# LAT X Mathematical Symbols

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The more unusual symbols are not defined in base LATEX (NFSS) and require \usepackage{amssymb}

## Greek and Hebrew letters

*α* \alpha *κ* \kappa *ψ* \psi J \digamma ∆ \Delta Θ \Theta

*β* \beta *λ* \lambda *ρ* \rho *ε* \varepsilon Γ \Gamma Υ \Upsilon

*χ* \chi *µ* \mu *σ* \sigma κ \varkappa Λ \Lambda Ξ \Xi

*δ* \delta *ν* \nu *τ* \tau *ϕ* \varphi Ω \Omega

*ϵ* \epsilon *o* o *θ* \theta *α* \varpi Φ \Phi \aleph

ℵ

*η* \eta *ω* \omega *υ* \upsilon *Q* \varrho Π \Pi E \beth

*γ* \gamma *φ* \phi *ξ* \xi *ς* \varsigma Ψ \Psi v \daleth

*ι* \iota *π* \pi *ζ* \zeta *ϑ* \vartheta Σ \Sigma ג \gimel

## LATEX math constructs

*abc xyz*

\frac{abc}{xyz} *abc* \overline{abc} −*a*→*bc* \overrightarrow{abc}

*f′* f’ *abc* \underline{abc} ←*ab*−*c* \overleftarrow{abc}

√*n*

√*abc* \sqrt{abc}

*a*^*bc* \widehat{abc} ¸*a*x*b*`*c*˛ \overbrace{abc}

*abc* \sqrt[n]{abc}

## Delimiters

*a*˜*bc* \widetilde{abc} `*a*˛*b*¸*c*x \underbrace{abc}

| | { \{ [ \lfloor */* / ⇑ \Uparrow ı \llcorner

| \vert } \} ♩ \rfloor \ \backslash ↑ \uparrow y \lrcorner ǁ \| ⟨ \langle [ \lceil [ [ ⇓ \Downarrow p \ulcorner ǁ \Vert ⟩ \rangle | \rceil ] ] ↓ \downarrow ’ \urcorner

Use the pair \left*s*1 and \right*s*2 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.

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

\sum

ΣQ

\prod

\int

\oint

∫H

\biguplus

\bigcap

UT

\bigoplus

\bigotimes

LN

\bigvee

\bigwedge

WV

` \coprod ∫∫ \iint S \bigcup J \bigodot . \bigsqcup

## Standard Function Names

Function names should appear in Roman, not Italic, e.g., Correct: \tan(at-n\pi) −→ tan(*at* − *nπ*)

Incorrect: tan(at-n\pi) −→ *tan*(*at* − *nπ*)

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

## Binary Operation/Relation Symbols

∗ \ast ± \pm ∩ \cap a \lhd

*\** \star ∓ \mp ∪ \cup D \rhd

· \cdot N \amalg ] \uplus *a* \triangleleft

* \circ Ⓢ \odot H \sqcap *d* \triangleright
* \bullet g \ominus H \sqcup Ð \unlhd

Ⓧ \bigcirc ⊕ \oplus ∧ \wedge B \unrhd

⬦ \diamond ø \oslash ∨ \vee q \bigtriangledown

× \times ⊗ \otimes † \dagger Δ \bigtriangleup

\div \wr \ddagger \setminus

\ ‡ \

÷

. \centerdot Q \Box x \barwedge V \veebar

② \circledast ☒ \boxplus Ω \curlywedge Y \curlyvee

} \circledcirc Ø \boxminus A \Cap d \Cup

Ⓢ \circleddash ☒ \boxtimes \bot \top

⊥ T

+ \dotplus © \boxdot | \intercal s \rightthreetimes

÷ \divideontimes Q \square ç \doublebarwedge 7 \leftthreetimes

≡ \equiv ≤ \leq ≥ \geq ⊥ \perp

∼

= \cong ≺ \prec > \succ | \mid

/= \neq ≤ \preceq ≥ \succeq ǁ \parallel

∼ \sim \ll \gg *da* \bowtie

' \simeq ⊂ \subset ⊃ \supset un \Join

≈ \approx ⊆ \subseteq ⊇ \supseteq n \ltimes

==*.*

\asymp и \sqsubset и \sqsupset u \rtimes

\doteq ± \sqsubseteq ± \sqsupseteq *×* \smile

∝ \propto E \dashv ► \vdash *-* \frown

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| |= | \models | ∈ | \in | s | \ni | ∈*/* | \notin |
| ÷ | \approxeq | ≤ | \leqq | ≥ | \geqq | ≶ | \lessgtr |
| ∼ | \thicksim | ≤ | \leqslant | ≥ | \geqslant | Q | \lesseqgtr |
| ~ | \backsim | € | \lessapprox | ' | \gtrapprox | S | \lesseqqgtr |
| w | \backsimeq | ≪ | \lll | ≫ | \ggg | T | \gtreqqless |
| , | \triangleq | « | \lessdot | m | \gtrdot | R | \gtreqless |
| ® | \circeq | 4 | \lesssim | 4 | \gtrsim | ≷ | \gtrless |
| l | \bumpeq | ¿ | \eqslantless | 1 | \eqslantgtr | s | \backepsilon |
| m | \Bumpeq | 4 | \precsim | 4 | \succsim | # | \between |
| o | \doteqdot | € | \precapprox | v | \succapprox | M | \pitchfork |
| ≈ | \thickapprox | b | \Subset | $ | \Supset | ı | \shortmid |
| ; | \fallingdotseq | ⊆ | \subseteqq | ≥ | \supseteqq | - | \smallfrown |
| : | \risingdotseq | и | \sqsubset | и | \sqsupset | × | \smallsmile |
| ∝ | \varpropto | “ | \preccurlyeq | < | \succcurlyeq | D | \Vdash |
| ∴ | \therefore | 2 | \curlyeqprec | 3 | \curlyeqsucc | ► | \vDash |
| ∵ | \because | K | \blacktriangleleft | ► | \blacktriangleright |  | \Vvdash |
| ¤ | \eqcirc | Ð | \trianglelefteq | B | \trianglerighteq | " | \shortparallel |
| /= | \neq | a | \vartriangleleft | D | \vartriangleright | u | \nshortparallel |
|  | \ncong | # | \nleq | § | \ngeq | ¢ | \nsubseteq |
| ‡ | \nmid | Ą | \nleqq | p | \ngeqq | + | \nsupseteq |
| ∦ | \nparallel | ¢ | \nleqslant | § | \ngeqslant | ¢ | \nsubseteqq |
| c | \nshortmid | ≮ | \nless | ≯ | \ngtr | # | \nsupseteqq |
| u | \nshortparallel | ⊀ | \nprec | 9 | \nsucc | Ç | \subsetneq |
|  | \nsim |  | \npreceq | 3 | \nsucceq | ≥ | \supsetneq |
| ¤ | \nVDash | ; | \precnapprox | ; | \succnapprox | ; | \subsetneqq |
| $ | \nvDash | ; | \precnsim | ; | \succnsim | ; | \supsetneqq |
| b | \nvdash | ; | \lnapprox | ; | \gnapprox |  | \varsubsetneq |
| Ø | \ntriangleleft | Ç | \lneq | ≥ | \gneq | 3 | \varsupsetneq |
| Ø | \ntrianglelefteq | ; | \lneqq | ; | \gneqq | Ç | \varsubsetneqq |
| Ø | \ntriangleright | ; | \lnsim | ; | \gnsim | \ | \varsupsetneqq |
| Ø | \ntrianglerighteq | ; | \lvertneqq | ; | \gvertneqq |  |  |

## Arrow symbols

← \leftarrow ←− \longleftarrow ↑ \uparrow

⇐ \Leftarrow ⇐= \Longleftarrow ⇑ \Uparrow

→ \rightarrow −→ \longrightarrow ↓ \downarrow

⇒ \Rightarrow =⇒ \Longrightarrow ⇓ \Downarrow

— \leftrightarrow ←→ \longleftrightarrow ‡ \updownarrow

⇔ \Leftrightarrow ⇐⇒ \Longleftrightarrow Ⓘ \Updownarrow

\mapsto \longmapsto \nearrow

›→ −→ 3

*›* \hookleftarrow *‹* \hookrightarrow \searrow

← → \

*-* \leftharpoonup *-* \rightharpoonup \swarrow

(

*7* \leftharpoondown *z* \rightharpoondown \nwarrow

s

\rightleftharpoons ~ \leadsto

−−· \dashrightarrow ·−− \dashleftarrow ⇔ \leftleftarrows

4 \leftrightarrows @ \Lleftarrow ← \twoheadleftarrow

< \leftarrowtail R \looparrowleft \leftrightharpoons

a \curvearrowleft Ç \circlearrowleft t \Lsh

‡ \upuparrows ² \upharpoonleft f \downharpoonleft

a \multimap x \leftrightsquigarrow ⇒ \rightrightarrows

« \rightleftarrows ⇒ \rightrightarrows « \rightleftarrows

→ \twoheadrightarrow > \rightarrowtail R \looparrowright

\rightleftharpoons a \curvearrowright \ \circlearrowright

F \Rsh M \downdownarrows T \upharpoonright

] \downharpoonright ~ \rightsquigarrow

~ \nleftarrow ~ \nrightarrow a \nLeftarrow

a \nRightarrow ~ \nleftrightarrow & \nLeftrightarrow

## Miscellaneous symbols

\infty \forall k \Bbbk *℘* \wp

∞ ∀

\nabla \exists F \bigstar ∠ \angle

∇ ∃

*∂* \partial $ \nexists \ \diagdown ] \measuredangle

ð \eth ∅ \emptyset / \diagup q \sphericalangle

♣ \clubsuit ∅ \varnothing ♦ \Diamond C \complement

* + \diamondsuit *ı* \imath 4 \Finv o \triangledown

♥ \heartsuit ** \jmath 3 \Game Δ \triangle

♠ \spadesuit *l* \ell k \hbar o \vartriangle

∫∫∫∫

· ·.· \cdots \iiiint k \hslash ◆ \blacklozenge

. \vdots ∫∫∫∫∫ \iiint ♦ \lozenge □ \blacksquare

*. . .* \ldots

\iint V \mho ▲ \blacktriangle

. . . \ddots *]* \sharp j \prime V \blacktrinagledown

= \Im *b* \flat

√

঩ \Re *q* \natural

## Math mode accents

Q \square › \backprime

\surd ② \circledS

*a*´ \acute{a}

*a*˘ \breve{a}

*a*¯ \bar{a} *A*´

*a*ˇ \check{a} *A*˘

\Acute{\Acute{A}}

\Breve{\Breve{A}}

*A*¯ \Bar{\Bar{A}}

*A*ˇ \Check{\Check{A}}

*a*¨ \ddot{a}

*a*˙ \dot{a}

*A*¨ \Ddot{\Ddot{A}}

*A*˙ \Dot{\Dot{A}}

*a*` \grave{a} *a*ˆ \hat{a} *A*`

\Grave{\Grave{A}} *A*ˆ

\Hat{\Hat{A}}

*a*˜ \tilde{a} *→a* \vec{a}

*A*˜ \Tilde{\Tilde{A}} *A****→***

\Vec{\Vec{A}}

## Array environment, examples

Simplest version: \begin{array}{*cols*} *row*1 \\ *row*2 \\ . . . *rowm* \end{array}

where *cols* includes one character [lrc] for each column (with optional characters | inserted for vertical lines) and *rowj* 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-frac5{12} \\ 3\psi & \frac{\pi}8 \end{array} \right)

2*τ* 3*ψ*

7*φ* −

*π*

8

5

12

*x*

*y*

and

3 4 5

1 3 729

\left( \begin{array}{c} x \\ y \end{array} \right)

\mbox{~and~} \left[ \begin{array}{cc|r}

3 & 4 & 5 \\ 1 & 3 & 729 \end{array} \right]

f(z) = \left\{ \begin{array}{rcl}



*z* + cos *z*

2

*f* (*z*) =



0

for |*z*| *<* 3

sin *z*

for |*z*| *>* 5

for 3 ≤ |*z*| ≤ 5

\overline{\overline{z^2}+\cos z} & \mbox{for} & |z|<3 \\ 0 & \mbox{for} & 3\leq|z|\leq5 \\

\sin\overline{z} & \mbox{for} & |z|>5

\end{array}\right.

## Other Styles (math mode only)

**Caligraphic letters**: $\mathcal{A}$ etc.: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

**Mathbb letters**: $\mathbb{A}$ etc.: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

**Mathfrak letters**: $\mathfrak{A}$ etc.: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c 1 2 3 **Math Sans serif letters**: $\mathsf{A}$ etc.: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c 1 2 3 **Math bold letters**: $\mathbf{A}$ etc.: **A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c 1 2 3**

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

***A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c 1 2 3***

## Font sizes

**Math Mode:**

∫ *f−*1(*x* − *xa*) *dx* ${\displaystyle \int f^{-1}(x-x\_a)\,dx}$

*f−*1(*x* − *xa*) *dx* ${\textstyle \int f^{-1}(x-x\_a)\,dx}$

∫

∫

*f−*1(*x−xa*) *dx* ${\scriptstyle \int f^{-1}(x-x\_a)\,dx}$

∫ *f−*1(*x−xa*) *dx* ${\scriptscriptstyle \int f^{-1}(x-x\_a)\,dx}$

\tiny = smallest

\scriptsize = very small

**Text Mode:**

\footnotesize = smaller

\small = small

\normalsize = normal

\large = large

\Large = Large

\LARGE = LARGE

\huge = huge

\Huge = Huge

## Text Mode: Accents and Symbols

o \b{o} ˚A \AA ˚a \aa ß \ss ı \i  \j ˝s \H s

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ´o | \’{o} | ¨o \"{o} | ˆo \^{o} | `o | \‘{o} | ˜o | \~{o} | ¯o | \={o} s. | \d | s |
| o˙ | \.{o} | ˘o \u{o} | ˝o \H{o} | o*ˆ* o | \t{oo} | o¸ | \c{o} | o. | \d{o} ˚s | \r | s |

ø¯ \o *ˆ*s \t s ˇs \v s Ø \O fj \P § \S

æ \ae Æ \AE † \dag ‡ \ddag Ⓧc \copyright £ \pounds