

hangulmath

Hangul jamo as mathematical symbols

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訓民正號

훈민정호 — 백성을 가르치는 바른 기호

The Correct Symbols for the Instruction of the People

나랏 수식이 로마자와 희랍자에 머물러 그 수가 넉넉디 아니할쎄, 이런 전차로 어린 수학자가 쓰고져
홀 새 변수가 이셔도 마참내 제 뜨들 시러 퍼디 못할 노미 하니라.

내 이랄 어엿비 너겨 새로 마흔 기호를 맹가노니, 학자마다 수비 니겨 날로 레이텍에 쑤메 편안케
하고져 할 따라미니라.

$$\#\{\neg, \sqcup, \sqcap, \dots, \neg, \neg\} = 19 + 21 = 40$$

병오년(2026) 한글날

Whereas the symbols of our mathematics remain confined to the Roman and Greek letters, and their number is not sufficient, many a humble mathematician, though wishing to write a new variable, has in the end been unable to express his meaning.

Taking pity on them, I have newly made forty symbols, so that every scholar may learn them with ease and use them daily in $\text{\LaTeX}$; and this is all I desire.

$$\#\{\neg, \sqcup, \sqcap, \dots, \neg, \neg\} = 19 + 21 = 40$$

Given on Hangul Day, in the year 2026

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1 Introduction

Mathematical notation draws almost entirely on the Latin and Greek alphabets, and in a long paper one easily runs out of distinct letters. The Korean alphabet, Hangul, offers a clean supply of new symbols: its letters (*jamo*) are built from simple geometric strokes, are visually distinct from Latin and Greek, and each has a well-established name.

The `hangulmath` package makes the 40 jamo of modern Hangul available in mathematics: 14 basic consonants, 5 double consonants, 10 basic vowels and 11 compound vowels. Each symbol has a command named after the letter, so Γ is `\giyeok`, much as α is `\alpha`. Consonants also have a four-letter alias that is easy to remember (`\giug`).

$$\sum_{k=1}^n \gamma_k^2 \leq \left(\sum_{k=1}^n \gamma_k \right)^2, \quad \square^2 \vec{A} = -\mu_0 \vec{J}, \quad \lim_{x \rightarrow \infty} f(x) = b.$$

The symbols are taken from a bundled subset of the Noto Sans CJK KR typeface, so no Korean font needs to be installed.

2 Requirements and installation

`hangulmath` requires **XeLaTeX** or **LuaLaTeX** (it uses `fontspec`) and a LaTeX kernel from 2022 or later. It does not work with pdfLaTeX; the package stops with an error if loaded there.

TeX Live and MiKTeX. Once the package is distributed via CTAN it is installed with the usual package manager (`tlmgr install hangulmath`, or automatically by MiKTeX).

Manual installation. Copy the following files into the directory of your document, or into your local texmf tree (`tex/latex/hangulmath/` and `fonts/opentype/public/hangulmath/`), then run `mktexlsr` if appropriate:

```
hangulmath.sty
hangulmath-metrics.def
hangulmath-sans.otf
hangulmath-sans-light.otf
```

Overleaf. Upload the four files above into your project and set the compiler to XeLaTeX (*Menu* $\rightarrow$ *Compiler*), or add a file `latexmkrc` containing `$pdf_mode = 5;`.

3 Usage

```
\usepackage{hangulmath}
...
$\giyeok + \nieun = \digeut$   or, with aliases,   $\giug + \niun = \diud$
```

Every symbol command works in math mode and also in running text (it uses `\ensuremath`). The symbols are ordinary math symbols (`\mathord`): they take sub- and superscripts and scale correctly in script styles. They are always set upright, whatever the surrounding text font.

$\$ \backslash \text{giug}_{\{ \text{ah} \}}(x) \$$, $\$ \backslash \text{niun}^{\{ \text{ih j} \}} \$$, $\$ X \backslash \text{giug } x \backslash \text{niun} \$$

$\neg_{\vdash}(x), \sqsubset^j, X \neg x \sqsubset$

3.1 Package options

option	meaning
<code>font=$\langle font \rangle$</code>	Font for the symbols, given by name or file name. Default: the bundled <code>hangulmath-sans.otf</code> (HangulMath Sans DemiLight).
<code>opfont=$\langle font \rangle$</code>	Font for the large operator forms (Section 5). Default: the bundled, lighter <code>hangulmath-sans-light.otf</code> .
<code>metrics=$\langle file \rangle$</code>	Name (without <code>.def</code>) of the metrics file that describes the glyphs of <code>font</code> . Default: <code>hangulmath-metrics</code> , which matches the bundled font. See Section 7.
<code>scale=$\langle number \rangle$</code>	Scale factor for the symbol font. Default: taken from the metrics file (about 1.24 for the bundled font).
<code>sidebearing=$\langle em \rangle$</code>	Space, in em, added to the left and right of each glyph. Default: 0.06.

If a requested font is not installed, `hangulmath` issues a warning and uses the bundled font instead, so that documents always compile.

3.2 Using with kotex

`hangulmath` works together with the Korean typesetting package `kotex` (`xetexko` or `luatexko`), loaded before or after it. `kotex` normally sends every Hangul character to its own Korean text font; `hangulmath` switches this off locally inside its symbols, so they always come from the symbol font, with the same size and alignment as without `kotex`.

`kotex` already uses the command name `\rieul` (as a josa command), so `hangulmath` leaves that name untouched and prints a warning. Write $\ni$ as `\liul` instead.

`\hangulsym`. More generally, if any command name is already taken by another package, `hangulmath` does not overwrite it but warns, naming the alternatives. Every symbol can always be reached by name:

$\$ \backslash \text{hangulsym}\{\text{rieul}\} = \backslash \text{hangulsym}\{\text{liul}\} = \backslash \text{liul} \$$

$\ni = \ni = \ni$

4 The symbols

4.1 Naming rules

- **Official names** follow the Revised Romanization of Korean: `\giyeok`, `\nieun`, ..., `\ssanggiyeok`.
- **Consonant aliases** have four letters: the consonant, `iu`, and the consonant again, imitating the shape of the Korean letter names (기역 $\rightarrow$ `\giug`, 니은 $\rightarrow$ `\niun`). Their first letters are all different, so the first letter alone identifies the consonant. Two adjustments are needed: $\circ$ has no initial sound and is `\iung`; ㄷ is written with `c` to keep four letters, `\ciuc`. $\ni$ uses `l`, its sound at the end of a syllable.

- **Double consonants** double the first letter of the alias: `\ggiug`, `\ddiud`, `\bbiub`, `\ssius`, `\jjiuj`.
- **Vowels** are written as pronounced, followed by `h`: `\ah`, `\eoh`, `\ih`. The trailing `h` avoids clashes with existing commands such as `\a`, `\o`, `\u` and `\i`. In compound vowels the glide *w* is written `u` (`\uah` for `ㅜ`). `ㅟ` is `\euih` (`-+ㅣ`) to distinguish it from `ㅜㅣ`, `\uih`.

4.2 Consonants

	official	alias	Unicode		official	alias	Unicode
ㄱ	<code>\giyeok</code>	<code>\giug</code>	U+3131	ㅇ	<code>\ieung</code>	<code>\iung</code>	U+3147
ㄴ	<code>\nieun</code>	<code>\niun</code>	U+3134	ㅈ	<code>\jieut</code>	<code>\jiuj</code>	U+3148
ㄷ	<code>\digeut</code>	<code>\diud</code>	U+3137	ㅊ	<code>\chieut</code>	<code>\ciuc</code>	U+314A
ㄹ	<code>\rieul</code>	<code>\liul</code>	U+3139	ㅋ	<code>\kieuk</code>	<code>\kiuk</code>	U+314B
ㅁ	<code>\mieum</code>	<code>\mium</code>	U+3141	ㅌ	<code>\tieut</code>	<code>\tiut</code>	U+314C
ㅂ	<code>\bieup</code>	<code>\biub</code>	U+3142	ㅍ	<code>\pieup</code>	<code>\piup</code>	U+314D
ㅅ	<code>\siot</code>	<code>\sius</code>	U+3145	ㅎ	<code>\hieut</code>	<code>\hiuh</code>	U+314E

4.3 Double consonants

	official	alias	Unicode
ㄱㅅ	<code>\ssanggiyeok</code>	<code>\ggiug</code>	U+3132
ㄷㅌ	<code>\ssangdigeut</code>	<code>\ddiud</code>	U+3138
ㅃ	<code>\ssangbieup</code>	<code>\bbiub</code>	U+3143
ㅆ	<code>\ssangsiot</code>	<code>\ssius</code>	U+3146
ㅉ	<code>\ssangjieut</code>	<code>\jjiuj</code>	U+3149

4.4 Vowels and compound vowels

	command	Unicode		command	Unicode
ㅏ	<code>\ah</code>	U+314F	ㅗ	<code>\aeh</code>	U+3150
ㅑ	<code>\yah</code>	U+3151	ㅛ	<code>\yaeh</code>	U+3152
ㅓ	<code>\eoh</code>	U+3153	ㅜ	<code>\eh</code>	U+3154
ㅕ	<code>\yeoh</code>	U+3155	ㅠ	<code>\yeh</code>	U+3156
ㅗ	<code>\oh</code>	U+3157	ㅜㅏ	<code>\uah</code>	U+3158
ㅛ	<code>\yoh</code>	U+315B	ㅜㅑ	<code>\uaeh</code>	U+3159
ㅜ	<code>\uh</code>	U+315C	ㅜㅓ	<code>\oeh</code>	U+315A
ㅠ	<code>\yuh</code>	U+3160	ㅜㅕ	<code>\ueoh</code>	U+315D
ㅡ	<code>\euh</code>	U+3161	ㅜㅗ	<code>\ueh</code>	U+315E
ㅣ	<code>\ih</code>	U+3163	ㅜㅑ	<code>\uih</code>	U+315F
			ㅟ	<code>\euih</code>	U+3162

5 Operator forms

The symbol commands produce ordinary symbols. To use a symbol as an operator, wrap it in one of the following commands. They accept any math symbol, not only Hangul.

command	behaviour
<code>\hangulsum{⟨sym⟩}</code>	Large; in display style, limits below and above (like <code>\sum</code>).
<code>\hangulint{⟨sym⟩}</code>	Large; limits at the side (like <code>\int</code>).
<code>\hangullim{⟨sym⟩}</code>	Normal size; in display style, limits below (like <code>\lim</code>).
<code>\hangulopscale{⟨d⟩}{⟨t⟩}</code>	Sets the magnification of the large forms in display and text style (defaults 2.0 and 1.3).

The large forms are drawn with the lighter operator font (`opfont`), so that magnification does not make their strokes heavier than those of `\sum` and `\int`.

`\[ \hangulsum\tiut_{k=1}^n k^2 = \frac{n(n+1)(2n+1)}{6} \]`

$$\bigcup_{k=1}^n k^2 = \frac{n(n+1)(2n+1)}{6}, \quad \bigcup_{i=1}^m \bigcup_{j=1}^n a_{ij} \quad \text{vs.} \quad \sum_{i=1}^m \sum_{j=1}^n a_{ij}$$

Inline: $\bigcup_{k=1}^n \neg_k = \sum_{k=1}^n \neg_k$.

`\[ \hangulint\diud_{x=0}^{x=1} f(x) = a \quad \quad \quad \hangullim\liul_{x\to\infty} f(x) = b \]`

$$\bigcup_{x=0}^{x=1} f(x) = a \quad \quad \quad \bigcup_{x \rightarrow \infty} f(x) = b \quad \quad \quad \bigcup_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n = e$$

6 More examples

Each example below shows the $\text{\LaTeX}$ input (shaded, labelled **LaTeX**) directly above its typeset result (labelled **Output**). Unless an example says otherwise, the input is math and is set in display style. The notations are suggestions, not standards; define them in your text before using them.

6.1 Vowels as brackets

The vowels $\lrcorner$ and $\llcorner$ are mirror images, with a stroke pointing outwards like the angle brackets $\langle \rangle$. They give a Dirac notation in which a bra is $\lrcorner\psi$ and a ket is $\phi\llcorner$. The vowels with two strokes, $\lrcorner$ and $\llcorner$, give double brackets $\langle\langle \rangle\rangle$, as used for operators in Liouville space. Reversed pairs, with the strokes pointing inwards, make further kinds of bracket. Macros such as `\newcommand\ket[1]{\lrcorner\lrcorner\ah}` shorten the input.

LaTeX
`\eoh\psi|\phi\ah = \int \psi^*(x)\,\phi(x)\,dx`

Output

$$\lrcorner\psi|\phi\llcorner = \int \psi^*(x) \phi(x) dx$$

LaTeX
`\eoh\phi|\psi\ah = \eoh\psi|\phi\ah^*`

Output

$$\lrcorner\phi|\psi\llcorner = \lrcorner\psi|\phi\llcorner^*$$

LaTeX
`|\psi\ah = \sum_n c_n\,|n\ah, \quad \quad \quad \qquad c_n = \eoh n|\psi\ah`

Output

$$|\psi\llcorner = \sum_n c_n |n\llcorner, \quad \quad \quad c_n = \lrcorner n|\psi\llcorner$$

LaTeX `\sum_n |n\rangle\langle n| = \mathbf{1}`

Output

$$\sum_n |n\rangle\langle n| = \mathbf{1}$$

LaTeX `\langle A \rangle = \langle \psi | A | \psi \rangle, \quad (\Delta A)^2 = \langle A^2 \rangle - \langle A \rangle^2`

Output

$$\langle A \rangle = \langle \psi | A | \psi \rangle, \quad (\Delta A)^2 = \langle A^2 \rangle - \langle A \rangle^2$$

LaTeX `\langle x | p \rangle = \frac{1}{\sqrt{2\pi\hbar}} e^{ipx/\hbar}`

Output

$$\langle x | p \rangle = \frac{1}{\sqrt{2\pi\hbar}} e^{ipx/\hbar}$$

LaTeX `\langle x | x' \rangle = \delta(x - x')`

Output

$$\langle x | x' \rangle = \delta(x - x')$$

LaTeX `\langle A | B \rangle = \operatorname{Tr}(A^\dagger B)`

Output

$$\langle A | B \rangle = \operatorname{Tr}(A^\dagger B)$$

LaTeX `\frac{d}{dt} |\rho\rangle = \mathcal{L} |\rho\rangle`

Output

$$\frac{d}{dt} |\rho\rangle = \mathcal{L} |\rho\rangle$$

LaTeX `\langle A(t) \rangle = \langle A | e^{\mathcal{L}t} | \rho_0 \rangle`

Output

$$\langle A(t) \rangle = \langle A | e^{\mathcal{L}t} | \rho_0 \rangle$$

LaTeX `\langle A, B \rangle = AB + BA, \quad \langle \psi(x), \psi^\dagger(y) \rangle = \delta(x - y)`

Output

$$\langle A, B \rangle = AB + BA, \quad \langle \psi(x), \psi^\dagger(y) \rangle = \delta(x - y)$$

LaTeX `\langle A | B \rangle = \int_0^1 \operatorname{Tr}(A^\dagger \rho^s B \rho^{1-s}) ds`

Output

$$\langle A | B \rangle = \int_0^1 \operatorname{Tr}(A^\dagger \rho^s B \rho^{1-s}) ds$$

LaTeX `\langle P, Q \rangle = -(-1)^{(p-1)(q-1)} \langle Q, P \rangle, \quad \langle \pi, \pi \rangle = 0`

Output

$$\langle P, Q \rangle = -(-1)^{(p-1)(q-1)} \langle Q, P \rangle, \quad \langle \pi, \pi \rangle = 0$$

6.2 Consonants as function names

Followed by an argument, a consonant reads naturally as the name of a function. Some shapes suggest a meaning: ∇ looks like a mirrored Γ , and makes a good name for the reciprocal gamma function; $\square$ is a box, the rectangle function; $\blacktriangle$ is a tent, the triangle function; and $\bigcirc$ is a disc, the circle function of optics.

LaTeX	<code>\giug(x),\ \niun(x),\ \diud(x),\ \liul(x),\ \mium(x),\ \biub(x),\ \sius(x)</code>
Output	$\neg(x), \sqsubset(x), \sqsubset(x), \sqsupset(x), \Box(x), \boxplus(x), \wp(x)$
LaTeX	<code>\iung(x),\ \jiuj(x),\ \ciuc(x),\ \kiuk(x),\ \tiut(x),\ \piup(x),\ \hiuh(x)</code>
Output	$\mathcal{O}(x), \mathfrak{T}(x), \mathfrak{A}(x), \mathfrak{C}(x), \mathfrak{E}(x), \mathfrak{H}(x), \mathfrak{G}(x)$
LaTeX	<code>\ggiug(x),\ \ddiud(x),\ \bbiub(x),\ \ssius(x),\ \jjuij(x)</code>
Output	$\sqcap(x), \sqcap(x), \boxtimes(x), \mathbb{A}(x), \mathbb{A}(x)$
LaTeX	<code>\giug(z) = \frac{1}{\Gamma(z)}, \quad \quad \quad \giug(z)\backslash,\giug(1-z) = \frac{\sin \pi z}{\pi}</code>
Output	$\neg(z) = \frac{1}{\Gamma(z)}, \quad \quad \quad \neg(z) \neg(1-z) = \frac{\sin \pi z}{\pi}$
LaTeX	<code>\giug(z) = z\backslash,e^{\gamma z}\prod_{n=1}^{\infty}\Bigl(1 + \frac{z}{n}\Bigr)e^{-z/n}</code>
Output	$\neg(z) = z e^{\gamma z} \prod_{n=1}^{\infty} \left(1 + \frac{z}{n}\right) e^{-z/n}$
LaTeX	<code>\mium(x) = \begin{cases} 1, & x < \frac{1}{2} \\ 0, & x > \frac{1}{2} \end{cases}</code>
Output	$\Box(x) = \begin{cases} 1, & x < \frac{1}{2} \\ 0, & x > \frac{1}{2} \end{cases}$
LaTeX	<code>\sius(x) = \max(1 - x , 0)</code>
Output	$\wp(x) = \max(1 - x , 0)$
LaTeX	<code>\mium * \mium = \sius, \quad \quad \hat{\mium}(k) = \operatorname{sinc}\frac{k}{2}</code>
Output	$\Box * \Box = \wp, \quad \quad \hat{\Box}(k) = \operatorname{sinc} \frac{k}{2}$
LaTeX	<code>\hat{\sius}(k) = \operatorname{sinc}^2\frac{k}{2}</code>
Output	$\hat{\wp}(k) = \operatorname{sinc}^2 \frac{k}{2}$
LaTeX	<code>\iung(r) = \begin{cases} 1, & r < 1 \\ 0, & r > 1 \end{cases}</code>
Output	$\mathcal{O}(r) = \begin{cases} 1, & r < 1 \\ 0, & r > 1 \end{cases}$

LaTeX `\hat{\iung}(\rho) = \frac{J_1(2\pi\rho)}{\rho}`

Output $\hat{\mathcal{O}}(\rho) = \frac{J_1(2\pi\rho)}{\rho}$

6.3 $\mathbb{H}$ the Hamiltonian, Ξ the Lagrangian

With its two horizontal bars and two posts, $\mathbb{H}$ is a sturdy letter for the Hamiltonian; Ξ is the first consonant of 라그랑지안.

LaTeX `\piup\,,|\psi\ah = E\,,|\psi\ah`

Output $\mathbb{H}|\psi\rangle = E|\psi\rangle$

LaTeX `i\hbar\,,\frac{\partial}{\partial t}|\psi(t)\ah = \piup\,,|\psi(t)\ah`

Output $i\hbar \frac{\partial}{\partial t}|\psi(t)\rangle = \mathbb{H}|\psi(t)\rangle$

LaTeX `\piup = \frac{p^2}{2m} + V(x)\,, \quad E_n = \langle n|\piup|n\ah`

Output $\mathbb{H} = \frac{p^2}{2m} + V(x), \quad E_n = \langle n|\mathbb{H}|n\rangle$

LaTeX `\frac{dA}{dt} = \frac{i}{\hbar}[\piup, A] + \frac{\partial A}{\partial t}`

Output $\frac{dA}{dt} = \frac{i}{\hbar}[\mathbb{H}, A] + \frac{\partial A}{\partial t}$

LaTeX `\frac{df}{dt} = \{f, \piup\}`

Output $\frac{df}{dt} = \{f, \mathbb{H}\}$

LaTeX `Z = \operatorname{Tr} e^{-\beta\piup}\,, \quad \rho = \frac{e^{-\beta\piup}}{Z}`

Output $Z = \operatorname{Tr} e^{-\beta\mathbb{H}}, \quad \rho = \frac{e^{-\beta\mathbb{H}}}{Z}$

LaTeX `F = -\frac{1}{\beta}\ln Z`

Output $F = -\frac{1}{\beta} \ln Z$

LaTeX `\langle q_f|e^{-i\piup t/\hbar}|q_i\ah = \int \mathcal{D}q\; e^{iS[q]/\hbar}`

Output $\langle q_f|e^{-i\mathbb{H}t/\hbar}|q_i\rangle = \int \mathcal{D}q e^{iS[q]/\hbar}$

LaTeX `S[q] = \int \mathbb{L}\,dt`

Output $S[q] = \int \Xi dt$

LaTeX	<code>\frac{d}{dt}\frac{\partial\liul}{\partial\dot q}=\frac{\partial\liul}{\partial q}</code>
Output	$\frac{d}{dt}\frac{\partial\Xi}{\partial\dot q} = \frac{\partial\Xi}{\partial q}$
LaTeX	<code>\piup = p\,\dot q - \liul</code>
Output	$\Pi = p\dot q - \Xi$
LaTeX	<code>\dot q = \frac{\partial\piup}{\partial p}</code>
Output	$\dot q = \frac{\partial\Pi}{\partial p}$
LaTeX	<code>\dot p = -\frac{\partial\piup}{\partial q}</code>
Output	$\dot p = -\frac{\partial\Pi}{\partial q}$
LaTeX	<code>\liul = -\tfrac{1}{4} F_{\mu\nu}F^{\mu\nu} + \bar\psi\gamma^\mu D_\mu\psi</code>
Output	$\Xi = -\frac{1}{4}F_{\mu\nu}F^{\mu\nu} + \bar\psi(i\gamma^\mu D_\mu - m)\psi$

6.4 大 as a superscript mark

Set as a superscript, 大 joins the prime, the asterisk and the dagger as a mark for a new kind of conjugate, dual or distinguished point.

LaTeX	<code>A',\quad A^*,\quad A^\dagger,\quad A^{\text{ciuc}}</code>
Output	$A', \quad A^*, \quad A^\dagger, \quad A^\text{大}$
LaTeX	<code>(AB)^{\text{ciuc}} = B^{\text{ciuc}}A^{\text{ciuc}}, \quad (A^{\text{ciuc}})^{\text{ciuc}} = A</code>
Output	$(AB)^\text{大} = B^\text{大}A^\text{大}, \quad (A^\text{大})^\text{大} = A$
LaTeX	<code>\eoh\psi A\phi\ah = \eoh A^{\text{ciuc}}\psi \phi\ah</code>
Output	$\langle\psi A\phi\rangle = \langle A^\text{大}\psi \phi\rangle$
LaTeX	<code>f^{\text{ciuc}}(y) = \sup_x\bigl(xy - f(x)\bigr)</code>
Output	$f^\text{大}(y) = \sup_x(xy - f(x))$
LaTeX	<code>f^{\text{ciuc}\text{ciuc}} = f \quad \text{\textit{f convex}}</code>
Output	$f^{\text{大}\text{大}} = f \quad (f \text{ convex})$
LaTeX	<code>\piup(q,p) = \liul^{\text{ciuc}} = \sup_{\dot q}\bigl(p\,\dot q - \liul(q,\dot q)\bigr)</code>
Output	$\Pi(q,p) = \Xi^\text{大} = \sup_{\dot q}(p\dot q - \Xi(q,\dot q))$

LaTeX `x^{\ciuc} = \operatorname*{arg\,min}_x f(x), \quad \qquad \nabla f(x^{\ciuc}) = 0`

Output $x^{\star} = \arg \min_x f(x), \quad \nabla f(x^{\star}) = 0$

LaTeX `T^{\ciuc}, \ p^{\ciuc}, \ V^{\ciuc}`

Output $T^{\star}, p^{\star}, V^{\star}$

6.5 $\perp$, $\ll$, $\top$, Π as arrows

The stroke of $\perp$ points up and that of $\top$ points down; $\ll$ and Π have two strokes. They serve as arrows: spins up and down, the electrons of an oxygen atom in its orbitals, gas evolved and precipitate formed, monotone limits, and Knuth's arrow notation. Wrap them in `\mathrel` or `\mathbin` where they act as relations or operations, so that they get the right spacing.

LaTeX `\sigma_z|\oh\ah = +|\oh\ah, \quad \quad \sigma_z|\uh\ah = -|\uh\ah`

Output $\sigma_z|\perp = +|\perp, \quad \sigma_z|\top = -|\top$

LaTeX `S_+|\uh\ah = \hbar\,|\oh\ah`

Output $S_+|\top = \hbar|\perp$

LaTeX `|\psi^-\ah = \frac{1}{\sqrt{2}}\bigl(|\oh\uh\ah - |\uh\oh\ah\bigr)`

Output $|\psi^- = \frac{1}{\sqrt{2}}(|\perp\top - |\top\perp)$

LaTeX `|\yoh\ah = |\oh\oh\ah, \quad |\yuh\ah = |\uh\uh\ah`

Output $|\ll = |\perp\perp, \quad |\Pi = |\top\top$

LaTeX `1s\boxed{\oh\uh}\; \; 2s\boxed{\oh\uh}\; \; 2p\boxed{\oh\uh}\boxed{\oh}\boxed{\oh}`

Output $1s\boxed{\perp\top} \quad 2s\boxed{\perp\top} \quad 2p\boxed{\perp\top}\boxed{\perp}\boxed{\perp}$

LaTeX `\mathrm{CaCO_3 + 2HCl \to CaCl_2 + H_2O + CO_2}\ah`

Output $\mathrm{CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2} \perp$

LaTeX `\mathrm{Ag^{+}} + \mathrm{Cl^{-}} \to \mathrm{AgCl}\ah`

Output $\mathrm{Ag^{+} + Cl^{-} \rightarrow AgCl} \top$

LaTeX `\mathrm{Ba^{2+}} + \mathrm{SO_4^{2-}} \to \mathrm{BaSO_4}\ah`

Output $\mathrm{Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4} \top$

LaTeX `x \mathrel{\ah} 0 \quad \quad (x \downarrow 0)`

Output $x \top 0 \quad (x \downarrow 0)$

LaTeX `f_n \mathrel{\mathbin{\lrcorner}} f \implies \int f_n d\mu \mathrel{\mathbin{\lrcorner}} \int f d\mu`

Output $f_n \mathbin{\lrcorner} f \implies \int f_n d\mu \mathbin{\lrcorner} \int f d\mu$

LaTeX `a \mathbin{\mathbb{A}} b = a^b, \quad 2 \mathbb{A} 4 = 2^{2^2} = 65536`

Output $a \mathbin{\mathbb{A}} b = a^b, \quad 2 \mathbb{A} 4 = 2^{2^2} = 65536$

6.6 Consonants as element symbols

With pre-scripts for mass and atomic numbers, consonants become the symbols of imaginary elements, and enter formulas, equations and equilibrium constants like real ones.

LaTeX `{\scriptsize 298}_{120}\giug \to {\scriptsize 294}_{118}\niun + {\scriptsize 4}_2\mathrm{He}`

Output ${}^{298}_{120}\mathfrak{G} \rightarrow {}^{294}_{118}\mathfrak{N} + {}^4_2\mathrm{He}$

LaTeX `{\scriptsize 14}_6\ciuc \to {\scriptsize 14}_7\diud + e^- + \bar{\nu}_e`

Output ${}^{14}_6\mathfrak{C} \rightarrow {}^{14}_7\mathfrak{D} + e^- + \bar{\nu}_e$

LaTeX `2\,\giug_2 + \iung_2 \rightleftharpoons 2\,\giug_2\iung`

Output $2\mathfrak{G}_2 + \mathfrak{O}_2 \rightleftharpoons 2\mathfrak{G}_2\mathfrak{O}$

LaTeX `K = \frac{[\giug_2\iung]^2}{[\giug_2]^2[\iung_2]}`

Output $K = \frac{[\mathfrak{G}_2\mathfrak{O}]^2}{[\mathfrak{G}_2]^2[\mathfrak{O}_2]}$

LaTeX `\ssius^{2+} + 2\,\diud^- \to \ssius\diud_2\,\uh`

Output $\mathfrak{S}^{2+} + 2\mathfrak{D}^- \rightarrow \mathfrak{S}\mathfrak{D}_2\mathfrak{T}$

LaTeX `\biub\liul_3 + 3\,\mathrm{H}_{20} \to \biub(\mathrm{OH})_3 + 3\,\mathrm{H}\liul`

Output $\mathfrak{B}\mathfrak{L}_3 + 3\mathrm{H}_2\mathrm{O} \rightarrow \mathfrak{B}(\mathrm{OH})_3 + 3\mathrm{H}\mathfrak{L}$

LaTeX `\mathrm{C}_{6\mathrm{H}_{12}\mathrm{O}_6} + 6\,\iung_2 \to 6\,\mathrm{C}\iung_2 + 6\,\mathrm{H}_2\iung`

Output $\mathrm{C}_6\mathrm{H}_{12}\mathrm{O}_6 + 6\mathfrak{O}_2 \rightarrow 6\mathrm{C}\mathfrak{O}_2 + 6\mathrm{H}_2\mathfrak{O}$

6.7 Operators

The shape of $\Box$ suggests the d'Alembertian (box) operator, and the operator forms of Section 5 give sums, products, integrals and limits. A large $\prod$, the first consonant of $\boxplus$ (product), stands in for $\prod$ (here over primes p).

LaTeX `\mum^2 \equiv \nabla^2 - \frac{1}{c^2} \frac{\partial^2}{\partial t^2}`

Output $\Box^2 \equiv \nabla^2 - \frac{1}{c^2} \frac{\partial^2}{\partial t^2}$

LaTeX `\mum^2 A^\mu = -\mu_0 J^\mu, \quad \Box^2 A^\mu = -\mu_0 J^\mu, \quad (\Box^2 - m^2) \phi = 0`

Output $\Box^2 A^\mu = -\mu_0 J^\mu, \quad (\Box^2 - m^2) \phi = 0$

LaTeX `\zeta(s) = \sum_{n \geq 1} n^{-s} = \prod_p (1 - p^{-s})^{-1}`

Output $\zeta(s) = \sum_{n \geq 1} n^{-s} = \prod_p (1 - p^{-s})^{-1}$

LaTeX `\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}`

Output $\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}$

LaTeX `\lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n = e`

Output $\lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n = e$

LaTeX `{}_2\mathbf{H}_1(a,b;c;z) = \sum_{n \geq 0} \frac{(a)_n (b)_n}{(c)_n n!} z^n`

Output ${}_2\mathbf{H}_1(a,b;c;z) = \sum_{n \geq 0} \frac{(a)_n (b)_n}{(c)_n n!} z^n$

6.8 In running text

The symbol commands also work outside math mode. This input is text, not math.

LaTeX `Spin up is  $\uparrow$ , spin down  $\downarrow$ ; also in plain text:  $\uparrow$  and  $\downarrow$ .`

Output Spin up is $\uparrow$, spin down $\downarrow$; also in plain text: $\uparrow$ and $\downarrow$.

7 Using other fonts

Hangul compatibility jamo are drawn small and high in the em square of most Korean fonts, with large side bearings. `hangulmath` therefore scales all glyphs by a common factor, lowers them by a common amount so that consonants sit on the baseline, and trims each glyph to its ink. These values depend on the font and are stored in a metrics file.

To use another font, generate a metrics file with the Python script `hangulmath-metrics.py` (Python 3.10+, `pip install fonttools`):

```
python3 hangulmath-metrics.py "Nanum Gothic" -o nanum.def
```

and load it together with the font:

```
\usepackage[font={Nanum Gothic}, metrics=nanum]{hangulmath}
```

`\hangulmathfont{<font>}` and `\hangulmathopfont{<font>}` change the fonts later in the preamble.

8 Caveats

- **Look-alikes.** — resembles a minus sign and $|$ a vertical bar. Use them with care, and say in the text which letter you mean.
- **Engines.** pdfLaTeX is not supported. Check whether your publisher or preprint server compiles with XeLaTeX or LuaLaTeX before relying on the package for a submission.
- **Name clashes.** If another package defines a command with the same name as a symbol, the other package wins and `hangulmath` warns; use the alias or `\hangulsym` (Section 3.2).
- **Searchability.** The symbols are real Unicode characters in the PDF, so they can be copied and searched.

9 Korean summary (한국어 요약)

`hangulmath`는 현대 한글 자모 40자(기본 자음 14, 쌍자음 5, 기본 모음 10, 복모음 11)를 수식 기호로 쓸 수 있게 하는 패키지입니다. XeLaTeX 또는 LuaLaTeX에서 동작하며, 기호용 고딕체 글꼴이 함께 들어 있어 따로 한글 글꼴을 설치할 필요가 없습니다.

명령어는 로마자 표기법에 따른 공식 이름(`\giyeok`)과 외우기 쉬운 네 글자 약어(`\giug`)가 있습니다. 약어는 자음, `iu`, 자음의 순서이며, 쌍자음은 첫 글자를 두 번 씁니다(`\ggiug`). 모음은 소리 나는 대로 쓰고 끝에 `h`를 붙입니다(`\ah`, `\uah`).

합, 적분, 극한처럼 쓰려면 `\hangulsum`, `\hangulint`, `\hangullim`으로 감쌉니다. 모음은 괄호로도 쓸 수 있습니다. 예컨대 디랙 표기 $\langle\psi|\phi\rangle$ 를 $\langle\psi|\phi\rangle$ 로 씁니다. 6절에 예제가 더 있습니다.

$$\backslash\text{hangulsum}\backslash\text{tiut}_{\{k=1\}^{\{n\}}}\ a_k \Rightarrow \sum_{k=1}^n a_k$$

10 License

Copyright © 2026 Inkyu Park. Source code and issue tracker: <https://github.com/krunyx/hangulmath>.

The package files may be distributed and/or modified under the conditions of the L^AT_EX Project Public License, version 1.3c or (at your option) any later version.

The bundled fonts `hangulmath-sans.otf` and `hangulmath-sans-light.otf` are modified (subset and renamed) versions of Noto Sans CJK KR, copyright 2014–2021 Adobe, and are distributed under the SIL Open Font License 1.1; see `OFL.txt`. They are rebuilt with `hangulmath-fonts.py`.

11 Change history

- v0.7 (2026/10/15)** Works with `kotex` (`xetexko` and `luatexko`) in either loading order: the symbols no longer fall into `kotex`'s Korean text font. Command names already defined by another package (such as `kotex`'s `\rieul`) are left alone with a warning instead of causing an error. New command `\hangulsym{\langle name \rangle}`. New one-page example `hangulmath-minimal.tex`.
- v0.6 (2026/10/11)** Documentation: Section 6 greatly expanded, with each example shown as $\text{\LaTeX}$ input and typeset output: vowels as brackets, consonants as function names, Π as the Hamiltonian, $\text{\text{ㅈ}}$ as a superscript mark, $\perp$ and $\top$ as arrows, consonants as element symbols. No change to the package code. The preface (Korean and English) rewritten as a closer parody of the Hunminjeongeum; the document preamble offers commented-out lines for choosing another Korean font.
- v0.5 (2026/10/10)** First public release.