

L^AT_EX Mathematical Symbols

The more unusual symbols are not defined in base L^AT_EX (NFSS) and require `\usepackage{amssymb}`

1 Greek and Hebrew letters

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

2 L^AT_EX math constructs

$\frac{abc}{xyz}$	<code>\frac{abc}{xyz}</code>	\overline{abc}	<code>\overline{abc}</code>	\overrightarrow{abc}	<code>\overrightarrow{abc}</code>
f'	<code>f'</code>	\underline{abc}	<code>\underline{abc}</code>	\overleftarrow{abc}	<code>\overleftarrow{abc}</code>
\sqrt{abc}	<code>\sqrt{abc}</code>	\widehat{abc}	<code>\widehat{abc}</code>	\overbrace{abc}	<code>\overbrace{abc}</code>
$\sqrt[n]{abc}$	<code>\sqrt[n]{abc}</code>	\widetilde{abc}	<code>\widetilde{abc}</code>	\underbrace{abc}	<code>\underbrace{abc}</code>

3 Delimiters

		{	\{		\lfloor	/	/	↑	\Uparrow	┐	\llcorner
	\vert	}	\}		\rfloor	\	\backslash	↑	\uparrow	┘	\lrcorner
	\	<	\langle		\lceil	[[↓	\Downarrow	└	\ulcorner
	\Vert	>	\rangle		\rceil]]	↓	\downarrow	┘	\urcorner

Use the pair `\lefts1` and `\rights2` to match height of delimiters s_1 and s_2 to the height of their contents, e.g.,
`\left| expr \right|` `\left\{ expr \right\}` `\left\Vert expr \right\Vert`

4 Variable-sized symbols (displayed formulae show larger version)

\sum	<code>\sum</code>	\int	<code>\int</code>	\bigoplus	<code>\bigoplus</code>	\bigoplus	<code>\bigoplus</code>	\bigvee	<code>\bigvee</code>
\prod	<code>\prod</code>	\oint	<code>\oint</code>	\bigcap	<code>\bigcap</code>	\bigotimes	<code>\bigotimes</code>	\bigwedge	<code>\bigwedge</code>
\coprod	<code>\coprod</code>	\iint	<code>\iint</code>	\bigcup	<code>\bigcup</code>	\bigodot	<code>\bigodot</code>	\bigsqcup	<code>\bigsqcup</code>

5 Standard Function Names

Function names should appear in Roman, not Italic, e.g.,

Correct: `\tan(at-n\pi)` \longrightarrow $\tan(at - n\pi)$
 Incorrect: `tan(at-n\pi)` \longrightarrow $\tan(at - n\pi)$

<code>arccos</code>	<code>\arccos</code>	<code>arcsin</code>	<code>\arcsin</code>	<code>arctan</code>	<code>\arctan</code>	<code>arg</code>	<code>\arg</code>
<code>cos</code>	<code>\cos</code>	<code>cosh</code>	<code>\cosh</code>	<code>cot</code>	<code>\cot</code>	<code>coth</code>	<code>\coth</code>
<code>csc</code>	<code>\csc</code>	<code>deg</code>	<code>\deg</code>	<code>det</code>	<code>\det</code>	<code>dim</code>	<code>\dim</code>
<code>exp</code>	<code>\exp</code>	<code>gcd</code>	<code>\gcd</code>	<code>hom</code>	<code>\hom</code>	<code>inf</code>	<code>\inf</code>
<code>ker</code>	<code>\ker</code>	<code>lg</code>	<code>\lg</code>	<code>lim</code>	<code>\lim</code>	<code>lim inf</code>	<code>\liminf</code>
<code>lim sup</code>	<code>\limsup</code>	<code>ln</code>	<code>\ln</code>	<code>log</code>	<code>\log</code>	<code>max</code>	<code>\max</code>
<code>min</code>	<code>\min</code>	<code>Pr</code>	<code>\Pr</code>	<code>sec</code>	<code>\sec</code>	<code>sin</code>	<code>\sin</code>
<code>sinh</code>	<code>\sinh</code>	<code>sup</code>	<code>\sup</code>	<code>tan</code>	<code>\tan</code>	<code>tanh</code>	<code>\tanh</code>

6 Binary Operation/Relation Symbols

*	\backslash ast	±	\backslash pm	∩	\backslash cap	△	\backslash lhd
★	\backslash star	∓	\backslash mp	∪	\backslash cup	▽	\backslash rhhd
·	\backslash cdot	∏	\backslash amalg	⊕	\backslash uplus	◁	\backslash triangleleft
○	\backslash circ	⊙	\backslash odot	⊔	\backslash sqcap	▷	\backslash triangleright
●	\backslash bullet	⊖	\backslash ominus	⊔	\backslash sqcup	◁	\backslash unlhd
◯	\backslash bigcirc	⊕	\backslash oplus	∧	\backslash wedge	▷	\backslash unrhd
◇	\backslash diamond	⊗	\backslash oslash	∨	\backslash vee	▽	\backslash bigtriangledown
×	\backslash times	⊗	\backslash otimes	†	\backslash dagger	△	\backslash bigtriangleup
÷	\backslash div	∩	\backslash wr	‡	\backslash ddagger	∖	\backslash setminus
·	\backslash centerdot	□	\backslash Box	⋈	\backslash barwedge	∨	\backslash veebar
⊛	\backslash circledast	⊕	\backslash boxplus	⋈	\backslash curlywedge	∨	\backslash curlyvee
⊙	\backslash circledcirc	⊖	\backslash boxminus	⊖	\backslash Cap	⊖	\backslash Cup
⊖	\backslash circleddash	⊗	\backslash boxtimes	⊖	\backslash bot	⊖	\backslash top
+	\backslash dotplus	□	\backslash boxdot	⊖	\backslash intercal	×	\backslash rightthreetimes
*	\backslash divideontimes	□	\backslash square	∧	\backslash doublebarwedge	×	\backslash leftthreetimes
≡	\backslash equiv	≤	\backslash leq	≥	\backslash geq	⊥	\backslash perp
≅	\backslash cong	≲	\backslash prec	≳	\backslash succ	∣	\backslash mid
≠	\backslash neq	≳	\backslash preceq	≲	\backslash succeq	∥	\backslash parallel
≈	\backslash sim	≅	\backslash ll	≅	\backslash gg	⊗	\backslash bowtie
≈	\backslash simeq	⊂	\backslash subset	⊃	\backslash supset	⋈	\backslash Join
≈	\backslash approx	⊂	\backslash subseteq	⊃	\backslash supseteq	×	\backslash ltimes
∞	\backslash asymp	⊂	\backslash sqsubset	⊃	\backslash sqsupset	×	\backslash rtimes
≐	\backslash doteq	⊂	\backslash sqsubseq	⊃	\backslash sqsupseteq	∪	\backslash smile
∝	\backslash propto	⊥	\backslash dashv	⊥	\backslash vdash	∪	\backslash frown
⊨	\backslash models	⊆	\backslash in	⊆	\backslash ni	∉	\backslash notin
≈	\backslash approxeq	≤	\backslash leqq	≥	\backslash geqq	≪	\backslash lessgtr
≈	\backslash thicksim	≤	\backslash leqslant	≥	\backslash geqslant	≪	\backslash lesseqgtr
∩	\backslash backsim	≈	\backslash lessapprox	≈	\backslash gtrapprox	≪	\backslash lesseqqgtr
∩	\backslash backsimseq	≪	\backslash lll	≪	\backslash ggg	≪	\backslash gtreqqlless
∩	\backslash triangleq	∩	\backslash lessdot	∩	\backslash gtrdot	≪	\backslash gtreqless
∩	\backslash circeq	∩	\backslash lesssim	∩	\backslash gtrsim	≪	\backslash gtrless
∩	\backslash bumpeq	∩	\backslash eqslantless	∩	\backslash eqslantgtr	∩	\backslash backepsilon
∩	\backslash Bumpeq	∩	\backslash precsim	∩	\backslash succsim	∩	\backslash between
∩	\backslash doteqdot	∩	\backslash precapprox	∩	\backslash succapprox	∩	\backslash pitchfork
∩	\backslash thickapprox	∩	\backslash Subset	∩	\backslash Supset	∩	\backslash shortmid
∩	\backslash fallingdotseq	∩	\backslash subseteqq	∩	\backslash supseteqq	∩	\backslash smallfrown
∩	\backslash risingdotseq	∩	\backslash sqsubset	∩	\backslash sqsupset	∩	\backslash smallsmile
∩	\backslash varpropto	∩	\backslash preccurlyeq	∩	\backslash succcurlyeq	∩	\backslash Vdash
∩	\backslash therefore	∩	\backslash curlyeqprec	∩	\backslash curlyeqsucc	∩	\backslash vDash
∩	\backslash because	∩	\blacktriangleleft	∩	\blacktriangleright	∩	\backslash Vvdash
∩	\backslash eqcirc	∩	\backslash trianglelefteq	∩	\backslash trianglerighteq	∩	\backslash shortparallel
∩	\backslash neq	∩	\backslash vartriangleleft	∩	\backslash vartriangleright	∩	\backslash nshortparallel
∩	\backslash ncong	∩	\backslash nleq	∩	\backslash ngeq	∩	\backslash nsubseteq
∩	\backslash nmid	∩	\backslash nleqq	∩	\backslash ngeqq	∩	\backslash nsubseteq
∩	\backslash nparallel	∩	\backslash nleqslant	∩	\backslash ngeqslant	∩	\backslash nsubseteqq
∩	\backslash nshortmid	∩	\backslash nless	∩	\backslash ngtr	∩	\backslash nsubseteqq
∩	\backslash nshortparallel	∩	\backslash nprec	∩	\backslash nsucc	∩	\backslash nsubsetneq
∩	\backslash nsim	∩	\backslash npreceq	∩	\backslash nsucceq	∩	\backslash nsubsetneq
∩	\backslash nVDash	∩	\backslash precnapprox	∩	\backslash succnapprox	∩	\backslash nsubsetneqq
∩	\backslash nvDash	∩	\backslash precnsim	∩	\backslash succnsim	∩	\backslash nsubsetneqq
∩	\backslash nvdash	∩	\backslash lnapprox	∩	\backslash gnapprox	∩	\backslash varsubsetneq
∩	\backslash ntriangleleft	∩	\backslash lneq	∩	\backslash gneq	∩	\backslash varsubsetneq
∩	\backslash ntrianglelefteq	∩	\backslash lneqq	∩	\backslash gneqq	∩	\backslash varsubsetneqq
∩	\backslash ntriangleright	∩	\backslash lnsim	∩	\backslash gnsim	∩	\backslash varsubsetneqq
∩	\backslash ntrianglerighteq	∩	\backslash lvertneqq	∩	\backslash gvertneqq	∩	\backslash varsubsetneqq

7 Arrow symbols

\leftarrow	<code>\leftarrow</code>	\longleftarrow	<code>\longleftarrow</code>	\uparrow	<code>\uparrow</code>
\Lleftarrow	<code>\Lleftarrow</code>	\Llongleftarrow	<code>\Llongleftarrow</code>	\Uparrow	<code>\Uparrow</code>
\rightarrow	<code>\rightarrow</code>	\longrightarrow	<code>\longrightarrow</code>	\downarrow	<code>\downarrow</code>
\Rrightarrow	<code>\Rrightarrow</code>	\Rlongrightarrow	<code>\Rlongrightarrow</code>	\Downarrow	<code>\Downarrow</code>
$\leftrightharpoonrightarrow$	<code>\leftrightharpoonrightarrow</code>	\longleftarrowrightarrow	<code>\longleftarrowrightarrow</code>	\updownarrow	<code>\updownarrow</code>
\Leftrightarrow	<code>\Leftrightarrow</code>	$\Llongleftarrowrightarrow$	<code>\Llongleftarrowrightarrow</code>	\Updownarrow	<code>\Updownarrow</code>
\mapsto	<code>\mapsto</code>	\longmapsto	<code>\longmapsto</code>	\nearrow	<code>\nearrow</code>
\hookrightarrow	<code>\hookrightarrow</code>	\hookleftarrow	<code>\hookleftarrow</code>	\searrow	<code>\searrow</code>
\lhookrightarrow	<code>\lhookrightarrow</code>	\rhookrightarrow	<code>\rhookrightarrow</code>	\swarrow	<code>\swarrow</code>
\leftharpoonup	<code>\leftharpoonup</code>	\rightharpoonup	<code>\rightharpoonup</code>	\nwarrow	<code>\nwarrow</code>
\leftharpoondown	<code>\leftharpoondown</code>	\leadsto	<code>\leadsto</code>		
\rightleftharpoons	<code>\rightleftharpoons</code>				
\dashrightarrow	<code>\dashrightarrow</code>	\dashleftarrow	<code>\dashleftarrow</code>	\leftleftarrows	<code>\leftleftarrows</code>
\leftrightharpoons	<code>\leftrightharpoons</code>	\Lleftarrow	<code>\Lleftarrow</code>	\twoheadleftarrow	<code>\twoheadleftarrow</code>
\leftarrowtail	<code>\leftarrowtail</code>	\looparrowleft	<code>\looparrowleft</code>	\leftrightharpoons	<code>\leftrightharpoons</code>
\curvearrowleft	<code>\curvearrowleft</code>	\circlearrowleft	<code>\circlearrowleft</code>	\Lsh	<code>\Lsh</code>
\upuparrows	<code>\upuparrows</code>	\upharpoonleft	<code>\upharpoonleft</code>	\downharpoonleft	<code>\downharpoonleft</code>
\multimap	<code>\multimap</code>	\leftrightsquigarrow	<code>\leftrightsquigarrow</code>	\rightrightarrows	<code>\rightrightarrows</code>
\rightleftarrows	<code>\rightleftarrows</code>	\rightrightarrows	<code>\rightrightarrows</code>	\rightleftarrows	<code>\rightleftarrows</code>
\twoheadrightarrow	<code>\twoheadrightarrow</code>	\rightarrowtail	<code>\rightarrowtail</code>	\looparrowright	<code>\looparrowright</code>
\rightleftharpoons	<code>\rightleftharpoons</code>	\curvearrowright	<code>\curvearrowright</code>	\circlearrowright	<code>\circlearrowright</code>
\Rsh	<code>\Rsh</code>	\downdownarrows	<code>\downdownarrows</code>	\upharpoonright	<code>\upharpoonright</code>
\downharpoonright	<code>\downharpoonright</code>	\rightsquigarrow	<code>\rightsquigarrow</code>		
\nleftarrow	<code>\nleftarrow</code>	\nrightarrow	<code>\nrightarrow</code>	\nLeftarrow	<code>\nLeftarrow</code>
\nrightarrow	<code>\nrightarrow</code>	$\nleftrightharpoonrightarrow$	<code>\nleftrightharpoonrightarrow</code>	\nLeftrightarrow	<code>\nLeftrightarrow</code>

8 Miscellaneous symbols

∞	<code>\infty</code>	\forall	<code>\forall</code>	\mathbb{k}	<code>\Bbbk</code>	\wp	<code>\wp</code>
∇	<code>\nabla</code>	\exists	<code>\exists</code>	\bigstar	<code>\bigstar</code>	\sphericalangle	<code>\angle</code>
∂	<code>\partial</code>	\nexists	<code>\nexists</code>	\diagdown	<code>\diagdown</code>	\sphericalangle	<code>\measuredangle</code>
\eth	<code>\eth</code>	\emptyset	<code>\emptyset</code>	\diagup	<code>\diagup</code>	\sphericalangle	<code>\sphericalangle</code>
\clubsuit	<code>\clubsuit</code>	\varnothing	<code>\varnothing</code>	\diamond	<code>\Diamond</code>	\complement	<code>\complement</code>
\diamondsuit	<code>\diamondsuit</code>	\imath	<code>\imath</code>	\Finv	<code>\Finv</code>	\triangledown	<code>\triangledown</code>
\heartsuit	<code>\heartsuit</code>	\jmath	<code>\jmath</code>	\Game	<code>\Game</code>	\triangle	<code>\triangle</code>
\spadesuit	<code>\spadesuit</code>	ℓ	<code>\ell</code>	\hbar	<code>\hbar</code>	\vartriangle	<code>\vartriangle</code>
\cdots	<code>\cdots</code>	\iiint	<code>\iiint</code>	\hbar	<code>\hslash</code>	\blacklozenge	<code>\blacklozenge</code>
\vdots	<code>\vdots</code>	\iiint	<code>\iiint</code>	\lozenge	<code>\lozenge</code>	\blacksquare	<code>\blacksquare</code>
\ldots	<code>\ldots</code>	\iint	<code>\iint</code>	\mho	<code>\mho</code>	\blacktriangle	<code>\blacktriangle</code>
\ddots	<code>\ddots</code>	\sharp	<code>\sharp</code>	\prime	<code>\prime</code>	\blacktriangledown	<code>\blacktriangledown</code>
\Im	<code>\Im</code>	\flat	<code>\flat</code>	\square	<code>\square</code>	\backprime	<code>\backprime</code>
\Re	<code>\Re</code>	\natural	<code>\natural</code>	\surd	<code>\surd</code>	\circledS	<code>\circledS</code>

9 Math mode accents

\acute{a}	<code>\acute{a}</code>	\bar{a}	<code>\bar{a}</code>	\acute{A}	<code>\Acute{\Acute{A}}</code>	\bar{A}	<code>\Bar{\Bar{A}}</code>
\breve{a}	<code>\breve{a}</code>	\check{a}	<code>\check{a}</code>	\breve{A}	<code>\Breve{\Breve{A}}</code>	\check{A}	<code>\Check{\Check{A}}</code>
\ddot{a}	<code>\ddot{a}</code>	\dot{a}	<code>\dot{a}</code>	\ddot{A}	<code>\Ddot{\Ddot{A}}</code>	\dot{A}	<code>\Dot{\Dot{A}}</code>
\grave{a}	<code>\grave{a}</code>	\hat{a}	<code>\hat{a}</code>	\grave{A}	<code>\Grave{\Grave{A}}</code>	\hat{A}	<code>\Hat{\Hat{A}}</code>
\tilde{a}	<code>\tilde{a}</code>	\vec{a}	<code>\vec{a}</code>	\tilde{A}	<code>\Tilde{\Tilde{A}}</code>	\vec{A}	<code>\Vec{\Vec{A}}</code>

10 Array environment, examples

Simplest version:
$$\begin{array}{c} row_1 \\ row_2 \\ \dots \\ row_m \end{array}$$
 where *cols* includes one character [lrc] for each column (with optional characters | inserted for vertical lines) and *row_j* includes character & a total of (*n* - 1) times to separate the *n* elements in the row. Examples:

```
\left( \begin{array}{cc} 2\tau & 7\phi - \frac{5}{12} \\ 3\psi & \frac{\pi}{8} \end{array} \right) \\
\left( \begin{array}{c} x \\ y \end{array} \right) \\
\mbox{\~and} \left[ \begin{array}{cc|c} 3 & 4 & 5 \\ 1 & 3 & 729 \end{array} \right]
```

$$\left(\begin{array}{cc} 2\tau & 7\phi - \frac{5}{12} \\ 3\psi & \frac{\pi}{8} \end{array} \right) \left(\begin{array}{c} x \\ y \end{array} \right) \text{ and } \left[\begin{array}{cc|c} 3 & 4 & 5 \\ 1 & 3 & 729 \end{array} \right]$$

```
f(z) = \left\{ \begin{array}{r} \overline{\overline{z^2 + \cos z}} \\ & |z| < 3 \\ & 0 \\ & 3 \leq |z| \leq 5 \\ & \sin \overline{z} \\ & |z| > 5 \end{array} \right.
```

$$f(z) = \begin{cases} \overline{\overline{z^2 + \cos z}} & \text{for } |z| < 3 \\ 0 & \text{for } 3 \leq |z| \leq 5 \\ \sin \bar{z} & \text{for } |z| > 5 \end{cases}$$

11 Other Styles (math mode only)

Caligraphic letters: \mathcal{A} etc.: *ABCDEFGHIJKLMNOPQRSTUVWXYZ*

Mathbb letters: \mathbb{A} etc.: *ABCDEFGHIJKLMNOPQRSTUVWXYZ*

Mathfrak letters: \mathfrak{A} etc.: *ABCDEFGHIJKLMNOPQRSTUVWXYZ abc 123*

Math Sans serif letters: A etc.: *ABCDEFGHIJKLMNOPQRSTUVWXYZ abc 123*

Math bold letters: \mathbf{A} etc.: ***ABCDEFGHIJKLMNOPQRSTUVWXYZ abc 123***

Math bold italic letters: define $\def\mathbi#1{\textbf{\em #1}}$ then use \mathbi{A} etc.:
ABCDEFGHIJKLMNOPQRSTUVWXYZ abc 123

12 Font sizes

Math Mode:	$\int f^{-1}(x - x_a) dx$	$\{\displaystyle \int f^{-1}(x - x_a) dx\}$
	$\int f^{-1}(x - x_a) dx$	$\{\textstyle \int f^{-1}(x - x_a) dx\}$
	$\int f^{-1}(x - x_a) dx$	$\{\scriptstyle \int f^{-1}(x - x_a) dx\}$
	$\int f^{-1}(x - x_a) dx$	$\{\scriptscriptstyle \int f^{-1}(x - x_a) dx\}$

Text Mode:	$\tiny = \text{smallest}$	$\normalsize = \text{normal}$	$\huge = \text{huge}$
	$\scriptsize = \text{very small}$	$\large = \text{large}$	$\Huge = \text{Huge}$
	$\footnotesize = \text{smaller}$	$\Large = \text{Large}$	
	$\small = \text{small}$	$\LARGE = \text{LARGE}$	

13 Text Mode: Accents and Symbols

ó $\backslash'o$	ö $\backslash"o$	ô \backslash^o	ò $\backslash' o$	õ $\backslash~o$	ō $\backslash= o$	š $\backslash d s$
ó $\backslash. o$	ö $\backslash u o$	ô $\backslash H o$	ò $\backslash t oo$	õ $\backslash c o$	ō $\backslash d o$	š $\backslash r s$
o $\backslash b o$	Å $\backslash AA$	å $\backslash aa$	ß $\backslash ss$	ı $\backslash i$	ı̇ $\backslash j$	š $\backslash H s$
ø $\backslash o$	š $\backslash t s$	š $\backslash v s$	Ø $\backslash O$	¶ $\backslash P$	§ $\backslash S$	
æ $\backslash ae$	Æ $\backslash AE$	† $\backslash dag$	‡ $\backslash ddag$	© $\backslash copyright$	£ $\backslash pounds$	