LaTeX

What you get is what you want

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What is LaTex?

- LaTeX (pronounced "Lay-tech" or "Lah-tech") is a **typesetting system**.
- Unlike Word, it's **not a word processor.** You write code that describes your document.
- Ideal for **scientific, technical, or academic documents**.
- Focuses on **structure and content**, formatting is automatic.

Why LaTeX over Word?

- **Professional formatting** – automatic numbering, headers, bibliography.
- **Consistency** – headings, captions, references always match.
- **Excellent for math** – formulas, equations, symbols.
- **Scalable** – handles long documents (thesis, books) without breaking layout.
- **Cross-references** – figures, tables, equations auto-update.

Where is LaTeX used?

- Academic papers & research journals.
- Thesis, dissertations, and reports.
- Curriculum Vitae (CV) / Resumes.
- Presentations (Beamer slides).
- Books, scientific articles, technical manuals.

Tools to use LaTeX

- **Overleaf** – online LaTeX editor, no installation needed, easy collaboration.
- **TeXLive** – full LaTeX distribution (Windows, Linux, Mac).
- **MiKTeX** – Windows LaTeX distribution.
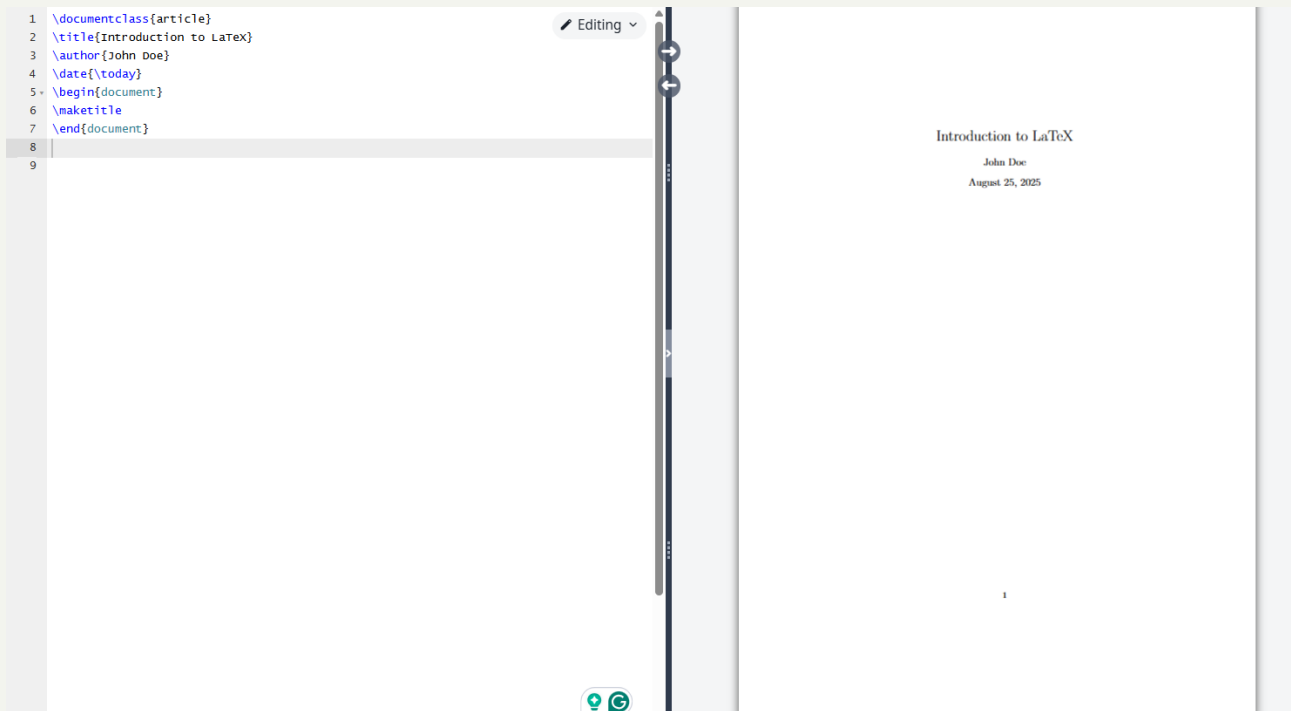- **Editors**: TeXstudio, TeXmaker, VSCode + LaTeX extension.

Basic LaTeX Document Structure

```
1   \documentclass{article}
2 ▾ \begin{document}
3   % Your content goes here
4   \end{document}
5
```

\documentclass{} → defines the type of document (article, report, book, beamer)

.\begin{document} ... \end{document} → everything between these commands is the content of your document.

Adding Title, Author, and Date

```
1  \documentclass{article}
2  \title{Introduction to LaTeX}
3  \author{John Doe}
4  \date{\today}
5  \begin{document}
6  \maketitle
7  \end{document}
8
9
```

Editing ▾

Introduction to LaTeX

John Doe

August 25, 2025

1

Sections and Subsections

8

Text Formatting in LaTeX

```latex
1  \documentclass{article}
2  \title{LaTeX Document}
3  \author{John Doe}
4  \date{\today}
5  \begin{document}
6  \maketitle
7
8  \section{Introduction}
9  This is my first LaTeX document.
10
11 \subsection{Text Formatting}
12 This is \textbf{bold}, \textit{italic}, and \underline{underlined} text.
13
14 \end{document}
15
```

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LaTeX Document

John Doe

August 25, 2025

1 Introduction

This is my first LaTeX document.

1.1 Text Formatting

This is **bold**, *italic*, and underlined text.

Text Superscript & Subscripts

```
18  \subsection{Text Formatting}
19  This is \textbf{bold}, \textit{italic},
    \underline{underlined} text.
20
21  \subsection{Text Superscripts and Subscripts}
22  x\textsuperscript{th} century
23  H\textsuperscript{+} ion
24
```

1.1 Text Formatting

This is **bold**, *italic*, and <u>underlined</u> text.

1.2 Text Superscripts and Subscripts

x^{th} century H^{+} ion

Unordered (bullets) Lists

```latex
1  \documentclass{article}
2  \title{LaTeX Document}
3  \author{John Doe}
4  \date{\today}
5  \begin{document}
6  \maketitle
7
8  \section{Introduction}
9  This is my first LaTeX document.
10
11 \subsection{Text Formatting}
12 This is \textbf{bold}, \textit{italic}, and \underline{underlined} text.
13
14 \subsection{Unordered (bullets) list:}
15 \begin{itemize}
16   \item First item
17   \item Second item
18   \item Third item
19 \end{itemize}
20
21
22 \end{document}
23
```

Editing ▾

1 Introduction

This is my first LaTeX document.

1.1 Text Formatting

This is **bold**, *italic*, and underlined text.

1.2 Unordered (bullets) list:

- First item

- Second item

- Third item

Ordered (numbered) list:

```
13
14▾  \subsection{Unordered (bullets) list:}
15▾  \begin{itemize}
16    \item First item
17    \item Second item
18    \item Third item
19  \end{itemize}
20
21▾  \subsection{Ordered (numbered) list:}
22▾  \begin{enumerate}
23    \item First item
24    \item Second item
25    \item Third item
26  \end{enumerate}
27
28  \end{document}
29
```

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1.2   Unordered (bullets) list:

- First item

- Second item

- Third item

1.3   Ordered (numbered) list:

1. First item

2. Second item

3. Third item

Code Snippets / Verbatim Text

```
28  \subsection{Code Snippets:}                          ✎ Editing ∨
29  \begin{verbatim}
30  #include <stdio.h>
31  int main() {
32      printf("Hello, World!\n");
33      return 0;
34  }
35  \end{verbatim}
36
37
38  \end{document}
39
```

1.4 Code Snippets:

```
#include <stdio.h>
int main() {
    printf("Hello, World!\n");
    return 0;
}
```
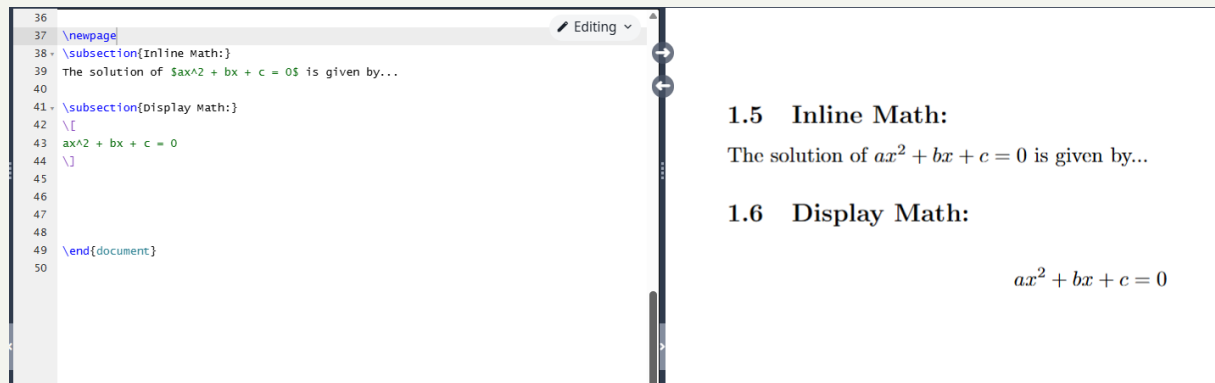
Introduction to Math in LaTeX

LaTeX is widely used for mathematics because it gives:
- Professional, clean equations.
- Precise control over symbols.

Two main modes:
- Inline math → inside text with $...$
- Display math → centered on a new line with \[...\]

Superscripts & Subscripts

```
45
46 ▼  \subsection{Superscripts and Subscripts:}          ✎ Editing ⌄
47  \[
48  E = mc^{2}, \quad a_{i}, \quad x_{i}^{n}
49  \]
50
51
52
53  \end{document}
54
```

1.7   **Superscripts and Subscripts:**

$$E = mc^2, \quad a_i, \quad x_i^n$$

Fraction & Roots

```
50
51  \subsection{Fraction and Roots:}
52  \[
53  \frac{1}{2}, \quad \sqrt{x}, \quad \sqrt[3]{y}
54  \]
55
56
57
58
59  \end{document}
60
```

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1.8   Fraction and Roots:

$$\frac{1}{2}, \quad \sqrt{x}, \quad \sqrt[3]{y}$$

Greek Letters & Common Symbols

```
57  \subsection{Greek Letters and Common Symbols:}      ✏ Editing ⌄
58  \textbf{Greek Letters:}
59
60  \[
61  \alpha, \beta, \gamma, \Delta, \Omega
62  \]
63
64  \textbf{Common Symbols:}
65
66  \[
67  \infty, \leq, \geq, \rightarrow
68  \]
69
70
71  \end{document}
72
```

1.9 Greek Letters and Common Symbols:

Greek Letters:

$$\alpha, \beta, \gamma, \Delta, \Omega$$

Common Symbols:

$$\infty, \leq, \geq, \rightarrow$$

Tables & Figures in LaTeX

- LaTeX provides powerful tools for creating professional tables and including figures.
- Tables: tabular environment.
- Figures: \includegraphics from the graphicx package.
- Supports captions and cross-referencing.

Basic Table

```latex
69
70  \section{Tables and Figures}
71
72  \subsection{Basic Table}
73
74  \begin{tabular}{|c|c|c|}
75  \hline
76  Name & Age & Grade \\
77  \hline
78  Alice & 20 & A \\
79  Bob   & 22 & B \\
80  Charlie & 21 & A \\
81  \hline
82  \end{tabular}
83
84  \end{document}
85
```

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2 Tables and Figures

2.1 Basic Table

Name	Age	Grade
Alice	20	A
Bob	22	B
Charlie	21	A

Table Formatting

```
83
84    \subsection{Table Formatting}                    ✏ Editing ⌄
85    |
86    \begin{tabular}{|c|c|c|}
87    \hline
88    \multicolumn{3}{|c|}{Student Info} \\
89    \hline
90    Name & Age & Grade \\
91    \hline
92    Alice & 20 & A \\
93    Bob   & 22 & B \\
94    \hline
95    \end{tabular}
96
97    \end{document}
98
```

2.2   Table Formatting

Student Info		
Name	Age	Grade
Alice	20	A
Bob	22	B

Adding Figures and Referencing

Labels & Cross-References

```
116  \section{Referencing and Bibliography}
117  \subsection{Labels and Cross-References}
118  \begin{equation}
119      E = mc^2
120      \label{eq:energy}
121  \end{equation}
122
123
124  Einstein's theory of relativity introduced
     one of the most famous equations in physics,
125  which describes the equivalence of mass and
     energy. This relationship is represented
126  mathematically in Equation~\ref{eq:energy},
     where energy ($E$) is equal to mass ($m$)
127  multiplied by the speed of light ($c$)
     squared. By using a label for the equation,
     we can
128  easily refer back to it anywhere in the
     document without manually typing the number.
129  If we later add or remove equations, LaTeX
     will automatically update the numbering,
130  ensuring that all references to
     Equation~\ref{eq:energy} remain correct and
     consistent.
131
```
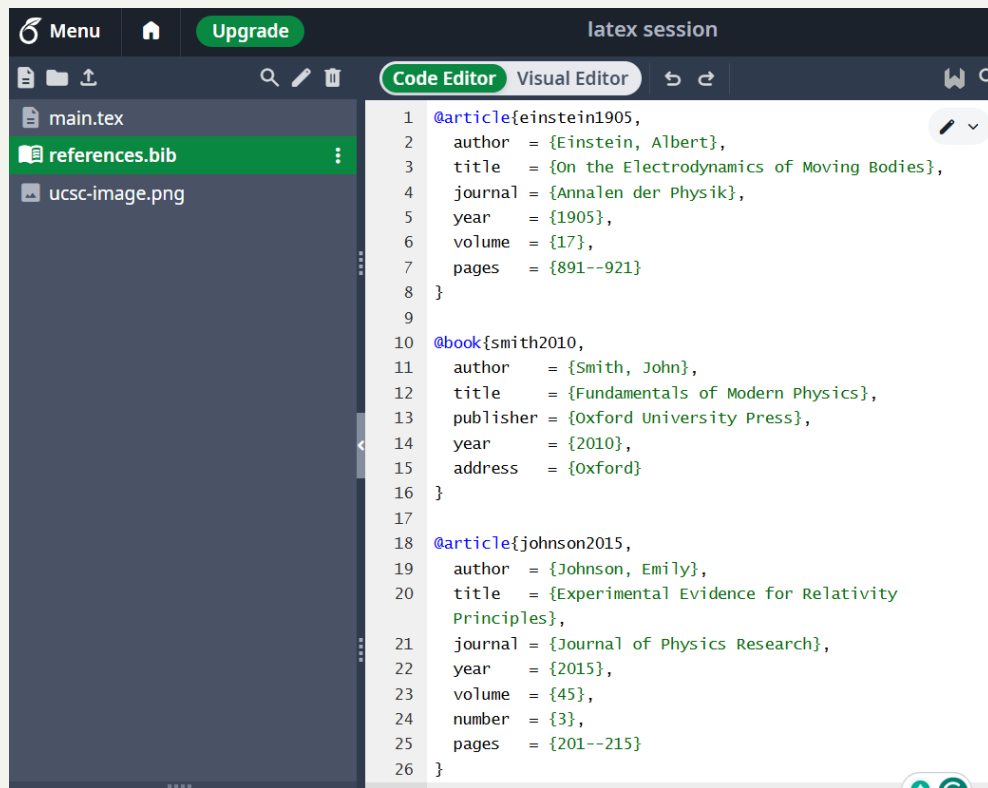
3 Referencing and Bibliography

3.1 Labels and Cross-References

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

Einstein's theory of relativity introduced one of the most famous equations in physics, which describes the equivalence of mass and energy. This relationship is represented mathematically in Equation 1, where energy (E) is equal to mass (m) multiplied by the speed of light (c) squared. By using a label for the equation, we can easily refer back to it anywhere in the document without manually typing the number. If we later add or remove equations, LaTeX will automatically update the numbering, ensuring that all references to Equation 1 remain correct and consistent.

Labels & Cross-References

Citations in LaTeX

References

Einstein, A. (1905), 'On the electrodynamics of moving bodies', *Annalen der Physik* **17**, 891–921.

Johnson, E. (2015), 'Experimental evidence for relativity principles', *Journal of Physics Research* **45**(3), 201–215.

Smith, J. (2010), *Fundamentals of Modern Physics*, Oxford University Press, Oxford.

Citations in LaTeX

```
133
134  \subsection{Citations in LaTeX}
135  \citet{einstein1905} introduced the theory of special
     relativity,
136  which fundamentally changed the understanding of space and
     time.
137  Their work demonstrated that energy and mass are
     equivalent,
138  a principle expressed in the famous equation $E=mc^2$.
139  Subsequent studies have provided strong experimental
     support
140  for this concept \citep{smith2010, johnson2015},
141  making it one of the cornerstones of modern physics.
142
143
144  \newpage
145  \bibliography{references}
```

3.2 Citations in LaTeX

Einstein (1905) introduced the theory of special relativity, which fundamentally changed the understanding of space and time. Their work demonstrated that energy and mass are equivalent, a principle expressed in the famous equation $E = mc^2$. Subsequent studies have provided strong experimental support for this concept (Smith 2010, Johnson 2015), making it one of the cornerstones of modern physics.

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3

Useful Packages

- graphicx (images)
- amsmath (better math)
- geometry (page layout)
- hyperref (clickable links)
- xcolor (colors)