UNIVERSITY OF CAMBRIDGE

How to use LaTeX

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April 20, 2019

Why LaTeX ?

An extremely good philosophical question.

- Microsoft Office Word and PowerPoint are boring.
- LaTeX is elegant, charming, or whatever...
- Excellent for mathematical typesetting.
- Powerful, lots and lots of power for you to extend it, be it theses, papers, slides (using Beamer), spreadsheets...
- Free and portable, supported by most OS platforms.

What LaTeX can do

- Write scientific papers
- Write theses
- Typeset books and publications
- Write typeset letters
- Play around with mathematical formulae
- Make presentation slides
- Beautify your CV
- and many more

Useful resources

Books list

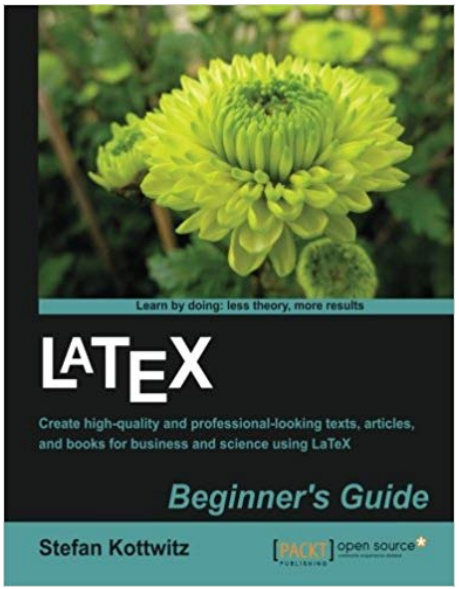


Figure 1: LaTeX Beginner's Guide

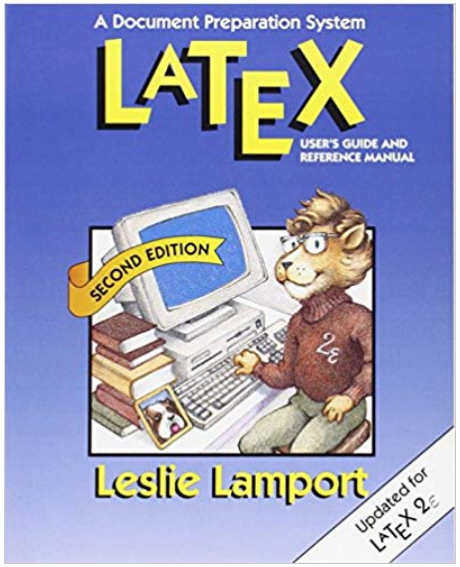


Figure 2: LaTeX: A Document Preparation System: User's Guide and Reference Manual

Useful resources

Learn LaTeX in one video :
https://www.youtube.com/watch?v=VhmkLrOjLsw

Mr Daoming Dong is also a good resource. He is nice and helpful.
Zhihu: @DDMichael

A brief history

In the mid 1970s, Donald Knuth, a Stanford CS geek and the academic world equivalent of Martin (the author of GOT), developed TEX in SAIL to typeset his "The Art of Computer Programming" (TAOCP). First public release in 1978. He reimplemented it in Pascal in the mid 80s (WEB, literate programming). Leslie Lamport, the genius, wrote LATEX in early 80s by porting the orginal TEX.

What is the relationship between TEX and LATEX?
LATEX uses the TEX typesetting programme to compile and generate its output. LATEX focuses on the content while TEX is the main programme for setting up the layout.

LaTeX version

The first LaTeX version available is 2.09 (strange number and strange version control). Later in 1994, LaTeX 2_ε replaced the old version, and remained ever since. LaTeX 3 is a long-term research project, which started from the 1990s.

How to pronounce LaTeX ?

First and foremost, the pronunciation of LaTeX. According to the father of TeX:

> *'English words like 'technology' stem from a Greek root beginning with the letters $\tau\epsilon\chi$...; and this same Greek word means art as well as technology. Hence the name TeX, which is an uppercase form of $\tau\epsilon\chi$.*
>
> *Insiders pronounce the χ of TeX as a Greek chi, not as an 'x', so that TeX rhymes with the word blecchhh. It's the 'ch' sound in Scottish words like loch or German words like ach; it's a Spanish 'j' and a Russian 'kh'. When you say it correctly to your computer, the terminal may become slightly moist.'*
>
> Donald Knuth

How to pronounce LaTeX ?

Another quote from the father of LaTeX:

> *'One of the hardest things about LaTeX is deciding how to pronounce it. This is also one of the few things I'm not going to tell you about LaTeX, since pronunciation is best determined by usage, not fiat. TeX is usually pronounced teck, making lah-teck, and lay-teck the logical choices; but language is not always logical, so lay-tecks is also possible.'* Leslie Lamport

Installation

We would highly recommend the following LaTeX distributions.

- For Windows users
  - TeX Live
  - MiKTeX
- For MacOS users
  - TeX Live
  - MacTeX

Note that the TeX Live distribution contains yearly updates, and the update installation must be done manually.

Editors

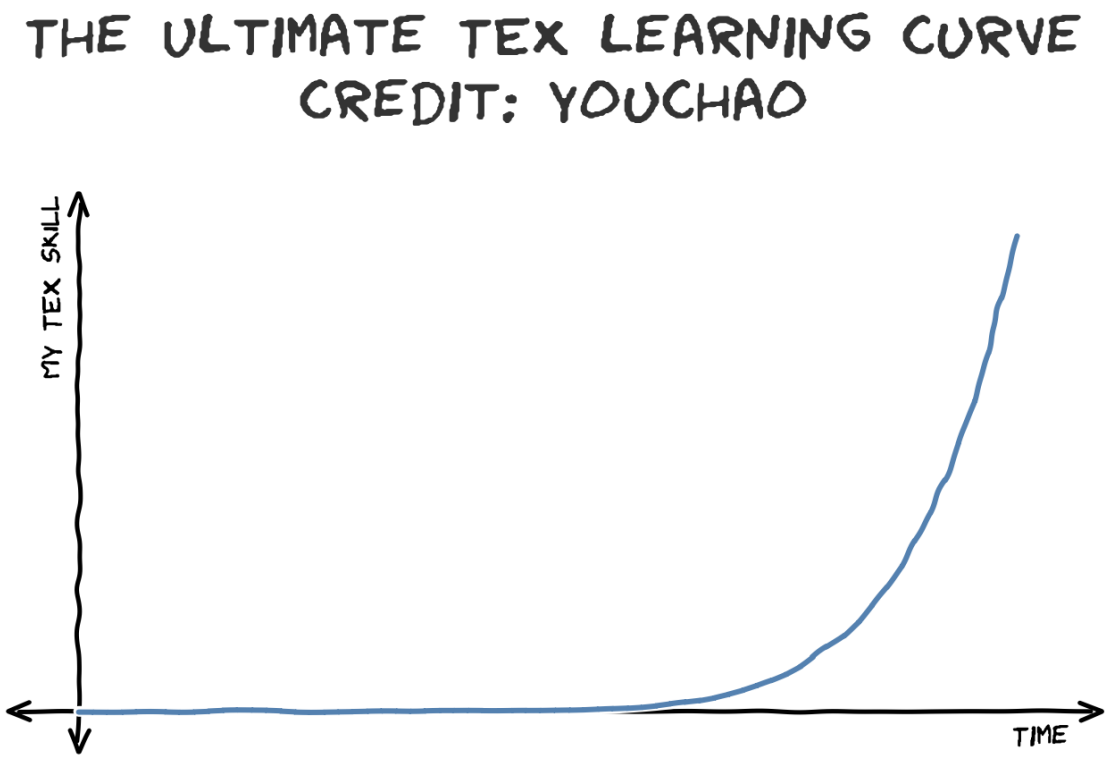
There are in fact numerous ways for you to write up a LaTeX document.

- TeXStudio **(behold, the beamer template we used for this tutorial cannot be built using this editor)**
- TeXShop
- Notepad Notepad++
- Sublime
- Visual Studio Code
- Vi / Vim
- *Word* !!!
- Overleaf (the online editor)

In fact, any plain-text editor shall suffice.

How to use

We have to remind you that learning LaTeX (might be) very hard



How to use

We have to remind you that learning LaTeX (might be) very hard [1]

Newbie

Give up

Master

[1] These arrows are plotted using a package called tikz

Some common knowledge

Since LaTeX is a package implemented in the TeX **typesetting language**, we should consider the TeX input syntax when use it.

TeX reads *.tex files and with lots of interesting background procedures, outputs *.pdf files.

Some common knowledge

- The effect of typing multiple spaces is the same as one space.
- The effect of typing multiple line feeds is the same as one line break.
- If you don't know how and when to use \ (backslash), **then you are doomed**.
- Be aware of the use of \xpace and whatever that follows the backslash after the ~mark, e.g., ~\ref.
- \(white space), this forces normal space, \@, this indicates that the next punctuation ends the sentence. Try out the differences by yourselves.

Some common knowledge

- Special meta characters as part of the TEX language syntax:
  - `# $ % ^ & _ { } ~ \`
- To use them you have to do the following

```
\# \$ \% \^ \& \_ \{ \} \textasciitilde \textbackslash
```

Changing fonts and styles

You may either use (1) lexical declarations or (2) commands. *Contents are referenced from the slides for a course held at the Computer Lab, Cambridge.*

`\mdseries`	`\textmd{text}`	Medium series
`\bfseries`	`\textbf{text}`	**Boldface series**
`\rmfamily`	`\textrm{text}`	Roman family
`\sffamily`	`\textsf{text}`	Sans-serif family
`\ttfamily`	`\texttt{text}`	`Typewriter family`
`\upshape`	`\textup{text}`	Upright shape
`\itshape`	`\textit{text}`	*Italic shape*
`\slshape`	`\textsl{text}`	*Slanted shape*
`\scshape`	`\textsc{text}`	Small caps shape
`\normalfont`	`\textnormal{text}`	Normal style

How to use dashes

There are, in fact, **en dashes**, **em dashes**, **hyphens** and **minus signs**.

- corresponds to - hyphen
-- corresponds to – en dash
--- corresponds to — em dash
$-$ corresponds to − minus sign

For example, line-breaks (*hyphen*), Figures 1–4 (*en dash*), people—like me—love to use LaTeX.
In terms of how to properly use them, try searching the internet for answers. **Metaphysics** it is.

How to use quotation marks

One of the (out of many) mistakes that you will definitely make throughout your LaTeX journey is the use of quotation marks. Unlike Word, TeX uses single quotation mark (') and the grave accent (`) to encode the differences.

´ corresponds to ' left quote

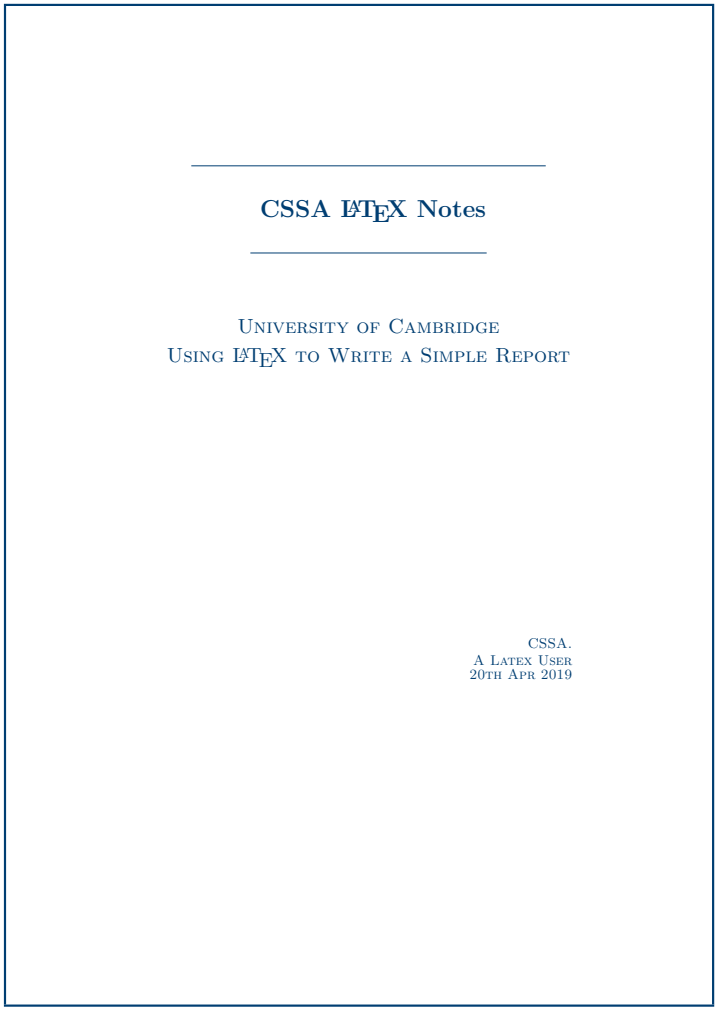
` corresponds to ` right quote

´ ´ corresponds to " left double

` ` corresponds to `` right double

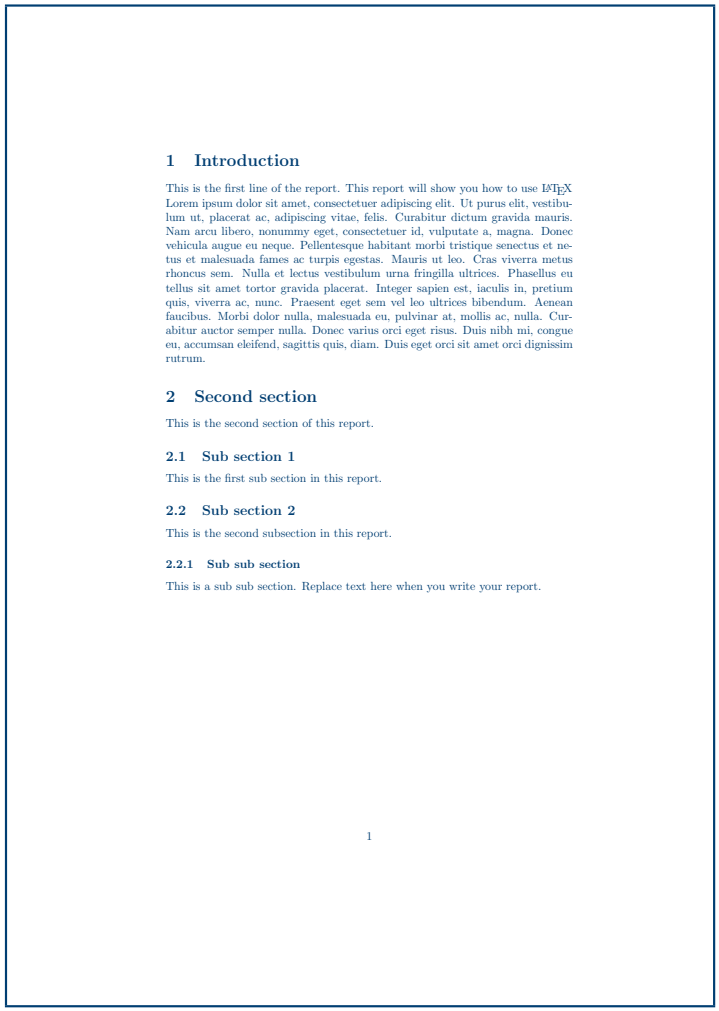
Starting a report and title page

```
1  \documentclass{article}
2  \begin{document}
3  \begin{titlepage}
4    \begin{center}
5      \line(1,0){300}\\
6      [0.25in]
7      \huge{\textbf{ CSSA \LaTeX\ Notes
           }}\\
8      [2mm]
9      \line(1,0){200}\\
10     [1.5cm]
11     \textsc{\LARGE University of
           Cambridge}\\
12     \textsc{\LARGE Using \LaTeX\ to
           Write a Simple Report}\\
13     [8cm]
14   \end{center}
15   \begin{flushright}
16     \textsc{\large CSSA. \\ A Latex
           User\\
17     20th Apr 2019}
18   \end{flushright}
19 \end{titlepage}
20 \end{document}
```



Sections

```
1  \section{Introduction}
2  This is the first line of the report.
       This report will show you how to
       use \LaTeX\\\
3  % Text holder: show one paragraph of
       \lipsum
4  \lipsum[1]
5  % Text holder: show one paragraph of
       \lipsum
6  \section{Second section}
7  This is the second section of this
       report.
8  \subsection{Sub section 1}
9  This is the first sub section in this
       report.
10 \subsection{Sub section 2}
11 This is the second sub section in this
        report.
12 \subsubsection{Sub sub section}
13 This is a sub sub section. Replace
       text here when you write your
       report.
```



1 Introduction

This is the first line of the report. This report will show you how to use LaTeX Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

2 Second section

This is the second section of this report.

2.1 Sub section 1

This is the first sub section in this report.

2.2 Sub section 2

This is the second subsection in this report.

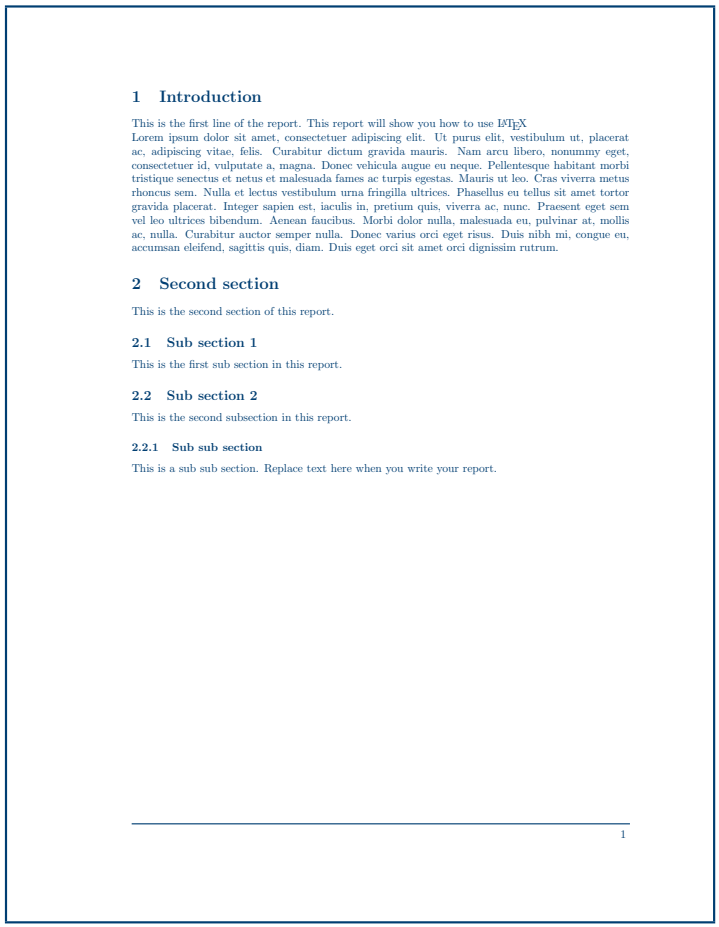
2.2.1 Sub sub section

This is a sub sub section. Replace text here when you write your report.

1

Margins, page number

```
\documentclass{article}
\usepackage{lipsum}
% geometry package, control the margin of the article
\usepackage[margin = 1 in, left = 1.5 in, includefoot]{geometry}
% Header and Footer Stuff
\usepackage{fancyhdr} % fancyhdr package
\pagestyle{fancy}
% Clear previous head and foot style
\fancyhead{}
\fancyfoot{}
% Position the page number RHS of the footer
\fancyfoot[R]{ \thepage\ }
% Clear the header line
\renewcommand{\headrulewidth}{0pt}
% Keep the footer line
\renewcommand{\footrulewidth}{1pt}
```



1 Introduction

This is the first line of the report. This report will show you how to use LaTeX
Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

2 Second section

This is the second section of this report.

2.1 Sub section 1

This is the first sub section in this report.

2.2 Sub section 2

This is the second subsection in this report.

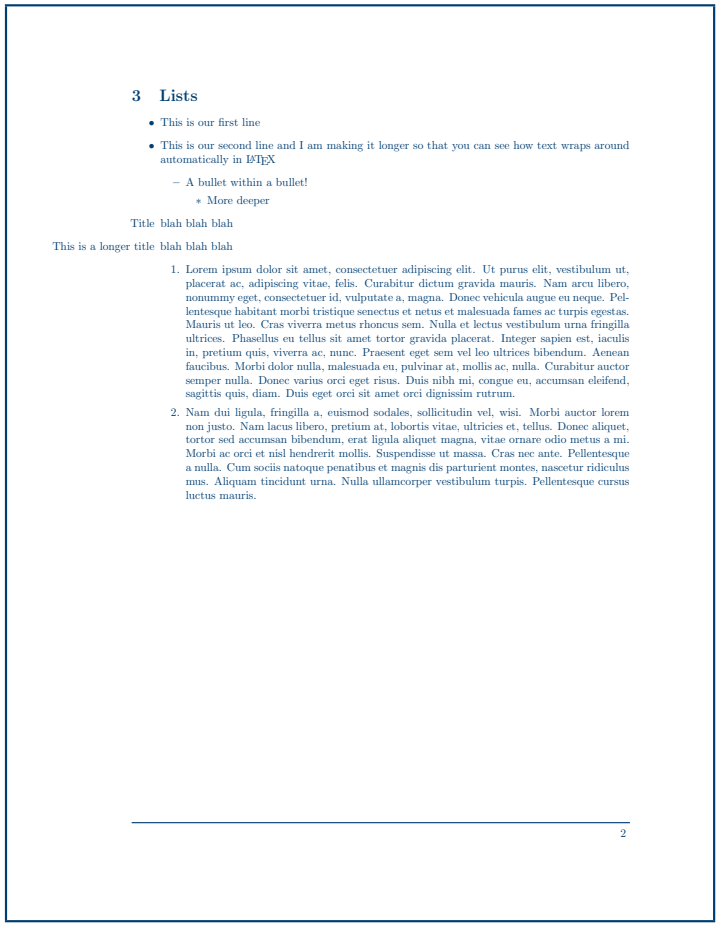
2.2.1 Sub sub section

This is a sub sub section. Replace text here when you write your report.

1

Lists

```latex
% Normal bullet point: itemized
\begin{itemize}
  \item This is our first line
  \item This is our second line and I
        am making it longer so that you
         can see how text wraps around
        automatically in \LaTeX
  \begin{itemize}
    \item A bullet within a bullet!
    \begin{itemize}
      \item More deeper
    \end{itemize}
  \end{itemize}
  \item [Title] blah blah blah
  \item [This is a longer title] blah
        blah blah
  \begin{enumerate}
    % Numberd lists
    \item \lipsum[1]
    % Just try to make the PDF looks
          okay for this presentation
    \item \lipsum[2]
  \end{enumerate}
\end{itemize}
```



3 Lists

- This is our first line
- This is our second line and I am making it longer so that you can see how text wraps around automatically in LaTeX
  - A bullet within a bullet!
    - More deeper

Title blah blah blah

This is a longer title blah blah blah

1. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.
2. Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

2

Figures and tables

```
\usepackage{graphicx}% Import images
\usepackage{float} % Control float
```

```
\section{Figures and Tables}
\subsection{Figures}
\begin{figure}[H]
  \centering
  \includegraphics[width = \textwidth
      ]{Figures/space.png}
  \caption{My desktop background}
      \label{fig}
\end{figure}
\subsection{Tables}
\begin{table}[H]
  \centering\label{tab}
  \caption{This is a very simple table
      }
  \begin{tabular}{l | c r}
    Name & University & Department
        \\\hline
    CSSA & Cambridge & Engineering \\
  \end{tabular}
\end{table}
Figure \ref{fig}. Table \ref{tab}.
```

4 Figures and Tables

4.1 Figures

Figure 1: My desktop background

4.2 Tables

Table 1: This is a very simple table

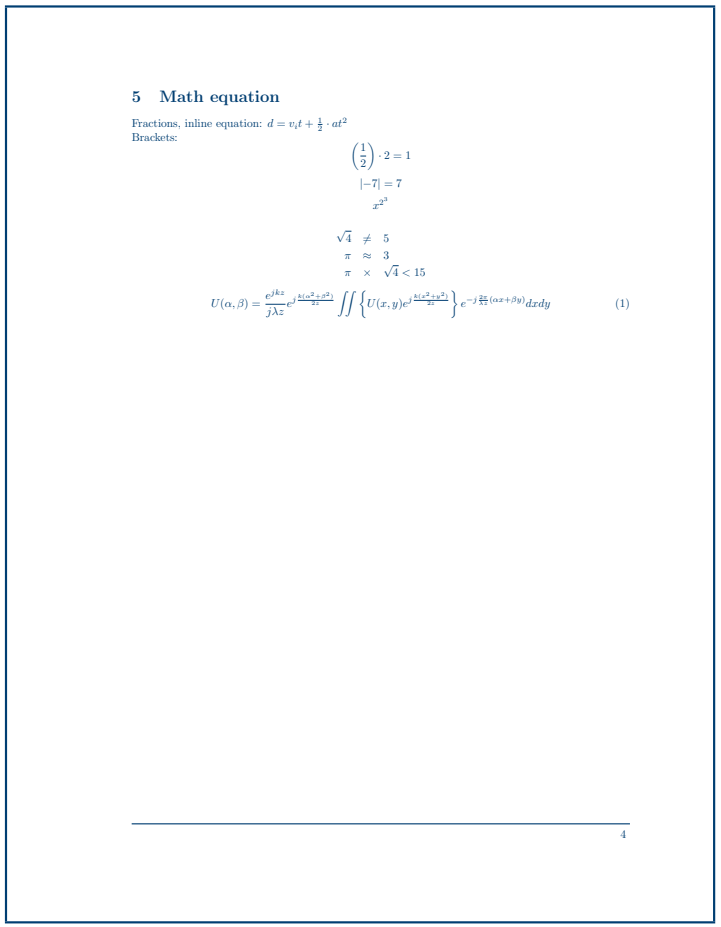
Name	University	Department
CSSA	Cambridge	Engineering

Figure 1. Table 1.

3

Math equations

```
\section{Math equation}
Fractions, inline equation: $d = v_it
    + \frac{1}{2} \cdot at^2$\\
Brackets:
$$\left(\frac{1}{2}\right) \cdot 2 =
    1$$
$$\left|-7 \right| = 7$$
$$x^{2^3}$$
\begin{eqnarray*}
    \sqrt{4} &\neq& 5 \\
    \pi &\approx& 3 \\
    \pi &\times& \sqrt{4} < 15
\end{eqnarray*}
\begin{equation}
  U(\alpha, \beta) = \frac{e^{jkz}}{j
      \lambda z}e^{j\frac{k(\alpha^2+
      \beta^2)}{2z}}\iint\left\{U(x,y
      )e^{j\frac{k(x^2+y^2)}{2z}}
      \right\}e^{-j\frac{2\pi}{
      \lambda z}(\alpha x+\beta y)}
      dxdy
  \label{eq:Fresnel}
\end{equation}
```



5 Math equation

Fractions, inline equation: $d = v_it + \frac{1}{2} \cdot at^2$
Brackets:

$$\left(\frac{1}{2}\right) \cdot 2 = 1$$

$$|-7| = 7$$

$$x^{2^3}$$

$$\begin{aligned} \sqrt{4} &\neq 5 \\ \pi &\approx 3 \\ \pi &\times \sqrt{4} < 15 \end{aligned}$$

$$U(\alpha,\beta) = \frac{e^{jkz}}{j\lambda z} e^{j\frac{k(\alpha^2+\beta^2)}{2z}} \iint \left\{ U(x,y) e^{j\frac{k(x^2+y^2)}{2z}} \right\} e^{-j\frac{2\pi}{\lambda z}(\alpha x+\beta y)} dxdy \quad (1)$$

4

References: set up

- LHS: Journal paper
- RHS: Conference paper

```
@article{GaborHolography,
  author = {D. Gabor},
  journal = {Nature},
  number = {161},
  pages = {777--778},
  publisher = {Nature},
  title = {A new microscopic principle},
  volume = {161},
  month = {May},
  year = {1948},
  url = {https://www.nature.com/articles/161777a0},
  doi = {https://doi.org/10.1038/161777a0},
}
```

```
@inproceedings{HardReview_84,
 author = {M. Lucente and Galyean, T. A.},
 title = {Rendering Interactive Holographic Images},
 booktitle = {Proceedings of the 22Nd Annual Conference on Computer Graphics and Interactive Techniques},
 series = {SIGGRAPH '95},
 year = {1995},
 isbn = {0-89791-701-4},
 pages = {387--394},
 numpages = {8},
 url = {http://doi.acm.org/10.1145/218380.218490},
 doi = {10.1145/218380.218490},
 acmid = {218490},
 publisher = {ACM},
 address = {New York, NY, USA},
}
```

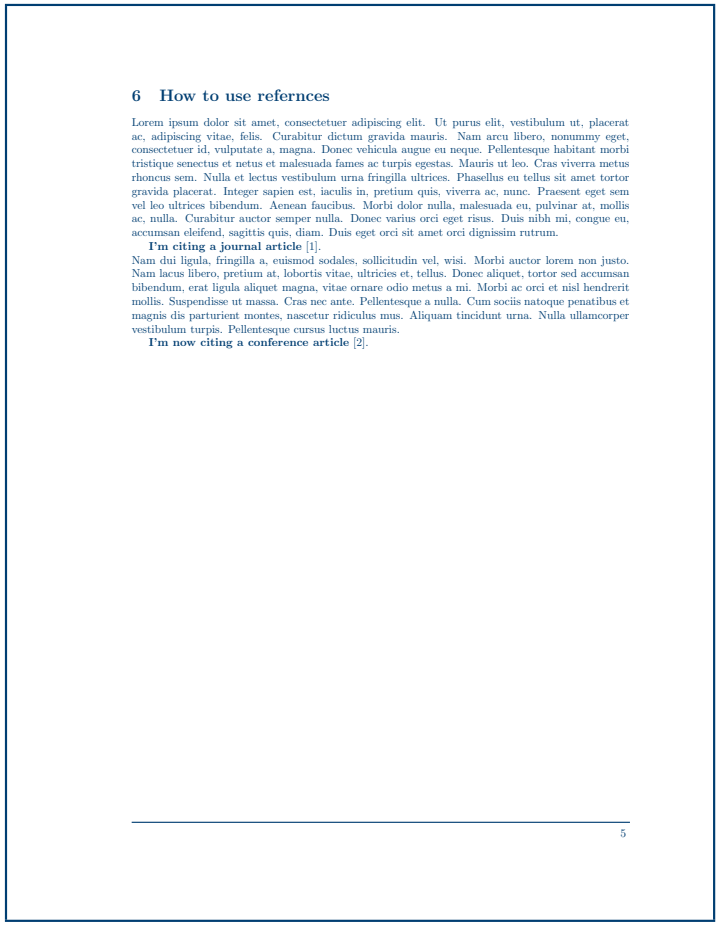
References: use

```
% Reference setup
\cleardoublepage

\section{How to use refernces}
\lipsum[1]
\textbf{I'm citing a journal article}
      \cite{GaborHolography}.\\
\lipsum[2]
\textbf{I'm now citing a conference
      article} \cite{HardReview_84}.


\bibliographystyle{IEEEtran}
\cleardoublepage
\bibliography{References/references.
      bib}
\addcontentsline{toc}{section}{
      \numberline{}References}
```

```
% .bibtex file
use google
```



6 How to use refernces

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

I'm citing a journal article [1].

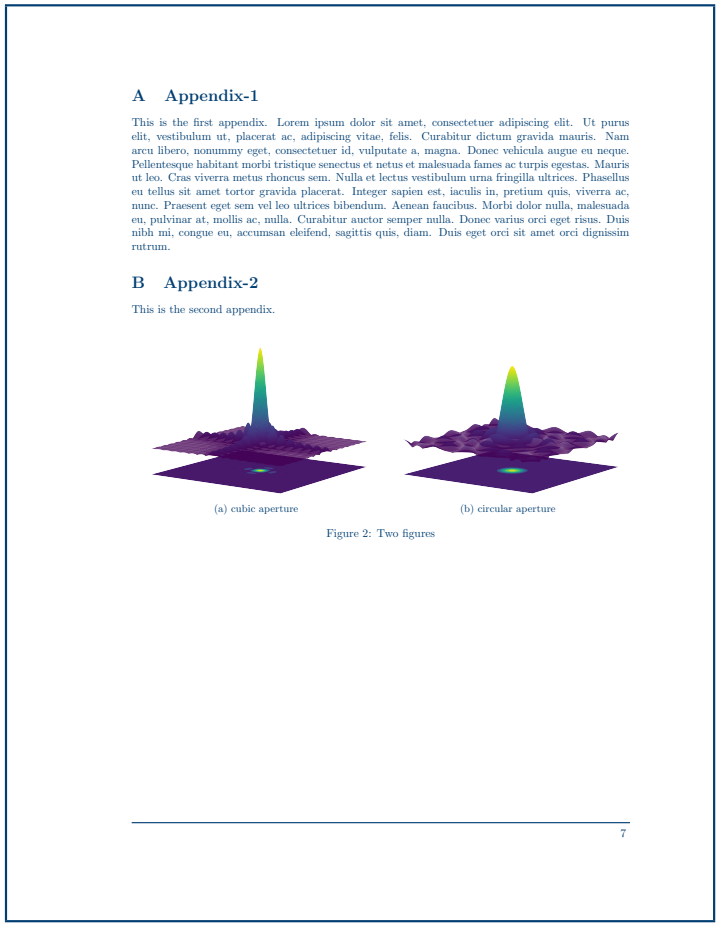
Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

I'm now citing a conference article [2].

5

Appendix

```
\cleardoublepage
\appendix
\section{Appendix-1}
This is the first appendix.
\lipsum[1]
\section{Appendix-2}
This is the second appendix.
\begin{figure}[H]
  \begin{subfigure}{0.5\linewidth}
    \includegraphics[width =
        \textwidth]{Figures/Cubic_
        aperture.png}
    \caption{cubic aperture}
    \label{cubicAperture}
  \end{subfigure}
  \begin{subfigure}{0.5\linewidth}
    \includegraphics[width =
        \textwidth]{Figures/Circular_
        aperture.png}
    \caption{circular aperture}
    \label{circularAperture}
  \end{subfigure}
  \caption{Two figures}
\end{figure}
```



A Appendix-1

This is the first appendix. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

B Appendix-2

This is the second appendix.

(a) cubic aperture (b) circular aperture

Figure 2: Two figures

7

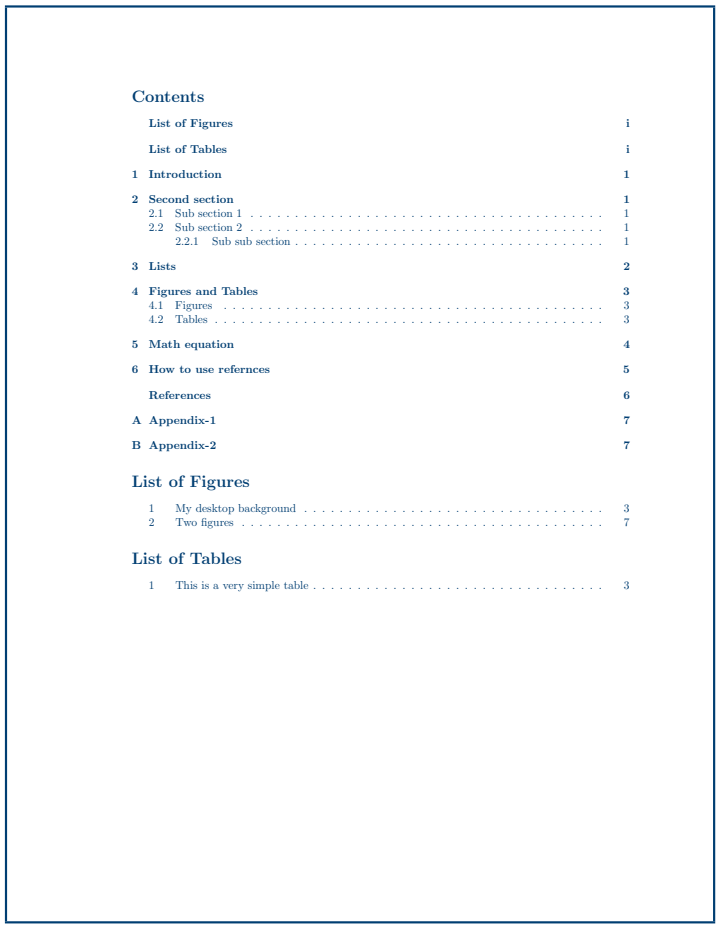
Table of contents, list of figures, list of tables

```
\end{titlepage}
\cleardoublepage
% Table of contents stuff
\pagenumbering{roman}
\tableofcontents
% \cleardoublepage
% List of figures, list of tables
\listoffigures
\listoftables

\thispagestyle{empty}
\addcontentsline{toc}{section}{
    \numberline{}List of Figures}
\addcontentsline{toc}{section}{
    \numberline{}List of Tables}
\cleardoublepage

% Main body stuff
\pagenumbering{arabic}
\setcounter{page}{1}

\cleardoublepage
\section{Introduction}
```



Contents

List of Figures

List of Tables

Templates

We will demonstrate some useful LaTeX templates.

However, keep in mind that before you use templates, you should make yourself comfortable with the basic LaTeX commands.

The last session: Q and A

Hopefully, hopefully and hopefully we will be able to answer your questions.

Thank you!