Introduction to LaTeX

Document Creation for Academics

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What is LaTeX?

LaTeX is a professional typesetting system widely used in academia. Unlike word processors, it uses markup commands to separate **content** from **formatting**.

> **KEY CONCEPT**
>
> You write plain text with commands, then **compile** to produce a beautifully formatted PDF.

- Professional quality output
- Superior math handling
- Automatic referencing
- Industry standard

Basic Document Structure

Every LaTeX document consists of two main parts: the **preamble** (settings) and the **document body** (content).

```latex
\documentclass{article}

% Preamble goes here

\begin{document}
  Hello, world!
\end{document}
```

1. **Document Class**
   Defines the type of document (article, report, book)
2. **Preamble**
   Area before \begin{document} for packages and settings
3. **Body**
   Content between \begin and \end{document}

Classes and Packages

Document Classes

Define the overall structure and layout of your document.

```
\documentclass{article}
```

- **article**: Short papers, journals
- **report**: Longer docs, chapters
- **book**: Books, front/back matter
- **beamer**: Presentations

Packages

Add specific functionality to your document.

```
\usepackage{packagename}
```

- **amsmath**: Advanced math formulas
- **graphicx**: Including images
- **hyperref**: Clickable links/refs
- **geometry**: Page margins

Text Formatting Basics

TEXT STYLES

`\textbf{Bold}`	→	**Bold**
`\textit{Italic}`	→	*Italic*
`\underline{Underline}`	→	Underline
`\emph{Emphasize}`	→	*Emphasize*

DOCUMENT STRUCTURE

```
\section{Introduction}
\subsection{Background}
\subsubsection{Motivation}
\paragraph{Details}
```

Tip: *Leave a blank line in your code to create a new paragraph. Don't use `||` for paragraphs!*

Mathematical Equations (Inline)

> Use dollar signs `$...$` to write math within a sentence.
> Example: "Let `$x$` be the price" renders as "Let x be the price".

COMMON SYMBOLS

`\alpha, \beta, \pi`	α, β, π
`\sigma, \mu, \lambda`	σ, μ, λ
`\times, \div, \pm`	$\times, \div, \pm$
`\leq, \geq, \neq`	$\leq, \geq, \neq$

STRUCTURES

`x^2, e^{rt}`	x^2, e^{rt}	Superscript
`x_1, S_t`	x_1, S_t	Subscript
`\sqrt{x}`	$\sqrt{x}$	Square root
`\frac{a}{b}`	$\frac{a}{b}$	Fraction

Mathematical Equations (Display)

> Use `\[...\]` or `\begin{equation}` to display math on its own line.

```
\[
  V_0 = e^{-rT} \mathbb{E}[\max(S_T - K, 0)]
\]
```

$$V_0 = e^{-rT}\mathbb{E}[\max(S_T - K, 0)]$$

```
\[ \sum_{i=1}^{n} i = \frac{n(n+1)}{2} \]
```

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$$

```
\[ \int_{-\infty}^{\infty} e^{-x^2} dx =
\sqrt{\pi} \]
```

$$\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}$$

Lists and Itemization

Unordered Lists (Bullets)

```
\begin{itemize}
  \item First point
  \item Second point
  \item Third point
\end{itemize}
```

- First point
- Second point
- Third point

Ordered Lists (Numbered)

```
\begin{enumerate}
  \item First step
  \item Second step
  \item Third step
\end{enumerate}
```

1. First step
2. Second step
3. Third step

Creating Tables

Including Figures and Images

```latex
\begin{figure}[h]
  \centering
  \includegraphics[width=0.8\textwidth]{plot.png}
  \caption{Stock price simulation}
  \label{fig:stock_sim}
\end{figure}
```

Important Notes

1. Requires `\usepackage{graphicx}` in preamble
2. Position options: **h** (here), **t** (top), **b** (bottom)
3. Always add a caption and label for referencing

[Image: plot.png]

Figure 1: Stock price simulation

Rendered Output

References and Cross-Referencing

LaTeX automatically manages numbering for sections, equations, and figures.

```
\section{Introduction}
\label{sec:intro}

As seen in Section \ref{sec:intro},
we discuss the model...
```

Compiles to

→

1 Introduction

As seen in Section 1,
we discuss the model...

★ **Benefit:** If you add a new section before Introduction, the reference automatically updates to "Section 2" without you changing the text!

Summary and Resources

KEY TAKEAWAYS

- ✓ LaTeX separates content from formatting for professional results
- ✓ Structure: Preamble (settings) + Body (content)
- ✓ Use **packages** to extend functionality (math, images)
- ✓ Math: Inline `$...$` and Display `\[...\]`
- ✓ Cross-references update automatically

GETTING STARTED

Overleaf

Free online LaTeX editor. No installation required. Great for collaboration.

`overleaf.com`

TeX Stack Exchange

The best place to find answers to specific LaTeX questions.

`tex.stackexchange.com`