

Mathematical Operators

Range: 2200–22FF

This file contains an excerpt from the character code tables and list of character names for *The Unicode Standard, Version 15.0*

This file may be changed at any time without notice to reflect errata or other updates to the Unicode Standard.
See <https://www.unicode.org/errata/> for an up-to-date list of errata.

See <https://www.unicode.org/charts/> for access to a complete list of the latest character code charts.
See <https://www.unicode.org/charts/PDF/Unicode-15.0/> for charts showing only the characters added in Unicode 15.0.
See <https://www.unicode.org/Public/15.0.0/charts/> for a complete archived file of character code charts for Unicode 15.0.
See <https://www.unicode.org/charts/About.html#Conventions> for conventions used in these code charts, and other general information.

Disclaimer

These charts are provided as the online reference to the character contents of the Unicode Standard, Version 15.0 but do not provide all the information needed to fully support individual scripts using the Unicode Standard. For a complete understanding of the use of the characters contained in this file, please consult the appropriate sections of The Unicode Standard, Version 15.0, online at <https://www.unicode.org/versions/Unicode15.0.0/>, as well as Unicode Standard Annexes #9, #11, #14, #15, #24, #29, #31, #34, #38, #41, #42, #44, #45, and #50, the other Unicode Technical Reports and Standards, and the Unicode Character Database, which are available online.

See <https://www.unicode.org/ucd/> and <https://www.unicode.org/reports/>

A thorough understanding of the information contained in these additional sources is required for a successful implementation.

Copying characters from the character code tables or list of character names is not recommended, because for production reasons the PDF files for the code charts cannot guarantee that the correct character codes will always be copied.

Fonts

The shapes of the reference glyphs used in these code charts are not prescriptive. Considerable variation is to be expected in actual fonts. The particular fonts used in these charts were provided to the Unicode Consortium by a number of different font designers, who own the rights to the fonts.

See <https://www.unicode.org/charts/fonts.html> for a list.

Terms of Use

You may freely use these code charts for personal or internal business uses only. You may not incorporate them either wholly or in part into any product or publication, or otherwise distribute them without express written permission from the Unicode Consortium. However, you may provide links to these charts.

The fonts and font data used in production of these code charts may NOT be extracted, or used in any other way in any product or publication, without permission or license granted by the typeface owner(s).

The Unicode Consortium is not liable for errors or omissions in this file or the standard itself. Information on characters added to the Unicode Standard since the publication of the most recent version of the Unicode Standard, as well as on characters currently being considered for addition to the Unicode Standard can be found on the Unicode web site.

See <https://www.unicode.org/pending/pending.html> and <https://www.unicode.org/alloc/Pipeline.html>.

Copyright © 1991–2022 Unicode, Inc. All rights reserved.

	220	221	222	223	224	225	226	227	228	229	22A	22B	22C	22D	22E	22F
0	∇ 2200	\amalg 2210	\angle 2220	\int 2230	\wr 2240	\doteq 2250	\neq 2260	\nless 2270	\nlessdot 2280	\sqsupset 2290	\boxtimes 22A0	ρok 22B0	\bigwedge 22C0	\in 22D0	\nlessdot 22E0	\ddots 22F0
1	\complement 2201	\sum 2211	\triangleleft 2221	\mathfrak{f} 2231	\approx 2241	\div 2251	\equiv 2261	\nless 2271	\nlessdot 2281	\sqsubseteq 2291	\boxdot 22A1	ρok 22B1	\bigvee 22C1	\supset 22D1	\nlessdot 22E1	\ddots 22F1
2	∂ 2202	$-$ 2212	\triangleleft 2222	\mathfrak{f} 2232	\wr 2242	\doteq 2252	\neq 2262	\nless 2272	\subset 2282	\sqsubseteq 2292	\vdash 22A2	\triangleleft 22B2	\cup 22C2	\supset 22D2	\nlessdot 22E2	\in 22F2
3	\exists 2203	\mp 2213	$ $ 2223	\mathfrak{f} 2233	\wr 2243	\doteq 2253	\equiv 2263	\nless 2273	\subset 2283	\sqsubseteq 2293	\vdash 22A3	\triangleleft 22B3	\cup 22C3	\supset 22D3	\nlessdot 22E3	\in 22F3
4	\nless 2204	$\dot{+}$ 2214	\dagger 2224	\ddots 2234	\nless 2244	\doteq 2254	\leq 2264	\nless 2274	\nlessdot 2284	\sqsubseteq 2294	\vdash 22A4	\triangleleft 22B4	\diamond 22C4	\supset 22D4	\nlessdot 22E4	\in 22F4
5	\emptyset 2205	$/$ 2215	\parallel 2225	\ddots 2235	\wr 2245	\doteq 2255	\geq 2265	\nless 2275	\nlessdot 2285	\oplus 2295	\perp 22A5	\triangleleft 22B5	\cdot 22C5	$\#$ 22D5	\nlessdot 22E5	$\dot{\in}$ 22F5
6	Δ 2206	\backslash 2216	$\#$ 2226	$:$ 2236	\nless 2246	\mathfrak{H} 2256	\leq 2266	\nless 2276	\subseteq 2286	\ominus 2296	\vdash 22A6	\hookrightarrow 22B6	\star 22C6	\triangleleft 22D6	\nless 22E6	\in 22F6
7	∇ 2207	$*$ 2217	\wedge 2227	\ddots 2237	\nless 2247	\doteq 2257	\geq 2267	\nless 2277	\subset 2287	\otimes 2297	\vdash 22A7	\hookrightarrow 22B7	\ast 22C7	\triangleleft 22D7	\nless 22E7	\in 22F7
8	\in 2208	\circ 2218	\vee 2228	$\dot{-}$ 2238	\approx 2248	\doteq 2258	\nless 2268	\nless 2278	\nlessdot 2288	\ominus 2298	\vdash 22A8	\hookrightarrow 22B8	\otimes 22C8	\ll 22D8	\nless 22E8	\in 22F8
9	\nless 2209	\cdot 2219	\cup 2229	$\dot{-}$ 2239	\nless 2249	\doteq 2259	\nless 2269	\nless 2279	\nlessdot 2289	\odot 2299	\vdash 22A9	$\dot{+}$ 22B9	\otimes 22C9	\gg 22D9	\nless 22E9	\in 22F9
A	\in 220A	$\sqrt{\quad}$ 221A	\cup 222A	$\dot{-}$ 223A	\approx 224A	\doteq 225A	\nless 226A	\nless 227A	\nlessdot 228A	\odot 229A	\vdash 22AA	\vdash 22BA	\otimes 22CA	\nless 22DA	\nlessdot 22EA	\in 22FA
B	\supset 220B	$\sqrt[3]{\quad}$ 221B	\int 222B	\sim 223B	\approx 224B	\doteq 225B	\nless 226B	\nless 227B	\nlessdot 228B	\otimes 229B	\vdash 22AB	\vee 22BB	\nless 22CB	\nless 22DB	\nlessdot 22EB	\in 22FB
C	\nless 220C	$\sqrt[4]{\quad}$ 221C	\iint 222C	\sim 223C	\approx 224C	\doteq 225C	\nless 226C	\nless 227C	\nlessdot 228C	\otimes 229C	\vdash 22AC	\nless 22BC	\nless 22CC	\nless 22DC	\nlessdot 22EC	\in 22FC
D	\supset 220D	α 221D	\iiint 222D	\sim 223D	\approx 224D	\doteq 225D	\nless 226D	\nless 227D	\nlessdot 228D	\otimes 229D	\vdash 22AD	\nless 22BD	\nless 22CD	\nless 22DD	\nlessdot 22ED	\in 22FD
E	\blacksquare 220E	∞ 221E	\mathfrak{f} 222E	\sim 223E	\approx 224E	\doteq 225E	\nless 226E	\nless 227E	\nlessdot 228E	\otimes 229E	\vdash 22AE	\nless 22BE	\nless 22CE	\nless 22DE	\ddots 22EE	\in 22FE
F	\amalg 220F	\perp 221F	\mathfrak{f} 222F	\sim 223F	\approx 224F	\doteq 225F	\nless 226F	\nless 227F	\nlessdot 228F	\otimes 229F	\vdash 22AF	\nless 22BF	\nless 22CF	\nless 22DF	\ddots 22EF	\in 22FF

Miscellaneous mathematical symbols

- 2200 \forall FOR ALL
= universal quantifier
- 2201 \complement COMPLEMENT
→ 0297 \complement latin letter stretched c
- 2202 ∂ PARTIAL DIFFERENTIAL
- 2203 \exists THERE EXISTS
= existential quantifier
- 2204 \nexists THERE DOES NOT EXIST
≡ 2203 \exists 0338 \emptyset
- 2205 \emptyset EMPTY SET
= null set
• used in linguistics to indicate a null morpheme or phonological “zero”
→ 00D8 \emptyset latin capital letter o with stroke
→ 2300 \emptyset diameter sign
~ 2205 FE00 \emptyset zero with long diagonal stroke overlay form
- 2206 Δ INCREMENT
= Laplace operator
= forward difference
= symmetric difference (in set theory)
• other symbols may also be used for symmetric difference
→ 0394 Δ greek capital letter delta
→ 25B3 Δ white up-pointing triangle
- 2207 ∇ NABLA
= backward difference
= gradient, del
• used for Laplacian operator (written with superscript 2)
→ 25BD ∇ white down-pointing triangle

Set membership

- 2208 \in ELEMENT OF
- 2209 \notin NOT AN ELEMENT OF
≡ 2208 \in 0338 \emptyset
- 220A ϵ SMALL ELEMENT OF
• originates in math pi fonts; not the straight epsilon
→ 03F5 ϵ greek lunate epsilon symbol
- 220B \ni CONTAINS AS MEMBER
= such that
- 220C \nsubseteq DOES NOT CONTAIN AS MEMBER
≡ 220B \ni 0338 \emptyset
- 220D \ni SMALL CONTAINS AS MEMBER
→ 03F6 \ni greek reversed lunate epsilon symbol

Miscellaneous mathematical symbol

- 220E \blacksquare END OF PROOF
= q.e.d.
→ 2023 \blacktriangleright triangular bullet
→ 25AE \blacksquare black vertical rectangle

N-ary operators

- 220F \prod N-ARY PRODUCT
= product sign
→ 03A0 \prod greek capital letter pi
- 2210 \coprod N-ARY COPRODUCT
= coproduct sign
- 2211 \sum N-ARY SUMMATION
= summation sign
→ 03A3 \sum greek capital letter sigma
→ 2140 \sum double-struck n-ary summation

Operators

- 2212 $-$ MINUS SIGN
→ 002D $-$ hyphen-minus
→ 2796 — heavy minus sign
- 2213 \mp MINUS-OR-PLUS SIGN
→ 00B1 \pm plus-minus sign
- 2214 $\dot{+}$ DOT PLUS
- 2215 $/$ DIVISION SLASH
• generic division operator
→ 002F $/$ solidus
→ 2044 $/$ fraction slash
→ 27CB $/$ mathematical rising diagonal
- 2216 \setminus SET MINUS
→ 005C \setminus reverse solidus
→ 27CD \setminus mathematical falling diagonal
→ 29F5 \setminus reverse solidus operator
- 2217 $*$ ASTERISK OPERATOR
→ 002A $*$ asterisk
- 2218 \circ RING OPERATOR
= composite function
= APL jot
→ 00B0 $^\circ$ degree sign
→ 0970 $^\circ$ devanagari abbreviation sign
→ 25E6 \circ white bullet
→ 10B39 $^\circ$ avestan abbreviation mark
- 2219 \bullet BULLET OPERATOR
→ 00B7 \bullet middle dot
→ 2022 \bullet bullet
→ 2024 \cdot one dot leader
- 221A $\sqrt{}$ SQUARE ROOT
= radical sign
→ 2713 \checkmark check mark
- 221B $\sqrt[3]{}$ CUBE ROOT
→ 0606 $\sqrt[3]{}$ arabic-indic cube root
- 221C $\sqrt[4]{}$ FOURTH ROOT
→ 0607 $\sqrt[4]{}$ arabic-indic fourth root
- 221D \propto PROPORTIONAL TO
→ 03B1 α greek small letter alpha

Miscellaneous mathematical symbol

- 221E ∞ INFINITY

Angles

Other angle symbols are found at 299B-29AF.

- 221F \angle RIGHT ANGLE
= with (in chess notation)
→ 2BFE \angle reversed right angle
- 2220 \sphericalangle ANGLE
• used in astrological contexts for aspect semisquare
→ 299F \sphericalangle acute angle
- 2221 \measuredangle MEASURED ANGLE
- 2222 \sphericalangle SPHERICAL ANGLE
= angle arc

Relations

- 2223 \mid DIVIDES
= such that
= APL stile
→ 007C \mid vertical line
→ 01C0 \mid latin letter dental click
- 2224 \nmid DOES NOT DIVIDE
≡ 2223 \mid 0338 \emptyset

- 2225 \parallel PARALLEL TO
 → 01C1 \parallel latin letter lateral click
 → 2016 \parallel double vertical line
- 2226 \nparallel NOT PARALLEL TO
 ≡ 2225 \parallel 0338 \nparallel

Logical and set operators

- 2227 \wedge LOGICAL AND
 = wedge, conjunction
 → 22C0 \bigwedge n-ary logical and
 → 2303 \wedge up arrowhead
 → 27D1 $\mathrel{\wedge}$ and with dot
- 2228 \vee LOGICAL OR
 = vee, disjunction
 → 22C1 \bigvee n-ary logical or
 → 2304 \vee down arrowhead
 → 27C7 $\mathrel{\vee}$ or with dot inside
- 2229 \cap INTERSECTION
 = cap, hat
 → 22C2 \cap n-ary intersection
 ~ 2229 FE00 \cap with serifs
- 222A \cup UNION
 = cup
 → 22C3 \cup n-ary union
 ~ 222A FE00 \cup with serifs

Integrals

- 222B \int INTEGRAL
 → 0283 \int latin small letter esh
- 222C \iint DOUBLE INTEGRAL
 ≈ 222B \int 222B \int
- 222D \iiint TRIPLE INTEGRAL
 → 2A0C \iiint quadruple integral operator
 ≈ 222B \int 222B \int 222B \int
- 222E \oint CONTOUR INTEGRAL
 → 2A15 \oint integral around a point operator
- 222F \oiint SURFACE INTEGRAL
 ≈ 222E \oint 222E \oint
- 2230 \iiint VOLUME INTEGRAL
 ≈ 222E \oint 222E \oint 222E \oint
- 2231 $\int\limits_{\circlearrowright}$ CLOCKWISE INTEGRAL
- 2232 $\oint\limits_{\circlearrowright}$ CLOCKWISE CONTOUR INTEGRAL
- 2233 $\oint\limits_{\circlearrowleft}$ ANTICLOCKWISE CONTOUR INTEGRAL
 • clockwise or anticlockwise arrows do not reverse during layout mirroring

Miscellaneous mathematical symbols

- 2234 \therefore THEREFORE
 → 26EC \therefore historic site
- 2235 \because BECAUSE

Relations

- 2236 $:$ RATIO
 • preferred to 003A $:$ for denotation of division or scale in mathematical use
 → 003A $:$ colon
- 2237 $::$ PROPORTION

Operator

- 2238 $\dot{-}$ DOT MINUS
 = saturating subtraction
 • sometimes claimed as notation for symmetric set difference, but 2206 Δ is preferred

Relation

- 2239 -- EXCESS

Operator

- 223A \asymp GEOMETRIC PROPORTION

Relations

- 223B \approx HOMOTHETIC
 → 2A6B \approx tilde operator with rising dots
- 223C \sim TILDE OPERATOR
 = varies with (proportional to)
 = difference between
 = similar to
 = not
 = cycle
 = APL tilde
 → 007E \sim tilde
 → 00AC \sim not sign
 → 02DC \sim small tilde
- 223D \smile REVERSED TILDE
 = lazy S
 • reversed tilde and lazy S are glyph variants
- 223E \simeq INVERTED LAZY S
 = most positive

Miscellaneous mathematical symbol

- 223F \sim SINE WAVE
 = alternating current

Operator

- 2240 \wr WREATH PRODUCT

Relations

- 2241 \napprox NOT TILDE
 ≡ 223C \sim 0338 \napprox
- 2242 \ncong MINUS TILDE
- 2243 \simeq ASYMPTOTICALLY EQUAL TO
- 2244 $\not\approx$ NOT ASYMPTOTICALLY EQUAL TO
 ≡ 2243 \simeq 0338 $\not\approx$
- 2245 \cong APPROXIMATELY EQUAL TO
 → 2A70 \cong approximately equal or equal to
- 2246 $\not\cong$ APPROXIMATELY BUT NOT ACTUALLY EQUAL TO
- 2247 \neq NEITHER APPROXIMATELY NOR ACTUALLY EQUAL TO
 ≡ 2245 \cong 0338 \neq
- 2248 \approx ALMOST EQUAL TO
 = asymptotic to
- 2249 \napprox NOT ALMOST EQUAL TO
 ≡ 2248 \approx 0338 \napprox
- 224A \approx ALMOST EQUAL OR EQUAL TO
- 224B \approx TRIPLE TILDE
- 224C \equiv ALL EQUAL TO
 • reversed tilde and lazy S are glyph variants
- 224D \times EQUIVALENT TO
- 224E \doteq GEOMETRICALLY EQUIVALENT TO
- 224F \doteq DIFFERENCE BETWEEN
- 2250 \doteq APPROACHES THE LIMIT
- 2251 \doteq GEOMETRICALLY EQUAL TO
- 2252 \doteq APPROXIMATELY EQUAL TO OR THE IMAGE OF
 = nearly equals
- 2253 \doteq IMAGE OF OR APPROXIMATELY EQUAL TO
- 2254 \doteq COLON EQUALS
- 2255 \doteq EQUALS COLON
- 2256 \doteq RING IN EQUAL TO
- 2257 \doteq RING EQUAL TO
 = approximately equal to
- 2258 \doteq CORRESPONDS TO

2259	\triangleq	ESTIMATES = corresponds to
225A	\trianglelefteq	EQUIANGULAR TO
225B	\trianglestar	STAR EQUALS
225C	\triangleapprox	DELTA EQUAL TO = equiangular = equal to by definition
225D	\triangleleftharpoons	EQUAL TO BY DEFINITION
225E	\equiv	MEASURED BY
225F	$\stackrel{?}{=}$	QUESTIONED EQUAL TO
2260	\neq	NOT EQUAL TO → 003D = equals sign → 01C2 ‡ latin letter alveolar click ≡ 003D = 0338 \neq
2261	\equiv	IDENTICAL TO
2262	\neq	NOT IDENTICAL TO ≡ 2261 ≡ 0338 \neq
2263	\equiv	STRICTLY EQUIVALENT TO
2264	\leq	LESS-THAN OR EQUAL TO → 003C < less-than sign
2265	\geq	GREATER-THAN OR EQUAL TO → 003E > greater-than sign
2266	\leq	LESS-THAN OVER EQUAL TO
2267	\geq	GREATER-THAN OVER EQUAL TO
2268	\nlessgtr	LESS-THAN BUT NOT EQUAL TO ~ 2268 FE00 \nlessgtr with vertical stroke
2269	\ngtrless	GREATER-THAN BUT NOT EQUAL TO ~ 2269 FE00 \ngtrless with vertical stroke
226A	\ll	MUCH LESS-THAN → 00AB « left-pointing double angle quotation mark
226B	\gg	MUCH GREATER-THAN → 00BB » right-pointing double angle quotation mark
226C	\bowtie	BETWEEN = plaintiff, quantic
226D	\nlessgtr	NOT EQUIVALENT TO ≡ 224D \nlessgtr 0338 \neq
226E	\nlessgtr	NOT LESS-THAN ≡ 003C < 0338 \neq
226F	\nlessgtr	NOT GREATER-THAN ≡ 003E > 0338 \neq
2270	\nlessgtr	NEITHER LESS-THAN NOR EQUAL TO ≡ 2264 \leq 0338 \neq
2271	\nlessgtr	NEITHER GREATER-THAN NOR EQUAL TO ≡ 2265 \geq 0338 \neq
2272	\lesseqgtr	LESS-THAN OR EQUIVALENT TO ~ 2272 FE00 \lesseqgtr following the slant of the lower leg
2273	\gtrlessgtr	GREATER-THAN OR EQUIVALENT TO ~ 2273 FE00 \gtrlessgtr following the slant of the lower leg
2274	\nlessgtr	NEITHER LESS-THAN NOR EQUIVALENT TO ≡ 2272 \leq 0338 \neq
2275	\nlessgtr	NEITHER GREATER-THAN NOR EQUIVALENT TO ≡ 2273 \geq 0338 \neq
2276	\leq	LESS-THAN OR GREATER-THAN
2277	\geq	GREATER-THAN OR LESS-THAN
2278	\nlessgtr	NEITHER LESS-THAN NOR GREATER-THAN ≡ 2276 \leq 0338 \neq
2279	\nlessgtr	NEITHER GREATER-THAN NOR LESS-THAN ≡ 2277 \geq 0338 \neq

227A	\prec	PRECEDES = lower rank than → 22B0 \prec precedes under relation
227B	\succ	SUCCEEDS = higher rank than → 22B1 \succ succeeds under relation
227C	\preceq	PRECEDES OR EQUAL TO
227D	\succeq	SUCCEEDS OR EQUAL TO
227E	\preceq	PRECEDES OR EQUIVALENT TO
227F	\succeq	SUCCEEDS OR EQUIVALENT TO
2280	\nprec	DOES NOT PRECEDE ≡ 227A \prec 0338 \neq
2281	\nprec	DOES NOT SUCCEED ≡ 227B \succ 0338 \neq
2282	\subset	SUBSET OF = included in set → 2E26 \subset left sideways u bracket
2283	\supset	SUPERSET OF = includes in set → 2E27 \supset right sideways u bracket
2284	\nsubset	NOT A SUBSET OF ≡ 2282 \subset 0338 \neq
2285	\nsupset	NOT A SUPERSET OF ≡ 2283 \supset 0338 \neq
2286	\subseteq	SUBSET OF OR EQUAL TO
2287	\supseteq	SUPERSET OF OR EQUAL TO
2288	\nsubseteq	NEITHER A SUBSET OF NOR EQUAL TO ≡ 2286 \subseteq 0338 \neq
2289	\nsupseteq	NEITHER A SUPERSET OF NOR EQUAL TO ≡ 2287 \supseteq 0338 \neq
228A	\subsetneq	SUBSET OF WITH NOT EQUAL TO ~ 228A FE00 \subsetneq with stroke through bottom members
228B	\supsetneq	SUPERSET OF WITH NOT EQUAL TO ~ 228B FE00 \supsetneq with stroke through bottom members

Operators

228C	\uplus	MULTISET
228D	\cup	MULTISET MULTIPLICATION → 2A03 \cup n-ary union operator with dot → 2A40 \cap intersection with dot
228E	\uplus	MULTISET UNION = z notation bag addition → 2A04 \cup n-ary union operator with plus

Relations

228F	\sqsubset	SQUARE IMAGE OF
2290	\sqsupset	SQUARE ORIGINAL OF
2291	\sqsubseteq	SQUARE IMAGE OF OR EQUAL TO
2292	\sqsupseteq	SQUARE ORIGINAL OF OR EQUAL TO

Operators

2293	\sqcap	SQUARE CAP → 2A05 \sqcap n-ary square intersection operator ~ 2293 FE00 \sqcap with serifs
2294	\sqcup	SQUARE CUP → 2A06 \sqcup n-ary square union operator ~ 2294 FE00 \sqcup with serifs
2295	\oplus	CIRCLED PLUS = direct sum = vector pointing into page → 2A01 \oplus n-ary circled plus operator → 1F728 \oplus alchemical symbol for verdigris ~ 2295 FE00 \oplus with white rim

- 2296 \ominus **CIRCLED MINUS**
= symmetric difference
→ 29B5 \ominus circle with horizontal bar
→ 1F714 \ominus alchemical symbol for salt
- 2297 \otimes **CIRCLED TIMES**
= tensor product
= vector pointing into page
→ 26D2 \otimes circled crossing lanes
→ 2A02 \otimes n-ary circled times operator
→ 2BBE \otimes circled x
→ 1F774 \otimes lot of fortune
~ 2297 FE00 \otimes with white rim
- 2298 \oslash **CIRCLED DIVISION SLASH**
- 2299 \odot **CIRCLED DOT OPERATOR**
= direct product
= vector pointing out of page
→ 0298 \odot latin letter bilabial click
→ 2609 \odot sun
→ 2A00 \odot n-ary circled dot operator
- 229A \odot **CIRCLED RING OPERATOR**
→ 233E \odot apl functional symbol circle jot
→ 25CE \odot bullseye
- 229B \circledast **CIRCLED ASTERISK OPERATOR**
→ 235F \circledast apl functional symbol circle star
- 229C \equiv **CIRCLED EQUALS**
= NoDerivatives (symbol used for Creative Commons licenses)
→ 1F16D \equiv circled cc
~ 229C FE00 \equiv with equal sign touching the circle
- 229D \ominus **CIRCLED DASH**
- 229E \boxplus **SQUARED PLUS**
- 229F \boxminus **SQUARED MINUS**
- 22A0 \boxtimes **SQUARED TIMES**
→ 2612 \boxtimes ballot box with x
→ 26DD \boxtimes squared saltire
→ 1F771 \boxtimes alchemical symbol for month
- 22A1 $\boxed{\cdot}$ **SQUARED DOT OPERATOR**
→ 1F755 $\boxed{\cdot}$ alchemical symbol for urine
→ 1FBBC $\boxed{\cdot}$ right open squared dot
- 22A2 \dashv **RIGHT TACK**
= turnstile
= proves, implies, yields
= reducible
- 22A3 \dashv **LEFT TACK**
= reverse turnstile
= non-theorem, does not yield

Miscellaneous mathematical symbols

- 22A4 \top **DOWN TACK**
= top
→ 2E06 \top raised interpolation marker
→ 1F768 \top alchemical symbol for crucible-4
- 22A5 \perp **UP TACK**
= base, bottom
→ 27C2 \perp perpendicular

Relations

- 22A6 \models **ASSERTION**
= reduces to
- 22A7 \models **MODELS**

- 22A8 \models **TRUE**
= statement is true, valid
= is a tautology
= satisfies
= results in
- 22A9 \Vdash **FORCES**
- 22AA \Vdash **TRIPLE VERTICAL BAR RIGHT TURNSTILE**
- 22AB \Vdash **DOUBLE VERTICAL BAR DOUBLE RIGHT TURNSTILE**
- 22AC \nVdash **DOES NOT PROVE**
 $\equiv 22A2 \vdash 0338 \nVdash$
- 22AD \nVdash **NOT TRUE**
 $\equiv 22A8 \models 0338 \nVdash$
- 22AE \nVdash **DOES NOT FORCE**
 $\equiv 22A9 \Vdash 0338 \nVdash$
- 22AF \nVdash **NEGATED DOUBLE VERTICAL BAR DOUBLE RIGHT TURNSTILE**
 $\equiv 22AB \Vdash 0338 \nVdash$
- 22B0 \preceq **PRECEDES UNDER RELATION**
→ 227A \preceq precedes
- 22B1 \succeq **SUCCEEDS UNDER RELATION**
→ 227B \succeq succeeds
- 22B2 \triangleleft **NORMAL SUBGROUP OF**
→ 25C5 \triangleleft white left-pointing pointer
- 22B3 \triangleright **CONTAINS AS NORMAL SUBGROUP**
→ 25BB \triangleright white right-pointing pointer
- 22B4 \trianglelefteq **NORMAL SUBGROUP OF OR EQUAL TO**
- 22B5 \trianglerighteq **CONTAINS AS NORMAL SUBGROUP OR EQUAL TO**
- 22B6 \rightsquigarrow **ORIGINAL OF**
- 22B7 \blacktriangleright **IMAGE OF**
- 22B8 \multimap **MULTIMAP**
- 22B9 \dagger **HERMITIAN CONJUGATE MATRIX**

Operators

- 22BA \intercal **INTERCALATE**
- 22BB \curlywedge **XOR**
→ 26BA \curlywedge semisextile
- 22BC \curlywedge **NAND**
→ 2305 \curlywedge projective
→ 26BB \curlywedge quincunx
- 22BD ∇ **NOR**

Miscellaneous mathematical symbols

- 22BE \angle **RIGHT ANGLE WITH ARC**
- 22BF \triangle **RIGHT TRIANGLE**

N-ary operators

- 22C0 \bigwedge **N-ARY LOGICAL AND**
• also used to denote the universal quantifier
→ 2227 \bigwedge logical and
- 22C1 \bigvee **N-ARY LOGICAL OR**
• also used to denote the existential quantifier
→ 2228 \bigvee logical or
- 22C2 \bigcap **N-ARY INTERSECTION**
= z notation generalised intersection
→ 2229 \bigcap intersection
- 22C3 \bigcup **N-ARY UNION**
= z notation generalised union
→ 222A \bigcup union

Operators

- 22C4 \blacklozenge **DIAMOND OPERATOR**
→ 25C7 \blacklozenge white diamond
→ 2B29 \blacklozenge black small diamond

22C5	·	DOT OPERATOR • preferred to 00B7 · for denotation of multiplication → 00B7 · middle dot
22C6	*	STAR OPERATOR • APL → 066D ★ arabic five pointed star → 2605 ★ black star → 2B50 ☆ white medium star
22C7	×	DIVISION TIMES → 00D7 × multiplication sign → 00F7 ÷ division sign → 2715 ✕ multiplication x

Relation

22C8	⌞	BOWTIE → 2445 ⌞ ocr bow tie
------	---	---------------------------------------

Operators

22C9	⋈	LEFT NORMAL FACTOR SEMIDIRECT PRODUCT
22CA	⋉	RIGHT NORMAL FACTOR SEMIDIRECT PRODUCT
22CB	⋊	LEFT SEMIDIRECT PRODUCT
22CC	⋋	RIGHT SEMIDIRECT PRODUCT → 2041 ⋋ caret insertion point

Relation

22CD	≍	REVERSED TILDE EQUALS
------	---	------------------------------

Logical operators

22CE	∨	CURLY LOGICAL OR
22CF	∧	CURLY LOGICAL AND

Relations

22D0	⊆	DOUBLE SUBSET
22D1	⊇	DOUBLE SUPerset

Operators

22D2	⋈	DOUBLE INTERSECTION
22D3	⋈	DOUBLE UNION

Relations

22D4	⋈	PITCHFORK = proper intersection
22D5	⋈	EQUAL AND PARALLEL TO → 2317 ⋈ viewdata square
22D6	⋈	LESS-THAN WITH DOT
22D7	⋈	GREATER-THAN WITH DOT
22D8	⋈	VERY MUCH LESS-THAN
22D9	⋈	VERY MUCH GREATER-THAN
22DA	⋈	LESS-THAN EQUAL TO OR GREATER-THAN ~ 22DA FE00 ⋈ with slanted equal
22DB	⋈	GREATER-THAN EQUAL TO OR LESS-THAN ~ 22DB FE00 ⋈ with slanted equal
22DC	⋈	EQUAL TO OR LESS-THAN
22DD	⋈	EQUAL TO OR GREATER-THAN
22DE	⋈	EQUAL TO OR PRECEDES
22DF	⋈	EQUAL TO OR SUCCEEDS
22E0	⋈	DOES NOT PRECEDE OR EQUAL ≡ 227C ⋈ 0338 ⋈
22E1	⋈	DOES NOT SUCCEED OR EQUAL ≡ 227D ⋈ 0338 ⋈
22E2	⋈	NOT SQUARE IMAGE OF OR EQUAL TO ≡ 2291 ⋈ 0338 ⋈
22E3	⋈	NOT SQUARE ORIGINAL OF OR EQUAL TO ≡ 2292 ⋈ 0338 ⋈

22E4	⋈	SQUARE IMAGE OF OR NOT EQUAL TO
22E5	⋈	SQUARE ORIGINAL OF OR NOT EQUAL TO
22E6	⋈	LESS-THAN BUT NOT EQUIVALENT TO
22E7	⋈	GREATER-THAN BUT NOT EQUIVALENT TO
22E8	⋈	PRECEDES BUT NOT EQUIVALENT TO
22E9	⋈	SUCCEEDS BUT NOT EQUIVALENT TO
22EA	⋈	NOT NORMAL SUBGROUP OF ≡ 22B2 ⋈ 0338 ⋈
22EB	⋈	DOES NOT CONTAIN AS NORMAL SUBGROUP ≡ 22B3 ⋈ 0338 ⋈
22EC	⋈	NOT NORMAL SUBGROUP OF OR EQUAL TO ≡ 22B4 ⋈ 0338 ⋈
22ED	⋈	DOES NOT CONTAIN AS NORMAL SUBGROUP OR EQUAL ≡ 22B5 ⋈ 0338 ⋈

































Matrix ellipses

These four ellipsis characters are used for matrix row/column elision.

22EE	:	VERTICAL ELLIPSIS → 205D : tricolon → 2026 ... horizontal ellipsis → FE19 : presentation form for vertical horizontal ellipsis
22EF	...	MIDLINE HORIZONTAL ELLIPSIS
22F0	⋈	UP RIGHT DIAGONAL ELLIPSIS
22F1	⋈	DOWN RIGHT DIAGONAL ELLIPSIS

Relations

22F2	⋈	ELEMENT OF WITH LONG HORIZONTAL STROKE
22F3	⋈	ELEMENT OF WITH VERTICAL BAR AT END OF HORIZONTAL STROKE
22F4	⋈	SMALL ELEMENT OF WITH VERTICAL BAR AT END OF HORIZONTAL STROKE
22F5	⋈	ELEMENT OF WITH DOT ABOVE
22F6	⋈	ELEMENT OF WITH OVERBAR
22F7	⋈	SMALL ELEMENT OF WITH OVERBAR
22F8	⋈	ELEMENT OF WITH UNDERBAR
22F9	⋈	ELEMENT OF WITH TWO HORIZONTAL STROKES
22FA	⋈	CONTAINS WITH LONG HORIZONTAL STROKE
22FB	⋈	CONTAINS WITH VERTICAL BAR AT END OF HORIZONTAL STROKE
22FC	⋈	SMALL CONTAINS WITH VERTICAL BAR AT END OF HORIZONTAL STROKE
22FD	⋈	CONTAINS WITH OVERBAR
22FE	⋈	SMALL CONTAINS WITH OVERBAR
22FF	⋈	Z NOTATION BAG MEMBERSHIP

Standardized Variation Sequences		
2205		EMPTY SET
	<small>2205</small>	
		zero with long diagonal stroke overlay form
	<small>2205 FE00</small>	
2229		INTERSECTION
	<small>2229</small>	
		with serifs
	<small>2229 FE00</small>	
222A		UNION
	<small>222A</small>	
		with serifs
	<small>222A FE00</small>	
2268		LESS-THAN BUT NOT EQUAL TO
	<small>2268</small>	
		with vertical stroke
	<small>2268 FE00</small>	
2269		GREATER-THAN BUT NOT EQUAL TO
	<small>2269</small>	
		with vertical stroke
	<small>2269 FE00</small>	
2272		LESS-THAN OR EQUIVALENT TO
	<small>2272</small>	
		following the slant of the lower leg
	<small>2272 FE00</small>	
2273		GREATER-THAN OR EQUIVALENT TO
	<small>2273</small>	
		following the slant of the lower leg
	<small>2273 FE00</small>	
228A		SUBSET OF WITH NOT EQUAL TO
	<small>228A</small>	
		with stroke through bottom members
	<small>228A FE00</small>	
228B		SUPERSET OF WITH NOT EQUAL TO
	<small>228B</small>	
		with stroke through bottom members
	<small>228B FE00</small>	
2293		SQUARE CAP
	<small>2293</small>	
		with serifs
	<small>2293 FE00</small>	
2294		SQUARE CUP
	<small>2294</small>	
		with serifs
	<small>2294 FE00</small>	
2295		CIRCLED PLUS
	<small>2295</small>	
		with white rim
	<small>2295 FE00</small>	
2297		CIRCLED TIMES
	<small>2297</small>	
		with white rim
	<small>2297 FE00</small>	
229C		CIRCLED EQUALS
	<small>229C</small>	
		with equal sign touching the circle
	<small>229C FE00</small>	
22DA		LESS-THAN EQUAL TO OR GREATER-THAN
	<small>22DA</small>	
		with slanted equal
	<small>22DA FE00</small>	
22DB		GREATER-THAN EQUAL TO OR LESS-THAN
	<small>22DB</small>	
		with slanted equal
	<small>22DB FE00</small>	