

LaTeX

A primer

House Rules



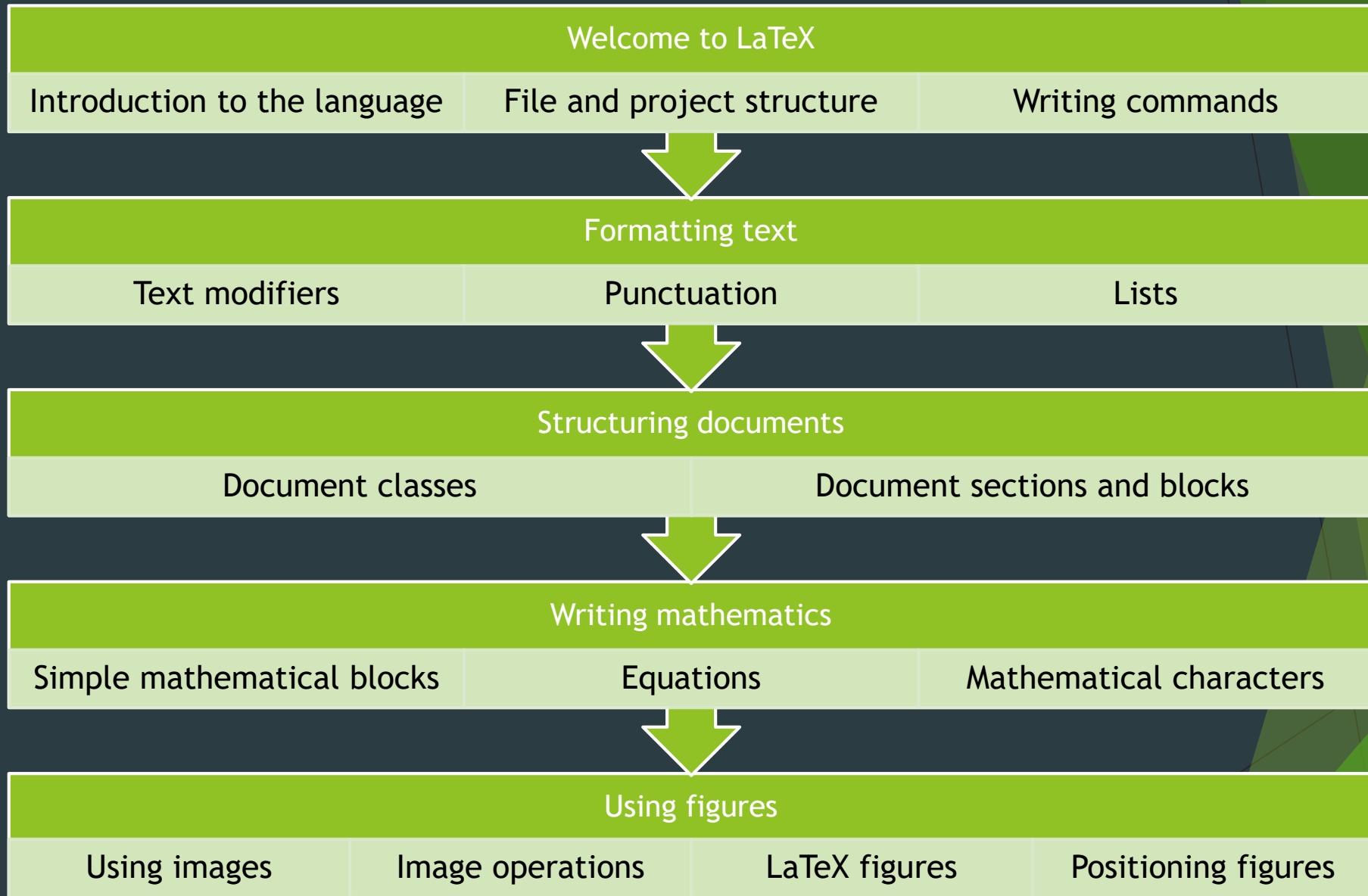
No such thing
as a silly
question...



... so ask me
at any
point...



...but I may
park questions
for later



Preamble

```
\documentclass[papersize, fontsize]{class}
  article | report | book

\title{title}
\author{author}
\date{\today}

\usepackage{setspace}
\spacing{1.6} %doublespace

% article - papers
% report - chaptered document
% book - for a book or thesis structure

%papersize: often a3paper, a4paper...

\usepackage{amsmath} %maths
\usepackage{amssymb} %maths symbols

\usepackage{graphicx}
\graphicspath{ {figures/} }
\DeclareGraphicsExtensions{.png,.pdf}
```

Main Body

```
\begin{document}
\maketitle
Typed text is as written

\textbf{bold}, \textit{italic}, \textsuperscript{super},
\textsubscript{sub}, \textsc{SMALLCAPS}, \underline{ul}

` or `` to start quotes

- \textendash \textemdash

tiny, scriptsize, footnotesize, small, normalsize, large,
Large, LARGE, huge, Huge

\begin{flushleft}           {center}           {flushright}
\end{...}

\begin{itemize|enumerate|description}[A.][i.] %lettered/roman
  \item bullet or numbered item
  \item[label] for description item

\begin{part|chapter|abstract}
\section{name} \subsection{} \subsubsection{} \paragraph{}
  \subparagraph{}

\includegraphics[width|height|scale|angle|clip]{filename}

\begin{figure}[position]
  \centering
  \includegraphics[]{}...
  \caption{caption text}
\end{figure}

\end{document}
```

Non-Textual

```
\command[options]{context}
#, $, %, ^, &, _, {, }, ~, \ are reserved
Multiple consecutive spaces = one space
2+ consecutive newlines = new paragraph

This is $inline$ maths
      $$block maths$$
\begin{equation}
  equation
\end{equation}

^{maths superscript}
_{maths subscript}

“\ ” - maths whitespace

\left( \left[ \left( \right) \right] ...

image units: \textwidth \columnwidth mm pt
              cm em...

\includegraphics[clip=true, trim left bot
right top]{imagepath}

\includegraphics[angle=45]{imagepath}

\setlength\fbxrule{2pt} %border thickness
\fbx{includegraphics...}

[h|t|b|p|!|H] - here, top, bottom,
own page, override!, HERE!
```

LaTeX - A Typesetting Language

- ▶ Lampert's TeX
- ▶ Released in 1989
- ▶ Based on the core TeX system ($\text{T}\epsilon\text{X}$)
- ▶ Extends the functionality of TeX with an extended framework
- ▶ Although technically Turing-complete, is not intended as a programming language

Word Processors and Typesetters

Word Processor

- ▶ WYSIWYG
- ▶ Menu-controlled layout
- ▶ Managing layout and content at the same time
- ▶ Cascading formatting changes
- ▶ Implicit formatting
- ▶ Large file footprint
- ▶ Limited special character support

Typesetting Language

- ▶ Source code
- ▶ Code-controlled layout
- ▶ Content and layout are programmatically separated
- ▶ Insulated format changes
- ▶ Explicit formatting
- ▶ Small core code footprint
- ▶ Extensive special character support

Why Typesetters?



Separate content creation and layout management



Formatting is more consistent and harder to break



Managing larger documents is much easier and faster



Equations and scientific notations are easier



Referencing and in-document links are much easier and automatable

Getting started

www.overleaf.com

Resources

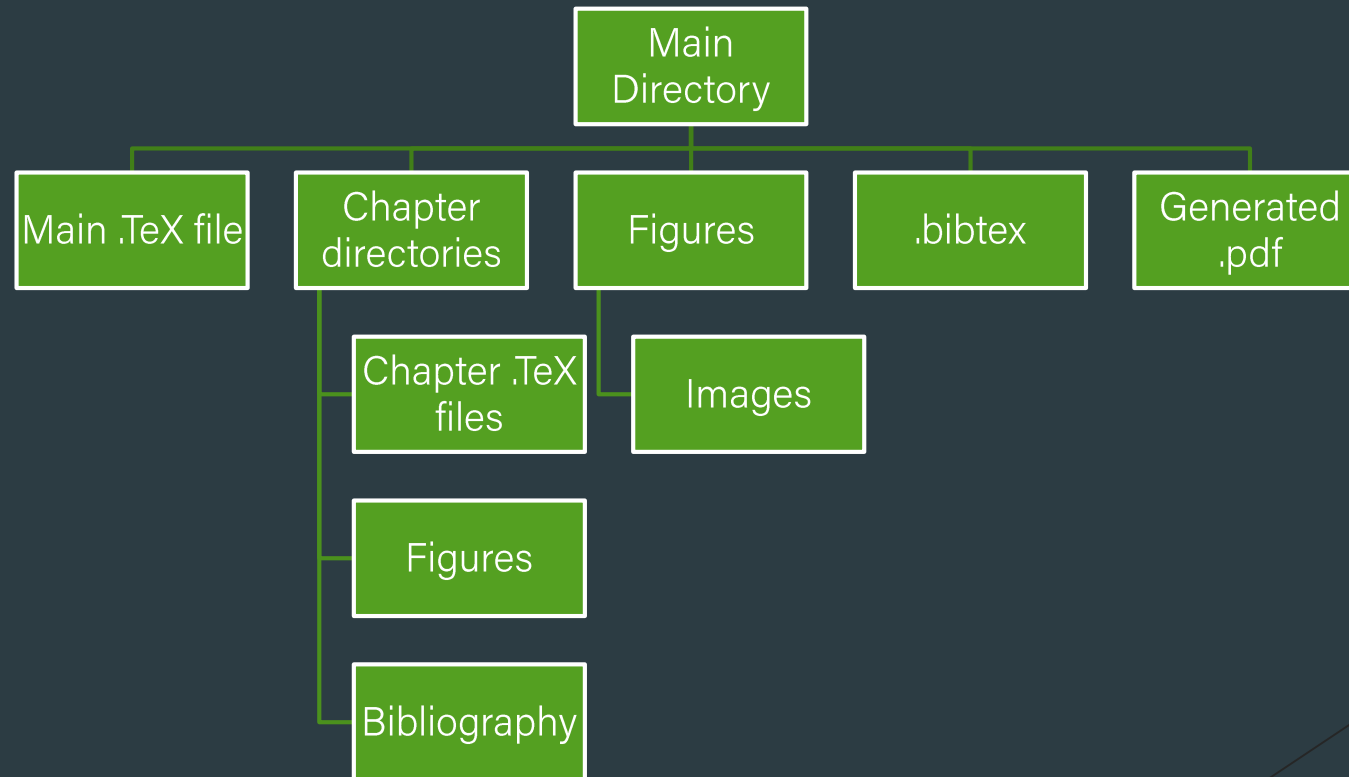
GitHub

<https://www.overleaf.com/learn>

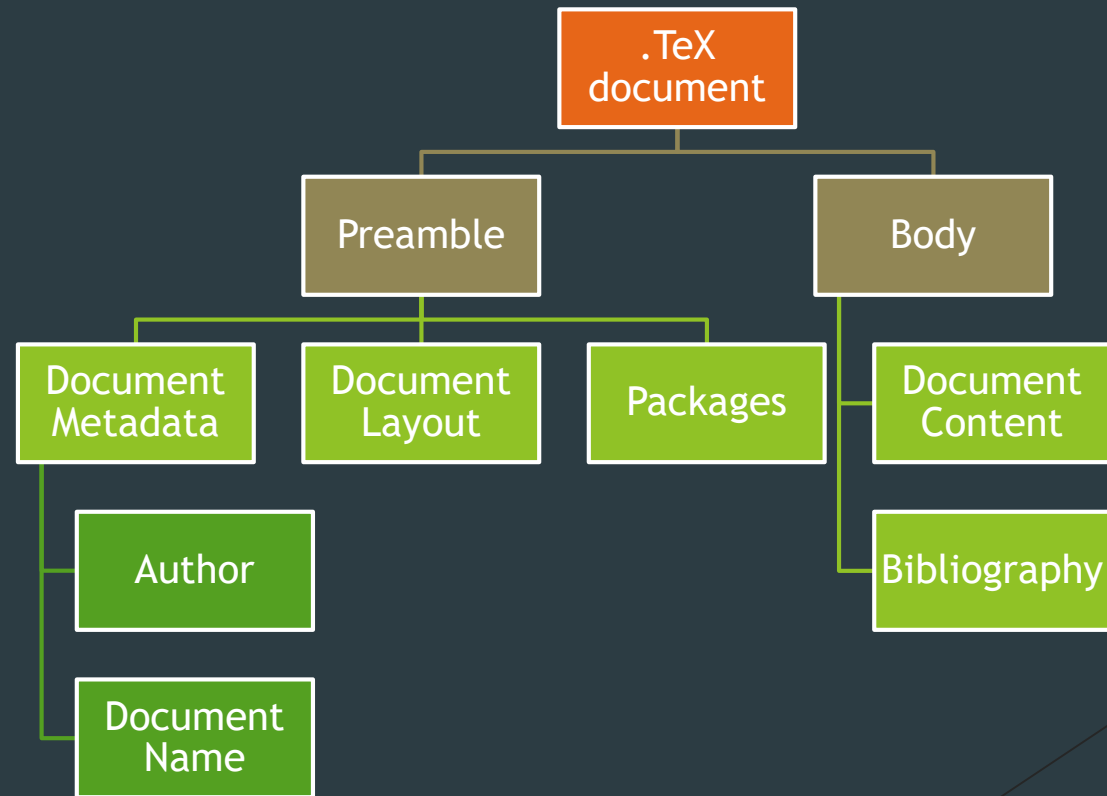
<https://TeX.stackexchange.com/>

<https://www.overleaf.com/learn/latex/Errors>

Hierarchy of a LaTeX project



Structure of a document



```
\documentclass[format]{class}
```

Preamble

```
\begin{document}
```

Main body

```
\end{document}
```

```
\documentclass[a4paper]{report}
  \title{example title}
  \author{Richard}
  \date{\today}
\begin{document}
  \maketitle
  This is my \textit{example} document
\end{document}
```

```
\documentclass[a4paper]{report}
  \title{example title}
  \author{Richard}
  \date{\today}
\begin{document}
  \maketitle
  This is my \textit{example} document
\end{document}
```

example title

Richard

November 11, 2019

This is my *example* document

```
\documentclass[a4paper]{report}
  \title{example title}
  \author{Richard}
  \date{\today}
\begin{document}
  \maketitle
  This is my \textit{example} document
\end{document}
```

example title

Richard

November 11, 2019

This is my *example* document

```
\documentclass[a4paper]{report}
  \title{example title}
  \author{Richard}
  \date{\today}

\begin{document}
  \maketitle
  This is my \textit{example} document
\end{document}
```


example title

Richard

November 11, 2019

This is my *example* document


```
\documentclass[a4paper]{report}
  \title{example title}
  \author{Richard}
  \date{\today}
\begin{document}
  \maketitle
  This is my \textit{example} document
\end{document}
```



example title

Richard

November 11, 2019

This is my *example* document

```
\documentclass[a4paper]{report}
  \title{example title}
  \author{Richard}
  \date{\today}
\begin{document}
  \maketitle
  This is my \textit{example} document
\end{document}
```

example title

Richard

November 11, 2019

This is my *example* document

Preamble

```
\documentclass[papersize, fontsize]{class}  
  article | report | book  
  
\title{title}  
\author{author}  
\date{\today}
```

Main Body

```
\begin{document}  
\maketitle  
Typed text is as written
```

```
\end{document}
```

Non-Textual

Commands

`\command[options]{context}`



Always start with a “\”



May be stand-alone, or need extra information



Control the document structure, formatting, equations, citations, images etc...



If it isn't just displaying simple text, you'll do it with a `\command`

Command complexity

```
\documentclass[a4paper]{report}
\begin{document}
\textbf{This is bold}
\begin{enumerate}
  \item this is a point
  \item this is beer \o l
\end{enumerate}
$\frac{1}{2}$
%this is a comment
\end{document}
```

This is bold

1. this is a point
2. this is beer øl

$$\frac{1}{2}$$

Reserved characters

\$ % ^ & _ { } ~
\\

These mean something to LaTeX and are reserved – if you need to use them you can use “\” to *escape* the character and let LaTeX read it literally.

Using a percentage % makes this a comment

Escaping it \% makes the symbol and this visible.

Using a percentage
Escaping it % makes the symbol and this visible.

Reserved characters

#

Comment

\$

Maths superscript

%

Alignment character

^

Maths subscript

&

Processing block

—

Unbreakable space

{ }

Command character

~

\

Macro parameter

Maths mode

Whitespace and returns

- ▶ In text mode, one or more consecutive spaces and tabs (aka “whitespace”) are treated as a single space.
- ▶ Whitespace at the beginning of a line is ignored
- ▶ One or more empty lines between text (two or more returns) are treated as a paragraph break.
- ▶ You can have a new line per sentence in a paragraph without issue
- ▶ These rules vary slightly in maths mode

Preamble

```
\documentclass[papersize, fontsize]{class}  
  article | report | book  
  
\title{title}  
\author{author}  
\date{\today}
```

Main Body

```
\begin{document}  
\maketitle  
Typed text is as written
```

```
\end{document}
```

Non-Textual

```
\command[options]{context}  
#, $, %, ^, &, _, {, }, ~, \ are reserved  
Multiple consecutive spaces = one space  
2+ consecutive newlines = new paragraph
```

Formatting text

Changing text attributes and layout within a textual setting

Text modifiers

- ▶ **Bold**

- ▶ *Italics*

- ▶ Superscript

- ▶ Subscript

- ▶ **Size**

- ▶ Punctuation marks ... - `` "

- ▶ SMALL CAPS

- ▶ Underlined

- ▶ San serif font

- ▶ Typewriter font

- ▶ Serif font

- ▶ Colour

Text modifiers

```
\textbf{bold}      \textsf{sans  
                  serif face}  
\textit{italic}  
S\textsuperscript{uper}  \textrf{roman /  
                           serif face}  
S\textsubscript{ub}      \texttt{typewrite  
                           r font}  
\Large{size}         \textcolor{red}{c  
                      colour}  
\textmdash ``"  
\textsc{Small  
Caps}  
\underline{lined}
```

bold

italic

S^{uper}

S_{ub}

size

—“”

SMALL CAPS

lined

sans serif face

roman

typewriter font

colour

This is an EXERCISE to **try out** *your* *formatting* skills —
what d_o yø^u think?

Give it a go

Replicate the following passage:

This is an EXERCISE to try out *your* formatting skills —
what d_o y^o think?

```
\documentclass[a4paper]{report}
```

```
\begin{document}
```

```
This is an \textsc{ExerCise} to \textbf{try out \textit{your}}  
form\textit{atting} skills \textemdash \\\what d\textsubscript{o}  
y\o \textsuperscript{u} \texttt{thin\textbf{k}}?
```

```
\end{document}
```

Punctuation - quotations

Not all quotation marks are created equal

'single' quotations and "double quotations"

' " starting quotations

Ending quotations " '

For opening quotes use `

`single' and ``double''

'single' and "double"

Punctuation - dashes

Not all dashes are created equal

Hyphens are used to join two words together like-this

“en” dashes are used to span numbers or categories together: 1939 – 1945

“em” dashes are used in the place of parentheses or for attribution.

-

`\textendash`

`\textemdash`

properly-hyphenated

Open 9–5

“Covfefe” — Donald Trump, aged $9\frac{1}{4}$

Preamble

```
\documentclass[papersize, fontsize]{class}  
  article | report | book  
  
\title{title}  
\author{author}  
\date{\today}
```

Main Body

```
\begin{document}  
\maketitle  
Typed text is as written  
  
\textbf{bold}, \textit{italic}, \textsuperscript{super},  
\textsubscript{sub}, \textsc{SMALLCAPS}, \underline{ul}  
  
` or `` to start quotes  
  
- \textendash \textemdash
```

```
\end{document}
```

Non-Textual

```
\command[options]{context}  
#, $, %, ^, &, _, {, }, ~, \ are reserved  
Multiple consecutive spaces = one space  
2+ consecutive newlines = new paragraph
```

Font size



The default size can be specified in the preamble

```
\documentclass[12pt]{report}
```



Deviations to the size can be defined in the main body:

```
\<size>{text}
```



Headings, Titles and subsections are handled differently

Font sizes

`\tiny{}`

`\scriptsize{}`

`\footnotesize{}`

`\small{}`

`\normalsize{}`

`\large{}`

`\Large{}`

`\LARGE{}`

`\huge{}`

`\Huge{}`

Text Alignment

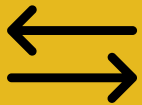
- ▶ Text is justified by default. You can deviate from default style with main body commands
- ▶ `\begin{flushleft}...\end{flushright}`
- ▶ `\begin{flushright}...\end{flushright}`
- ▶ `\begin{center}...\end{center}`

Text spacing



Default can be set in the preamble using:

```
\usepackage{setspace}  
\spacing{1|1.5|2}
```



You can deviate from the style with commands in the main body with:

```
\begin{spacing}{<size>}...\end{spacing}
```

Preamble

```
\documentclass[papersize, fontsize]{class}  
    article | report | book  
  
\title{title}  
\author{author}  
\date{\today}  
  
\usepackage{setspace}  
\spacing{1.6} %doublespace
```

Main Body

```
\begin{document}  
\maketitle  
Typed text is as written  
  
\textbf{bold}, \textit{italic}, \textsuperscript{super},  
\textsubscript{sub}, \textsc{SMALLCAPS}, \underline{uL}  
  
` or `` to start quotes  
  
- \textendash \textemdash  
  
tiny, scriptsize, footnotesize, small, normalsize, large,  
Large, LARGE, huge, Huge  
  
\begin{flushleft}           {center}           {flushright}  
\end{...}
```

```
\end{document}
```

Non-Textual

```
\command[options]{context}  
#, $, %, ^, &, _, {, }, ~, \ are reserved  
Multiple consecutive spaces = one space  
2+ consecutive newlines = new paragraph
```

Lists

Itemize

Bullet point/Unnumbered list

```
\begin{itemize}
```

```
  \item ...
```

```
  \item ...
```

```
\end{itemize}
```

Enumerate

Numbered list

```
\begin{enumerate}
```

```
  \item ...
```

```
  \item ...
```

```
\end{enumerate}
```

Variations on lists



**Making enumerates
alphabetic/roman:**

`\begin{enumerate}[A.]|[i.]`



**Description lists with labels,
not points:**

`\begin{description}`

• `\item[label] ...`

Preamble

```
\documentclass[papersize, fontsize]{class}  
  article | report | book  
  
\title{title}  
\author{author}  
\date{\today}  
  
\usepackage{setspace}  
\spacing{1.6} %doublespace
```

Main Body

```
\begin{document}  
\maketitle  
Typed text is as written  
  
\textbf{bold}, \textit{italic}, \textsuperscript{super},  
\textsubscript{sub}, \textsc{SMALLCAPS}, \underline{uL}  
  
` or `` to start quotes  
  
- \textendash \textemdash  
  
tiny, scriptsize, footnotesize, small, normalsize, large,  
Large, LARGE, huge, Huge  
  
\begin{flushleft}           {center}           {flushright}  
\end{...}  
  
\begin{itemize|enumerate|description}[A.][i.] %lettered/roman  
  \item bullet or numbered item  
  \item[label] for description item
```

```
\end{document}
```

Non-Textual

```
\command[options]{context}  
#, $, %, ^, &, _, {, }, ~, \ are reserved  
Multiple consecutive spaces = one space  
2+ consecutive newlines = new paragraph
```

Structuring documents

Specifying document types

`\documentclass[paper type, text size]{document type}`



Article - ideal for papers



Report - ideal for larger reports. Can have chapters



Book - Ideal for theses.



Paper types are typically “axpaper” - e.g. a3paper, a4paper...

Chapters and sections

Excluding *document*, each structural element follows the `\<element>\{title\}` pattern



Class elements and numbering

Elements	Article	Report	Book
Abstract	Yes	Yes	
Part	Yes	Yes	Yes
Chapter		1	1
Section	1	0.1	0.1
Subsection	0.1	0.0.1	0.0.1
Subsubsection	0.0.1	Yes	Yes
Paragraph	Yes	Yes	Yes
subparagraph	Yes	Yes	Yes

Exercise: sections

This is a report title

Au Thour

November 14, 2019

Abstract

This is an abstract

Chapter 1

This is a blank chapter

Chapter 2

This is a second chapter

In the report document, each chapter increments the count by 1

2.1 This is a section

in the report document, each section increments by 0.1. If it's an article or any non-chapter style, it increments by 1 instead.

2.1.1 This is a subsection

in the report document, each subsection increments by 0.0.1. In a non chapter style, it increments by 0.1

This is a subsubsection

This far down, the numbering stops for chapter-style classes, otherwise it iterates at a 0.0.1 level.

This is a paragraph This is a paragraph. You usually don't need to structure you paragraphs, but having a named paragraph can sometimes be useful

This is a subparagraph This is getting a little out of hand by now.

Exercise: sections

```
\documentclass[a4paper]{report}
\author{Au Thour}
\title{This is a report title}
\begin{document}
\maketitle
\begin{abstract}
This is an abstract
\end{abstract}
\chapter{This is a blank chapter}
\chapter{This is a second chapter}
In the report document, each chapter
increments the count by 1
\section{This is a section}
in the report document, each section
increments by 0.1. If it's an article or any non-
```

chapter style, it increments by 1 instead.

```
\subsection{This is a subsection}
```

in the report document, each subsection increments by 0.01. In a non chapter style, it increments by 0.1

```
\subsubsection{This is a subsubsection}
```

This far down, the numbering stops for chapter-style classes, otherwise it iterates at a 0.01 level.

```
\paragraph{This is a paragraph}
```

This is a paragraph. You usually don't need to structure you paragraphs, but having a named paragraph can sometimes be useful

```
\subparagraph{This is a subparagraph}
```

This is getting a little out of hand by now.

```
\end{document}
```

Preamble

```
\documentclass[papersize, fontsize]{class}  
  article | report | book
```

```
\title{title}  
\author{author}  
\date{\today}
```

```
\usepackage{setspace}  
\spacing{1.6} %doublespace
```

```
% article - papers  
% report - chaptered document  
% book - for a book or thesis structure
```

```
%papersize: often a3paper, a4paper...
```

Main Body

```
\begin{document}  
\maketitle  
Typed text is as written
```

```
\textbf{bold}, \textit{italic}, \textsuperscript{super},  
\textsubscript{sub}, \textsc{SMALLCAPS}, \underline{ul}
```

```
` or `` to start quotes
```

```
- \textendash \textemdash
```

```
tiny, scriptsize, footnotesize, small, normalsize, large,  
Large, LARGE, huge, Huge
```

```
\begin{flushleft}           {center}           {flushright}  
\end{...}
```

```
\begin{itemize|enumerate|description}[A.][i.] %lettered/roman  
  \item bullet or numbered item  
  \item[label] for description item
```

```
\begin{part|chapter|abstract}  
\section{name} \subsection{} \subsubsection{} \paragraph{}  
  \subparagraph{}
```

```
\end{document}
```

Non-Textual

```
\command[options]{context}  
#, $, %, ^, &, _, {, }, ~, \ are reserved  
Multiple consecutive spaces = one space  
2+ consecutive newlines = new paragraph
```


The background features a dark blue-grey field on the left, transitioning into a series of overlapping, semi-transparent green triangles on the right. These triangles vary in shades from a deep forest green to a bright, almost yellow-green, creating a dynamic, layered effect. The word "Mathematics" is positioned on the left side, within the dark blue area.

Mathematics

Maths mode



Latex allows you to typeset complex mathematical and technical notation, in addition to bodies of text



Maths can be types with **inline** and **display** blocks of maths, and even fully defined **equations**.



The **\$** symbol is used to demarcate blocks of maths



Same command structure in the mathematical mode, but the commands differ



Whitespace behaves differently – expecting equations not words

Inline and block maths

- ▶ This is an $y = mx^2$ inline piece of maths
- ▶ This is a $y = mx^2$ block of maths

This is an $y = mx^2$ inline piece of maths

This is a

$$y = mx^2$$

block of maths

Maths packages

```
\usepackage{amsmath}
```

```
\usepackage{amssymb}
```

Neatens up more complicated mathematical typography and supports a wider ranges of textual and mathematical symbols

To be used in the preamble

Equations

► Simple form

► $E=mc^2$

►

► Relativistic energy-momentum relation form

► $\begin{equation}$

► $R_r = \sqrt{(m_0c^2)^2 + (pc)^2}$

► $\end{equation}$

Simple form

$$E = mc^2$$

Relativistic energy-momentum relation form

$$R_r = \sqrt{(m_0c^2)^2 + (pc)^2} \quad (1)$$

description	code	examples
Greek letters	<code>\alpha \beta \gamma \rho \sigma \delta \epsilon</code> <code>\sigma \delta \epsilon</code>	$\alpha \beta \gamma \rho \sigma \delta \epsilon$
Binary operators	<code>\times \otimes \oplus \cup \cap</code> <code>\cap</code>	$\times \otimes \oplus \cup \cap$
Relation operators	<code>< > \subset \supset \subseteq \supseteq</code> <code>\supseteq</code>	$< > \subset \supset \subseteq \supseteq$
Others	<code>\int \oint \sum \prod</code>	$\int \oint \sum \prod$

Common commands

Further symbols

Greek Letters

αA	<code>\alpha A</code>	νN	<code>\nu N</code>
βB	<code>\beta B</code>	$\xi \Xi$	<code>\xi \Xi</code>
$\gamma \Gamma$	<code>\gamma \Gamma</code>	$o O$	<code>o O</code>
$\delta \Delta$	<code>\delta \Delta</code>	$\pi \Pi$	<code>\pi \Pi</code>
$\epsilon \varepsilon E$	<code>\epsilon \varepsilon E</code>	$\rho \varrho P$	<code>\rho \varrho P</code>
ζZ	<code>\zeta Z</code>	$\sigma \Sigma$	<code>\sigma \Sigma</code>
ηH	<code>\eta H</code>	τT	<code>\tau T</code>
$\theta \vartheta \Theta$	<code>\theta \vartheta \Theta</code>	$\upsilon \Upsilon$	<code>\upsilon \Upsilon</code>
ιI	<code>\iota I</code>	$\phi \varphi \Phi$	<code>\phi \varphi \Phi</code>
κK	<code>\kappa K</code>	χX	<code>\chi X</code>
$\lambda \Lambda$	<code>\lambda \Lambda</code>	$\psi \Psi$	<code>\psi \Psi</code>
μM	<code>\mu M</code>	$\omega \Omega$	<code>\omega \Omega</code>

Further symbols

Arrows

\leftarrow	<code>\leftarrow</code>	\Lleftarrow	<code>\Leftarrow</code>
\rightarrow	<code>\rightarrow</code>	\Rrightarrow	<code>\Rightarrow</code>
\leftrightarrow	<code>\leftrightarrow</code>	\rightleftharpoons	<code>\rightleftharpoons</code>
\uparrow	<code>\uparrow</code>	\downarrow	<code>\downarrow</code>
\Uparrow	<code>\Uparrow</code>	\Downarrow	<code>\Downarrow</code>
\Leftrightarrow	<code>\Leftrightarrow</code>	\Updownarrow	<code>\Updownarrow</code>
\mapsto	<code>\mapsto</code>	\longmapsto	<code>\longmapsto</code>
\nearrow	<code>\nearrow</code>	\searrow	<code>\searrow</code>
\swarrow	<code>\swarrow</code>	\nwarrow	<code>\nwarrow</code>
\leftharpoonup	<code>\leftharpoonup</code>	\rightharpoonup	<code>\rightharpoonup</code>
\leftharpoondown	<code>\leftharpoondown</code>	\rightharpoondown	<code>\rightharpoondown</code>

Further symbols

Common

∞	<code>\infty</code>	\forall	<code>\forall</code>
\Re	<code>\Re</code>	\Im	<code>\Im</code>
∇	<code>\nabla</code>	\exists	<code>\exists</code>
∂	<code>\partial</code>	\nexists	<code>\nexists</code>
\emptyset	<code>\emptyset</code>	\varnothing	<code>\varnothing</code>
\wp	<code>\wp</code>	\complement	<code>\complement</code>
\neg	<code>\neg</code>	\cdots	<code>\cdots</code>
\square	<code>\square</code>	$\sqrt{}$	<code>\sqrt{}</code>
\blacksquare	<code>\blacksquare</code>	\triangle	<code>\triangle</code>

Further symbols

Binary|Operation

\times	<code>\times</code>	\times	<code>\times</code>
\div	<code>\div</code>	\cap	<code>\cap</code>
\cup	<code>\cup</code>	\neq	<code>\neq</code>
\leq	<code>\leq</code>	\geq	<code>\geq</code>
\in	<code>\in</code>	\perp	<code>\perp</code>
\notin	<code>\notin</code>	\subset	<code>\subset</code>
\simeq	<code>\simeq</code>	\approx	<code>\approx</code>
\wedge	<code>\wedge</code>	\vee	<code>\vee</code>
\oplus	<code>\oplus</code>	\otimes	<code>\otimes</code>
\Box	<code>\Box</code>	\boxtimes	<code>\boxtimes</code>
\equiv	<code>\equiv</code>	\cong	<code>\cong</code>

Even more symbols

[http://www.rpi.edu/dept/arc/training/latex/
LaTeX_symbols.pdf](http://www.rpi.edu/dept/arc/training/latex/LaTeX_symbols.pdf)

“The great big list of LaTeX symbols”

$$E = mc^2 \quad (1)$$

$$y = mx + c$$

$$f(x) = \tanh(x) = \frac{(e^x - e^{-x})}{(1 + e^{-x})} \quad (2)$$

$$\hat{f}(\xi) = \int_{-\infty}^{\infty} f(x) e^{-2\pi i x \xi} dx, \quad (3)$$

Exercise

Preamble

```
\documentclass[papersize, fontsize]{class}  
  article | report | book
```

```
\title{title}  
\author{author}  
\date{\today}
```

```
\usepackage{setspace}  
\spacing{1.6} %doublespace
```

```
% article – papers  
% report – chaptered document  
% book – for a book or thesis structure
```

```
%papersize: often a3paper, a4paper...
```

```
\usepackage{amsmath} %maths  
\usepackage{amssymb} %maths symbols
```

Main Body

```
\begin{document}  
\maketitle  
Typed text is as written
```

```
\textbf{bold}, \textit{italic}, \textsuperscript{super},  
\textsubscript{sub}, \textsc{SMALLCAPS}, \underline{ul}
```

```
` or `` to start quotes
```

```
- \textendash \textemdash
```

```
tiny, scriptsize, footnotesize, small, normalsize, large,  
Large, LARGE, huge, Huge
```

```
\begin{flushleft}           {center}           {flushright}  
\end{...}
```

```
\begin{itemize|enumerate|description}[A.][i.] %lettered/roman  
  \item bullet or numbered item  
  \item[label] for description item
```

```
\begin{part|chapter|abstract}  
\section{name} \subsection{} \subsubsection{} \paragraph{}  
  \subparagraph{}
```

```
\end{document}
```

Non-Textual

```
\command[options]{context}  
#, $, %, ^, &, _, {, }, ~, \ are reserved  
Multiple consecutive spaces = one space  
2+ consecutive newlines = new paragraph
```

```
This is $inline$ maths  
      $$block maths$$
```

```
\begin{equation}  
      equation  
\end{equation}
```

```
^{maths superscript}  
_{maths subscript}
```

```
"\ " – maths whitespace
```

```
\left( \left[ \left(   \right) \right] ...
```

Figures

Graphics packages

Preamble

```
\usepackage{graphicx}  
\graphicspath{ {figures/} }
```

Body

```
\includegraphics[detail]{filename}
```

Graphics paths

- ▶ The graphics path specified should be relative.
- ▶ The `\graphicspath{ {figures/} }` figure sets the automatic path for graphics to a subfolder “figures”.
- ▶ A file extension isn’t needed, and it might be better to skip it – LaTeX will find all the matching files with the same name.
- ▶ You can specify the extension preference order with `\DeclareGraphicsExtensions{.png,.pdf}`
- ▶ This allows draft runs to use low res .pngs, and only use high-res pdfs if no png is available. For final versions, you can invert the order.

Image formats in LaTeX



JPG: Useful for including photos



PNG: Best choice for low-memory images and non-vector diagrams



PDF: Can be used to hold both bitmap and vector images. Better for vectors.



EPS: Ideal vector format, but can be slower to use.

Image size

```
\includegraphics[details]{relative imagepath}
```

```
[width=amount<unit>]
```

```
[height=amount<unit>]
```

If you only specify one dimension, the others will auto-scale to keep the same resolution

```
[scale=x] %scales the original image by the scale factor x  
          %2 is double original size, 0.5 is half
```

Units

If in doubt, use fractions of the dynamic sizes (e.g. `textwidth`)

`[width=0.5\textwidth]`

Abbreviation	Definition
<code>pt</code>	A point, is the default length unit. About 0.3515mm
<code>mm</code>	a millimetre
<code>cm</code>	a centimetre
<code>in</code>	an inch
<code>ex</code>	the height of an <code>x</code> in the current font
<code>em</code>	the width of an <code>m</code> in the current font
<code>\columnsep</code>	distance between columns
<code>\columnwidth</code>	width of the column
<code>\linewidth</code>	width of the line in the current environment
<code>\paperwidth</code>	width of the page
<code>\paperheight</code>	height of the page
<code>\textwidth</code>	width of the text
<code>\textheight</code>	height of the text
<code>\unitlength</code>	units of length in the <i>picture</i> environment.

Further image manipulation



Clipping

```
\includegraphics[clip=true, trim  
2mm 3mm 4mm 1mm]{imagepath}
```

The order is: left, bottom, right,
top



Rotation

```
\includegraphics[angle=45]{imagep  
ath}
```



Borders

```
\fbox{\includegraphics...}
```



Border Thickness

```
\setlength\fboxrule{2pt}  
\fbox{\includegraphics...}
```

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\left( \left[ \left( \right) \right] \right) ...

image units: \textwidth \columnwidth mm pt
              cm em...

\includegraphics[clip=true, trim left bot
right top]{imagepath}

\includegraphics[angle=45]{imagepath}

\setlength\fbboxrule{2pt} %border thickness
\fbbox{includegraphics...}
```

Images as figures



Figures are an environment that can encapsulate images, and text.

`\equation` is a better and purpose-built version of a figure for maths
the `\table` environment is better suited for tables; both can use similar positioning logic.



They usually involve an image and a caption, and contain information about where in the page and document it should reside.



These content-encapsulating environments are one of the more powerful features in LaTeX

Figure environments

```
\begin{figure}[position]  
  \centering  
    \includegraphics...  
    \caption{caption text}  
\end{figure}
```

Figures “float” around the document. LaTeX internally weighs the costs of breaking lines, sentences, paragraphs... when placing the figures in the best place possible. The position argument gives hints to where you would prefer the figure to appear.

Positioning



h – here: place the figure approximately here



t – top: place the figure at the top of the page



b – bottom: place the figure at the bottom page



p – page: place it on a separate for floats



! – override: any argument with ! to override internal hidden parameters



H – Here!: similar to h!, places a figure exactly at its location in the text.

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```

```
\includegraphics[width|height|scale|angle|clip]{filename}
```

```
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\includegraphics[]{}...
\caption{caption text}
\end{figure}
```

```
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own page, override!, HERE!
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Next time



Bibliographies



Autogenerated
meta-sections



Smart labelling



Advanced page
geometry



Font and style
management



Multifile
documents



Headers and
footers



Book-page
patterns



Colours



Tables