

How to L^AT_EX

David Mehrle

What is L^AT_EX?

L^AT_EX is a markup language and a computer program used to typeset .pdf documents. It is used almost universally to write and publish professional and scientific documents in physics, mathematics, computer science, and other fields. L^AT_EX makes it incredibly easy to write mathematical equations on a computer.

Document Structure

Every L^AT_EX document must have a documentclass, which is defined by the command `\documentclass{...}` at the beginning of the document. Every document must contain this command. Common document classes include:

<code>article</code>	The class of this document
<code>book</code>	For books
<code>amsart</code>	The AMS class for articles
<code>beamer</code>	For presentation slides
<code>letter</code>	For business letters
<code>memoir</code>	If you feel sentimental

To include any output, you must include the command `\begin{document}` before writing the body, which must be followed at the end of the document by `\end{document}`. The part of the document before the `\begin{document}` command is called the preamble, and the part after is the body. A very simple example document:

```
\documentclass{article}
\begin{document}
  Hello!
\end{document}
```

You may add options to the `\documentclass` command if, for example, you want to change the paper size to A4 or change the font size. This is done by writing `\documentclass[opt1,opt2]{...}`. Common options are:

<code>a4paper</code>	For Europeans
<code>landscape</code>	For landscape documents
<code>10pt/11pt/12pt</code>	Font sizes

If you want to include a title for your document, include `\title{...}` in the preamble. You may also specify `\author{...}` and `\date{...}`. Today's date will be displayed if you write `\today`. These will be displayed only if you include `\maketitle` in the body.

To do many things, you will need to include packages which define more commands. This is done by writing `\usepackage{...}` in the preamble for each package you wish to use. Packages you may want are

<code>amsmath</code>	the standard package for math
<code>amssymb</code> , <code>amsfont</code>	Math fonts and math symbols
<code>fullpage</code>	Reduce margins to one inch
<code>graphicx</code>	Pretty pictures

You may want to include comments in the code for your document, which can be done by putting a `%` at the beginning of the line which is to be a comment, for example: `%this is a comment`.

Sections in a document are delineated with the `\section{...}` command, or if you want unnumbered sections, `\section*{...}`. You can have subsections with `\subsection{...}` and sub-subsections with `\subsubsection{...}`. Adding the asterisk has the same effect. To add a table of contents anywhere in the document, use `\tableofcontents` where you want to put it.

If you want to define your own commands, use `\newcommand{\name}[args]{defn}`. The name of the command must begin with a backslash, `args` is a number and `defn` is the definition of the command, with `\#x` substituted for argument `x`. For example: `\newcommand{\quotes}[1]{‘‘#1’’}` defines a command `\quotes` which may be used as `\quotes{Hello!}` to produce the text “Hello!”.

Document Body

To include text in the document, simply type in the body and text will appear in the .pdf output. To make text italic, bold, or special in some way, you use a command:

<code>\textit{...}</code>	italics	<i>example</i>
<code>\textbf{...}</code>	bold	example
<code>\textsc{...}</code>	small caps	EXAMPLE
<code>\underline{...}</code>	underline	<u>example</u>
<code>\texttt{...}</code>	monospaced	example
<code>\textnormal{...}</code>	normal	example

You can also change the size of the font. These commands are slightly different, and should be used as `{\fontsize ...}`.

<code>\tiny</code>	example
<code>\scriptsize</code>	example
<code>\footnotesize</code>	example
<code>\small</code>	example
<code>\normalsize</code>	example
<code>\large</code>	example
<code>\Large</code>	example
<code>\LARGE</code>	example
<code>\huge</code>	example
<code>\Huge</code>	example

Additionally, there are some symbols which are interpreted as L^AT_EX code and therefore won't be displayed, so there are special ways to write them in the document body:

<code>\textbackslash</code>	<code>\</code>	backslash
<code>\%</code>	<code>%</code>	percent sign
<code>\\$</code>	<code>\$</code>	dollar sign
<code>\&</code>	<code>&</code>	ampersand
<code>\#</code>	<code>#</code>	octothorpe
<code>\{</code>	<code>{</code>	left brace
<code>\}</code>	<code>}</code>	right brace
<code>\^{} </code>	<code>^</code>	caret
<code>\~{} </code>	<code>~</code>	tilde
<code>_</code>	<code>_</code>	underscore

Other symbols are sometimes written in strange ways too. Take special note of the open quotation marks, which a weird character¹.

<code>\ldots</code>	...	ellipses
<code>\textbullet</code>	•	bullet
<code>\textbar</code>		vertical bar
<code>\S</code>	§	section mark
<code>‘</code>	“	open quote
<code>”</code>	”	close quote

If you want to make lists, you can do that with the `enumerate` environment (for numbered lists) or

¹This is the character that shares a key with the tilde on your keyboard.

`itemize` environment(for unnumbered). The usage is demonstrated below:

```
\begin{itemize}
  \item Item 1      • Item 1
  \item Item 2      • Item 2
\end{itemize}
```

Tables are made with the `tabular` environment. The tabular environment requires that the number columns and their justifications are specified as a sequence of the letters `l,c,r`. By adding `|` characters between these letters, vertical lines will separate the columns. When filling the table, cells in the same rows are separated by `&` characters, and lines are separated by `\\`. Lines may be drawn between rows by following the newline with a `\hline` command. For example:

```
\begin{tabular}{l|cr}
  a & b & c \\ \hline
  d & e & f \\
\end{tabular}
```

a	b	c
d	e	f

Typesetting Math

For inline math symbols, wrap your commands in `$. . . $` or `\(. . . \)`. For example, the command `$x+y$` produces $x + y$. For display math, wrap the commands in `$$. . . $$` or `\[. . . \]`. For example, the code `\[a+b+c=x+y+z\]` produces the display equation:

$$a + b + c = x + y + z$$

If you want your equations to be numbered, you may instead wrap your equation with `\begin{equation}` and `\end{equation}`. If you want to reference the equation number later, you can include a `\label{. . .}` after `\begin{equation}`. For example, the code:

```
\begin{equation} \label{eqn}
  a+b+c=x+y+z
\end{equation}
```

produces the equation

$$a + b + c = x + y + z \tag{1}$$

Equation (1) may be referenced with `\eqref{eqn}`.

To draw superscripts on a character, put a caret after it and then the superscript, i.e. `x^2` produces x^2 . Similarly, to draw subscripts, use an underscore: `x_0` produces x_0 . To put more than one character

in the super- or subscript, use braces: x^{n+1} becomes x^{n+1} . There are many useful math commands, which must be used in math mode:

<code>\sqrt{x}</code>	\sqrt{x}	<code>\sqrt[n]{x}</code>	$\sqrt[n]{x}$
<code>\frac{a}{b}</code>	$\frac{a}{b}$	<code>\binom{a}{b}</code>	$\binom{a}{b}$
<code>\forall</code>	\forall	<code>\exists</code>	\exists
<code>\geq</code>	\geq	<code>\leq</code>	\leq
<code>\neq</code>	\neq	<code>\approx</code>	\approx
<code>\pm</code>	\pm	<code>\mp</code>	\mp
<code>\times</code>	\times	<code>\div</code>	\div
<code>\in</code>	\in	<code>\notin</code>	\notin
<code>\cup</code>	\cup	<code>\cap</code>	\cap
<code>\subseteq</code>	\subseteq	<code>\subset</code>	\subset
<code>\supseteq</code>	\supseteq	<code>\supset</code>	\supset
<code>\leftarrow</code>	\leftarrow	<code>\rightarrow</code>	\rightarrow
<code>\Leftarrow</code>	\Leftarrow	<code>\Rightarrow</code>	\Rightarrow
<code>\iff</code>	\iff	<code>\infty</code>	∞

If you include the `amsmath` package, you can make blackboard bold and other fun fonts:

<code>\mathbb{...}</code>	blackboard bold	$\mathbb{N} \mathbb{Z} \mathbb{Q} \mathbb{R} \mathbb{C}$
<code>\mathcal{...}</code>	calligraphic	$\mathcal{A} \mathcal{B} \mathcal{C} \mathcal{D} \mathcal{E}$
<code>\mathfrak{...}</code>	fraktur	$\mathfrak{a} \mathfrak{b} \mathfrak{c} \mathfrak{d} \mathfrak{e} \mathfrak{f} \mathfrak{g}$

We can also make sums and integrals and products. Note that if displayed inline, the subscripts and superscripts are will display to the right of the symbol, although they appear above and below in display mode.

<code>\sum_{i=1}^n</code>	$\sum_{i=1}^n$	<code>\prod_{i=1}^n</code>	$\prod_{i=1}^n$
<code>\int_a^b</code>	\int_a^b	<code>\bigoplus_{i=1}^n</code>	$\bigoplus_{i=1}^n$
<code>\bigcup_{i=1}^n</code>	$\bigcup_{i=1}^n$	<code>\bigcap_{i=1}^n</code>	$\bigcap_{i=1}^n$

Delimiters like parentheses will not match the size of large equations, so you may surround your equation in `\left(` and `\right)` to have appropriate sized parentheses.

Matrices are also easy to make with the `bmatrix` environment. This is not unlike the `tabular` environment, except the number of columns need not be specified:

```
\begin{bmatrix}
a & b \\
c & d
\end{bmatrix}
```

You may also replace the `bmatrix` environment with `pmatrix` for a matrix with rounded brackets.

Sample Document

```
\documentclass[10pt,a4paper]{memoir}

\usepackage{amsmath}
\usepackage{amsmath}

\title{A \LaTeX\ Document}
\author{William Smalls}

%document
\begin{document}
\maketitle

\section{Some Stuff}
\textbf{Great Snakes!}

\left( \sum_{i=1}^n i \right)
= \frac{n(n-1)}{2}

\begin{tabular}{c|ccc}
& a & b & c \\ \hline
x & 1 & 2 & 3 \\
y & 4 & 5 & 5
\end{tabular}
\end{document}
```

L^AT_EX Resources

- The website [DeTeXify](#) allows you to draw a symbol and tells you the command for that symbol.
- The [wikibooks page for L^AT_EX](#) is an encyclopedia of L^AT_EX knowledge and a great guide.
- [tex.stackexchange](#) is a question-and-answer site for T_EX users and will help you sort out the most obscure bugs.
- You can download L^AT_EX from the people who made it at the [L^AT_EX project](#) website.
- The [Comprehensive T_EX Archive Network](#) is where you can download new packages.
- If you want to edit L^AT_EX documents online and collaboratively, visit either [sharelatex.com](#) or [writelatex.com](#).

E-mail address: dmehrle@cmu.edu