

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 9.0*

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See <http://www.unicode.org/errata/> for an up-to-date list of errata.

See <http://www.unicode.org/charts/> for access to a complete list of the latest character code charts.
See <http://www.unicode.org/charts/PDF/Unicode-9.0/> for charts showing only the characters added in Unicode 9.0.
See <http://www.unicode.org/Public/9.0.0/charts/> for a complete archived file of character code charts for Unicode 9.0.

Disclaimer

These charts are provided as the online reference to the character contents of the Unicode Standard, Version 9.0 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 9.0, online at <http://www.unicode.org/versions/Unicode9.0.0/>, as well as Unicode Standard Annexes #9, #11, #14, #15, #24, #29, #31, #34, #38, #41, #42, #44, and #45, the other Unicode Technical Reports and Standards, and the Unicode Character Database, which are available online.

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

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

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	220	221	222	223	224	225	226	227	228	229	22A	22B	22C	22D	22E	22F
0	∇ 2200	\sqcup 2210	\angle 2220	\mathbb{f} 2230	ζ 2240	\doteq 2250	\neq 2260	$\not\approx$ 2270	$\not\propto$ 2280	\sqsupset 2290	\boxtimes 22A0	\wp 22B0	\bigwedge 22C0	\in 22D0	$\not\in$ 22E0	\ddots 22F0
1	\complement 2201	Σ 2211	\triangleleft 2221	f 2231	ζ 2241	\doteq 2251	\equiv 2261	$\not\approx$ 2271	$\not\propto$ 2281	\sqsubseteq 2291	\boxdot 22A1	\wp 22B1	\bigvee 22C1	\supset 22D1	$\not\in$ 22E1	\ddots 22F1
2	∂ 2202	$-$ 2212	\triangleleft 2222	f 2232	ζ 2242	\doteq 2252	\neq 2262	$\not\approx$ 2272	\subset 2282	\sqsubseteq 2292	\vdash 22A2	\triangleleft 22B2	\cap 22C2	\supset 22D2	$\not\in$ 22E2	\in 22F2
3	\exists 2203	\mp 2213	$ $ 2223	f 2233	ζ 2243	\doteq 2253	\equiv 2263	$\not\approx$ 2273	\supset 2283	\sqsupset 2293	\vdash 22A3	\triangleleft 22B3	\cup 22C3	\supset 22D3	$\not\in$ 22E3	\in 22F3
4	\nexists 2204	$\dot{+}$ 2214	\dagger 2224	\ddots 2234	$\not\approx$ 2244	\doteq 2254	\leq 2264	$\not\approx$ 2274	$\not\propto$ 2284	\sqsupset 2294	\top 22A4	\triangleleft 22B4	\diamond 22C4	\supset 22D4	\sqsupset 22E4	\in 22F4
5	\emptyset 2205	$/$ 2215	\parallel 2225	\ddots 2235	\approx 2245	\doteq 2255	\geq 2265	$\not\approx$ 2275	$\not\propto$ 2285	\oplus 2295	\perp 22A5	\triangleleft 22B5	\cdot 22C5	$\#$ 22D5	\sqsupset 22E5	\in 22F5
6	\triangle 2206	\setminus 2216	$\#$ 2226	\cdot 2236	\approx 2246	\equiv 2256	\leq 2266	\geq 2276	\subset 2286	\ominus 2296	\vdash 22A6	\circ 22B6	\star 22C6	\triangleleft 22D6	$\not\approx$ 22E6	\in 22F6
7	∇ 2207	$*$ 2217	\wedge 2227	\ddots 2237	$\not\approx$ 2247	\doteq 2257	\geq 2267	\geq 2277	\supset 2287	\otimes 2297	\perp 22A7	\circ 22B7	$*$ 22C7	\triangleleft 22D7	$\not\approx$ 22E7	\in 22F7
8	\in 2208	\circ 2218	\vee 2228	$\dot{-}$ 2238	\approx 2248	\equiv 2258	\neq 2268	$\not\approx$ 2278	$\not\propto$ 2288	\ominus 2298	\perp 22A8	\circ 22B8	\boxtimes 22C8	\lll 22D8	$\not\approx$ 22E8	\in 22F8
9	\notin 2209	\cdot 2219	\cap 2229	$\dot{-}$ 2239	\approx 2249	\equiv 2259	\neq 2269	$\not\approx$ 2279	$\not\propto$ 2289	\odot 2299	\perp 22A9	$\dot{+}$ 22B9	\boxtimes 22C9	\lll 22D9	$\not\approx$ 22E9	\in 22F9
A	ϵ 220A	$\sqrt{\quad}$ 221A	\cup 222A	\ddots 223A	\approx 224A	\leq 225A	\lll 226A	\lrcorner 227A	\complement 228A	\odot 229A	\perp 22AA	\perp 22BA	\boxtimes 22CA	\lll 22DA	$\not\approx$ 22EA	\in 22FA
B	\ni 220B	$\sqrt[3]{\quad}$ 221B	\int 222B	\approx 223B	\approx 224B	\equiv 225B	\lll 226B	\lrcorner 227B	\complement 228B	\otimes 229B	\perp 22AB	\vee 22BB	\wedge 22CB	\lll 22DB	$\not\approx$ 22EB	\in 22FB
C	$\not\approx$ 220C	$\sqrt[4]{\quad}$ 221C	\iint 222C	ζ 223C	\equiv 224C	\equiv 225C	$\not\approx$ 226C	\lrcorner 227C	\in 228C	\ominus 229C	$\not\approx$ 22AC	\wedge 22BC	\wedge 22CC	\leq 22DC	$\not\approx$ 22EC	\in 22FC
D	\ni 220D	α 221D	\iiint 222D	ζ 223D	\smile 224D	$\stackrel{\text{def}}{=}$ 225D	$\not\approx$ 226D	\lrcorner 227D	\complement 228D	\ominus 229D	$\not\approx$ 22AD	∇ 22BD	\lrcorner 22CD	\leq 22DD	$\not\approx$ 22ED	\in 22FD
E	\blacksquare 220E	∞ 221E	f 222E	ζ 223E	\approx 224E	\equiv 225E	$\not\approx$ 226E	$\not\approx$ 227E	\in 228E	\boxplus 229E	$\not\approx$ 22AE	∇ 22BE	\vee 22CE	\wedge 22DE	\ddots 22EE	\in 22FE
F	\prod 220F	\llcorner 221F	\mathbb{f} 222F	ζ 223F	\approx 224F	\doteq 225F	$\not\approx$ 226F	$\not\approx$ 227F	\sqsupset 228F	\boxplus 229F	$\not\approx$ 22AF	\triangleleft 22BF	\wedge 22CF	\wedge 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 $\not\exists$
- 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 $\not\in$
- 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 $\not\ni$ DOES NOT CONTAIN AS MEMBER
≡ 220B \ni 0338 $\not\ni$
- 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 $\sum\limits$ 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 \dagger 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 \cdot middle dot
→ 2022 \bullet bullet
→ 2024 \cdot one dot leader
- 221A $\sqrt{\quad}$ SQUARE ROOT
= radical sign
→ 2713 \checkmark check mark
- 221B $\sqrt[3]{\quad}$ CUBE ROOT
→ 0606 $\sqrt[3]{\quad}$ arabic-indic cube root
- 221C $\sqrt[4]{\quad}$ FOURTH ROOT
→ 0607 $\sqrt[4]{\quad}$ 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 \llcorner RIGHT ANGLE
- 2220 \sphericalangle ANGLE
→ 299F \sphericalangle acute angle
- 2221 \sphericalangle MEASURED ANGLE
- 2222 \sphericalangle SPHERICAL ANGLE
= angle arc

Relations

- 2223 $|$ DIVIDES
= such that
= APL stile
→ 007C $|$ vertical line
→ 01C0 $|$ latin letter dental click
- 2224 \nmid DOES NOT DIVIDE
≡ 2223 $|$ 0338 $\not\mid$
- 2225 \parallel PARALLEL TO
→ 01C1 \parallel latin letter lateral click
→ 2016 \parallel double vertical line
- 2226 \nparallel NOT PARALLEL TO
≡ 2225 \parallel 0338 $\not\parallel$

Logical and set operators

- 2227 \wedge LOGICAL AND
= wedge, conjunction
→ 22C0 \bigwedge n-ary logical and
→ 2303 \frown up arrowhead
- 2228 \vee LOGICAL OR
= vee, disjunction
→ 22C1 \bigvee n-ary logical or
→ 2304 \smile down arrowhead
- 2229 \cap INTERSECTION
= cap, hat
→ 22C2 \bigcap n-ary intersection
~ 2229 FE00 \cap with serifs
- 222A \cup UNION
= cup
→ 22C3 \bigcup 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 $\int\limits_{\circlearrowleft}$ CLOCKWISE CONTOUR INTEGRAL
- 2233 $\int\limits_{\circlearrowright}$ 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 \equiv 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 \approx INVERTED LAZY S
= most positive

Miscellaneous mathematical symbol

- 223F \sim SINE WAVE
= alternating current

Operator

- 2240 \wr WREATH PRODUCT

Relations

- 2241 $\not\sim$ NOT TILDE
≡ 223C \sim 0338 $\not\sim$
- 2242 $\not\approx$ MINUS TILDE
- 2243 \approx ASYMPTOTICALLY EQUAL TO
- 2244 $\not\approx$ NOT ASYMPTOTICALLY EQUAL TO
≡ 2243 \approx 0338 $\not\approx$
- 2245 \cong APPROXIMATELY EQUAL TO
- 2246 $\not\cong$ APPROXIMATELY BUT NOT ACTUALLY EQUAL TO
- 2247 $\not\cong$ NEITHER APPROXIMATELY NOR ACTUALLY EQUAL TO
≡ 2245 \cong 0338 $\not\cong$
- 2248 \approx ALMOST EQUAL TO
= asymptotic to
- 2249 $\not\approx$ NOT ALMOST EQUAL TO
≡ 2248 \approx 0338 $\not\approx$
- 224A \cong ALMOST EQUAL OR EQUAL TO
- 224B \approx TRIPLE TILDE
- 224C \equiv ALL EQUAL TO
• reversed tilde and lazy S are glyph variants
- 224D \asymp 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 \doteq ESTIMATES
= corresponds to
- 225A \doteq EQUIANGULAR TO
- 225B \doteq STAR EQUALS
- 225C \doteq DELTA EQUAL TO
= equiangular
= equal to by definition

225D	≐	EQUAL TO BY DEFINITION
225E	≐	MEASURED BY
225F	≐	QUESTIONED EQUAL TO
2260	≠	NOT EQUAL TO → 003D = equals sign → 01C2 † latin letter alveolar click ≐ 003D = 0338 ∅
2261	≐	IDENTICAL TO
2262	≠	NOT IDENTICAL TO ≐ 2261 ≐ 0338 ∅
2263	≐	STRICTLY EQUIVALENT TO
2264	≤	LESS-THAN OR EQUAL TO
2265	≥	GREATER-THAN OR EQUAL TO
2266	≤	LESS-THAN OVER EQUAL TO
2267	≥	GREATER-THAN OVER EQUAL TO
2268	≠	LESS-THAN BUT NOT EQUAL TO ~ 2268 FE00 ≐ with vertical stroke
2269	≠	GREATER-THAN BUT NOT EQUAL TO ~ 2269 FE00 ≐ with vertical stroke
226A	≪	MUCH LESS-THAN → 00AB ≪ left-pointing double angle quotation mark
226B	≫	MUCH GREATER-THAN → 00BB ≫ right-pointing double angle quotation mark
226C	⋈	BETWEEN = plaintiff, quantic
226D	≠	NOT EQUIVALENT TO ≐ 224D ≠ 0338 ∅
226E	≠	NOT LESS-THAN ≐ 003C < 0338 ∅
226F	≠	NOT GREATER-THAN ≐ 003E > 0338 ∅
2270	≠	NEITHER LESS-THAN NOR EQUAL TO ≐ 2264 ≤ 0338 ∅
2271	≠	NEITHER GREATER-THAN NOR EQUAL TO ≐ 2265 ≥ 0338 ∅
2272	≲	LESS-THAN OR EQUIVALENT TO ~ 2272 FE00 ≲ following the slant of the lower leg
2273	≳	GREATER-THAN OR EQUIVALENT TO ~ 2273 FE00 ≳ following the slant of the lower leg
2274	≠	NEITHER LESS-THAN NOR EQUIVALENT TO ≐ 2272 ≲ 0338 ∅
2275	≠	NEITHER GREATER-THAN NOR EQUIVALENT TO ≐ 2273 ≳ 0338 ∅
2276	≍	LESS-THAN OR GREATER-THAN
2277	≍	GREATER-THAN OR LESS-THAN
2278	≍	NEITHER LESS-THAN NOR GREATER-THAN ≐ 2276 ≤ 0338 ∅
2279	≍	NEITHER GREATER-THAN NOR LESS-THAN ≐ 2277 ≥ 0338 ∅
227A	<	PRECEDES = lower rank than → 22B0 ≪ precedes under relation
227B	>	SUCCEEDS = higher rank than → 22B1 ≫ succeeds under relation
227C	≍	PRECEDES OR EQUAL TO
227D	≍	SUCCEEDS OR EQUAL TO
227E	≍	PRECEDES OR EQUIVALENT TO
227F	≍	SUCCEEDS OR EQUIVALENT TO

2280	≠	DOES NOT PRECEDE ≐ 227A < 0338 ∅
2281	≠	DOES NOT SUCCEED ≐ 227B > 0338 ∅
2282	⊂	SUBSET OF = included in set → 2E26 ⊂ left sideways u bracket
2283	⊃	SUPERSET OF = includes in set → 2E27 ⊃ right sideways u bracket
2284	⊄	NOT A SUBSET OF ≐ 2282 ⊂ 0338 ∅
2285	⊄	NOT A SUPERSET OF ≐ 2283 ⊃ 0338 ∅
2286	⊆	SUBSET OF OR EQUAL TO
2287	⊇	SUPERSET OF OR EQUAL TO
2288	⊄	NEITHER A SUBSET OF NOR EQUAL TO ≐ 2286 ⊆ 0338 ∅
2289	⊄	NEITHER A SUPERSET OF NOR EQUAL TO ≐ 2287 ⊇ 0338 ∅
228A	⊄	SUBSET OF WITH NOT EQUAL TO ~ 228A FE00 ⊄ with stroke through bottom members
228B	⊄	SUPERSET OF WITH NOT EQUAL TO ~ 228B FE00 ⊄ with stroke through bottom members

Operators

228C	⊎	MULTISET
228D	⊗	MULTISET MULTIPLICATION → 2A03 ⊔ n-ary union operator with dot → 2A40 ⊓ intersection with dot
228E	⊕	MULTISET UNION = z notation bag addition → 2A04 ⊔ n-ary union operator with plus

Relations

228F	⊆	SQUARE IMAGE OF
2290	⊆	SQUARE ORIGINAL OF
2291	⊆	SQUARE IMAGE OF OR EQUAL TO
2292	⊆	SQUARE ORIGINAL OF OR EQUAL TO

Operators

2293	⊓	SQUARE CAP → 2A05 ⊓ n-ary square intersection operator ~ 2293 FE00 ⊓ with serifs
2294	⊔	SQUARE CUP → 2A06 ⊔ n-ary square union operator ~ 2294 FE00 ⊔ with serifs
2295	⊕	CIRCLED PLUS = direct sum = vector pointing into page → 2A01 ⊕ n-ary circled plus operator → 1F728 ⊕ alchemical symbol for verdigris ~ 2295 FE00 ⊕ with white rim
2296	⊖	CIRCLED MINUS = symmetric difference → 29B5 ⊖ circle with horizontal bar → 1F714 ⊖ alchemical symbol for salt

- 2297 ⊗ CIRCLED TIMES
= tensor product
= vector pointing into page
→ 26D2 ⊗ circled crossing lanes
→ 2A02 ⊗ n-ary circled times operator
→ 2BBE ⊗ circled x
~ 2297 FE00 ⊗ with white rim
- 2298 ⊘ CIRCLED DIVISION SLASH
- 2299 ⊙ CIRCLED DOT OPERATOR
= direct product
= vector pointing out of page
→ 0298 ⊙ latin letter bilabial click
→ 2609 ⊙ sun
→ 2A00 ⊙ n-ary circled dot operator
- 229A ⊚ CIRCLED RING OPERATOR
→ 233E ⊚ apl functional symbol circle jot
→ 25CE ⊚ bullseye
- 229B ⊛ CIRCLED ASTERISK OPERATOR
→ 235F ⊛ apl functional symbol circle star
- 229C ⊖ CIRCLED EQUALS
~ 229C FE00 ⊖ with equal sign touching the circle
- 229D ⊖ CIRCLED DASH
- 229E ⊞ SQUARED PLUS
- 229F ⊞ SQUARED MINUS
- 22A0 ⊠ SQUARED TIMES
→ 2612 ⊠ ballot box with x
→ 26DD ⊠ squared saltire
→ 1F771 ⊠ alchemical symbol for month
- 22A1 ⊡ SQUARED DOT OPERATOR
→ 1F755 ⊡ alchemical symbol for urine
- 22A2 ⊢ RIGHT TACK
= turnstile
= proves, implies, yields
= reducible
- 22A3 ⊣ LEFT TACK
= reverse turnstile
= non-theorem, does not yield

Miscellaneous mathematical symbols

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

Relations

- 22A6 ⊢ ASSERTION
= reduces to
- 22A7 ⊨ MODELS
- 22A8 ⊨ TRUE
= statement is true, valid
= is a tautology
= satisfies
= results in
- 22A9 ⊨ FORCES
- 22AA ≡ TRIPLE VERTICAL BAR RIGHT TURNSTILE
- 22AB ≡ DOUBLE VERTICAL BAR DOUBLE RIGHT TURNSTILE
- 22AC ≢ DOES NOT PROVE
≡ 22A2 ⊢ 0338 ∅
- 22AD ≢ NOT TRUE
≡ 22A8 ⊨ 0338 ∅

- 22AE ≢ DOES NOT FORCE
≡ 22A9 ⊨ 0338 ∅
- 22AF ≢ NEGATED DOUBLE VERTICAL BAR DOUBLE RIGHT TURNSTILE
≡ 22AB ⊨ 0338 ∅
- 22B0 ≺ PRECEDES UNDER RELATION
→ 227A < precedes
- 22B1 ≻ SUCCEEDS UNDER RELATION
→ 227B > succeeds
- 22B2 ◁ NORMAL SUBGROUP OF
→ 25C5 ◁ white left-pointing pointer
- 22B3 ▷ CONTAINS AS NORMAL SUBGROUP
→ 25BB ▷ white right-pointing pointer
- 22B4 ◁ NORMAL SUBGROUP OF OR EQUAL TO
- 22B5 ▷ CONTAINS AS NORMAL SUBGROUP OR EQUAL TO
- 22B6 ↪ ORIGINAL OF
- 22B7 ↩ IMAGE OF
- 22B8 ↲ MULTIMAP
- 22B9 † HERMITIAN CONJUGATE MATRIX

Operators

- 22BA ⊔ INTERCALATE
- 22BB ⊕ XOR
→ 26BA ⊕ semisextile
- 22BC ⊘ NAND
→ 2305 ⊘ projective
→ 26BB ⊘ quincunx
- 22BD ⊖ NOR

Miscellaneous mathematical symbols

- 22BE ⊔ RIGHT ANGLE WITH ARC
- 22BF ⊔ RIGHT TRIANGLE

N-ary operators

- 22C0 ∧ N-ARY LOGICAL AND
• also used to denote the universal quantifier
→ 2227 ∧ logical and
- 22C1 ∨ N-ARY LOGICAL OR
• also used to denote the existential quantifier
→ 2228 ∨ logical or
- 22C2 ∩ N-ARY INTERSECTION
= z notation generalised intersection
→ 2229 ∩ intersection
- 22C3 ∪ N-ARY UNION
= z notation generalised union
→ 222A ∪ union

Operators

- 22C4 ∙ DIAMOND OPERATOR
→ 25C7 ∙ white diamond
→ 2B29 ∙ 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

Relation

22C8 \bowtie BOWTIE
→ 2445 \bowtie ocr bow tie

Operators

22C9 \ltimes LEFT NORMAL FACTOR SEMIDIRECT PRODUCT
22CA \rtimes RIGHT NORMAL FACTOR SEMIDIRECT PRODUCT
22CB \lrcorner LEFT SEMIDIRECT PRODUCT
22CC \rceil RIGHT SEMIDIRECT PRODUCT
→ 2041 \lrcorner caret insertion point

Relation

22CD \preceq REVERSED TILDE EQUALS

Logical operators

22CE \vee CURLY LOGICAL OR
22CF \wedge CURLY LOGICAL AND

Relations

22D0 \Subset DOUBLE SUBSET
22D1 \Supset DOUBLE SUPERSET

Operators

22D2 \pitchfork DOUBLE INTERSECTION
22D3 \uplus DOUBLE UNION

Relations

22D4 \pitchfork PITCHFORK
= proper intersection
22D5 $\#$ EQUAL AND PARALLEL TO
→ 2317 $\#$ viewdata square
22D6 \lessdot LESS-THAN WITH DOT
22D7 \gtrdot GREATER-THAN WITH DOT
22D8 \lll VERY MUCH LESS-THAN
22D9 \ggg VERY MUCH GREATER-THAN
22DA \lesseqgtr LESS-THAN EQUAL TO OR GREATER-THAN
~ 22DA FE00 \lesseqgtr with slanted equal
22DB \gtreqlessgtr GREATER-THAN EQUAL TO OR LESS-THAN
~ 22DB FE00 \gtreqlessgtr with slanted equal
22DC \lesseqgtr EQUAL TO OR LESS-THAN
22DD \gtreqlessgtr EQUAL TO OR GREATER-THAN
22DE \lesseqgtr EQUAL TO OR PRECEDES
22DF \gtreqlessgtr EQUAL TO OR SUCCEEDS
22E0 \nsubseteq DOES NOT PRECEDE OR EQUAL
≡ 227C \leq 0338 \neq
22E1 \nsucceq DOES NOT SUCCEED OR EQUAL
≡ 227D \geq 0338 \neq
22E2 \ncong NOT SQUARE IMAGE OF OR EQUAL TO
≡ 2291 \sqsubseteq 0338 \neq
22E3 \ncong NOT SQUARE ORIGINAL OF OR EQUAL TO
≡ 2292 \sqsupseteq 0338 \neq
22E4 \nsquare SQUARE IMAGE OF OR NOT EQUAL TO
22E5 \nsquare SQUARE ORIGINAL OF OR NOT EQUAL TO
22E6 \nlessdot LESS-THAN BUT NOT EQUIVALENT TO
22E7 \ngtrdot GREATER-THAN BUT NOT EQUIVALENT TO
22E8 \npreceq PRECEDES BUT NOT EQUIVALENT TO
22E9 \nsucceq SUCCEEDS BUT NOT EQUIVALENT TO
22EA \nsubseteq NOT NORMAL SUBGROUP OF
≡ 22B2 \triangleleft 0338 \neq
22EB \nsubseteq DOES NOT CONTAIN AS NORMAL SUBGROUP
≡ 22B3 \triangleright 0338 \neq
22EC \nsubseteq NOT NORMAL SUBGROUP OF OR EQUAL TO
≡ 22B4 \trianglelefteq 0338 \neq

22ED \nsubseteq DOES NOT CONTAIN AS NORMAL SUBGROUP OR EQUAL
≡ 22B5 \trianglerighteq 0338 \neq

22EE \vdots VERTICAL ELLIPSIS

- these four ellipses are used for matrix row/column elision
- 205D \vdots tricolon
- 2026 \dots horizontal ellipsis
- FE19 \vdots presentation form for vertical horizontal ellipsis

22EF \cdots MIDLINE HORIZONTAL ELLIPSIS

22F0 \therefore UP RIGHT DIAGONAL ELLIPSIS

22F1 \therecedil DOWN RIGHT DIAGONAL ELLIPSIS

22F2 \in ELEMENT OF WITH LONG HORIZONTAL STROKE

22F3 \in ELEMENT OF WITH VERTICAL BAR AT END OF HORIZONTAL STROKE

22F4 \in SMALL ELEMENT OF WITH VERTICAL BAR AT END OF HORIZONTAL STROKE

22F5 \in ELEMENT OF WITH DOT ABOVE

22F6 \in ELEMENT OF WITH OVERBAR

22F7 \in SMALL ELEMENT OF WITH OVERBAR

22F8 \in ELEMENT OF WITH UNDERBAR

22F9 \in ELEMENT OF WITH TWO HORIZONTAL STROKES

22FA \ni CONTAINS WITH LONG HORIZONTAL STROKE

































22FB \ni CONTAINS WITH VERTICAL BAR AT END OF HORIZONTAL STROKE

22FC \ni SMALL CONTAINS WITH VERTICAL BAR AT END OF HORIZONTAL STROKE

22FD \ni CONTAINS WITH OVERBAR

22FE \ni SMALL CONTAINS WITH OVERBAR

22FF \in 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>