How To Write Mathematical Equations, Expressions, and Symbols with LaTeX: A cheatsheet.

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1 What is LaTeX?

LaTeX is a programming language that can be used for writing documents. It is especially useful to write mathematical notations: equations, formulae, etc. LaTeX makes special symbols and equations look good! **Note: you don't have to learn LaTeX to use Authorea. You can write mathematics in Authorea using a visual equation editor.** If you're interested in using LaTeX, keep reading.

2 Writing LaTeX notation in Authorea

Authorea Beta supports LaTeX writing. In order to insert LaTeX: **click on the Insert button in the toolbar and then select LaTeX from the dropdown**. A LaTeX label shows next to the LaTeX block in which you can write LaTeX notation. Here are some tips for writing LaTeX in Authorea:

1. Click anywhere outside of the LaTeX block to render it.
2. Hover on Preview to see a Preview of the rendered content.
3. Do not paste an entire LaTeX article! Instead import documents from your homepage.
4. Only type LaTeX content in a LaTeX block, i.e. everything you would write after `\begin{document}` .
5. Do not type preamble (e.g. documentclass), frontmatter, macros or figures.
6. To add macros (newcommands) and packages, click Settings → Edit Macros
7. Use the Insert Figure button to insert images (and data).
8. Use math mode for equations, e.g. $\mathcal{L}_{EM} = -\frac{1}{4}F^{\mu\nu}F_{\mu\nu}$.

11. You can use sectioning commands like `\section{},\subsection{},\subsubsection{}` to add headings.[1]

There are three ways to present a mathematical expression— *inline* (in the middle of a text line), as an *equation*, on a separate dedicated line, and as a full-sized inline expression (*displaystyle*).

2.1 Inline mathematical expressions

Inline expressions occur in the middle of a sentence. To produce an inline expression, place the math expression between dollar signs (`$`). For example, typing `$E=mc^2$` yields $E = mc^2$.

2.2 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

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \tag{1}$$

2.3 Displaystyle

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

3 Symbols (in *math* mode)

3.1 The basics

Math mode in LaTeX happens inside the dollar signs (`$...$`), inside the square brackets `\[...\]` and inside `equation` and `displaystyle` environments.

description	*command*	*output*
addition	`+`	$+$
subtraction	`-`	$-$
plus or minus	`\pm`	$\pm$
multiplication (times)	`\times`	$\times$
multiplication (dot)	`\cdot`	$\cdot$
division symbol	`\div`	$\div$
division (slash)	`/`	$/$
simple text	`\text{text}`	text
infinity	`\infty`	∞
dots	`1,2,3,\ldots`	$1, 2, 3, \ldots$

exponentiation	`a^b`	a^b
subscript	`a_b`	a_b
absolute value	`|x|`	$\|x\|$
natural log	`\ln(x)`	$\ln(x)$
logarithms	`\log_{a}b`	$\log_a b$
exponential function	`e^x=\exp(x)`	$e^x = \exp(x)$
deg	`\deg(f)`	$\deg(f)$
degree	`\degree`	$^\circ$
arcmin	`^\prime`	$'$
arcsec	`^{\prime\prime}`	$''$
circle plus	`\oplus`	$\oplus$
circle times	`\otimes`	$\otimes$
equal	`=`	$=$
not equal	`\ne`	$\neq$
less than	`<`	$<$
less than or equal to	`\le`	$\leq$
greater than or equal to	`\ge`	$\geq$
approximately equal to	`\approx`	$\approx$

1. You can toggle heading numbering on/off from the article settings. This footnote is generated via `\footnote{}` ↩

3.2 Functions

description	*command*	*output*
maps to	`\to`	$\to$
composition	`\circ`	$\circ$

3.3 Greek and Hebrew letters

command	*output*	*command*	*output*
`\alpha`	α	`\tau`	τ
`\beta`	β	`\theta`	θ
`\chi`	χ	`\upsilon`	υ
`\delta`	δ	`\xi`	ξ
`\epsilon`	ϵ	`\zeta`	ζ

`\kappa`	κ	`\Phi`	Φ
`\lambda`	λ	`\Pi`	Π
`\mu`	μ	`\Psi`	Ψ
`\nu`	ν	`\Sigma`	Σ
`\omega`	ω	`\Theta`	Θ
`\phi`	ϕ	`\Upsilon`	Υ
`\varphi`	φ	`\Xi`	Ξ
`\pi`	π	`\aleph`	$\aleph$
`\psi`	ψ	`\beth`	$\beth$
`\rho`	ρ	`\daleth`	$\daleth$
`\sigma`	σ	`\gimel`	$\gimel$

3.4 Vectors

description	*command*	*output*
vector	`\vec{v}`	$\vec{v}$
vector	`\mathbf{v}`	$\mathbf{v}$
norm	`||\vec{v}||`	$\|\|\vec{v}\|\|$

3.5 Set theory

description	*command*	*output*
set brackets	`\{1,2,3\}`	$\{1,2,3\}$
element of	`\in`	$\in$
subset of	`\subset`	$\subset$
subset of	`\subseteq`	$\subseteq$
contains	`\supset`	$\supset$
contains	`\supseteq`	$\supseteq$
union	`\cup`	$\cup$
intersection	`\cap`	$\cap$
big union	`\bigcup_{n=1}^{10}A_n`	$\bigcup_{n=1}^{10} A_n$
big intersection	`\bigcap_{n=1}^{10}A_n`	$\bigcap_{n=1}^{10} A_n$
empty set	`\emptyset`	$\emptyset$
power set	`\mathcal{P}`	$\mathcal{P}$
minimum	`\min`	$\min$

limit inferior	`\liminf`	$\liminf$
closure	`\overline{A}`	$\overline{A}$

3.6 Logic

description	*command*	*output*
not	`\sim`	$\sim$
and	`\land`	$\land$
or	`\lor`	$\lor$
if...then	`\to`	$\to$
if and only if	`\leftrightarrow`	$\leftrightarrow$
logical equivalence	`\equiv`	$\equiv$
therefore	`\therefore`	$\therefore$
there exists	`\exists`	$\exists$
for all	`\forall`	$\forall$
implies	`\Rightarrow`	$\Rightarrow$
equivalent	`\Leftrightarrow`	$\Leftrightarrow$

3.7 Calculus

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

3.8 Number theory

description	*command*	*output*
divides	`|`	$\|$
does not divide	`\not |`	$\nmid$

3.9 Geometry and trigonometry

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

4 Symbols (in *text* mode)

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

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

5 Further reading