

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

수식의 기호가 로마와 희랍의 글자에만 머물러 그 수가 넉넉지 아니하니, 이런 까닭으로 어리석은 수학자가 적고자 하는 바가 있어도 마침내 제 뜻을 수식에 실어 펴지 못하는 이가 많으니라. 내 이를 위하여 어여뻐 여겨 새로 마흔 자를 수식에 들이노니, 자음 열아홉과 모음 스물하나라.

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

사람마다 쉬이 익혀 날마다 수식을 쓰에 편안케 하고자 할 따름이니라.

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Because the symbols of mathematics dwell only among the letters of Rome and of Greece, they are not sufficient in number; and for this cause there be many a humble mathematician who, having something he would set down, can never at the last express his meaning in a formula.

Taking pity upon them, I have newly brought forty letters into mathematics: nineteen consonants and twenty-one vowels.

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

I desire only that every person may learn them with ease, and use them in comfort day by day.

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.

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: ㅇ has no initial sound and is `\iung`; ㄷ is written with `c` to keep four letters, `\ciuc`. ㄹ 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 ㅘ). ㅚ is `\euih` (ㅡㅚㅣ) to distinguish it from ㅞ, `\uih`.

4.2 Consonants

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

4.3 Double consonants

	official	alias	Unicode
ㄲ	\ssanggiyeok	\ggiug	U+3132
ㄸ	\ssangdigeut	\ddiud	U+3138
ㄴㄴ	\ssangbieup	\bbiub	U+3143
ㄷㄷ	\ssangsiot	\ssius	U+3146
ㅃ	\ssangjieut	\jjiuj	U+3149

4.4 Vowels and compound vowels

	command	Unicode		command	Unicode
ㅏ	\ah	U+314F	ㅗ	\aeh	U+3150
ㅑ	\yah	U+3151	ㅛ	\yaeh	U+3152
ㅓ	\eoh	U+3153	ㅝ	\eh	U+3154
ㅕ	\yeoh	U+3155	ㅟ	\yeh	U+3156
ㅗ	\oh	U+3157	ㅛ	\uah	U+3158
ㅛ	\yoh	U+315B	ㅜ	\uaeh	U+3159
ㅜ	\uh	U+315C	ㅡ	\oeh	U+315A
ㅠ	\yuh	U+3160	ㅟ	\ueoh	U+315D
ㅡ	\euh	U+3161	ㅟ	\ueh	U+315E
ㅣ	\ih	U+3163	ㅟ	\uih	U+315F
			ㅟ	\euih	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
\hangulsum{ <i><sym></i> }	Large; in display style, limits below and above (like \sum).
\hangulint{ <i><sym></i> }	Large; limits at the side (like \int).
\hangullim{ <i><sym></i> }	Normal size; in display style, limits below (like \lim).
\hangulopscale{ <i><d></i> }{ <i><t></i> }	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`.

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

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

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

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

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

6 More examples

\mum as the d'Alembertian. The shape of $\square$ suggests the box operator.

$\sum^2 \equiv \nabla^2 - \mu_0 \epsilon_0 \frac{\partial^2}{\partial t^2}$,
 $\sum^2 \vec{A} = -\mu_0 \vec{J}$

$$\square^2 \equiv \nabla^2 - \mu_0 \epsilon_0 \frac{\partial^2}{\partial t^2}, \quad \square^2 \vec{A} = -\mu_0 \vec{J}$$

Pre- and post-scripts. Like any ordinary symbol, a jamo can carry scripts on both sides, for instance in a hypergeometric-style notation.

$\{_{123}\}_{\text{biub}_{45}}$, $\{_{2}\}_{\text{biub}_1}(a,b;c;z)$, $\{^{\text{ih}}_{\text{ah}}\}^{\text{uh}}_{\text{oh}}$

$${}_{123}\mathbf{H}_{45}, \quad {}_2\mathbf{H}_1(a,b;c;z), \quad \begin{matrix} | \\ \hline \end{matrix} \mathbf{H}^\top_\perp$$

Mixed with Latin and Greek. Jamo combine freely with other symbols.

$$\neg_{\perp}(x) = \sum_{\perp=0}^{\infty} \frac{\perp^{\perp}}{\perp!} x^{\perp}, \quad \alpha \neg \beta \perp \gamma, \quad \mathfrak{A}_{\perp} + \mathbb{T}^{\perp}$$

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.
- **Searchability.** The symbols are real Unicode characters in the PDF, so they can be copied and searched.

9 Korean summary (한국어 요약)

hangulmath는 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.

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

10 License

Copyright © 2026 Inkyu Park.

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

v0.5 (2026/10/10) First public release.