LaTeX from first principles

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1 How LaTeX works

1.1 The idea

You write a text file ending in `.tex`, and a program called an *engine* turns it into a PDF. That step is called *compiling*. It's closer to running code than to saving a Word file: errors stop it, and the source and result are separate.

minimal.tex

```
\documentclass{article}

\begin{document}
Hello, world. One plus one is $1 + 1 = 2$.
\end{document}
```

Compile it with:

```
pdflatex minimal
```

What you should see at the end of the run

```
Output written on minimal.pdf (1 page, 15054 bytes).
Transcript written on minimal.log.
```

This makes `minimal.pdf`, plus helper files such as `minimal.log`, which records what happened, and `minimal.aux`, which remembers numbers between runs.

1.2 The parts of a document

- **The preamble** is everything before `\begin{document}`. It sets the document type and loads packages. Nothing here is printed.
- **The body** is everything between `\begin{document}` and `\end{document}`.

1.3 Syntax

- **A command** starts with a backslash: `\section{Method}`. Required inputs, or *arguments*, go in braces, and optional ones in square brackets: `\documentclass[11pt]{article}`.
- **An environment** has a start and an end, and changes what's between them: `\begin{center}` and `\end{center}`.



Figure 1.1: The top of minimal.pdf.

- **A comment** starts with `%` and runs to the end of the line.
- **A blank line** starts a new paragraph. Single line breaks and extra spaces are ignored.
- **Special characters** need a backslash to print: `\%`, `\$`, `\&`, `\#`, `\_`, `\{`, `\}`.

1.4 Why you sometimes compile more than once

Numbers for sections, equations and citations are only known after a full pass. LaTeX writes them to the `.aux` file on one run, and reads them on the next. So a contents page or a reference can need two or three runs. A warning saying `Rerun to get cross-references right` means exactly that.

The full sequence with a bibliography is:

```
pdflatex main
bibtex main
pdflatex main
pdflatex main
```

On the first run of the complete report, LaTeX doesn't yet know the numbers, so it says so. These warnings are normal at this stage, and they went away after the full sequence:

What you should see (only the warning and result lines)

```
$ pdflatex main
Package natbib Warning: Citation `clarke2001' on page 1 undefined on input line
LaTeX Warning: Reference `sec:method' on page 1 undefined on input line 30.
LaTeX Warning: Reference `tab:walls' on page 1 undefined on input line 31.
LaTeX Warning: Reference `fig:loss' on page 1 undefined on input line 31.
LaTeX Warning: Reference `eq:loss' on page 1 undefined on input line 39.
Package natbib Warning: There were undefined citations.
LaTeX Warning: There were undefined references.
LaTeX Warning: Label(s) may have changed. Rerun to get cross-references right.

$ pdflatex main     (the last run of the sequence)
Output written on main.pdf (2 pages, 107972 bytes).
```

The tool `latexmk -pdf main` works out how many runs are needed and does them for you, though it needs Perl on Windows.

1.5 Choosing an engine

Engine	Use it when
`pdflatex`	The default for most documents, with the widest compatibility
`xelatex`	You want system fonts, or scripts such as Urdu and Arabic
`lualatex`	You want system fonts plus scripting with Lua

1.6 Reading errors

An error line starts with `!`. Press Enter past it in a terminal, or use `-interaction=nonstopmode` so that it doesn't stop. Fix the **first** error, because one fault can cause many later ones.

```
! Undefined control sequence.
l.12 \sectoin
```

```
3               {Method}
```

This says line 12 uses a command that doesn't exist, here a misspelling. The troubleshooting chapter lists common errors.

2 Structure, text and appearance

2.1 Document classes

The class sets the overall type of document.

Class	For
`article`	Papers and short reports
`report`	Long reports with chapters
`book`	Books
`beamer`	Slides

2.2 Headings and contents

```
\section{Method}
\subsection{Data}
\subsubsection{Cleaning}
\tableofcontents
```

In a complete `report`, the title page, the contents and each chapter start on new pages:

chapters.tex

```
% A long document with a title page, contents and chapters. Build: pdflatex chapters, twice
\documentclass[11pt,a4paper]{report}

\title{Heat Loss Through a Wall}
\author{A Student}
\date{1 November 2026}

\begin{document}
\maketitle
\tableofcontents

\chapter{Method}
Heat flows through a wall in proportion to its area and the temperature difference.

\section{Data}
The walls come from a small survey.

\subsection{Cleaning}
Walls with no recorded U-value were left out.

\section*{Thanks}
A starred heading has no number, and stays out of the contents.

\chapter{Results}
Insulated walls lose the least heat.
\end{document}
```

Compile it twice, because the contents are only known after the first run.

Numbers come automatically, and adding a star, as in `\section*{Thanks}`, leaves a heading unnumbered and out of the contents. Split long documents into files with `\input{chapter1}`.

Heat Loss Through a Wall

A Student

1 November 2026

Figure 2.1: Title page

Contents

1 Method **2**
1.1 Data 2
1.1.1 Cleaning 2

2 Results **3**

1

Figure 2.2: Contents

Chapter 1

Method

Heat flows through a wall in proportion to its area and the temperature difference.

1.1 Data

The walls come from a small survey.

1.1.1 Cleaning

Walls with no recorded U-value were left out.

Thanks

A starred heading has no number, and stays out of the contents.

2

Figure 2.3: First chapter

2.3 Text and fonts

```
\emph{emphasis}  \textbf{bold}  \texttt{code}  \underline{underlined}
{\small smaller text}  {\large larger text}
```

Prefer `\emph` over forcing italics, because it describes meaning, and it adapts when nested. For dashes, `-` joins words, `--` makes ranges such as 10--20, and `---` is a long dash. Quotes are written as two backticks and two apostrophes.

2.4 Fonts

With `pdflatex`, fonts come from packages, for example `\usepackage{helvet}` with `\renewcommand{\familydefault` for a sans-serif body. With `xelatex`, you can name any installed font:

```
\usepackage{fontspec}
\setmainfont{Source Serif 4}
```

2.5 Colour

```
\usepackage{xcolor}
\definecolor{brand}{HTML}{0D6A6E}
\textcolor{brand}{Coloured text}
```

Define each colour once, by name, so that you can change the whole document from one line. Don't rely on colour alone to carry meaning, because some readers can't see the difference and pages may be printed in black and white.

2.6 Lists

```
\begin{itemize}
  \item A point
\end{itemize}
\begin{enumerate}
  \item A first step
\end{enumerate}
```

2.7 Page layout

```
\usepackage[a4paper,margin=2.5cm]{geometry}
\usepackage{setspace}
\onehalfspacing
\usepackage{fancyhdr}
\pagestyle{fancy}
```

2.8 Links

```
\usepackage{hyperref}           % load this near the end of the preamble
\href{https://example.org}{a link}
\url{https://example.org}
```

`hyperref` also makes every cross-reference and contents entry clickable.

3 Mathematics

3.1 Inline and displayed

Inline maths sits within a sentence, and displayed maths gets its own line. Load `amsmath` for anything beyond the basics.

```
The energy is $E = mc^2$ here.

\[ E = mc^2 \]          % displayed, no number

\begin{equation}        % displayed and numbered
  E = mc^2
  \label{eq:energy}
\end{equation}
```

In the file below, these forms and some of the building blocks come together. Only the numbered equations get a number at the right.

maths.tex

```
% The maths from this chapter in one document. Build: pdflatex maths
\documentclass[11pt]{article}
\usepackage{amsmath}

\begin{document}
The energy is $E = mc^2$ here.

\[ E = mc^2 \]

\begin{equation}
  E = mc^2
  \label{eq:energy}
\end{equation}

\begin{align}
  r &= \frac{s}{c + v} \\
    &= \frac{e v}{c + v} \\
    &= \frac{e}{1 + c/v}.
\end{align}

Building blocks: $x_{i,j}$, $\sqrt{x}$, $\alpha$, $\Delta$, $\sum_{i=1}^{n} x_i$,
$\int_0^1 x \, dx$, $a \approx b$ and $\left( \frac{a}{b} \right)$.
\end{document}
```

3.2 The building blocks

You want	You write
Superscript and subscript	`x^2`, `x_i`, `x_{i,j}`
Fraction	`\frac{a}{b}`
Square root	`\sqrt{x}`
Greek letters	`\alpha`, `\mu`, `\Delta`
Sum and integral	`\sum_{i=1}^{n}`, `\int_0^1`
Operators and relations	`\times`, `\approx`, `\leq`, `\rightarrow`

You want	You write
Words in maths	`\text{hours}`
Spacing	`\,` small, `\quad` wide
Brackets that grow	`\left( \frac{a}{b} \right)`

Braces group things, so `x^{10}` raises the whole 10, while `x^10` raises only the 1.

3.3 Aligned derivations

Long derivations read best one step per line. Use `&` to mark where lines align, and `\\` to end a line.

```
\begin{align}
  r &= \frac{s}{c + v} \\
    &= \frac{e v}{c + v} \\
    &= \frac{e}{1 + c/v}.
\end{align}
```

Each line gets a number, and `align*` removes all of them. `\nonumber` removes one.

3.4 Maths as your own commands

If a symbol means something in your project, name it once, and every use will follow.

```
\newcommand{\rate}{\ensuremath{r}}
```

3.5 Tips

- Spell out what each symbol means in the text around the equation.
- Treat an equation as part of a sentence, with punctuation.
- Don't use `$` or `$$` for displayed equations in LaTeX. Use `\[ \]`, because `$$` skips LaTeX's spacing rules.

The energy is $E = mc^2$ here.

$$E = mc^2$$

$$E = mc^2 \tag{1}$$

$$\begin{aligned} r &= \frac{s}{c+v} && (2)\\ &= \frac{ev}{c+v} && (3)\\ &= \frac{e}{1+c/v}. && (4) \end{aligned}$$

Building blocks: $x_{i,j}$, $\sqrt{x}$, α, Δ, $\sum_{i=1}^{n} x_i$, $\int_0^1 x\,dx$, $a \approx b$ and $\left(\frac{a}{b}\right)$.

Figure 3.1: What that file compiles to.

4 Tables and figures

4.1 Tables

A `tabular` builds the grid, and a `table` around it adds a caption and lets it float to a good position. The `booktabs` package gives clean horizontal rules, and it's best to avoid vertical lines altogether.

```
\begin{table}[ht]
  \centering
  \caption{Heat loss through a wall.}
  \label{tab:walls}
  \begin{tabular}{lrr}      % left, right, right
    \toprule
    Wall & $U$ & $Q$ \\
    \midrule
    Solid brick & 2.10 & 315 \\
    Insulated   & 0.45 & 68 \\
    \bottomrule
  \end{tabular}
\end{table}
```

4.2 Figures

```
\usepackage{graphicx}

\begin{figure}[ht]
  \centering
  \includegraphics[width=0.8\linewidth]{figures/map.pdf}
  \caption{Heat loss across the study area.}
  \label{fig:map}
\end{figure}
```

Use PDF or SVG-derived vector files for plots, as they stay sharp at any size. Use PNG for images at 300 dpi or more for print.

Table 1: Heat loss through a 10 m^2 wall at a difference of 15 K.

Wall	U (W/m^2K)	Q (W)
Solid brick	2.10	315
Unfilled cavity	1.50	225
Insulated	0.45	68

Figure 4.1: The table in the complete report, with three walls. Note the horizontal rules, and no vertical ones.

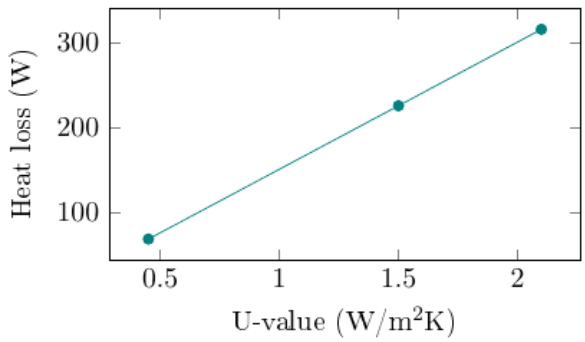


Figure 1: Heat loss rises in proportion to the U-value.

Figure 4.2: The same plot compiled in the complete report. Its labels use the same font as the text.

4.3 Plots drawn from data

`pgfplots` draws a chart directly in LaTeX, so its fonts match the document.

```
\begin{tikzpicture}
  \begin{axis}[xlabel={U-value}, ylabel={Heat loss (W)}]
    \addplot coordinates {(0.45,68) (1.5,225) (2.1,315)};
  \end{axis}
\end{tikzpicture}
```

For anything complex, generate the figure with a script, such as Python with Matplotlib, and include the file. Then the figure can be rebuilt from its data.

4.4 Introducing them properly

Every table and figure should be mentioned in the text before it appears, and each needs a caption that says what it shows. Put the `\label` after the `\caption`, or the reference will point to the section number instead. Floats move: `[ht]` asks for here or the top of a page, which is why you should refer to "Table 1" and not "the table below".

5 References, links and bibliographies

5.1 Cross-references

Give anything numbered a label, then refer to it. The number updates itself if things move.

```
\section{Method}\label{sec:method}
See Section~\ref{sec:method} and Equation~\eqref{eq:energy}.
```

The ~ is a non-breaking space, which keeps "Section" and its number on one line. A prefix such as `sec:`, `eq:`, `tab:` or `fig:` is a helpful habit. The `cleveref` package can add the word for you: `\cref{sec:method}`.

5.2 Citations

Keep references in a separate `.bib` file, and cite them by key:

refs.bib

```
@book{clarke2001,
  author    = {Clarke, Joseph A.},
  title     = {Energy Simulation in Building Design},
  edition   = {2},
  publisher = {Butterworth-Heinemann},
  address   = {Oxford},
  year      = {2001}
}
```

```
\usepackage[round]{natbib}
...
As \citet{clarke2001} shows, this holds \citep{clarke2001}.
...
\bibliographystyle{plainnat}
\bibliography{refs}
```

The bibliography tool picks up only the items you cite. Zotero can export a `.bib` file, and its Better BibTeX add-on keeps that file updated. `biblatex` with the `biber` tool is a more flexible alternative, while journals often supply their own `.bst` style for BibTeX.

5.3 A complete small report

This pulls together everything so far: sections, equations, a table, a chart, cross-references, a bibliography and links.

main.tex

```
% A complete small report: sections, maths, a table, a figure, cross-references, a bibliography and links.
% Build: pdflatex main, bibtex main, pdflatex main, pdflatex main
\documentclass[11pt,a4paper]{article}

% Packages. hyperref goes last among these, because it changes how others work.
\usepackage[T1]{fontenc}
\usepackage[margin=2.5cm]{geometry}
```

```
\usepackage{amsmath}
\usepackage{booktabs}
\usepackage{graphicx}
\usepackage{pgfplots}
\usepackage[round]{natbib}
\usepackage{xcolor}
\usepackage[colorlinks=true,linkcolor=teal,citecolor=teal,urlcolor=teal]{hyperref}
\pgfplotsset{compat=1.17}

% Your own command: change the look of every "term" from this one line.
\newcommand{\term}[1]{\textbf{#1}}

\title{Heat Loss Through a Wall}
\author{A Student}
\date{\today}

\begin{document}
\maketitle
\tableofcontents

\section{Introduction}\label{sec:intro}
A \term{U-value} measures heat flow through one square metre of a surface for each degree of
temperature difference \citep{clarke2001}. Section~\ref{sec:method} gives the equation, and
Table~\ref{tab:walls} and Figure~\ref{fig:loss} apply it.

\section{Method}\label{sec:method}
Heat loss $Q$ follows from the U-value $U$, the area $A$ and the temperature difference $\Delta T$:
\begin{equation}
  Q = U A \, \Delta T.
  \label{eq:loss}
\end{equation}
Equation~\eqref{eq:loss} is a steady-state estimate. Longer derivations line up at the equals sign:
\begin{align}
  Q &= 2.1 \times 10 \times 15 \\
    &= 315 \text{ W}.
\end{align}

\section{Results}\label{sec:results}
\begin{table}[ht]
  \centering
  \caption{Heat loss through a 10 m$^2$ wall at a difference of 15 K.}
  \label{tab:walls}
  \begin{tabular}{lrr}
    \toprule
    Wall & $U$ (W/m$^2$K) & $Q$ (W) \\
    \midrule
    Solid brick & 2.10 & 315 \\
    Unfilled cavity & 1.50 & 225 \\
    Insulated & 0.45 & 68 \\
    \bottomrule
  \end{tabular}
\end{table}

\begin{figure}[ht]
  \centering
  \begin{tikzpicture}
    \begin{axis}[width=8cm, height=5cm, xlabel={U-value (W/m$^2$K)}, ylabel={Heat loss (W)}]
      \addplot[teal, mark=*] coordinates {(0.45,68) (1.5,225) (2.1,315)};
    \end{axis}
  \end{tikzpicture}
  \caption{Heat loss rises in proportion to the U-value.}
  \label{fig:loss}
\end{figure}

\section{Conclusion}
Find this project's source at \url{https://ahmadammar.github.io/teaching/latex/}.
```

```
\bibliographystyle{plainnat}
\bibliography{refs}
\end{document}
```

It compiles to these two pages. The links are coloured teal, and every number comes from a label.

Heat Loss Through a Wall

A Student

November 1, 2026

Contents

1 Introduction 1

2 Method 1

3 Results 1

4 Conclusion 1

1 Introduction

A **U-value** measures heat flow through one square metre of a surface for each degree of temperature difference (Clarke, 2001). Section 2 gives the equation, and Table 1 and Figure 1 apply it.

2 Method

Heat loss Q follows from the U-value U, the area A and the temperature difference ΔT:

$$Q = U A \, \Delta T. \tag{1}$$

Equation (1) is a steady-state estimate. Longer derivations line up at the equals sign:

$$\begin{aligned} Q &= 2.1 \times 10 \times 15 && (2)\\ &= 315 \text{ W}. && (3) \end{aligned}$$

3 Results

Table 1: Heat loss through a 10 m^2 wall at a difference of 15 K.

Wall	U ($\text{W/m}^2\text{K}$)	Q (W)
Solid brick	2.10	315
Unfilled cavity	1.50	225
Insulated	0.45	68

4 Conclusion

Find this project's source at `https://ahmadammar.github.io/teaching/latex/`.

Figure 5.1: Page 1

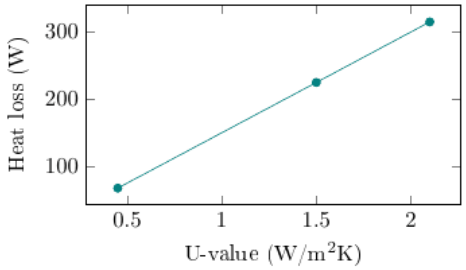


Figure 1: Heat loss rises in proportion to the U-value.

References

Joseph A. Clarke. *Energy Simulation in Building Design*. Butterworth-Heinemann, Oxford, 2 edition, 2001.

Figure 5.2: Page 2

6 Your own commands, packages and themes

6.1 LaTeX as a language

LaTeX is a programming language, and its commands behave like functions and variables.

```
% A variable: one place to change a value
\newcommand{\studyarea}{Greater London}

% A function with one parameter, used as \term{surplus value}
\newcommand{\term}[1]{\textbf{#1}}

% A function with two parameters, where the first is optional
\newcommand{\money}[2][PKR]{#1~#2}   % \money{160} gives PKR 160
```

#1 is the first parameter. `\renewcommand` changes an existing command.

6.2 Environments and counters

```
\newtheorem{example}{Example}[section]      % numbered within each section

\begin{example}[A coffee-shop worker]
  ...
\end{example}

\newcounter{step}
\stepcounter{step}\thestep
```

6.3 Numbers from your analysis

Don't type results by hand into a document. Have your analysis write a file of commands:

```
% Written by a script. Do not edit by hand.
\newcommand{\meanDemand}{369}
```

Then `\input{numbers}` and write `\meanDemand` in the text. When the data changes, the document follows. This prevents the most common errors in scientific writing, as described in the Git and automation guide.

6.4 Your own style file

Put a shared look in a `.sty` file, then load it in any document.

```
% mystyle.sty
\ProvidesPackage{mystyle}
\RequirePackage{xcolor}
\definecolor{brand}{HTML}{0D6A6E}
```

```
\usepackage{mystyle}
```

For a whole document type, such as a thesis, write a `.cls` class file instead. Most journals and universities supply one. Keep your text separate from the style, so that moving to a different template only needs one change.

6.5 Useful packages

Package	Purpose
`amsmath`	Mathematics
`geometry`	Page size and margins
`graphicx`	Images
`booktabs`	Clean tables
`longtable`, `tabularx`	Long and flexible tables
`xcolor`	Colour
`hyperref`	Links
`cleveref`	Automatic reference words
`natbib`, `biblatex`	Citations
`siunitx`	Numbers and units
`tikz`, `pgfplots`	Diagrams and plots
`glossaries`	Glossaries and acronyms
`tcolorbox`	Coloured boxes
`beamer`	Slides, as a class

Load only what you use, and load `hyperref` late, as it changes many others.

7 Slides, Word, web pages and images

7.1 Slides with Beamer

slides.tex

```
% Slides with the beamer class. Build: pdflatex slides
\documentclass[aspectratio=169]{beamer}
\usetheme{default}
\setbeamertemplate{navigation symbols}{}
\title{Heat Loss Through a Wall}
\author{A Student}
\begin{document}
\begin{frame}
  \titlepage
\end{frame}
\begin{frame}{The equation}
  \begin{itemize}
    \item<1-> Heat loss depends on the wall, its area and the temperature.
    \item<2-> $Q = U A \, \Delta T$
  \end{itemize}
\end{frame}
\end{document}
```

It compiles to three PDF pages, because each reveal is its own page:

<1-> and <2-> reveal items one click at a time. `\usetheme` changes the look.

7.2 Posters

The `beamerposter`, `tikzposter` and `baposter` packages make large single pages. Set the paper size, then build it like any other document.

7.3 Word

Journals and co-authors often want `.docx`. Pandoc converts LaTeX, including citations:

```
pandoc main.tex -o main.docx --citeproc --bibliography=refs.bib
```

Pandoc writes equations as editable Word equations, and `--csl` with a style file sets the citation style. Complex layouts and custom commands may not survive, so always check the result, especially tables. My research-helpers[1] package has a `latex2docx` tool built for this.

7.4 Web pages

Pandoc also makes HTML. `pandoc main.tex -o main.html --mathjax` gives one page, with equations drawn by MathJax in the browser. For a whole site, split the document by section, and let a site generator such as MkDocs handle the navigation.

[1] `https://github.com/GeospatialGeeks/research-helpers`



Figure 7.1: Title slide

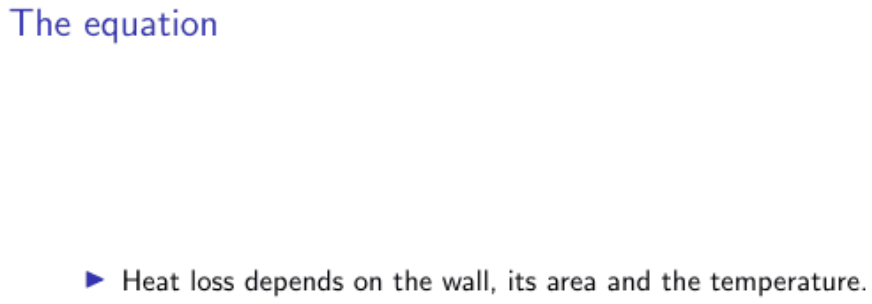


Figure 7.2: First reveal

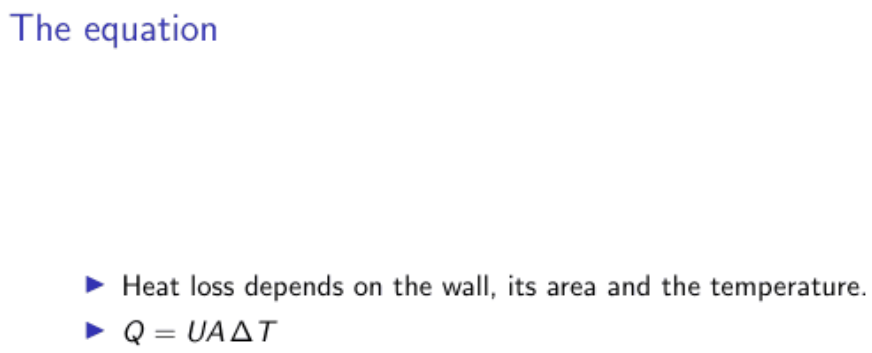


Figure 7.3: Second reveal

Things need care in conversion, so test the result in a browser. In my own pamphlet project[2], these all caused real faults:

- Dollar signs for money turned text into maths.
- Print-only commands such as `\toprule` showed in red inside equations.
- Commands the browser doesn't know, such as `\pounds`, needed defining.
- Labels needed converting into links and numbers.

7.5 PowerPoint and images

PowerPoint has no good route from LaTeX, so the reliable method is to compile to PDF, turn each page into an image, then build a deck with those images and speaker notes:

```
from research_helpers.carousel import pdf_to_images, images_to_pptx

images = pdf_to_images("slides.pdf", "images", pixels=1440)
images_to_pptx(images, "slides.pptx", notes=["Read this aloud."] * len(images))
```

The slides look exact, though you edit them in LaTeX and not in PowerPoint.

7.6 One source, many outputs

The principle across all of these is to edit one source and generate everything else. The Git and automation guide shows how to make this happen by itself.

[2] `https://github.com/AhmadAmmar/marxist-economics`

8 Good practice and version control

8.1 A tidy project

```
paper/
  main.tex        the document's skeleton
  sections/       one file for each section
  figures/        generated by scripts
  tables/         generated by scripts
  refs.bib
  code/           scripts that make the figures, tables and numbers
  build/          outputs, not tracked
```

8.2 Version control

LaTeX is text, so Git handles it well. Put each sentence on its own line, so that a change shows as one changed sentence. Keep helper files out of Git with a `.gitignore`:

```
*.aux
*.log
*.out
*.toc
*.bbl
*.blg
*.synctex.gz
```

Tag each version you send out, as covered in the Git and automation guide.

8.3 Reproducible builds

A document is reproducible if someone else can rebuild it from your files.

- Record the commands in a README or a script.
- Generate figures, tables and numbers with code.
- Build in a clean folder now and then, because old helper files can hide faults.
- Keep paths relative, never tied to your own machine.
- Fix `\date{...}` to a real date for a version, because `\today` changes at every compile.

8.4 Accessible documents

- Use real headings, lists and captions.
- Choose colours with good contrast that still work in greyscale.
- Prefer colourblind-safe palettes.
- Set the document's title and language, for screen readers: `\hypersetup{pdftitle={...}}`.

8.5 Working with others

Overleaf offers live co-editing, and it can sync with Git. Otherwise, agree who changes what, keep to one sentence per line, and use `latexdiff old.tex new.tex > changes.tex` to produce a marked-up comparison for readers who don't use Git.

9 Troubleshooting and cheat sheet

9.1 Common errors

Message	Usual cause	Fix
`Undefined control sequence`	A misspelt command, or a missing package	Check the spelling, or load the package
`Missing $ inserted`	Maths outside maths mode, or an unescaped _ or ^	Add `$ $`, or write `\_`
`Missing } inserted`	Unbalanced braces	Find the unmatched {
`File 'x.sty' not found`	A package isn't installed	Install it, or let MiKTeX do so
`File 'x' not found`	A wrong image or input path	Check the relative path
`Citation 'x' undefined`	The key is wrong, or BibTeX hasn't run	Check the key, then run the full sequence
`Reference 'x' undefined`	A missing label, or too few runs	Add the label, or compile again
`Overfull \hbox`	A line is too wide	A warning, so rewrite if it's visible
`Command \x already defined`	A name clash	Rename your command, as with `\day`

If a document breaks after a strange failure, delete the helper files and compile again.

9.2 Cheat sheet

```tex
\documentclass[11pt]{article}          % document type
\usepackage{amsmath}                   % load a package
\newcommand{\name}[1]{...#1...}        % your own command
\section{Title}\label{sec:x}           % heading with a label
\ref{sec:x}   \eqref{eq:y}             % refer to a number
\citep{key}                            % citation
\emph{a} \textbf{b} \texttt{c}         % emphasis, bold, code
$a^2$   \[ x \]   \frac{a}{b}          % maths
\includegraphics[width=\linewidth]{f}  % image
\input{file}                           % another file
```

```
pdflatex main      # compile
bibtex main        # build the bibliography
latexmk -pdf main  # do all the runs
latexmk -c         # remove helper files
```

9.3 References and further reading

LaTeX Project (n.d.) *LaTeX documentation*. https://www.latex-project.org/help/documentation/

MacTeX (n.d.) *MacTeX*. TeX Users Group. https://www.tug.org/mactex/

MiKTeX (n.d.) *MiKTeX*. https://miktex.org

Overleaf (n.d.) *Overleaf*. https://www.overleaf.com

TeX Live (n.d.) *TeX Live*. TeX Users Group. https://www.tug.org/texlive/

Wikibooks (n.d.) *LaTeX*. https://en.wikibooks.org/wiki/LaTeX

Ammar, A. (n.d.) *research-helpers*. https://github.com/GeospatialGeeks/research-helpers

Ammar, A. (n.d.) *Marxian political economy: project source*. https://github.com/AhmadAmmar/marxist-economics