleft}

\begin{center}
Four score and seven years ago our fathers brought forth on this continent, a new nation, conceived in Liberty, and dedicated to the proposition that all men are created equal.
\end{center}

5.2.5 Text size

There are 10 commands to alter the size of type. Notice the use of a variable called \temp, which was defined using \def. Also note the use of the \LaTeX{} command, which is used religiously by the \LaTeX{} community to refer to the project.

\def\temp{\LaTeX{} is weird but cool\ldots}
\tiny\temp
\scriptsize\temp
\footnotesize\temp
\small\temp
\normalsize\temp
\large\temp
\Large\temp
\LARGE\temp
\huge\temp
\Huge\temp

5.2.6 Macros

You can define your own macros. There are 3 methods: \def, \newcommand and \renewcommand. \def is the primitive \TeX command, and will overwrite an existing definition. \newcommand and \renewcommand are new to \LaTeX, and behave exactly the same as \def, except that \newcommand will produce an error if it tries to redefine an existing macro. \newcommand and \renewcommand are provided so that you don’t accidentally overwrite an existing macro, unless you specifically intend to, of course.

Commands can even have arguments, identified by numbers.
\LaTeX{} is easy.
Corey was here.
Hi!!!

\[\text{\def\is#1#2{#1 is #2.}}\]
\[\text{\is{\LaTeX{}}{easy}}\]

\[\text{\def\was#1{#1 was here.}}\]
\[\text{\was{Corey}}\]

\[\text{\def\hi{Hi!!!}}\]
\[\text{\hi}\]

Compare with \texttt{\textbackslash{}newcommand}. Notice that the number of arguments must be given inside the square brackets. If the square brackets are not present, then it defaults to 0.

\[\text{\newcommand{\is}{[2]{#1 is #2.}}}\]
\[\text{\is{\LaTeX{}}{easy}}\]

\[\text{\newcommand{\was}{[1]{#1 was here.}}}\]
\[\text{\was{Corey}}\]

\[\text{\newcommand{\hi}{[1]{Hi!!!}}}\]
\[\text{\hi}\]

\section*{5.2.7 Lists}
Here is a list.

\begin{itemize}
\item I am the first item.
\item I am the second item.
\item I am the third.
\end{itemize}

Here is a numbered list.

\begin{enumerate}
\item I am the first item.
\item I am the second item.
\item I am the third.
\end{enumerate}

\section*{5.2.8 Tables}
Tables are evil. Chapters of books are written about them, so please realize that this is a very short introduction to the topic. The general form is:

\[\begin{\texttt{\textbackslash{}begin\{tabular\}[\pos\}{\textbackslash{}preamble}\end{\texttt{tabular}}}\]
\texttt{\textbackslash{}rows}\texttt{\textbackslash{}end\{tabular\}}

[pos] has to do with vertical alignment of the table, and may be omitted unless necessary.

\texttt{preamble} specifies the columns and their inner text alignment.

Within the \texttt{rows} area, each column must be separated with an \texttt{"&"}, and end with a \texttt{"\"} and a \texttt{\textbackslash{}hline} (if a horizontal line is desired. Notice that the extra spaces do not impact the final display, but make the source code easier to read.

\[
\begin{tabular}{|rcl|}
\hline
Four & score & and \\
seven & years & ago \\
our & fathers & brought \\
forth & on & this \\
\hline
\end{tabular}
\]

Compare the previous example with this one, which has a different preamble section and additional \texttt{\hline} commands.

\[
\begin{tabular}{|c|c|c|}
\hline
four & score & and \\
seven & years & ago \\
our & fathers & brought \\
forth & on & this \\
\hline
\end{tabular}
\]

For more info, check out https://en.wikibooks.org/wiki/LaTeX/Tables.
5.3 Advanced Scripting

You can write complicated scripts in \LaTeX{}, but they are not always straightforward to design.

https://cscrunch.com/blog/corey-pennycuff/scripting-latex-create-base-conversion-worksheet

Here is an example of scripting in \LaTeX{}, as well as a description of how the code was constructed.

5.4 Additional Resources

https://www.overleaf.com/learn/latex/Learn_LaTeX_in_30_minutes

http://detexify.kirelabs.org/

http://shapecatcher.com

Also, your favorite search engine.