

L^AT_EX Complete Guide

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★1 Introduction to LaTeX

This guide is designed for absolute beginners who know nothing about LaTeX and takes you to advanced professional levels. It covers everything from basics to pro tips, including all mathematical symbols, image insertion, and more.

Question

What is LaTeX?

Answer

LaTeX is a typesetting system used for producing high-quality scientific and mathematical documents. It is not a word processor like Microsoft Word; instead, you write plain text with markup commands, and LaTeX compiles it into a PDF or other formats. It excels in handling complex math, references, and layouts.

Question

Why use LaTeX?

Answer

LaTeX produces professional-looking documents, handles large documents easily, automates numbering and cross-references, and is free. It's standard in academia for papers, theses, and books.

Question

How to Use LaTeX ?

Answer

Open Overleaf , create account and log in to your profile . Open a blank document and go to menu at top left corner , click it , change the compiler to XeLaTeX . Now let's get started .

Question

What are the essential elements of a LaTeX document?

Answer

Every document must have a document class (e.g., `article`), preamble with package imports, and the `\begin{document} ... \end{document}` block.

1.1 Text Formatting

- **Bold text:** `\textbf{...}`
- *Italic text:* `\textit{...}`

- Underline: `\underline{...}`
- Monospaced: `\texttt{...}`
- Lists: `itemize`, `enumerate`, `description`

★2 Mathematical Environments

2.1 Inline and Display Modes

Inline math: $a^2 + b^2 = c^2$. Display math:

$$e^{i\pi} + 1 = 0.$$

2.2 Common Symbols

- Greek letters: $\alpha, \beta, \gamma, \dots, \Omega$.
- Operators: $\sum, \int, \prod, \lim, \sin, \cos, \log$.
- Relations: $=, \neq, \leq, \geq, \approx, \equiv$.
- Arrows: $\rightarrow, \leftarrow, \Rightarrow, \leftrightarrow$.
- Delimiters: $() , [] , \{ \} , \langle \rangle , || , |||$.
- Accents: $\hat{x}, \bar{x}, \tilde{x}, \vec{v}$.

★3 Advanced Mathematics

3.1 Aligned Equations and Modulos

$$x + y = 10$$

$$2x - y = 3$$

$$2^{18} \equiv 1 \pmod{19} \implies (2^{18})^{96} \not\equiv 2 \pmod{19}$$

3.2 Symbols

♣	♠	■	♥	∞	$\sqrt[n]{x}$
△	ℏ	ℑ	∅	∇	≠
μ	∂	ζ	χ	†	⊗

Table 1: Symbols

Referencing equations: see Equation ??.

3.3 More advanced Symbols

3.3.1 Integral

$$\int_0^1 \ln(x) = -1$$

$$\iint_D f(x, y) dx dy \quad , \quad \iiint_V f(x, y, z) dV \quad , \quad \int \cdots \int_{g(x_1, x_2, \dots, x_n)} f(x_1, \dots, x_n) dx_1 dx_2 \cdots dx_n.$$

3.3.2 Derivative

$$\frac{\partial^2 f}{\partial x^2} \quad , \quad \frac{\partial^2 f}{\partial x \partial y} \quad , \quad D^\alpha f = \frac{\partial^{|\alpha|} f}{\partial x_1^{\alpha_1} \partial x_2^{\alpha_2} \cdots \partial x_m^{\alpha_m}},$$

where $\alpha = (\alpha_1, \dots, \alpha_m)$ is a multi-index and $|\alpha| = \sum_{i=1}^m \alpha_i$.

3.3.3 NT

$$|x|_p = p^{-\nu_p(x)}, \quad x = p^{\nu_p(x)} \sum_{i=0}^{\infty} a_i p^i, \quad (a_i \in \{0, 1, \dots, p-1\}).$$

An analytic (continuous) function on \mathbb{Z}_p can be written via its Mahler expansion:

$$f(x) = \sum_{n=0}^{\infty} c_n \binom{x}{n}, \quad c_n = \Delta^n f(0),$$

where $\binom{x}{n} = \frac{x(x-1)\cdots(x-n+1)}{n!}$ and Δ^n is the finite-difference operator.

3.3.4 Putnam 2003 B3

Show that for each positive integer n ,

$$n! = \prod_{i=1}^n \text{lcm} \{1, 2, \dots, \lfloor \frac{n}{i} \rfloor\}$$

(Here lcm denotes the least common multiple, and $\lfloor x \rfloor$ denotes the greatest integer $\leq x$.)

3.4 Matrices and Cases

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix}, \quad f(x) = \begin{cases} x^2 & x \geq 0, \\ -x & x < 0. \end{cases}$$

L^AT_EX

Figure 1: An Example Image

A	B	C
1	2	3
4	5	6

Table 2: Simple Table

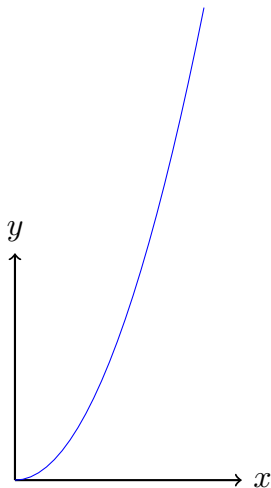
★4 Figures and Tables

4.1 Image Insertion

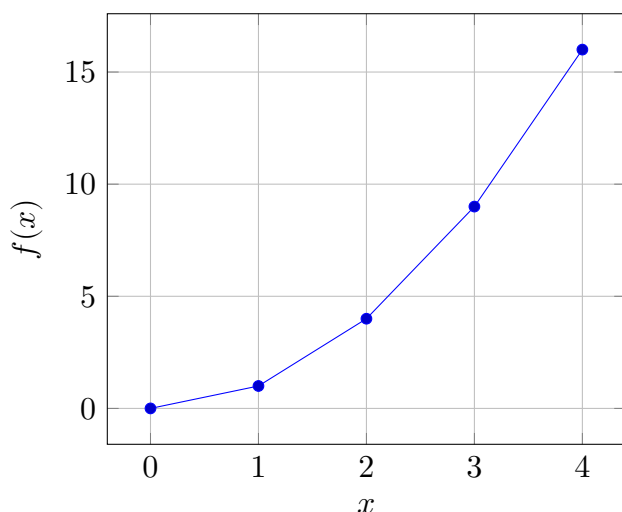
4.2 Tables

★5 Drawing and Plotting

5.1 Basic TikZ Illustration



5.2 Plotting Data



★6 Customization

6.1 Custom Environments

Theorem Pythagoras

In a right triangle, $a^2 + b^2 = c^2$.

★7 References

Let's cite! Einstein's journal paper [**einstein**] and Donald Knuth [**knuth**] are physics-related items.

@articleeinstein, author = "Albert Einstein", title = "Zur Elektrodynamik bewegter Körper. (German) [On the electrodynamics of moving bodies]", journal = "Annalen der Physik", volume = "322", number = "10", pages = "891–921", year = "1905", DOI = "http://dx.doi.org/10.1002/andp.19053221004", keywords = "physics"

@onlineknuthwebsite, author = "Donald Knuth", title = "Knuth: Computers and Typesetting", url = "http://www-cs-faculty.stanford.edu/uno/abcde.html"