

A quick guide to L^AT_EX

What is L^AT_EX?

L^AT_EX (usually pronounced “LAY teck,” sometimes “LAH teck,” and never “LAY tex”) is a mathematics typesetting program that is the standard for most professional mathematics writing. It is based on the typesetting program T_EX created by Donald Knuth of Stanford University (his first version appeared in 1978). Leslie Lamport was responsible for creating L^AT_EX, a more user friendly version of T_EX. A team of L^AT_EX programmers created the current version, L^AT_EX 2 ϵ .

Math vs. text vs. functions

In properly typeset mathematics variables appear in italics (e.g., $f(x) = x^2 + 2x - 3$). The exception to this rule is predefined functions (e.g., $\sin(x)$). Thus it is important to **always** treat text, variables, and functions correctly. See the difference between x and x , -1 and -1 , and $\sin(x)$ and $\sin(x)$. There are two ways to present a mathematical expression—*inline* or as an *equation*.

Inline mathematical expressions

Inline expressions occur in the middle of a sentence. To produce an inline expression, place the math expression between dollar signs (\$). For example, typing `$90^\circ$` is the same as `$\frac{\pi}{2}$ radians` yields 90° is the same as $\frac{\pi}{2}$ radians.

Equations

Equations are mathematical expressions that are given their own line and are centered on the page. These are usually used for important equations that deserve to be showcased on their own line or for large equations that cannot fit inline. To produce an inline expression, place the mathematical expression between the symbols \[and \]. Typing `\[x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}\]` yields

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Displaystyle

To get full-sized inline mathematical expressions use `\displaystyle`. Use this sparingly. Typing `I want this $\displaystyle \sum_{n=1}^{\infty} \frac{1}{n}$, not this $\sum_{n=1}^{\infty} \frac{1}{n}$.` yields I want this $\sum_{n=1}^{\infty} \frac{1}{n}$, not this $\sum_{n=1}^{\infty} \frac{1}{n}$.

Images

You can put images (pdf, png, jpg, or gif) in your document. They need to be in the same location as your .tex file when you compile the document. Omit `[width=.5in]` if you want the image to be full-sized.

```
\begin{figure}[ht]
\includegraphics[width=.5in]{imagename.jpg}
\caption{The (optional) caption goes here.}
\end{figure}
```

Text decorations

Your text can be *italics* (`\textit{italics}`), **boldface** (`\textbf{boldface}`), or underlined (`\underline{underlined}`). Your math can contain boldface, **R** (`\mathbf{R}`), or blackboard bold, **R** (`\Bbb{R}`). You may want to use these to express the sets of real numbers (\mathbb{R} or **R**), integers (\mathbb{Z} or **Z**), rational numbers (\mathbb{Q} or **Q**), and natural numbers (\mathbb{N} or **N**). To have text appear in a math expression use `\text`. `(0,1]=\{x\in\mathbb{R}:x>0\text{ and }x\leq 1\}` yields $(0,1] = \{x \in \mathbb{R} : x > 0 \text{ and } x \leq 1\}$. (Without the `\text` command it treats “and” as three variables: $(0,1] = \{x \in \mathbb{R} : x > 0 \text{ and } x \leq 1\}$.)

Spaces and new lines

L^AT_EX ignores extra spaces and new lines. For example, `This sentence will look fine after it is compiled.`

This sentence will look fine after it is compiled.

Leave one full empty line between two paragraphs. Place `\` at the end of a line to create a new line (but not create a new paragraph).

This
compiles

like\

this.

This compiles

like

this.

Use `\noindent` to prevent a paragraph from indenting.

Comments

Use `%` to create a comment. Nothing on the line after the `%` will be typeset. `$f(x)=\sin(x)$ %this is the sine function` yields $f(x) = \sin(x)$

Delimiters

description	command	output
parentheses	<code>(x)</code>	(x)
brackets	<code>[x]</code>	$[x]$
curly braces	<code>\{x\}</code>	$\{x\}$

To make your delimiters large enough to fit the content, use them together with `\right` and `\left`. For example, `\left\{\sin\left(\frac{1}{n}\right)\right\}_n^{\infty}` produces $\left\{\sin\left(\frac{1}{n}\right)\right\}_n^{\infty}$.

Curly braces are non-printing characters that are used to gather text that has more than one character. Observe the differences between the four expressions `x^2`, `x^{2}`, `x^{2t}`, `x^{2t}` when typeset: x^2 , x^2 , x^{2t} , x^{2t} .

Lists

You can produce ordered and unordered lists.

description	command	output
unordered list	<code>\begin{itemize}</code>	
	<code>\item</code>	
	<code>Thing 1</code>	• Thing 1
	<code>\item</code>	• Thing 2
	<code>Thing 2</code>	
	<code>\end{itemize}</code>	
ordered list	<code>\begin{enumerate}</code>	
	<code>\item</code>	
	<code>Thing 1</code>	1. Thing 1
	<code>\item</code>	2. Thing 2
	<code>Thing 2</code>	
	<code>\end{enumerate}</code>	

Symbols (in math mode)

The basics

description	command	output
addition	<code>+</code>	$+$
subtraction	<code>-</code>	$-$
plus or minus	<code>\pm</code>	\pm
multiplication (times)	<code>\times</code>	\times
multiplication (dot)	<code>\cdot</code>	\cdot
division symbol	<code>\div</code>	\div
division (slash)	<code>/</code>	$/$
circle plus	<code>\oplus</code>	\oplus
circle times	<code>\otimes</code>	\otimes
equal	<code>=</code>	$=$
not equal	<code>\neq</code>	\neq
less than	<code><</code>	$<$
greater than	<code>></code>	$>$
less than or equal to	<code>\leq</code>	\leq
greater than or equal to	<code>\geq</code>	\geq
approximately equal to	<code>\approx</code>	\approx
infinity	<code>\infty</code>	∞
dots	<code>1,2,3,\ldots</code>	$1, 2, 3, \dots$
dots	<code>1+2+3+\cdots</code>	$1 + 2 + 3 + \dots$
fraction	<code>\frac{a}{b}</code>	$\frac{a}{b}$
square root	<code>\sqrt{x}</code>	\sqrt{x}
nth root	<code>\sqrt[n]{x}</code>	$\sqrt[n]{x}$
exponentiation	<code>a^b</code>	a^b
subscript	<code>a_b</code>	a_b
absolute value	<code> x </code>	$ x $
natural log	<code>\ln(x)</code>	$\ln(x)$
logarithms	<code>\log_{a}b</code>	$\log_a b$
exponential function	<code>e^x=\exp(x)</code>	$e^x = \exp(x)$
degree	<code>\deg(f)</code>	$\deg(f)$

Functions

description	command	output
maps to	<code>\to</code>	\rightarrow
composition	<code>\circ</code>	\circ
	<code> x =</code>	
	<code>\begin{cases}</code>	
piecewise function	<code>x & x \ge 0 \\ -x & x < 0 \\ \end{cases}</code>	$ x = \begin{cases} x & x \geq 0 \\ -x & x < 0 \end{cases}$

Greek and Hebrew letters

command	output	command	output
<code>\alpha</code>	α	<code>\tau</code>	τ
<code>\beta</code>	β	<code>\theta</code>	θ
<code>\chi</code>	χ	<code>\upsilon</code>	υ
<code>\delta</code>	δ	<code>\xi</code>	ξ
<code>\epsilon</code>	ϵ	<code>\zeta</code>	ζ
<code>\varepsilon</code>	ε	<code>\Delta</code>	Δ
<code>\eta</code>	η	<code>\Gamma</code>	Γ
<code>\gamma</code>	γ	<code>\Lambda</code>	Λ
<code>\iota</code>	ι	<code>\Omega</code>	Ω
<code>\kappa</code>	κ	<code>\Phi</code>	Φ
<code>\lambda</code>	λ	<code>\Pi</code>	Π
<code>\mu</code>	μ	<code>\Psi</code>	Ψ
<code>\nu</code>	ν	<code>\Sigma</code>	Σ
<code>\omega</code>	ω	<code>\Theta</code>	Θ
<code>\phi</code>	ϕ	<code>\Upsilon</code>	Υ
<code>\varphi</code>	φ	<code>\Xi</code>	Ξ
<code>\pi</code>	π	<code>\aleph</code>	\aleph
<code>\psi</code>	ψ	<code>\beth</code>	\beth
<code>\rho</code>	ρ	<code>\daleth</code>	\daleth
<code>\sigma</code>	σ	<code>\gimel</code>	\gimel

Set theory

description	command	output
set brackets	<code>\{1,2,3\}</code>	$\{1,2,3\}$
element of	<code>\in</code>	\in
not an element of	<code>\notin</code>	\notin
subset of	<code>\subset</code>	\subset
subset of	<code>\subseteq</code>	\subseteq
not a subset of	<code>\not\subset</code>	$\not\subset$
contains	<code>\supset</code>	\supset
contains	<code>\supseteq</code>	\supseteq
union	<code>\cup</code>	\cup
intersection	<code>\cap</code>	\cap
big union	<code>\bigcup_{n=1}^{10} A_n</code>	$\bigcup_{n=1}^{10} A_n$
big intersection	<code>\bigcap_{n=1}^{10} A_n</code>	$\bigcap_{n=1}^{10} A_n$
empty set	<code>\emptyset</code>	\emptyset
power set	<code>\mathcal{P}</code>	\mathcal{P}
minimum	<code>\min</code>	min
maximum	<code>\max</code>	max
supremum	<code>\sup</code>	sup
infimum	<code>\inf</code>	inf
limit superior	<code>\limsup</code>	lim sup
limit inferior	<code>\liminf</code>	lim inf
closure	<code>\overline{A}</code>	\overline{A}

Calculus

description	command	output
derivative	<code>\frac{df}{dx}</code>	$\frac{df}{dx}$
derivative	<code>\f'</code>	f'
partial derivative	<code>\frac{\partial f}{\partial x}</code>	$\frac{\partial f}{\partial x}$
integral	<code>\int</code>	\int
double integral	<code>\iint</code>	\iint
triple integral	<code>\iiint</code>	\iiint
limits	<code>\lim_{x \rightarrow \infty}</code>	$\lim_{x \rightarrow \infty}$
summation	<code>\sum_{n=1}^{\infty} a_n</code>	$\sum_{n=1}^{\infty} a_n$
product	<code>\prod_{n=1}^{\infty} a_n</code>	$\prod_{n=1}^{\infty} a_n$

Logic

description	command	output
not	<code>\sim</code>	\sim
and	<code>\wedge</code>	\wedge
or	<code>\vee</code>	\vee
if...then	<code>\to</code>	\rightarrow
if and only if	<code>\leftrightarrow</code>	\leftrightarrow
logical equivalence	<code>\equiv</code>	\equiv
therefore	<code>\therefore</code>	\therefore
there exists	<code>\exists</code>	\exists
for all	<code>\forall</code>	\forall
implies	<code>\Rightarrow</code>	\Rightarrow
equivalent	<code>\Leftrightarrow</code>	\Leftrightarrow

Linear algebra

description	command	output
vector	<code>\vec{v}</code>	\vec{v}
vector	<code>\mathbf{v}</code>	\mathbf{v}
norm	<code> \vec{v} </code>	$ \vec{v} $
	<code>\left[\begin{array}{ccc} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 0 \end{array} \right]</code>	$\left[\begin{array}{ccc} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 0 \end{array} \right]$
matrix	<code>\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 0 \end{bmatrix}</code>	$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 0 \end{bmatrix}$
	<code>\left \begin{array}{ccc} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 0 \end{array} \right </code>	$\left \begin{array}{ccc} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 0 \end{array} \right $
determinant	<code>\det(A)</code>	$\det(A)$
trace	<code>\operatorname{tr}(A)</code>	$\operatorname{tr}(A)$
dimension	<code>\dim(V)</code>	$\dim(V)$

Number theory

description	command	output
divides	<code> </code>	$ $
does not divide	<code>\not </code>	\nmid
div	<code>\operatorname{div}</code>	div
mod	<code>\mod</code>	mod
greatest common divisor	<code>\gcd</code>	gcd
ceiling	<code>\lceil x \rceil</code>	$\lceil x \rceil$
floor	<code>\lfloor x \rfloor</code>	$\lfloor x \rfloor$

Geometry and trigonometry

description	command	output
angle	<code>\angle ABC</code>	$\angle ABC$
degree	<code>90^\circ</code>	90°
triangle	<code>\triangle ABC</code>	$\triangle ABC$
segment	<code>\overline{AB}</code>	\overline{AB}
sine	<code>\sin</code>	sin
cosine	<code>\cos</code>	cos
tangent	<code>\tan</code>	tan
cotangent	<code>\cot</code>	cot
secant	<code>\sec</code>	sec
cosecant	<code>\csc</code>	csc
inverse sine	<code>\arcsin</code>	arcsin
inverse cosine	<code>\arccos</code>	arccos
inverse tangent	<code>\arctan</code>	arctan

Symbols (in *text* mode)

The followign symbols do **not** have to be surrounded by dollar signs.

description	command	output
dollar sign	<code>\\$</code>	$\$$
percent	<code>\%</code>	$\%$
ampersand	<code>\&</code>	$\&$
pound	<code>\#</code>	$\#$
backslash	<code>\textbackslash</code>	\backslash
left quote marks	<code>‘ ‘</code>	‘ ‘
right quote marks	<code>’ ’</code>	’ ’
single left quote	<code>‘</code>	‘
single right quote	<code>’</code>	’
hyphen	<code>X-ray</code>	X-ray
en-dash	<code>pp. 5--15</code>	pp. 5–15
em-dash	<code>Yes---or no?</code>	Yes—or no?

Resources

Great symbol look-up site: [Detexify](#)
[L^AT_EX Mathematical Symbols](#)
[The Comprehensive L^AT_EX Symbol List](#)
[The Not So Short Introduction to L^AT_EX 2 \$\epsilon\$](#)
[TUG: The T_EX Users Group](#)
[CTAN: The Comprehensive T_EX Archive Network](#)

L^AT_EX for the Mac: [MacT_EX](#)
L^AT_EX for the PC: [T_EXnicCenter](#) and [MiK_TE_X](#)

Dave Richeson
Dickinson College
<http://divisbyzero.com/>