

## 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 17.0*

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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-17.0/> for charts showing only the characters added in Unicode 17.0. See <https://www.unicode.org/Public/17.0.0/charts/> for a complete archived file of character code charts for Unicode 17.0. See <https://www.unicode.org/charts/About.html#Conventions> for conventions used in these code charts, and other general information.

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These charts are provided as the online reference to the character contents of the Unicode Standard, Version 17.0 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 17.0, online at <https://www.unicode.org/versions/Unicode17.0.0/>, as well as the Unicode Standard Annexes, 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.

### Fonts

The shapes of the reference glyphs used in these code charts are not prescriptive. Considerable variation is to be expected in actual fonts.

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

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

**Miscellaneous mathematical symbols**

- 2200  $\forall$  FOR ALL  
= universal quantifier
- 2201  $\complement$  COMPLEMENT  
→ 0297  $\complement$  latin letter stretched c
- 2202  $\partial$  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  $\Delta$  INCREMENT  
= Laplace operator  
= forward difference  
= symmetric difference (in set theory)  
• other symbols may also be used for symmetric difference  
→ 0394  $\Delta$  greek capital letter delta  
→ 25B3  $\Delta$  white up-pointing triangle
- 2207  $\nabla$  NABLA  
= backward difference  
= gradient, del  
• used for Laplacian operator (written with superscript 2)  
→ 25BD  $\nabla$  white down-pointing triangle

**Set membership**

- 2208  $\in$  ELEMENT OF
- 2209  $\notin$  NOT AN ELEMENT OF  
≡ 2208  $\in$  0338  $\not\in$
- 220A  $\epsilon$  SMALL ELEMENT OF  
• originates in math pi fonts; not the straight epsilon  
→ 03F5  $\epsilon$  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  $\sum$  double-struck n-ary summation

**Operators**

- 2212  $-$  MINUS SIGN  
→ 002D  $-$  hyphen-minus  
→ 2796  $\text{—}$  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  
• may be used to represent the telephony asterisk seen on keypads  
→ 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  $\cdot$  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  $\alpha$  greek small letter alpha

**Miscellaneous mathematical symbol**

- 221E  $\infty$  INFINITY

**Angles**

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

- 221F  $\perp$  RIGHT ANGLE  
= with (in chess notation)  
→ 2BFE  $\perp$  reversed right angle
- 2220  $\sphericalangle$  ANGLE  
• used in astrological contexts for aspect semisquare  
→ 299F  $\sphericalangle$  acute angle
- 2221  $\sphericalapprox$  MEASURED ANGLE
- 2222  $\sphericalarc$  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 TO  
 → 01C1 || latin letter lateral click  
 → 2016 || double vertical line
- 2226 † NOT PARALLEL TO  
 ≡ 2225 || 0338 ∅

**Logical and set operators**

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

**Integrals**

- 222B ∫ INTEGRAL  
 → 0283 ∫ latin small letter esh
- 222C ∬ DOUBLE INTEGRAL  
 ≈ 222B ∫ 222B ∫
- 222D ∭ TRIPLE INTEGRAL  
 → 2A0C ∭ quadruple integral operator  
 ≈ 222B ∫ 222B ∫ 222B ∫
- 222E ∮ CONTOUR INTEGRAL  
 → 2A15 ∮ integral around a point operator
- 222F ∯ SURFACE INTEGRAL  
 ≈ 222E ∮ 222E ∮
- 2230 ∭ VOLUME INTEGRAL  
 ≈ 222E ∮ 222E ∮ 222E ∮
- 2231 ∫ CLOCKWISE INTEGRAL
- 2232 ∮ CLOCKWISE CONTOUR INTEGRAL
- 2233 ∮ ANTICLOCKWISE CONTOUR INTEGRAL  
 • clockwise or anticlockwise arrows do not reverse during layout mirroring

**Miscellaneous mathematical symbols**

- 2234 ∴ THEREFORE  
 → 26EC ∴ historic site
- 2235 ∵ BECAUSE

**Relations**

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

**Operator**

- 2238 ∸ DOT MINUS  
 = saturating subtraction  
 • sometimes claimed as notation for symmetric set difference, but 2206 Δ is preferred

**Relation**

- 2239 ∹ EXCESS

**Operator**

- 223A ∷ GEOMETRIC PROPORTION

**Relations**

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

**Miscellaneous mathematical symbol**

- 223F ∼ SINE WAVE  
 = alternating current

**Operator**

- 2240 ∸ WREATH PRODUCT

**Relations**

- 2241 ∽ NOT TILDE  
 ≡ 223C ∼ 0338 ∅
- 2242 ∸ MINUS TILDE
- 2243 ≈ ASYMPTOTICALLY EQUAL TO
- 2244 ≠ NOT ASYMPTOTICALLY EQUAL TO  
 ≡ 2243 ≈ 0338 ∅
- 2245 ≐ APPROXIMATELY EQUAL TO  
 → 2A70 ≐ approximately equal or equal to
- 2246 ≏ APPROXIMATELY BUT NOT ACTUALLY EQUAL TO
- 2247 ≠ NEITHER APPROXIMATELY NOR ACTUALLY EQUAL TO  
 ≡ 2245 ≐ 0338 ∅
- 2248 ≈ ALMOST EQUAL TO  
 = asymptotic to
- 2249 ≠ NOT ALMOST EQUAL TO  
 ≡ 2248 ≈ 0338 ∅
- 224A ≐ ALMOST EQUAL OR EQUAL TO
- 224B ≏ TRIPLE TILDE
- 224C ≐ ALL EQUAL TO  
 • reversed tilde and lazy S are glyph variants
- 224D ∸ EQUIVALENT TO
- 224E ⇔ GEOMETRICALLY EQUIVALENT TO
- 224F ∸ DIFFERENCE BETWEEN
- 2250 ∸ APPROACHES THE LIMIT
- 2251 ∸ GEOMETRICALLY EQUAL TO
- 2252 ∸ APPROXIMATELY EQUAL TO OR THE IMAGE OF  
 = nearly equals
- 2253 ∸ IMAGE OF OR APPROXIMATELY EQUAL TO
- 2254 ∸ COLON EQUALS
- 2255 ∸ EQUALS COLON
- 2256 ∸ RING IN EQUAL TO
- 2257 ∸ RING EQUAL TO  
 = approximately equal to
- 2258 ≐ CORRESPONDS TO

2259	$\hat{=}$	ESTIMATES = corresponds to	2279	$\nrightarrow$	NEITHER GREATER-THAN NOR LESS-THAN $\equiv 2277 \gtrsim 0338 \not\phi$
225A	$\hat{=}$	EQUIANGULAR TO	227A	$\prec$	PRECEDES = lower rank than $\rightarrow 22B0 \prec$ precedes under relation
225B	$\hat{=}$	STAR EQUALS	227B	$\succ$	SUCCEEDS = higher rank than $\rightarrow 22B1 \succ$ succeeds under relation
225C	$\hat{=}$	DELTA EQUAL TO = equiangular = equal to by definition	227C	$\preceq$	PRECEDES OR EQUAL TO
225D	$\hat{=}$	EQUAL TO BY DEFINITION	227D	$\succeq$	SUCCEEDS OR EQUAL TO
225E	$\hat{=}$	MEASURED BY	227E	$\preceq$	PRECEDES OR EQUIVALENT TO
225F	$\hat{=}$	QUESTIONED EQUAL TO	227F	$\succeq$	SUCCEEDS OR EQUIVALENT TO
2260	$\neq$	NOT EQUAL TO $\rightarrow 003D =$ equals sign $\rightarrow 01C2 \ddagger$ latin letter alveolar click $\equiv 003D = 0338 \not\phi$	2280	$\nrightarrow$	DOES NOT PRECEDE $\equiv 227A \prec 0338 \not\phi$
2261	$\equiv$	IDENTICAL TO	2281	$\nrightarrow$	DOES NOT SUCCEED $\equiv 227B \succ 0338 \not\phi$
2262	$\not\equiv$	NOT IDENTICAL TO $\equiv 2261 \equiv 0338 \not\phi$	2282	$\subset$	SUBSET OF = included in set $\rightarrow 2E26 \subset$ left sideways u bracket
2263	$\equiv$	STRICTLY EQUIVALENT TO	2283	$\supset$	SUPERSET OF = includes in set $\rightarrow 2E27 \supset$ right sideways u bracket
2264	$\leq$	LESS-THAN OR EQUAL TO $\rightarrow 003C <$ less-than sign	2284	$\not\subset$	NOT A SUBSET OF $\equiv 2282 \subset 0338 \not\phi$
2265	$\geq$	GREATER-THAN OR EQUAL TO $\rightarrow 003E >$ greater-than sign	2285	$\not\supset$	NOT A SUPERSET OF $\equiv 2283 \supset 0338 \not\phi$
2266	$\leq$	LESS-THAN OVER EQUAL TO	2286	$\subseteq$	SUBSET OF OR EQUAL TO
2267	$\leq$	GREATER-THAN OVER EQUAL TO	2287	$\supseteq$	SUPERSET OF OR EQUAL TO
2268	$\leq$	LESS-THAN BUT NOT EQUAL TO $\rightarrow 2A87 \leq$ less-than and single-line not equal to $\sim 2268 FE00 \leq$ with vertical stroke	2288	$\not\subseteq$	NEITHER A SUBSET OF NOR EQUAL TO $\equiv 2286 \subseteq 0338 \not\phi$
2269	$\leq$	GREATER-THAN BUT NOT EQUAL TO $\rightarrow 2A88 \geq$ greater-than and single-line not equal to $\sim 2269 FE00 \geq$ with vertical stroke	2289	$\not\supseteq$	NEITHER A SUPERSET OF NOR EQUAL TO $\equiv 2287 \supseteq 0338 \not\phi$
226A	$\ll$	MUCH LESS-THAN $\rightarrow 00AB \ll$ left-pointing double angle quotation mark	228A	$\not\subseteq$	SUBSET OF WITH NOT EQUAL TO $\sim 228A FE00 \not\subseteq$ with stroke through bottom members
226B	$\gg$	MUCH GREATER-THAN $\rightarrow 00BB \gg$ right-pointing double angle quotation mark	228B	$\not\supseteq$	SUPERSET OF WITH NOT EQUAL TO $\sim 228B FE00 \not\supseteq$ with stroke through bottom members
226C	$\text{\textcircled{B}}$	BETWEEN = plaintiff, quantic	<b>Operators</b>		
226D	$\nrightarrow$	NOT EQUIVALENT TO $\equiv 224D \asymp 0338 \not\phi$	228C	$\text{\textcircled{B}}$	MULTISET
226E	$\nrightarrow$	NOT LESS-THAN $\equiv 003C < 0338 \not\phi$	228D	$\text{\textcircled{B}}$	MULTISET MULTIPLICATION $\rightarrow 2A03 \text{\textcircled{B}}$ n-ary union operator with dot $\rightarrow 2A40 \text{\textcircled{B}}$ intersection with dot
226F	$\nrightarrow$	NOT GREATER-THAN $\equiv 003E > 0338 \not\phi$	228E	$\text{\textcircled{B}}$	MULTISET UNION = z notation bag addition $\rightarrow 2A04 \text{\textcircled{B}}$ n-ary union operator with plus
2270	$\nrightarrow$	NEITHER LESS-THAN NOR EQUAL TO $\equiv 2264 \leq 0338 \not\phi$	<b>Relations</b>		
2271	$\nrightarrow$	NEITHER GREATER-THAN NOR EQUAL TO $\equiv 2265 \geq 0338 \not\phi$	228F	$\square$	SQUARE IMAGE OF
2272	$\lesssim$	LESS-THAN OR EQUIVALENT TO $\sim 2272 FE00 \lesssim$ following the slant of the lower leg	2290	$\square$	SQUARE ORIGINAL OF
2273	$\gtrsim$	GREATER-THAN OR EQUIVALENT TO $\sim 2273 FE00 \gtrsim$ following the slant of the lower leg	2291	$\square$	SQUARE IMAGE OF OR EQUAL TO
2274	$\nrightarrow$	NEITHER LESS-THAN NOR EQUIVALENT TO $\equiv 2272 \lesssim 0338 \not\phi$	2292	$\square$	SQUARE ORIGINAL OF OR EQUAL TO
2275	$\nrightarrow$	NEITHER GREATER-THAN NOR EQUIVALENT TO $\equiv 2273 \gtrsim 0338 \not\phi$	<b>Operators</b>		
2276	$\leq$	LESS-THAN OR GREATER-THAN	2293	$\sqcap$	SQUARE CAP $\rightarrow 2A05 \sqcap$ n-ary square intersection operator $\sim 2293 FE00 \sqcap$ with serifs
2277	$\geq$	GREATER-THAN OR LESS-THAN	2294	$\sqcup$	SQUARE CUP $\rightarrow 2A06 \sqcup$ n-ary square union operator $\sim 2294 FE00 \sqcup$ with serifs
2278	$\nrightarrow$	NEITHER LESS-THAN NOR GREATER-THAN $\equiv 2276 \leq 0338 \not\phi$			

- 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  $\otimes$  CIRCLED ASTERISK OPERATOR  
→ 235F  $\otimes$  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  $\boxdot$  SQUARED DOT OPERATOR  
→ 1F755  $\boxdot$  alchemical symbol for urine  
→ 1FBBC  $\boxdot$  right open squared dot
- 22A2  $\vdash$  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  $\vdash$  ASSERTION  
= reduces to
- 22A7  $\vDash$  MODELS
- 22A8  $\vDash$  TRUE  
= statement is true, valid  
= is a tautology  
= satisfies  
= results in
- 22A9  $\Vdash$  FORCES
- 22AA  $\equiv$  TRIPLE VERTICAL BAR RIGHT TURNSTILE
- 22AB  $\Vdash$  DOUBLE VERTICAL BAR DOUBLE RIGHT TURNSTILE
- 22AC  $\nVdash$  DOES NOT PROVE  
 $\equiv$  22A2  $\vdash$  0338  $\not\vdash$
- 22AD  $\nVdash$  NOT TRUE  
 $\equiv$  22A8  $\vDash$  0338  $\not\vdash$
- 22AE  $\nVdash$  DOES NOT FORCE  
 $\equiv$  22A9  $\Vdash$  0338  $\not\vdash$
- 22AF  $\nVdash$  NEGATED DOUBLE VERTICAL BAR DOUBLE RIGHT TURNSTILE  
 $\equiv$  22AB  $\Vdash$  0338  $\not\vdash$
- 22B0  $\preceq$  PRECEDES UNDER RELATION  
→ 227A  $<$  precedes
- 22B1  $\succeq$  SUCCEEDS UNDER RELATION  
→ 227B  $>$  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  $\circleftarrow$  ORIGINAL OF
- 22B7  $\circrightarrow$  IMAGE OF
- 22B8  $\multimap$  MULTIMAP
- 22B9  $\dagger$  HERMITIAN CONJUGATE MATRIX

**Operators**

- 22BA  $\Uparrow$  INTERCALATE
- 22BB  $\nabla$  XOR  
→ 26BA  $\nabla$  semisextile
- 22BC  $\bar{\wedge}$  NAND  
→ 2305  $\bar{\wedge}$  projective  
→ 26BB  $\bar{\wedge}$  quincunx
- 22BD  $\nabla$  NOR

**Miscellaneous mathematical symbols**

- 22BE  $\sphericalangle$  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  $\wedge$  logical and
- 22C1  $\bigvee$  N-ARY LOGICAL OR  
• also used to denote the existential quantifier  
→ 2228  $\vee$  logical or
- 22C2  $\bigcap$  N-ARY INTERSECTION  
= z notation generalised intersection  
→ 2229  $\cap$  intersection
- 22C3  $\bigcup$  N-ARY UNION  
= z notation generalised union  
→ 222A  $\cup$  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  
• ambiguous sign conflating two operators  
→ 00B1 ± plus-minus sign  
→ 00D7 × multiplication sign  
→ 00F7 ÷ division sign  
→ 2715 X 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
	2205
	 zero with long diagonal stroke overlay form
	2205 FE00
2229	 INTERSECTION
	2229
	 with serifs
	2229 FE00
222A	 UNION
	222A
	 with serifs
	222A FE00
2268	 LESS-THAN BUT NOT EQUAL TO
	2268
	 with vertical stroke
	2268 FE00
2269	 GREATER-THAN BUT NOT EQUAL TO
	2269
	 with vertical stroke
	2269 FE00
2272	 LESS-THAN OR EQUIVALENT TO
	2272
	 following the slant of the lower leg
	2272 FE00
2273	 GREATER-THAN OR EQUIVALENT TO
	2273
	 following the slant of the lower leg
	2273 FE00
228A	 SUBSET OF WITH NOT EQUAL TO
	228A
	 with stroke through bottom members
	228A FE00
228B	 SUPERSET OF WITH NOT EQUAL TO
	228B
	 with stroke through bottom members
	228B FE00
2293	 SQUARE CAP
	2293
	 with serifs
	2293 FE00
2294	 SQUARE CUP
	2294
	 with serifs
	2294 FE00
2295	 CIRCLED PLUS
	2295
	 with white rim
	2295 FE00
2297	 CIRCLED TIMES
	2297
	 with white rim
	2297 FE00
229C	 CIRCLED EQUALS
	229C
	 with equal sign touching the circle
	229C FE00
22DA	 LESS-THAN EQUAL TO OR GREATER-THAN
	22DA
	 with slanted equal
	22DA FE00
22DB	 GREATER-THAN EQUAL TO OR LESS-THAN
	22DB
	 with slanted equal
	22DB FE00