



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.

L^AT_EX

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.



L^AT_EX

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.



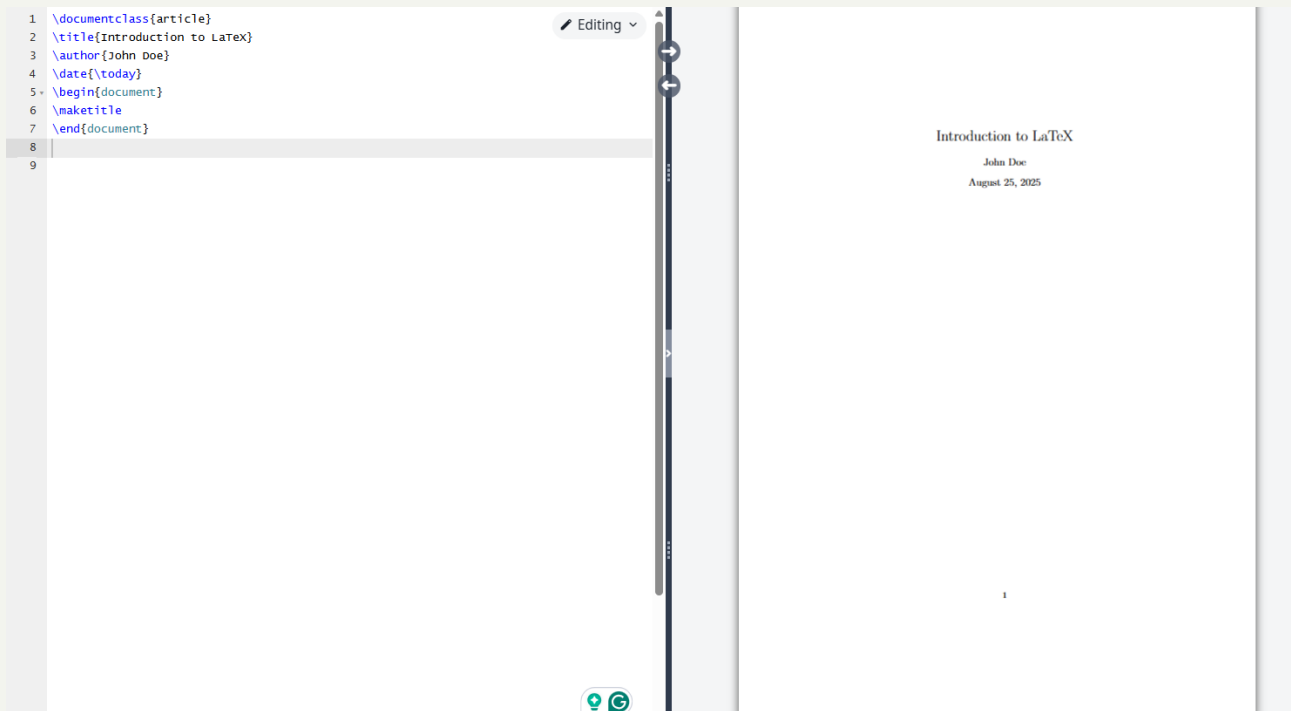
Basic LaTeX Document Structure

```
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



Sections and Subsections

```
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{Background}
12 LaTeX automatically formats sections.
13 \end{document}
14
```

Editing ▾

LaTeX Document

John Doe

August 25, 2025

1 Introduction

This is my first LaTeX document.

1.1 Background

LaTeX automatically formats sections.

Text Formatting in 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
```

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 ▾	<code>\subsection{Text Formatting}</code>	
19	This is <code>\textbf{bold}</code> , <code>\textit{italic}</code> , <code>\underline{underlined}</code> text.	1.1 Text Formatting This is bold, <i>italic</i> , and <u>underlined</u> text.
20		
21 ▾	<code>\subsection{Text Superscripts and Subscripts}</code>	1.2 Text Superscripts and Subscripts
22	<code>xth</code> century	x^{th} century
23	<code>H+</code> ion	H^+ ion
24		
25		

Unordered (bullets) Lists

```
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
```

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
```

Editing ▾

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:}

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

Editing ▾

→

←

1.4 Code Snippets:

#include <stdio.h>

int main() {

printf("Hello, World!\n");

return 0;

}

13

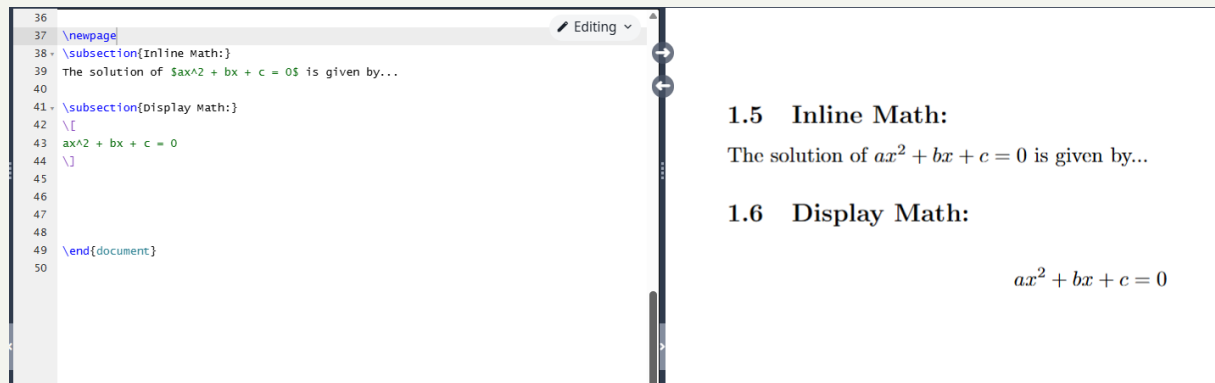
Introduction to Math in LaTeX

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
$$...$$



The screenshot shows a LaTeX editor interface. On the left, a code editor displays the following LaTeX code:

```
36
37 \newpage
38 \subsection{Inline Math:}
39 The solution of  $ax^2 + bx + c = 0$  is given by...
40
41 \subsection{Display Math:}
42 \[
43 ax^2 + bx + c = 0
44 \]
45
46
47
48
49 \end{document}
50
```

On the right, the rendered output is shown. It contains two sections:

1.5 Inline Math:
The solution of $ax^2 + bx + c = 0$ is given by...

1.6 Display Math:
$$ax^2 + bx + c = 0$$

Superscripts & Subscripts

45

46 `\subsection{Superscripts and Subscripts:}`

47 `\[`

48 `E = mc^{2}, \quad a_{i}, \quad x_{i}^{n}`

49 `\]`

50

51

52

53 `\end{document}`

54

Editing ▾

→

←

100%

1.7 Superscripts and Subscripts:

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

15

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
```

Editing ▾

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:}
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
```

Editing

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

```
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
```

Editing ▾

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}
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

```
104
105 \begin{figure}[H]
106   \centering
107   \includegraphics[width=0.4\textwidth]
108     {ucsc-image.png}
109   \caption{UCSC}
110   \label{fig:UCSC}
111 \end{figure}
112 As shown in Figure~\ref{fig:UCSC},
113 we can easily include images in LaTeX.
114
115
116
117 \end{document}
118
```

2.3 Adding Figures and Referencing



Figure 1: UCSC

As shown in Figure 1, we can easily include images in LaTeX.

Labels & Cross-References

```
115
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
125 one of the most famous equations in physics,
126 which describes the equivalence of mass and
127 energy. This relationship is represented
128 mathematically in Equation~\ref{eq:energy},
129 where energy ( $E$ ) is equal to mass ( $m$ )
130 multiplied by the speed of light ( $c$ )
131 squared. By using a label for the equation,
132 we can
133 easily refer back to it anywhere in the
134 document without manually typing the number.
135 If we later add or remove equations, LaTeX
136 will automatically update the numbering,
137 ensuring that all references to
138 Equation~\ref{eq:energy} remain correct and
139 consistent.
```

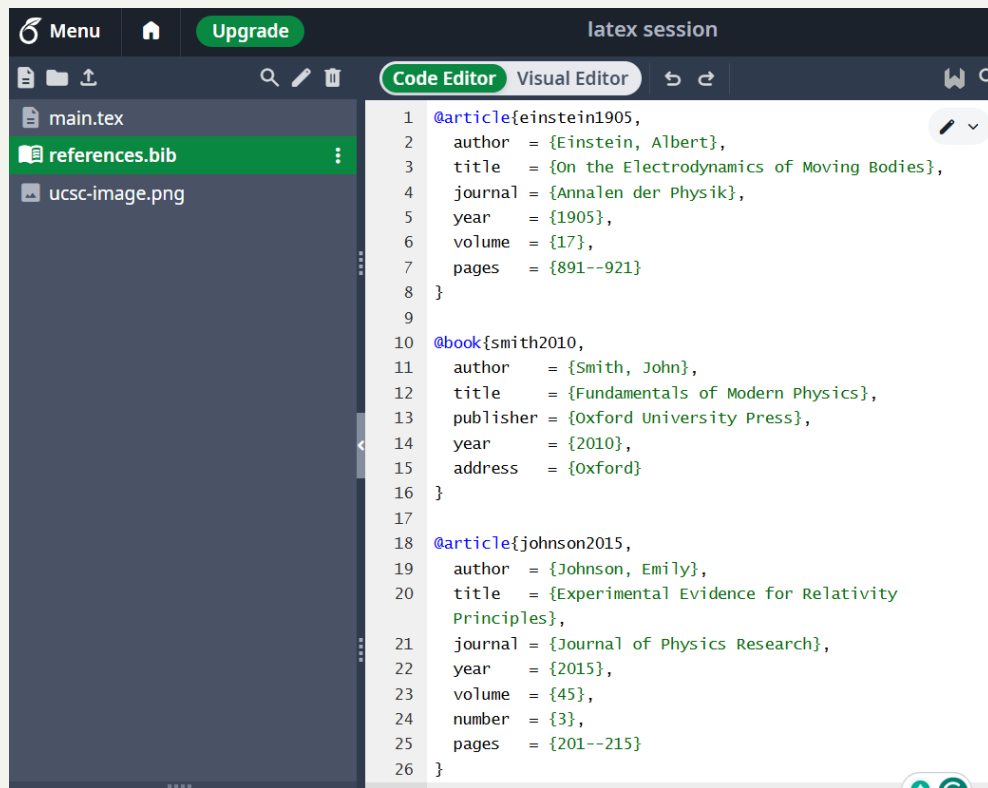
3 Referencing and Bibliography

3.1 Labels and Cross-References

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

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



The screenshot shows a LaTeX editor window titled "latex session". The interface includes a top bar with "Menu", "Upgrade", and "Visual Editor" tabs. A left sidebar displays a file explorer with "main.tex", "references.bib" (selected), and "ucsc-image.png". The main editor area shows the content of "references.bib" with line numbers 1 through 27. The file contains three BibTeX entries: an article by Einstein (1905), a book by Smith (2010), and an article by Johnson (2015).

```
1 @article{einstein1905,  
2   author = {Einstein, Albert},  
3   title  = {On the Electrodynamics of Moving Bodies},  
4   journal = {Annalen der Physik},  
5   year   = {1905},  
6   volume = {17},  
7   pages  = {891--921}  
8 }  
9  
10 @book{smith2010,  
11   author = {Smith, John},  
12   title  = {Fundamentals of Modern Physics},  
13   publisher = {Oxford University Press},  
14   year   = {2010},  
15   address = {Oxford}  
16 }  
17  
18 @article{johnson2015,  
19   author = {Johnson, Emily},  
20   title  = {Experimental Evidence for Relativity  
21             Principles},  
22   journal = {Journal of Physics Research},  
23   year   = {2015},  
24   volume = {45},  
25   number = {3},  
26   pages  = {201--215}  
27 }
```

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
136 relativity,
137 which fundamentally changed the understanding of space and
138 time.
139 Their work demonstrated that energy and mass are
140 equivalent,
141 a principle expressed in the famous equation  $E=mc^2$ .
142 Subsequent studies have provided strong experimental
143 support
144 for this concept \citep{smith2010, johnson2015},
145 making it one of the cornerstones of modern physics.
146
147 \newpage
148 \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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3.2 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.

Useful Packages

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