

Title

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1 Introduction

L^AT_EX, pronounced *LAY-tek* or *LAH-tek*, is a software system for typesetting documents. It was created in the 1980s by the computer scientist Leslie Lamport, building on a more basic system called T_EX, which had been created in the 1970s by the computer scientist Donald Knuth. Nowadays, these systems are extremely standard in scientific writing.

To create L^AT_EX documents on your own computer, you need a *compiler*, and for maximum convenience, an *editor* as well. You edit a `.tex` file in the editor, then click “compile” (or use a keyboard shortcut) to tell the compiler to create a `.pdf` document. In doing so, the compiler will create a bunch of extra files with extensions like `.aux`, `.log`, and so on. For this reason, it’s helpful to keep all the documents for a given project within a single folder.

Alternatively, **Overleaf** is a website where you can create L^AT_EX documents online, after first creating a free account. The makers also wrote a very nice guide to L^AT_EX itself:

https://www.overleaf.com/learn/latex/Learn_LaTeX_in_30_minutes

This webpage contains guidance on choosing and installing a compiler:

https://www.overleaf.com/learn/latex/Choosing_a_LaTeX_Compiler

2 Section

2.1 Subsection

A L^AT_EX document consists of

1. a `\documentclass[ ]{ }` command, specifying the type of document;
2. a *preamble* where packages can be loaded, and custom commands and/or environments can be defined; and
3. a `document` environment, where the actual document is written.

In general, the syntax for a `blah` environment is

```
\begin{blah}
...
\end{blah}
```

For instance, the list above was created using the `enumerate` environment. To get an unnumbered list, use the `itemize` environment.

The introduction section contains hyperlinks that were typeset using the `\href{ }{ }` and `\url{ }` commands. The latter were placed within `quote` environments. If you want to learn how to make custom commands, see:

https://www.overleaf.com/learn/latex/Commands#Defining_a_new_command

2.2 Non-Mathematical Text

To typeset quotation marks, use ``` and `'`. To typeset diacritics, use commands like `\'{ }`, which produces an acute accent.

```Poincar\'e''` gives “Poincaré”.

Note that `"` does not produce correct double-quotation marks.

Use `\cite[ ]{ }` to create a citation. Use an en dash (in  $\text{\TeX}$ : `--`) instead of a hyphen (`-`) to typeset page ranges. For instance,

`\cite[82--83]{munkres}` gives [M, 82–83].

The hyperlink goes to a bibliography entry at the end of this document.

You can use commands like `\textbf{ }` or `\textit{ }` to produce text in **bold** or *italics*. Note that `\emph{ }` also produces italics. Use `\textsf{ }` or `\texttt{ }` to produce text in **sans-serif** or **typewriter** font.

## 2.3 Mathematical Text

To typeset math inline with non-math text (*inline mode*), use `$...$`. For instance,

Einstein's `$E = mc^2$` gives Einstein's  $E = mc^2$ .

To typeset math as a centered display (*display mode*), there are several methods. The quickest is to use `$$...$$`. The `equation` environment will give the same result, but with a numbered label next to the display. To omit the numbered label, use `equation*`.

I tend to use the `align` and `align*` environments for everything, because they let you line up expressions using `&`:

$$(2.1) \quad X = Y \cap \bigcup_{i=1}^{\infty} Z_i$$

$$(2.2) \quad = \bigcup_{i=1}^{\infty} (Y \cap Z_i).$$

To make a multi-line display with a single label, put a `split` environment inside an `align` environment.

Note that `\bigcap`, `\bigcup` produce the large symbols  $\bigcap, \bigcup$ , whereas `\cap`, `\cup` produce the small symbols  $\cap, \cup$ . The display above shows how the larger symbols have a different use from the smaller ones.

Completely separately, some commands produce different sizes for inline mode versus display mode. For instance, compare  $C_n = \frac{1}{n+1} \binom{2n}{n}$  to

$$C_n = \frac{1}{n+1} \binom{2n}{n}.$$

Use `\displaystyle` and `\textstyle` to modify this behavior.

Lastly, L<sup>A</sup>T<sub>E</sub>X offers several different alphabets in math mode, including

- `\mathbb{ }` for blackboard boldface ( $\mathbb{A}$ ),
- `\mathbf{ }` for ordinary boldface ( $\mathbf{A}$ ),
- `\mathcal{ }` for calligraphic ( $\mathcal{A}$ ),

among others. L<sup>A</sup>T<sub>E</sub>X also offers several ways to decorate a symbol in math mode, including `\bar{ }`, `\hat{ }`, `\widehat{ }`, `\tilde{ }`, and `\vec{ }`.

## 2.4 More Math Environments

*Proof.* The `proof` environment is used for proofs. □

The `theoremstyle` commands in the preamble of this document define some other useful environments.

**Theorem 2.1.** *A theorem environment.*

**Lemma 2.2** (Munkres). *This lemma environment has a label in parentheses. To make it, I used the syntax `\begin{lem}[Munkres]... \end{lem}`.*

**Definition 2.3.** A definition environment. It has a link to Theorem 2.1.

*Remark 2.4.* A remark environment. It has a link to equation (2.1).

## References

[M] J. Munkres. *Topology*. 2nd Edition. Pearson Education, Ltd. (2014).