ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ORGANISATION INTERNATIONALE DE NORMALISATION

ISO/IEC JTC1/SC2/WG2

Universal Multiple-Octet Coded Character Set (UCS)

ISO/IEC JTC1/SC2/WG2 N2191
Date: 2000-03-14

Title: Proposal for Encoding Additional Mathematical Symbols in the BMP
Source: U.S. National Body
Status: Working Document of JTC1/SC2/WG2 (and Summary Proposal Form)
Action: For review and comment by JTC1/SC2/WG2
Distribution: Members of JTC1/SC2/WG2

Introduction

This document constitutes the consolidated proposal for completion of the set of mathematical symbols encoded in ISO/IEC 10646.

Additional alphanumeric symbols were added to the CD for 10646-2, and have been under ballot. This proposal provides for the complementary set – those math symbols, operators, and delimiters that are currently missing from the repertoire of math symbols encoded in the BMP of 10646-1.

This proposal is the culmination of a several-year process of collation and review of mathematical symbols, with close cooperation between the Unicode Technical Committee and the STIX Project, involving extensive expertise from the mathematical, scientific, and technical publishing industry. In our opinion, this proposal is now quite mature, having passed the technical scrutiny of the mathematicians and technical publishing experts of the STIX Project, and the character encoding scrutiny of the UTC. It is now ready for review and comment by WG2. We urge consideration for a new subdivision of work for an Amendment to 10646-1 to add this repertoire to the UCS, to meet the expressed needs of the international mathematical, scientific, and technical publishing industry for the representation of mathematics using the ISO/IEC 10646 character encoding.

The document we present here is divided into six parts:
- Introduction, background, rationale, and references
- Annex 1: Proposal summary form
- Annex 2: Draft charts and names list, enumerating the proposed repertoire
- Annex 3: Relevant excerpts from L2/00-002, to illustrate glyphs currently missing from Annex 2
- Annex 4: Symbol variants defined using a Variation Selector (VS)
- Annex 5: Letters of support from major mathematical organizations

Background

This proposal originated as the work of the STIX Project (Scientific and Technical Information eXchange), a working group reporting to STIPUB, a consortium of publishers of mathematical, scientific, and technical books and journals. The ultimate product of the STIX group will be the creation of one comprehensive set of fonts for scientific and technical publishing. This set of fonts should be adopted and supported by all major STM (scientific, technical, and mathematics) publishers internationally. It will also be made available for general use under license but free of charge, with the explicit aim to ease and foster the uninhibited flow, exchange, and linking of scientific information worldwide.

The symbol complement of the STIX font set will be based on the symbols in this proposal along with many other symbols already encoded in ISO/IEC 10646, as well as variant forms not included here (because they are required by publishing house styles without different meaning from symbols included above). Additional technical symbols from areas other than mathematics will also be included in the font definitions.

More information about the STIX Project can be found at the STIX web site, hosted by the American Mathematical Society (AMS): http://www.ams.org/STIX/

The Unicode Technical Committee worked closely with the STIX Project over the past two years, to refine the proposal into a character encoding proposal, suitable for addition to ISO/IEC 10646. During this process, duplicates have been identified and removed, and clarification of distinctions between characters, glyphs, and variants has been made. The original proposal was divided into two large portions: a proposal for the addition of alphanumeric symbols (under ballot for the CD for 10646-2), and this proposal for the addition of other mathematical symbols.

As this proposal has developed, it has been connected to other standardization efforts, which are now interdependent on the completion of mathematical symbol encoding in ISO/IEC 10646. In particular, the special problems of handling technical texts have been examined in detail by the W3C HTML Math Working Group; their MathML proposal, which is interdependent with this proposed repertoire of math symbols for ISO/IEC 10646, was accepted as a W3C Recommendation on 7 April 1998 [see http://www.w3c.org/Math].The work of the HTML Math Working Group is also related to the work of the OpenMath Consortium. Major vendors of mathematical formatting software are also dependent on the resolution of the encoding of additional mathematical symbols in ISO/IEC 10646-1.

Rationale

Scientific communication and publication via the World Wide Web are currently hindered by the absence both of suitable symbol fonts and of recognized methods of indicating particular symbols and their relationships to one another.

The availability of a complete UCS character encoding of mathematical symbols, and of a correlated universal font set for their rendering will benefit scientific and technical publishing in several ways:

- Elimination of certain legal problems with distributing PDF files and publishing on the World Wide Web
- Ease of exchange of documents from different publishers
- Simpler and more robust re-use of archived material

The STIX Project group has agreed that the basis for the organization of such a font set should be ISO/IEC 10646/Unicode. ISO/IEC 10646 is the reference character set for XML, and therefore for MathML as well. It is the character set of the programming language Java and underlies all current Windows operating systems, as well as many others. In XML documents, and most importantly for use in MathML, one must be able to identify all notation, either by numerical character reference or by entity reference. But numerical character references are ISO/IEC 10646 numbers, since that is the character set underlying XML. If entity names are used, they must still be mapped to something that applications will be able to handle and render. All of these considerations argue very strongly that the set of mathematical symbols encoded in the UCS should be completed, so as to enable the representation and presentation of mathematics and other technical materials dependent on mathematics – both for the World Wide Web and for data interchange dependent on XML.

In the charts and lists shown in the Annexes, we have included only what we believe to be unique symbols not currently covered by the repertoire of ISO/IEC 10646. The language of mathematics is fluid, and symbols are defined in context to represent particular mathematical concepts. The tool set of an active mathematician ideally consists of several alphabets, whose members can be distinguished from one another, to represent various classes of variables and constants, and a fairly extensive collection of similarly-sized shapes to represent various operations or delimitation of expressions. There are of course many fully standardized shapes that are now used almost exclusively to represent particular operations and relations, but even these are sometimes adopted in fields where they are not already in use and redefined to have some other particular meaning. For this reason, the names suggested for the symbols listed here are in some cases not functionally precise; where multiple varying meanings are possible, or a single precise meaning is not available, the name simply describes the shape of the proposed character.

Variants

Many math symbols occur in two or more variant forms, with the same or similar meanings usually, but not always, attached to both. In order to accommodate the sometimes strong preferences of authors and publishers, a single Variation Selector (VS) is recommended, to be applied to a fixed list of symbols with predetermined results. The Variation Selector follows the symbol whose variant it specifies. As a character by itself, the Variation Selector has no independent appearance; it only functions to choose a particular variant for the character it follows. Only combinations defined by the standard should be meaningful. In any other context, the Variation Selector character should be ignored.

The Variation Selector (VS) in this proposal is completely analogous to the Mongolian Free Variation Selector (MVS) characters already in ISO/IEC 10646. The difference is merely that the MVS characters are only meaningful in combination with other Mongolian characters, to select variants of those characters. The VS is separately proposed, for use in combination with mathematical symbol characters, to select variants of those characters.

The exact list of variants currently known to be required for mathematical, scientific, and technical publishing is shown in Annex 4.

Letter-like Symbols

For a mathematician or other scientist, alphabets provide the symbols to represent ad hoc variables as well as a number of more well-defined concepts. Different styles of alphabets have different meanings, some of which have been formally standardized in some disciplines, but many of which follow only the strength of custom, or even current necessity.

The CD for ISO/IEC 10646-2 includes sets of mathematical alphanumeric symbols that are regularly used in mathematical and technical literature; those alphabets and digits will not be further dealt with here.

There remain, however, some individual letters from or related to these alphabets that are routinely used in a turned or inverted orientation, as well as a few symbols in the style of a particular math alphabet but not part of its normal alphabetic complement. These are considered distinct letter-like symbols, and are therefore candidates for code assignments. They are included in this proposal, along with the larger collection of general mathematical symbols and operators.

Brace Parts

A small collection of brace and bracket parts has also been included in this proposal. These characters are intended to complete the coverage of the PostScript symbol set, as well as some character-like entities used by TeX and other technical typesetting systems. These brace parts are explicitly intended as compatibility characters to match those preexisting repertoires. Their inclusion facilitates the interconversion of data from such systems with systems using the ISO/IEC 10646 character encoding.

Explanation of Conventions in the Annexes

In Annex 3, four data elements are given for each symbol:
- an arbitrary reference ID indicating location in the corresponding chart
- an asterisk (*) if there is an existing symbol in Unicode or another symbol in this collection that appears to be similar
- a one-letter code indicating the class of the symbol
- a proposed name for the symbol (usually based on form; occasionally based on meaning, if dominant)

Note: the proposed name shown in Annex 3 may have been superseded by the name shown in Annex 2. In all cases, the name shown in Annex 2 should take precedence for this proposal. Annex 3 is only attached because of the difficulty of completing a high-quality font for Annex 2 in time to meet the deadline for consideration at the Beijing WG2 meeting.

The one-letter codes indicating the class of the symbol are as follows:
       N: normal or ordinary; e.g., symbol used as a variable
       A: alphabetic; subclass of ordinary
       D: diacritic or combining symbol

P: punctuation
B: binary operator, e.g., $a + b$
R: relation, e.g., $a = b$
L: large operator, e.g. sum, product
O: opening delimiter (assuming left-to-right presentation)
C: closing delimiter (assuming left-to-right presentation)
F: nondirectional delimiter (fence post)

In Annex 3, the two white and two black squares shown as DXEC, DXED, DXF0 and DXF1 are meant to form a size-graded sequence with the present ISO/IEC 10646 squares 25A0, 25A1, 25AA and 25AB. Ideally, the largest should be just a bit larger than 25A0 (but not as large as 2588), and the smallest, just a bit smaller than 25AA (but not quite as small as the dot operator, 22C5). These are used ad hoc to define various operations, with different sizes often indicating the degree of conformity to a particular notion. (Several different geometric shapes are used in this manner, the most common being squares and circles.)

References

International Organization for Standardization, ISO 31/XI-1992. Mathematical signs and symbols for use in the physical sciences and technology, 2nd edition, 1992. (by ref. in ANSI/IEEE P1324)

American Society of Mechanical Engineers, ANSI Y10.20-1975. Mathematical signs and symbols for use in physical sciences and technology, 1975.

Institute of Electrical and Electronics Engineers, ANSI/IEEE P1324 (draft revision of Y10.20), Draft standard mathematical signs and symbols for use in physical sciences and technology, 1992.

ISO/IEC 8879:1986, Information Processing --- Text and Office Systems --- Standard Generalized Markup Language (SGML), Annex D: Public text

ISO/IEC 9573-13, Information Technology --- SGML Support Facilities --- Techniques for Using SGML --- Part 13: Public entity sets for mathematics and science

Stepney, Susan (editor), Proposal to add the ISO Standard Z character set to Unicode/ISO-IEC 10646

SC2 N3393, Committee Draft ISO/IEC CD 10646-2.

L2/98-405, Request for assignment of codes to mathematical and technical symbols that do not appear in Unicode 2.0 or ISO/IEC 10646

L2/98-406, Proposal to encode mathematical variant tags

L2/99-045, Proposal to encode mathematical alphanumeric symbols

L2/99-049, Addendum to L2/98-405: Request for assignment of codes to mathematical and technical symbols

L2/99-159, Request for assignment of codes to mathematical and technical symbols that do not appear in Unicode 2.0 or ISO/IEC 10646 (revised)

L2/99-160, Proposal to encode mathematical variant tags

L2/99-195, Proposal to encode mathematical alphanumeric symbols

L2/99-199, Mathematical Alphabets (for L2/99-195)

L2/99-244R, Request for assignment of codes to mathematical and technical symbols that do not appear in Unicode 2.0 or ISO/IEC 10646

L2/99-346, Mathematical brace pieces.

L2/00-002, Request for assignment of codes to mathematical and technical symbols that do not appear in Unicode 2.0 or ISO/IEC 10646 (supersedes L2/99-244R)

ISO/IEC JTC 1/SC 2/WG 2
PROPOSAL SUMMARY FORM TO ACCOMPANY SUBMISSIONS
FOR ADDITIONS TO THE REPERTOIRE OF ISO/IEC 10646

Please fill Sections A, B and C below. Section D will be filled by SC 2/WG 2.

For instructions and guidance for filling in the form please see the document " Principles and Procedures for Allocation of New Characters and Scripts" (http://www.dkuug.dk/JTC1/SC2/WG2/prot)

A. Administrative

1. Title: **Proposal for Encoding Additional Mathematical Symbols in the BMP**

2. Requester's name: **U.S.**

3. Requester type (Member body/Liaison/Individual contribution): **Member body**

4. Submission date: **2000-03-14**

5. Requester's reference (if applicable): **WG2 N2191**

6. **This is a complete proposal.**

B. Technical - General

1. (Choose one of the following:)

b. The proposal is for addition of character(s) to an existing block.

Name of the existing block:

> Greek and Coptic (3)
> General Punctuation (14)
> Combining Diacritical Marks for Symbols (4)
> Letterlike Symbols (15)
> Arrows (12)
> Mathematical Operators (14)
> Miscellaneous Technical (29)
> Geometric Shapes (8)
> Supplemental Arrows [New block 2900..297F] (128)
> Miscellaneous Math Symbols [New block 2980..29FF] (117)
> Supplemental Math Operators [New block 2A00..2AFF] (247)

Note that the proposed new blocks are conceptually extensions of the existing Arrows and Mathematical Operators blocks, and do not constitute new scripts.

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2. Number of characters in proposal: **951**

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3. Proposed category (see section II, Character Categories):

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4. Proposed Level of Implementation (see clause 15, ISO/IEC 10646-1): **Level 3**

Is a rationale provided for the choice? **Yes**

If Yes, reference:

The repertoire includes 4 combining characters, which can be used in free combinations with other existing 10646 characters. Many relational operators are intended to be usable with overlaid combining marks U+0338 COMBINING LONG SOLIDUS OVERLAY or U+20D2 COMBINING LONG VERTICAL LINE OVERLAY to productively indicate negation. Finally, the mathematical repertoire in general is intended for complex rendering, with the productive application of other combining marks to indicate derivatives, vectors, and many other concepts.

Limited subsets of the mathematical symbols can, of course, be used for Level 1 implementations, but the repertoire addressed by this proposal is aimed at full and complete mathematical rendering and interchange. (Note that this proposal encompasses the symbols needed for mathematical content, but is not intended to cover mathematical markup languages or layout controls.)

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5. Is a repertoire including character names provided? **Yes. See Annex 2.**

a. If YES, are the names in accordance with the 'character naming guidelines' in Annex K of ISO/IEC 10646-1? **Yes**

b. Are the character shapes attached in a reviewable form? **Yes. See Annexes 2 and 3.**

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6. Who will provide the appropriate computerized font (ordered preference: True Type, PostScript or 96x96 bit-mapped format) for publishing the standard?

The Unicode Consortium, working in collaboration with STIPUB and various professional font vendors.

If available now, identify source(s) for the font (include address, e-mail, ftp-site, etc.) and indicate the tools used:

7. References:

a. Are references (to other character sets, dictionaries, descriptive texts etc.) provided? **Yes**

c. Are published examples (such as samples from newspapers, magazines, or other sources) of use of proposed characters attached?

No, not in WG2 N2191. However, a very large collection of source citations has been collected by the STIX Project group of STIPUB. That group constitutes a consortium of mathematical, scientific, and technical publishers who have refined this repertoire on the basis of their publication requirements for symbol usage.

8. Special encoding issues:

Use of a VARIATION SELECTOR. The use of this character is described in the proposal.

Does the proposal address other aspects of character data processing (if applicable) such as input, presentation, sorting, searching, indexing, transliteration etc. (if yes please enclose information)? **Yes**

There are no new input or presentation issues not already present for the existing repertoire of math symbols. Sorting, indexing, and transliteration are generally not an issue for math symbols. Some special letterlike symbols are provided in the repertoire to facilitate searching for some common key mathematical concepts in text documents.

C. Technical - Justification

1. Has this proposal for addition of character(s) been submitted before? **No (with a few exceptions)**

If YES explain.

Note that a few individual characters among the repertoire of 951 may appear in other proposals before WG2. For example, the Q-shaped koppa letters have independently been requested. Several arrow characters from a recent Japanese proposal for symbols to cover JIS X 0213 are also included. The vast majority of the 951 characters in this proposal are requested here for the first time.

2. Has contact been made to members of the user community (for example: National Body, user groups of the script or characters, other experts, etc.)? **Yes**

If YES, with whom?

STIPUB (Scientific and Technical Information Publishing Consortium), representing mathematical and other major technical publishing interests. American Mathematical Society. International Mathematical Union. major mathematical software vendors. W3C MathML participants.

If YES, available relevant documents? See the references and appended approval letters in the proposal.

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3. Information on the user community for the proposed characters (for example: size, demographics, information technology use, or publishing use) is included?

The repertoire is intended for all international mathematical information technology use and for mathematical, scientific, and technical publishing worldwide. It is intended to complete the base symbol set for MathML. It is also intended as the underlying symbol encoding for all major mathematical layout software programs.

Reference:

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4. The context of use for the proposed characters (type of use; common or rare):

Common to rare, depending on the particular subfield of mathematics involved.

Reference:

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5. Are the proposed characters in current use by the user community? **Yes**

If YES, where?

Books, journals, articles, online documents. Reference: STIPUB can provide voluminous references. This constitutes the complete world community of mathematical users: all books, journals, magazines, and other publications in mathematics and scientific and technical disciplines that make use of mathematics, worldwide.

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6. After giving due considerations to the principles in N 1352 must the proposed characters be entirely in the BMP? **Yes**

If YES, is a rationale provided? **Yes**

If YES, reference: **See WG2 N2191.**

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7. Should the proposed characters be kept together in a contiguous range (rather than being scattered)? **Yes and No.**

Exact details of the proposed distribution of the characters into existing and new blocks of 10646 are provided in Annex 2.

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8. Can any of the proposed characters be considered a presentation form of an existing character or character

sequence? **Yes (a few)**

If YES, is a rationale for its inclusion provided? **No**

In these instances, the precedents are already clearly established in the standard. For example, a quadruple integral character is requested; the double and triple integral are already encoded as characters.

If YES, reference:

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9. Can any of the proposed character(s) be considered to be similar (in appearance or function) to an existing character? **Yes**

If YES, is a rationale for its inclusion provided? **No, not in detail.**

There are numerous instances among mathematical symbols where one symbols is generically similar to another in appearance, but where it is well understood in mathematical practice to **not** be the same symbol. Annex 2 provides a number of cross-references, where there might be confusions regarding the distinctiveness of a particular character, either with respect to existing encoded characters in 10646, or with respect to other characters in this proposal. Mathematical symbols are also replete with examples where the same *function* can be represented by different symbols. Multiplication, for example, can already be represented by U+00D7 MULTIPLY or U+2219 BULLET OPERATOR. However, it can also be represented by a zero-width operator, such as in *xy* where this expression represents the variable *x* multiplied by the variable *y*. Multiple symbols corresponding to the same abstract mathematical functions are requested for encoding as separate characters when their *form* is distinct in different mathematical traditions or subfields.

If YES, reference:

WG2 2191 does provide a detailed rationale for the request for two additional sets of squares as geometric shape characters.

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10. Does the proposal include use of combining characters and/or use of composite sequences (see clause 4.11 and 4.13 in ISO/IEC 10646-1)? **Yes**

If YES, is a rationale for such use provided? **Yes**

If YES, reference: **See B.4 above.**

Is a list of composite sequences and their corresponding glyph images (graphic symbols) provided? **No**

Such a list would be unmanageably long, since combining marks are intended for productive use in mathematics.

If YES, reference:

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11. Does the proposal contain characters with any special properties such as control function or similar semantics? **Yes**

If YES, describe in detail (include attachment if necessary)

The VARIATION SELECTOR is described in WG2 N2191, and the list of variants it selects is detailed in

Annex 4.

D. SC 2/WG 2 Administrative (To be completed by SC 2/WG 2)

1. Relevant SC 2/WG 2 document numbers:

2. Status (list of meeting number and corresponding action or disposition):

3. Additional contact to user communities, liaison organizations etc:

4. Assigned category and assigned priority/time frame:

Math Symbols Proposal

First Draft MTHM000307.lst

Created from L2/00-033R and L2/00-002.

File Statistics:

Total Characters: 591
Lines in file: 746
 + Generated: 86
 Name lines: 677
  Characters: 591
  Reserved: 0
  Unassigned: 86
 Secondary lines: 102
  Aliases: 33
  Comments: 14
  Cross Refs: 41
  Can. Decomps: 0
  Compatibility: 14
  Ignored: 0
 Header Lines: 53
  Blocks: 11
  Subheaders: 40
  Notices: 0
  Title lines: 1
  Subtitles: 1
  Page breaks: 0
 Empty lines: 0
 Iso Comments   0
 AnnexP Notes   0

	037	038	039	03A	03B	03C	03D	03E	03F
0			ϊ 0390	Π 03A0	ϋ 03B0	π 03C0			
1			Α 0391	Ρ 03A1	α 03B1	ρ 03C1			
2			Β 0392		β 03B2	ς 03C2			
3			Γ 0393	Σ 03A3	γ 03B3	σ 03C3			
4		΄ 0384	Δ 0394	Τ 03A4	δ 03B4	τ 03C4			Θ 03F4
5		΅ 0385	Ε 0395	Υ 03A5	ε 03B5	υ 03C5			
6		Ά 0386	Ζ 0396	Φ 03A6	ζ 03B6	φ 03C6			
7		· 0387	Η 0397	Χ 03A7	η 03B7	χ 03C7			
8		Έ 0388	Θ 0398	Ψ 03A8	θ 03B8	ψ 03C8	Ϙ 03D8		
9		Ή 0389	Ι 0399	Ω 03A9	ι 03B9	ω 03C9	ϙ 03D9		
A		Ί 038A	Κ 039A	Ϊ 03AA	κ 03BA	ϊ 03CA			
B			Λ 039B	Ϋ 03AB	λ 03BB	ϋ 03CB			
C		Ό 038C	Μ 039C	ά 03AC	μ 03BC	ό 03CC			
D			Ν 039D	έ 03AD	ν 03BD	ύ 03CD			
E	; 037E	Ύ 038E	Ξ 039E	ή 03AE	ξ 03BE	ώ 03CE			
F		Ώ 038F	Ο 039F	ί 03AF	ο 03BF				

Archaic Greek Letters

03D8   Ϙ   GREEK LETTER Q-KOPPA
03D9   ϙ   GREEK SMALL LETTER Q-KOPPA

Greek symbol

03F4   ϴ   GREEK THETA SYMBOL WITH STRAIGHT
         BAR
           → 0472   cyrillic capital letter fita
           ≈ 03B8 θ

	200	201	202	203	204	205	206
0	NQSP 2000		† 2020	‰ 2030		⋯ 2050	
1	MQSP 2001	NB 2011	‡ 2021			⁑ 2051	FA 2061
2	ENSP 2002		● 2022	′ 2032		⁒ 2052	IT 2062
3	MQSP 2003	— 2013	″ 2033			⁓ 2053	VS 2063
4	3/M SP 2004	— 2014		⁄ 2044		⁔ 2054	
5	4/M SP 2005	— 2015				⁕ 2055	
6	6/M SP 2006		… 2026			⁖ 2056	
7	FSP 2007	‗ 2017				⁗ 2057	
8	PSP 2008	' 2018	LSEP 2028				
9	THSP 2009	' 2019	PSEP 2029	‹ 2039			
A	HSP 200A	' 201A	LRE 202A	› 203A		SS 206A	
B	ZWSP 200B	' 201B	RLE 202B			ASS 206B	
C	ZWNJ 200C	" 201C	PDF 202C	‼ 203C		IAFS 206C	
D	ZWJ 200D	" 201D	LRO 202D			AAFS 206D	
E	LRM 200E	„ 201E	RLO 202E	‾ 203E	⁎ 204E	NADS 206E	
F	RLM 200F		NNBSP 202F		⁏ 204F	205F	NODS 206F	

2000   ▨   <reserved>
2001   ▨   <reserved>
2002   ▨   <reserved>
2003   ▨   <reserved>
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2006   ▨   <reserved>
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2008   ▨   <reserved>
2009   ▨   <reserved>
200A   ▨   <reserved>
200B   ▨   <reserved>
200C   ▨   <reserved>
200D   ▨   <reserved>
200E   ▨   <reserved>
200F   ▨   <reserved>
2010   ▨   <reserved>
2011   ▨   <reserved>
2012   ▨   <reserved>
2013   ▨   <reserved>
2014   ▨   <reserved>
2015   ▨   <reserved>
2016   ▨   <reserved>
2017   ▨   <reserved>
2018   ▨   <reserved>
2019   ▨   <reserved>
201A   ▨   <reserved>
201B   ▨   <reserved>
201C   ▨   <reserved>
201D   ▨   <reserved>
201E   ▨   <reserved>
201F   ▨   <reserved>
2020   ▨   <reserved>
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202C   ▨   <reserved>
202D   ▨   <reserved>
202E   ▨   <reserved>
202F   ▨   <reserved>
2030   ▨   <reserved>
2031   ▨   <reserved>
2032   ▨   <reserved>
2033   ▨   <reserved>
2034   ▨   <reserved>
2035   ▨   <reserved>
2036   ▨   <reserved>
2037   ▨   <reserved>
2038   ▨   <reserved>

2039   ▨   <reserved>
203A   ▨   <reserved>
203B   ▨   <reserved>
203C   ▨   <reserved>
203D   ▨   <reserved>
203E   ▨   <reserved>
203F   ▨   <reserved>
2040   ▨   <reserved>
2041   ▨   <reserved>
2042   ▨   <reserved>
2043   ▨   <reserved>
2044   ▨   <reserved>
2045   ▨   <reserved>
2046   ▨   <reserved>
2047   ▨   <reserved>
2048   ▨   <reserved>
2049   ▨   <reserved>
204A   ▨   <reserved>
204B   ▨   <reserved>
204C   ▨   <reserved>
204D   ▨   <reserved>
204E   ∗   LOW ASTERISK
204F   ⁏   REVERSED SEMICOLON
2050   ‥   EM LEADER
2051   ⁑   TWO ASTERISKS ALIGNED VERTICALLY
2052   ⁒   SOLIDUS OVERBAR
2053   ⁓   REVERSE SOLIDUS WITH HORIZONTAL STROKE
2054   ⁄   BIG SOLIDUS
2055   ⁔   BIG REVERSE SOLIDUS
      = z notation schema hiding
2056   ⅋   TURNED AMPERSAND
2057   ⁗   QUADRUPLE PRIME
      ≈ 2035   2035   2035
2058   ▨   <reserved>
2059   ▨   <reserved>
205A   ▨   <reserved>
205B   ▨   <reserved>
205C   ▨   <reserved>
205D   ▨   <reserved>
205E   ▨   <reserved>
205F   MEDIUM MATH SPACE
      • four-eighteenths of an em
      ≈ 0020 [SP]
2060   ▨   <reserved>
2061   [FA]   FUNCTION APPLICATION
      • contiguity operator indicating application of a function
2062   [IT]   INVISIBLE TIMES
      • contiguity operator indicating multiplication
2063   [VS]   VARIATION SELECTOR
      • in conjunction with preceding character indicates variant choice

	20D	20E	20F
0			
1			
2			
3			
4			
5		/ 20E5	
6		‖ 20E6	
7		⌐ 20E7	
8		••• 20E8	
9			
A			
B			
C			
D			
E			
F			

Combining Symbols

20E5 ╱   COMBINING REVERSE SOLIDUS OVERLAY
20E6 ╫   COMBINING DOUBLE VERTICAL STROKE
      OVERLAY
      = z notation finite function
20E7 ⌐   ANNUITY SYMBOL
      = actuarial bend
20E8 ⸱⸱⸱   TRIPLE UNDERDOT

	210	211	212	213	214
0					Σ 2140
1					Ꙅ 2141
2			™ 2122		⅂ 2142
3			ℓ 2113		⅃ 2143
4					⅄ 2144
5	% 2105				$\mathbb{D}$ 2145
6		№ 2116	Ω 2126		ⅆ 2146
7					ℯ 2147
8					ⅈ 2148
9					ⅉ 2149
A					
B				∊ 213B	
C				∍ 213C	
D				γ 213D	
E			e 212E	Γ 213E	
F				∏ 213F	

Letterlike symbols

213B ε GREEK SYMBOL STRAIGHT EPSILON
  ≈ <font> 03B5 ε
213C ϶ GREEK SYMBOL REVERSED STRAIGHT
  EPSILON
213D γ OPEN-FACE GREEK SMALL LETTER GAMMA
  ≈ <font> 03B3 γ
213E Γ OPEN-FACE GREEK CAPITAL GAMMA
  ≈ <font> 0393 Γ
213F Π OPEN-FACE GREEK CAPITAL PI
  ≈ <font> 03A0 Π
2140 Σ OPEN-FACE SUM
  ≈ <font> 03A3 Σ
2141 ⅁ TURNED SANS SERIF CAPITAL G
  = game
2142 ⅂ TURNED SANS SERIF CAPITAL L
2143 ⅃ REVERSED SANS SERIF CAPITAL L
2144 ⅄ INVERTED SANS SERIF CAPITAL Y
2145 ⅅ CAPITAL DIFFERENTIAL D
  ≈ <font> 0044 D
2146 ⅆ DIFFERENTIAL D
  ≈ <font> 0064 d
2147 ⅇ EXPONENTIAL E
  ≈ <font> 0065 e
2148 ⅈ IMAGINARY I
  ≈ <font> 0069 i
2149 ⅉ IMAGINARY J
  ≈ <font> 006A j

	219	21A	21B	21C	21D	21E	21F
0	← 2190						
1	↑ 2191						
2	→ 2192						
3	↓ 2193						
4	↔ 2194						⮴ 21F4
5	↕ 2195						⇵ 21F5
6							⇶ 21F6
7							↤ 21F7
8		↕ 21A8					↦ 21F8
9							↔ 21F9
A							↤ 21FA
B							↦ 21FB
C							↔ 21FC
D							← 21FD
E							→ 21FE
F							↔ 21FF

Arrows
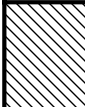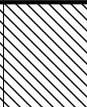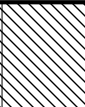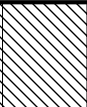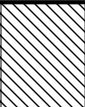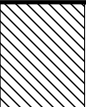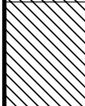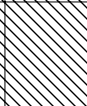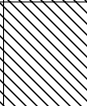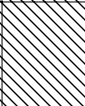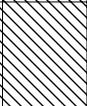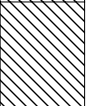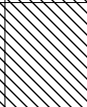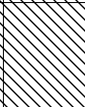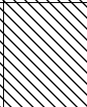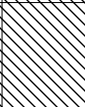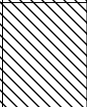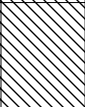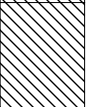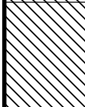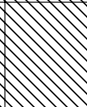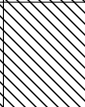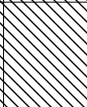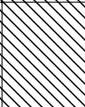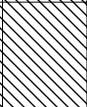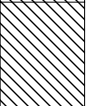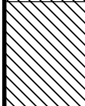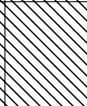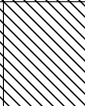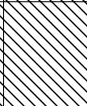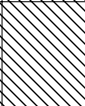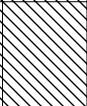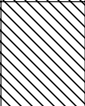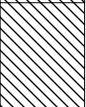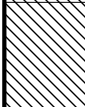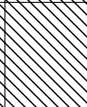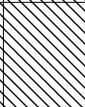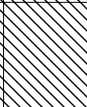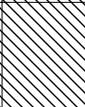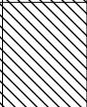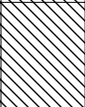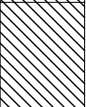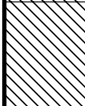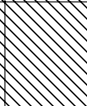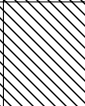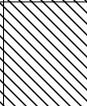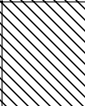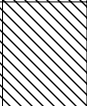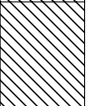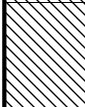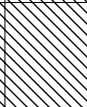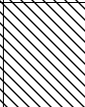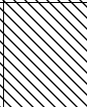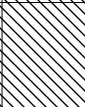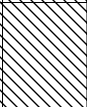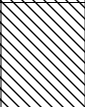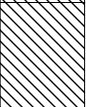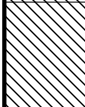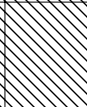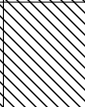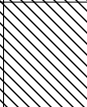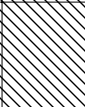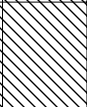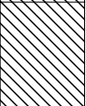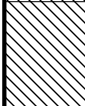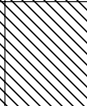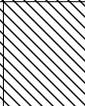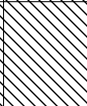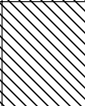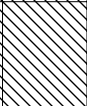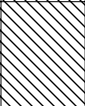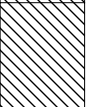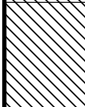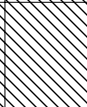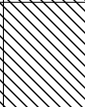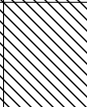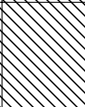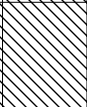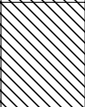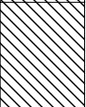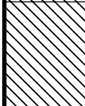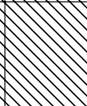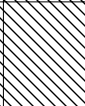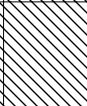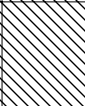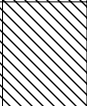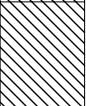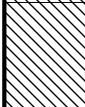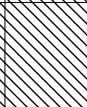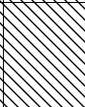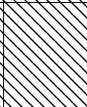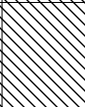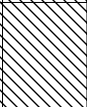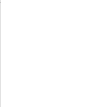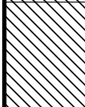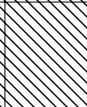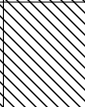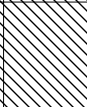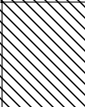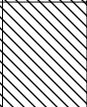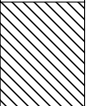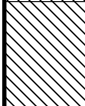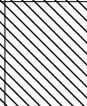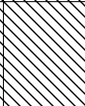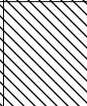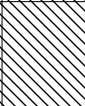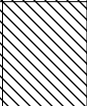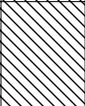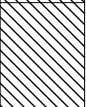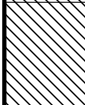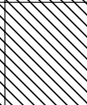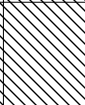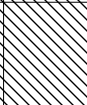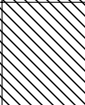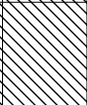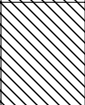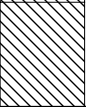
21F4 ⇩ DOWNWARDS WHITE ARROW WITH CORNER
LEFTWARDS
= return

21F5 ⇅ DOWNWARDS ARROW LEFTWARDS OF
UPWARDS ARROW

21F6 ⇶ THREE RIGHTWARDS ARROWS

21F7 ↫ LEFTWARDS ARROW WITH VERTICAL
STROKE

21F8 ↬ RIGHTWARDS ARROW WITH VERTICAL
STROKE
= z notation partial function

21F9 ↭ LEFT RIGHT ARROW WITH VERTICAL
STROKE
= z notation partial relation

21FA ↫ LEFTWARDS ARROW WITH DOUBLE
VERTICAL STROKE

21FB ↬ RIGHTWARDS ARROW WITH DOUBLE
VERTICAL STROKE
= z notation finite function

21FC ↭ LEFT RIGHT ARROW WITH DOUBLE
VERTICAL STROKE
= z notation finite relation

21FD ← LEFTWARDS OPEN-HEADED ARROW

21FE → RIGHTWARDS OPEN-HEADED ARROW

21FF ↔ LEFT RIGHT OPEN-HEADED ARROW

	220	221	222	223	224	225	226	227
0							≠ 2260	
1		Σ 2211					≡ 2261	
2	∂ 2202	− 2212						
3								
4							≤ 2264	
5		∕ 2215					≥ 2265	
6	∆ 2206							
7								
8					≈ 2248			
9		∙ 2219	∩ 2229					
A		√ 221A						
B			∫ 222B					
C								
D								
E		∞ 221E						
F	∏ 220F	⌊ 221F						

	228	229	22A	22B	22C	22D	22E	22F
0								
1								
2								∈ 22F2
3								∋ 22F3
4								∊ 22F4
5								∊̇ 22F5
6								∊̄ 22F6
7								∊̄ 22F7
8								∈ 22F8
9								∈ 22F9
A								∋ 22FA
B								∋ 22FB
C								∋ 22FC
D								∋ 22FD
E								∋ 22FE
F								∃ 22FF

Mathematical operators

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

	230	231	232	233	234	235	236	237
0		2310	2320					
1			2321					
2	2302							
3								
4								
5								
6								
7								
8								
9								
A								
B								
C								237C
D								
E								
F								

	238	239	23A	23B	23C	23D	23E	23F
0			23A0					
1			23A1					
2			23A2					
3			23A3					
4			23A4	23B4				
5			23A5	23B5				
6			23A6	23B6				
7			23A7					
8			23A8					
9			23A9					
A			23AA					
B		239B	23AB					
C		239C	23AC					
D		239D	23AD					
E		239E	23AE					
F		239F						

Miscellaneous technical

237C ⅄ RIGHT ANGLE WITH DOWNWARDS ZIGZAG
         ARROW

Brace pieces

239B ⎛ LEFT PARENTHESIS UPPER HOOK
239C ⎜ LEFT PARENTHESIS EXTENSION
239D ⎝ LEFT PARENTHESIS LOWER HOOK
239E ⎞ RIGHT PARENTHESIS UPPER HOOK
239F ⎟ RIGHT PARENTHESIS EXTENSION
23A0 ⎠ RIGHT PARENTHESIS LOWER HOOK
23A1 ⎡ LEFT BRACKET UPPER CORNER
23A2 ⎢ LEFT BRACKET EXTENSION
23A3 ⎣ LEFT BRACKET LOWER CORNER
23A4 ⎤ RIGHT BRACKET UPPER CORNER
23A5 ⎥ RIGHT BRACKET EXTENSION
23A6 ⎦ RIGHT BRACKET LOWER CORNER
23A7 ⎧ LEFT CURLY BRACE UPPER HOOK
23A8 ⎨ LEFT CURLY BRACE MIDDLE PIECE
23A9 ⎩ LEFT CURLY BRACE LOWER HOOK
23AA ⎪ CURLY BRACE EXTENSION
23AB ⎫ RIGHT CURLY BRACE UPPER HOOK
23AC ⎬ RIGHT CURLY BRACE MIDDLE PIECE
23AD ⎭ RIGHT CURLY BRACE LOWER HOOK
23AE ⎮ INTEGRAL EXTENSION
23AF HORIZONTAL LINE EXTENSION
23B0 UPPER LEFT OR LOWER RIGHT BRACE
         SECTION
23B1 UPPER RIGHT OR LOWER LEFT BRACE
         SECTION

Summation sign parts

23B2 SUMMATION SYMBOL TOP
23B3 SUMMATION SYMBOL BOTTOM

Vertical brackets

23B4 ⎺ TOP SQUARE BRACKET
23B5 � BOTTOM SQUARE BRACKET
23B6 ⎼ BOTTOM ABOVE TOP SQUARE BRACKET

	25A	25B	25C	25D	25E	25F
0	■ 25A0					
1	□ 25A1					
2		▲ 25B2				
3						
4			◀ 25C4			
5						
6					○ 25E6	
7						
8				◙ 25D8		◹ 25F8
9				◉ 25D9		◸ 25F9
A	▪ 25AA	▶ 25BA	◊ 25CA			◺ 25FA
B	▫ 25AB		○ 25CB			□ 25FB
C	▬ 25AC	▼ 25BC				■ 25FC
D						▫ 25FD
E						▪ 25FE
F			● 25CF			◈ 25FF

Geometric shapes

25F8 ◸ UPPER LEFT TRIANGLE
25F9 ◹ UPPER RIGHT TRIANGLE
25FA ◺ LOWER LEFT TRIANGLE
25FB □ WHITE MEDIUM SQUARE
25FC ■ BLACK MEDIUM SQUARE
25FD ▫ WHITE VERY SMALL SQUARE
25FE ▪ BLACK VERY SMALL SQUARE
25FF ◇ WHITE DIAMOND WITH CENTERED DOT

	290	291	292	293	294	295	296	297
0	⇸ 2900	⤐ 2910	↦ 2920	⤰ 2930	↺ 2940	⥐ 2950	⥠ 2960	⥰ 2970
1	⇻ 2901	⤑ 2911	⤡ 2921	⤱ 2931	↻ 2941	⥑ 2951	⥡ 2961	⥱ 2971
2	⇺ 2902	⤒ 2912	⤢ 2922	⤲ 2932	⇄ 2942	⥒ 2952	⥢ 2962	⥲ 2972
3	⇛ 2903	⤓ 2913	⤣ 2923	⤳ 2933	⇆ 2943	⥓ 2953	⥣ 2963	⥳ 2973
4	⇼ 2904	⤔ 2914	⤤ 2924	⤴ 2934	⇌ 2944	⥔ 2954	⥤ 2964	⥴ 2974
5		⤕ 2915	⤥ 2925	⤵ 2935	⥅ 2945	⥕ 2955	⥥ 2965	⥵ 2975
6	⇹ 2906	⤖ 2916	⤦ 2926	⤶ 2936	⥆ 2946	⥖ 2956	⥦ 2966	⥶ 2976
7	⇏ 2907	⤗ 2917	⤧ 2927	⤷ 2937	⥇ 2947	⥗ 2957	⥧ 2967	⥷ 2977
8	↕ 2908	⤘ 2918	⤨ 2928	⤸ 2938	⥈ 2948	⥘ 2958	⥨ 2968	⥸ 2978
9	↥ 2909	⤙ 2919	⤩ 2929	⤹ 2939	⥉ 2949	⥙ 2959	⥩ 2969	⥹ 2979
A	⤊ 290A	⤚ 291A	⤪ 292A	⤺ 293A	⥊ 294A	⥚ 295A	⥪ 296A	⥺ 297A
B	⤋ 290B	⤛ 291B	⤫ 292B	⤻ 293B	⥋ 294B	⥛ 295B	⥫ 296B	⥻ 297B
C	⟵ 290C	⤜ 291C	⤬ 292C	⤼ 293C	⥌ 294C	⥜ 295C	⥬ 296C	⥼ 297C
D	⟶ 290D	⤝ 291D	⤭ 292D	⤽ 293D	⥍ 294D	⥝ 295D	⥭ 296D	⥽ 297D
E	⟸ 290E	⤞ 291E	⤮ 292E	⤾ 293E	⥎ 294E	⥞ 295E	⥮ 296E	⥾ 297E
F	⟹ 290F	⤟ 291F	⤯ 292F		⥏ 294F	⥟ 295F	⥯ 296F	⥿ 297F

Supplemental arrows

2900 ⤀ RIGHTWARDS TWO-HEADED ARROW WITH VERTICAL STROKE
= z notation partial surjection

2901 ⤁ RIGHTWARDS TWO-HEADED ARROW WITH DOUBLE VERTICAL STROKE
= z notation finite surjection

2902 ⤂ LEFTWARDS DOUBLE ARROW WITH VERTICAL STROKE

2903 ⤃ RIGHTWARDS DOUBLE ARROW WITH VERTICAL STROKE

2904 ⤄ LEFT RIGHT DOUBLE ARROW WITH VERTICAL STROKE

2905 RIGHTWARDS TWO-HEADED ARROW FROM BAR
= maps to

2906 ⤆ LEFTWARDS DOUBLE ARROW FROM BAR
= maps from

2907 ⤇ RIGHTWARDS DOUBLE ARROW FROM BAR
= maps to

2908 ↧ DOWNWARDS ARROW WITH HORIZONTAL STROKE

2909 ↥ UPWARDS ARROW WITH HORIZONTAL STROKE

290A ⤊ UPWARDS TRIPLE ARROW

290B ⤋ DOWNWARDS TRIPLE ARROW

290C ⤌ LEFTWARDS BROKEN ARROW

290D ⤍ RIGHTWARDS BROKEN ARROW

290E ⤎ LEFTWARDS DOUBLY BROKEN ARROW

290F ⤏ RIGHTWARDS DOUBLY BROKEN ARROW

2910 ⤐ RIGHTWARDS TWO-HEADED BROKEN ARROW

2911 ⤑ RIGHTWARDS ARROW WITH DOTTED STEM

2912 ⤒ UPWARDS ARROW TO BAR

2913 ⤓ DOWNWARDS ARROW TO BAR

2914 ⤔ RIGHTWARDS ARROW WITH TAIL WITH VERTICAL STROKE
= z notation partial injection

2915 ⤕ RIGHTWARDS ARROW WITH TAIL WITH DOUBLE VERTICAL STROKE
= z notation finite injection

2916 ⤖ RIGHTWARDS TWO-HEADED ARROW WITH TAIL
= bijective mapping

2917 ⤗ RIGHTWARDS TWO-HEADED ARROW WITH TAIL WITH VERTICAL STROKE
= z notation surjective injection

2918 ⤘ RIGHTWARDS TWO-HEADED ARROW WITH TAIL WITH DOUBLE VERTICAL STROKE
= z notation finite surjective injection

2919 ⤙ LEFTWARDS ARROW-TAIL

291A ⤚ RIGHTWARDS ARROW-TAIL

291B ⤛ LEFTWARDS DOUBLE ARROW-TAIL

291C ⤜ RIGHTWARDS DOUBLE ARROW-TAIL

291D ⤝ LEFTWARDS ARROW TO FILLED DIAMOND

291E ⤞ RIGHTWARDS ARROW TO FILLED DIAMOND

291F ⤟ LEFTWARDS ARROW FROM BAR TO FILLED DIAMOND

2920 ⤠ RIGHTWARDS ARROW FROM BAR TO FILLED DIAMOND

2921 ⤡ NORTH WEST-SOUTH EAST ARROW

2922 ⤢ NORTH EAST-SOUTH WEST ARROW

2923 ⤣ NORTH WEST ARROW WITH HOOK

2924 ⤤ NORTH EAST ARROW WITH HOOK

2925 ⤥ SOUTH EAST ARROW WITH HOOK

2926 ⤦ SOUTH WEST ARROW WITH HOOK

2927 ⤧ NORTH WEST AND NORTH EAST ARROWS

2928 ⤨ NORTH EAST AND SOUTH EAST ARROWS

2929 ⤩ SOUTH EAST AND SOUTH WEST ARROWS

292A ⤪ SOUTH WEST AND NORTH WEST ARROWS

292B ⤫ RISING DIAGONAL CROSSING FALLING DIAGONAL

292C ⤬ FALLING DIAGONAL CROSSING RISING DIAGONAL

292D ⤭ SOUTH EAST ARROW CROSSING NORTH EAST ARROW

292E ⤮ NORTH EAST ARROW CROSSING SOUTH EAST ARROW

292F ⤯ FALLING DIAGONAL CROSSING NORTH EAST ARROW

2930 ⤰ RISING DIAGONAL CROSSING SOUTH EAST ARROW

2931 ⤱ NORTH EAST ARROW CROSSING NORTH WEST ARROW

2932 ⤲ NORTH WEST ARROW CROSSING NORTH EAST ARROW

2933 ⤳ WAVE ARROW POINTING DIRECTLY TO THE RIGHT
→ 219D   rightwards wave arrow

2934 ⤴ ARROW POINTING RIGHTWARDS THEN CURVING UPWARDS

2935 ⤵ ARROW POINTING RIGHTWARDS THEN CURVING DOWNWARDS

2936 ⤶ ARROW POINTING DOWNWARDS THEN CURVING LEFTWARDS

2937 ⤷ ARROW POINTING DOWNWARDS THEN CURVING RIGHTWARDS

2938 ⤸ RIGHT-SIDE ARC CLOCKWISE ARROW

2939 ⤹ LEFT-SIDE ARC ANTICLOCKWISE ARROW

293A ⤺ TOP ARC ANTICLOCKWISE ARROW

293B ⤻ BOTTOM ARC ANTICLOCKWISE ARROW

293C ⤼ TOP ARC CLOCKWISE ARROW WITH MINUS

293D ⤽ TOP ARC ANTICLOCKWISE ARROW WITH PLUS

293E ⤾ LOWER RIGHT SEMICIRCULAR CLOCKWISE ARROW

293F LOWER LEFT SEMICIRCULAR ANTICLOCKWISE ARROW

2940 ⥀ ANTICLOCKWISE CLOSED CIRCLE ARROW
→ 20DA   combining anticlockwise ring overlay

2941 ⥁ CLOCKWISE CLOSED CIRCLE ARROW
→ 20D9   combining clockwise ring overlay

2942 ⥂ RIGHTWARDS ARROW ABOVE SHORT LEFTWARDS ARROW

2943 ⥃ LEFTWARDS ARROW ABOVE SHORT RIGHTWARDS ARROW

2944 ⥄ SHORT RIGHTWARDS ARROW ABOVE LEFTWARDS ARROW

2945 ⥅ RIGHTWARDS ARROW WITH PLUS BELOW

2946 ⥆ LEFTWARDS ARROW WITH PLUS BELOW

2947	⇸	RIGHTWARDS ARROW THROUGH X
2948	⇹	SMALL CIRCLE WITH SUPERIMPOSED LEFT RIGHT ARROW
2949	↥	UPWARDS TWO-HEADED ARROW FROM SMALL CIRCLE
294A	⥊	LEFT-UP-RIGHT-DOWN HARPOON
294B	⥋	LEFT-DOWN-RIGHT-UP HARPOON
294C	⥌	UP-RIGHT-DOWN-LEFT HARPOON
294D	⥍	UP-LEFT-DOWN-RIGHT HARPOON
294E	⥎	LEFT-UP-RIGHT-UP HARPOON
294F	⥏	UP-RIGHT-DOWN-RIGHT HARPOON
2950	⥐	LEFT-DOWN-RIGHT-DOWN HARPOON
2951	⥑	UP-LEFT-DOWN-LEFT HARPOON
2952	⥒	LEFTWARDS HARPOON-UP TO BAR
2953	⥓	RIGHTWARDS HARPOON-UP TO BAR
2954	⥔	UPWARDS HARPOON-RIGHT TO BAR
2955	⥕	DOWNWARDS HARPOON-RIGHT TO BAR
2956	⥖	LEFTWARDS HARPOON-DOWN TO BAR
2957	⥗	RIGHTWARDS HARPOON-DOWN TO BAR
2958	⥘	UPWARDS HARPOON-LEFT TO BAR
2959	⥙	DOWNWARDS HARPOON-LEFT TO BAR
295A	⥚	LEFTWARDS HARPOON-UP FROM BAR
295B	⥛	RIGHTWARDS HARPOON-UP FROM BAR
295C	⥜	UPWARDS HARPOON-RIGHT FROM BAR
295D	⥝	DOWNWARDS HARPOON-RIGHT FROM BAR
295E	⥞	LEFTWARDS HARPOON-DOWN FROM BAR
295F	⥟	RIGHTWARDS HARPOON-DOWN FROM BAR
2960	⥠	UPWARDS HARPOON-LEFT FROM BAR
2961	⥡	DOWNWARDS HARPOON-LEFT FROM BAR
2962	⥢	LEFTWARDS HARPOON-UP ABOVE LEFTWARDS HARPOON-DOWN
2963	⥣	UPWARDS HARPOON-LEFT BESIDE UPWARDS HARPOON-RIGHT
2964	⥤	RIGHTWARDS HARPOON-UP ABOVE RIGHTWARDS HARPOON-DOWN
2965	⥥	DOWNWARDS HARPOON-LEFT BESIDE DOWNWARDS HARPOON-RIGHT
2966	⥦	LEFTWARDS HARPOON-UP ABOVE RIGHTWARDS HARPOON-UP
2967	⥧	LEFTWARDS HARPOON-DOWN ABOVE RIGHTWARDS HARPOON-DOWN
2968	⥨	RIGHTWARDS HARPOON-UP ABOVE LEFTWARDS HARPOON-UP
2969	⥩	RIGHTWARDS HARPOON-DOWN ABOVE LEFTWARDS HARPOON-DOWN
296A	⥪	LEFTWARDS HARPOON-UP ABOVE LONG DASH
296B	⥫	LEFTWARDS HARPOON-DOWN BELOW LONG DASH
296C	⥬	RIGHTWARDS HARPOON-UP ABOVE LONG DASH
296D	⥭	RIGHTWARDS HARPOON-DOWN BELOW LONG DASH
296E	⥮	UPWARDS HARPOON-LEFT BESIDE DOWNWARDS HARPOON-RIGHT
296F	⥯	DOWNWARDS HARPOON-LEFT BESIDE UPWARDS HARPOON-RIGHT
2970	⥰	RIGHT DOUBLE ARROW WITH ROUNDED HEAD
		→ 2283 superset of

2971	⥱	EQUAL ABOVE RIGHTWARDS ARROW
2972	⥲	TILDE OPERATOR ABOVE RIGHTWARDS ARROW
2973	⥳	LEFTWARDS ARROW ABOVE TILDE OPERATOR
2974	⥴	RIGHTWARDS ARROW ABOVE TILDE OPERATOR
2975	⥵	RIGHTWARDS ARROW ABOVE DOUBLE TILDE OPERATOR
2976	⥶	LESS THAN ABOVE LEFTWARDS ARROW
2977	⥷	LEFTWARDS ARROW THROUGH LESS-THAN
2978	⥸	GREATER-THAN ABOVE RIGHTWARDS ARROW
2979	⥹	SUBSET ABOVE RIGHTWARDS ARROW
297A	⥺	LEFTWARDS ARROW THROUGH SUBSET
297B	⥻	SUPERSET ABOVE LEFTWARDS ARROW
297C	⥼	LEFT FISH TAIL
297D	⥽	RIGHT FISH TAIL
297E	⥾	UP FISH TAIL
297F	⥿	DOWN FISH TAIL

	298	299	29A	29B	29C	29D	29E	29F
0	2980	2990	29A0	29B0	29C0	29D0	29E0	29F0
1	2981	2991	29A1	29B1	29C1	29D1	29E1	29F1
2	2982	2992	29A2	29B2	29C2	29D2	29E2	29F2
3	2983	2993	29A3	29B3	29C3	29D3	29E3	29F3
4	2984	2994	29A4	29B4	29C4	29D4	29E4	29F4
5	2985	2995	29A5	29B5	29C5	29D5	29E5	
6	2986	2996	29A6	29B6	29C6	29D6	29E6	
7	2987	2997	29A7	29B7	29C7	29D7	29E7	
8	2988	2998	29A8	29B8	29C8	29D8	29E8	
9	2989	2999	29A9	29B9	29C9	29D9	29E9	
A	298A	299A	29AA	29BA	29CA	29DA	29EA	
B	298B	299B	29AB	29BB	29CB	29DB	29EB	
C	298C	299C	29AC	29BC	29CC	29DC	29EC	
D	298D	299D	29AD	29BD	29CD	29DD	29ED	
E	298E	299E	29AE	29BE	29CE	29DE	29EE	
F	298F	299F	29AF	29BF	29CF	29DF	29EF	

Miscellaneous math symbols

2980 ⦀ TRIPLE VERTICAL BAR DELIMITER
→ 2AF4 triple vertical bar with horizontal stroke
2981 • Z NOTATION SPOT
• medium-sized filled circle
2982 ⦂ Z NOTATION TYPE COLON

Brackets

2983 ⦃ LEFT WHITE BRACE
2984 ⦄ RIGHT WHITE BRACE
2985 ⦅ LEFT WHITE ANGULAR BRACKET
→ 3108 left white tortoise shell bracket
2986 ⦆ RIGHT WHITE ANGULAR BRACKET
→ 3109 right white tortoise shell bracket
2987 ⦇ Z NOTATION LEFT IMAGE BRACKET
2988 ⦈ Z NOTATION RIGHT IMAGE BRACKET
2989 ⦉ Z NOTATION LEFT BINDING BRACKET
298A ⦊ Z NOTATION RIGHT BINDING BRACKET
298B ⦋ LEFT BRACKET UNDERBAR
298C ⦌ RIGHT BRACKET UNDERBAR
298D ⦍ LEFT BRACKET WITH REVERSE SOLIDUS TOP CORNER
298E ⦎ RIGHT BRACKET WITH REVERSE SOLIDUS BOTTOM CORNER
298F ⦏ LEFT BRACKET WITH SOLIDUS BOTTOM CORNER
2990 ⦐ RIGHT BRACKET WITH SOLIDUS TOP CORNER
2991 ⦑ LEFT ANGLE BRACKET WITH DOT
2992 ⦒ RIGHT ANGLE BRACKET WITH DOT
2993 ⦓ LEFT ARC LESS-THAN BRACKET
2994 ⦔ RIGHT ARC GREATER-THAN BRACKET
2995 ⦕ DOUBLE LEFT ARC GREATER-THAN BRACKET
2996 ⦖ DOUBLE RIGHT ARC LESS-THAN BRACKET
2997 ⦗ RIGHT MOUSTACHE
2998 ⦘ LEFT MOUSTACHE

Fence

2999 ⦙ DOTTED FENCE
• four close dots vertical

Miscellaneous math symbol

299A ⦚ VERTICAL ZIGZAG LINE

Angles

299B ⦛ MEASURED ANGLE OPENING LEFT
299C ⦜ RIGHT ANGLE VARIANT WITH SQUARE
299D ⦝ MEASURED RIGHT ANGLE WITH DOT
299E ⦞ ANGLE WITH S INSIDE
299F ⦟ ACUTE ANGLE
29A0 ⦠ SPHERICAL ANGLE OPENING LEFT
29A1 ⦡ SPHERICAL ANGLE OPENING UP
29A2 ⦢ TURNED ANGLE
29A3 ⦣ REVERSED ANGLE
29A4 ⦤ ANGLE WITH UNDERBAR
29A5 ⦥ REVERSED ANGLE WITH UNDERBAR
29A6 ⦦ LARGE DOWNWARDS POINTING ANGLE
29A7 ⦧ LARGE UPWARDS POINTING ANGLE

29A8 ⦨ MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING UP AND TO THE RIGHT
29A9 ⦩ MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING UP AND TO THE LEFT
29AA ⦪ MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING DOWN AND TO THE RIGHT
29AB ⦫ MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING DOWN AND TO THE LEFT
29AC ⦬ MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING RIGHT AND UP
29AD ⦭ MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING LEFT AND UP
29AE ⦮ MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING RIGHT AND DOWN
29AF ⦯ MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING LEFT AND DOWN

Empty sets

29B0 ⦰ REVERSED EMPTY SET
→ 2349 apl functional symbol circle backslash
29B1 ⦱ EMPTY SET OVERBAR
29B2 ⦲ EMPTY SET WITH SMALL CIRCLE ABOVE
29B3 ⦳ EMPTY SET RIGHT ARROW ABOVE
29B4 ⦴ EMPTY SET LEFT ARROW ABOVE

Circle symbols

29B5 ⦵ CIRCLE WITH HORIZONTAL BAR
29B6 ⦶ CIRCLED VERTICAL BAR
29B7 ⦷ CIRCLED PARALLEL
29B8 ⦸ CIRCLED FALLING DIAGONAL
29B9 ⦹ CIRCLED PERPENDICULAR
29BA ⦺ CIRCLE DIVIDED BY HORIZONTAL BAR AND TOP HALF DIVIDED BY VERTICAL
29BB ⦻ CIRCLE WITH SUPERIMPOSED X
29BC ⦼ CIRCLED ANTICLOCKWISE-ROTATED DIVISION SIGN
29BD ⦽ UP ARROW THROUGH CIRCLE
29BE ⦾ CIRCLED LARGE CIRCLE
→ 233E apl functional symbol circle jot
29BF ⦿ CIRCLED FILLED CIRCLE
29C0 ⧀ CIRCLED LESS-THAN
29C1 ⧁ CIRCLED GREATER-THAN
29C2 ⧂ CIRCLE WITH SMALL CIRCLE TO THE RIGHT
29C3 ⧃ CIRCLE WITH TWO HORIZONTAL STROKES TO THE RIGHT

Square symbols

29C4 ⧄ SQUARED RISING DIAGONAL SLASH
→ 2341 apl functional symbol quad slash
29C5 ⧅ SQUARED FALLING DIAGONAL SLASH
→ 2342 apl functional symbol quad backslash
29C6 ⧆ SQUARED ASTERISK
29C7 ⧇ SQUARED SMALL CIRCLE
→ 233B apl functional symbol quad circle

29C8 ▣ SQUARED SQUARE
29C9 ⊞ TWO JOINED SQUARES

Triangle symbols

29CA △ TRIANGLE WITH DOT OVER
29CB △ TRIANGLE WITH UNDERBAR
29CC △ S IN TRIANGLE
29CD △ TRIANGLE WITH SERIFS AT BOTTOM
29CE ⧎ RIGHT TRIANGLE ABOVE LEFT TRIANGLE
29CF ◁ LEFT TRIANGLE BESIDE VERTICAL BAR
29D0 ▷ VERTICAL BAR BESIDE RIGHT TRIANGLE

Bowtie symbols

29D1 ◤ LEFT FILLED BOWTIE
29D2 ◥ RIGHT FILLED BOWTIE
29D3 ◤ FILLED BOWTIE
29D4 ⋉ LEFT FILLED TIMES
      → 22C9   left normal factor semidirect product
29D5 ⋊ RIGHT FILLED TIMES
      → 22CA   right normal factor semidirect product
29D6 ⧖ WHITE HOURGLASS
      = vertical bowtie
29D7 ⧗ FILLED HOURGLASS

Miscellaneous math symbols

29D8 ∾ MOST POSITIVE
29D9 ∾ CONGRUENCE SIGN WITH LAZY S
29DA ≋ REVERSED MOST POSITIVE WITH LINE
      BELOW
29DB ≌ MOST POSITIVE WITH TWO LINES BELOW
29DC ∝ INFINITY SIGN WITH TOP RIGHT QUADRANT
      OMITTED
29DD ⧝ TIE OVER INFINITY
29DE ⧞ INFINITY NEGATED WITH VERTICAL BAR
29DF ⧟ DOUBLE-ENDED MULTIMAP
29E0 ⧠ SQUARE WITH CONTOURED OUTLINE
      = D'Alembertian
29E1 ⧡ INCREASES AS
29E2 ⧢ SHUFFLE PRODUCT
29E3 ≢ SLANTED PARALLEL SUPERIMPOSED ON
      EQUAL
      = homethetically congruent to
29E4 ≇ TILDE ABOVE SLANTED PARALLEL
      SUPERIMPOSED ON EQUAL
29E5 ≢ SLANTED PARALLEL SUPERIMPOSED ON
      THREE-LINE EQUAL
      = congruent and parallel
29E6 ⧦ TOP ARC ABOVE BOTTOM ARC
29E7 ⧧ THERMODYNAMIC
      • vertical bar crossed by two horizontals
29E8 ◺ DOWN-POINTING TRIANGLE WITH LEFT
      HALF BLACK
29E9 ◿ DOWN-POINTING TRIANGLE WITH RIGHT
      HALF BLACK
29EA ⧪ FILLED DIAMOND WITH DOWN ARROW
29EB ◆ FILLED LOZENGE
29EC ⧬ CIRCLE WITH DOWN ARROW
29ED ⧭ FILLED CIRCLE WITH DOWN ARROW

Error bar symbols

29EE ⧮ ERROR-BARRED WHITE SQUARE
29EF ⧯ ERROR-BARRED FILLED SQUARE
29F0 ⧰ ERROR-BARRED WHITE DIAMOND
29F1 ⧱ ERROR-BARRED FILLED DIAMOND
29F2 ⧲ ERROR-BARRED WHITE CIRCLE
29F3 ⧳ ERROR-BARRED FILLED CIRCLE

Miscellanous math symbol

29F4 ⤳ RULE-DELAYED
      = colon right arrow

	2A0	2A1	2A2	2A3	2A4	2A5	2A6	2A7
0	⊙ 2A00	∮ 2A10	≫ 2A20	⇐ 2A30	∈ 2A40	⧀ 2A50	△ 2A60	
1	⊕ 2A01	∯ 2A11	⌠ 2A21	⇐ 2A31	⇄ 2A41		⋁ 2A61	
2	⊗ 2A02	∲ 2A12	⌠ 2A22	⇒ 2A32	↿ 2A42		⋁ 2A62	
3	∪ 2A03	∳ 2A13	⌡ 2A23	⇒ 2A33	⤳ 2A43	⋁ 2A53	⋁ 2A63	
4	⊎ 2A04	∮ 2A14	⊐ 2A24	⇅ 2A34	↾ 2A44	⋀ 2A54	2A64	
5	⊓ 2A05	∮ 2A15	⊢ 2A25	⇵ 2A35	�ퟁ 2A45	⋀ 2A55	2A65	
6	⊔ 2A06	∮ 2A16	1 2A26	⇒ 2A36	⊃⊂ 2A46	⋁ 2A56	2A66	
7	⋀ 2A07	∮ 2A17	⌡ 2A27	⇒ 2A37	⊂⊃ 2A47	⋁ 2A57	2A67	
8	⋁ 2A08	∮ 2A18	⇐ 2A28	⇒ 2A38	⋃ 2A48	⋀ 2A58	2A68	
9	⨉ 2A09	∮ 2A19	⇑ 2A29	⇐ 2A39	⋓ 2A49	⋁ 2A59	2A69	
A	Σ 2A0A	∮ 2A1A	⇒ 2A2A	⇒ 2A3A	⋒ 2A4A	⋀ 2A5A	∼ 2A6A	
B	Σ 2A0B	∫ 2A1B	⇊ 2A2B	⇛ 2A3B	⋓ 2A4B	⋁ 2A5B	2A6B	
C	∫∫∫∫ 2A0C	∫ 2A1C	⇐ 2A2C	≦ 2A3C	⊐ 2A4C		≏ 2A6C	
D	∫ 2A0D	⋈ 2A1D	⇒ 2A2D	≼ 2A3D	⊐ 2A4D		⇆ 2A6D	
E	∫ 2A0E	◁ 2A1E	⇌ 2A2E	≽ 2A3E	2A4E	⋀ 2A5E	⇄ 2A6E	
F	∫ 2A0F	⧜ 2A1F	⇌ 2A2F	⊑ 2A3F	2A4F	△ 2A5F		

	2A8	2A9	2AA	2AB	2AC	2AD	2AE	2AF
0								
1								
2								
3								
4								
5								
6								
7								
8								
9								
A								
B								
C								
D								
E								
F								

N-ary operators

2A00 ⊙ N-ARY CIRCLED DOT OPERATOR
→ 2299   circled dot operator
2A01 ⊕ N-ARY CIRCLED PLUS OPERATOR
→ 2295   circled plus
2A02 ⊗ N-ARY CIRCLED TIMES OPERATOR
→ 2297   circled times
2A03 ⋃ N-ARY UNION OPERATOR WITH DOT
2A04 ⋃ N-ARY UNION OPERATOR WITH PLUS
→ 228E   multiset union
2A05 ⊓ N-ARY SQUARE INTERSECTION OPERATOR
→ 2293   square cap
2A06 ⊔ N-ARY SQUARE UNION OPERATOR
→ 2294   square cup
2A07 ⩚ TWO LOGICAL AND OPERATOR
= merge

→ 2A55 ⩕ two intersecting logical and
2A08 ⩚ TWO LOGICAL OR OPERATOR

→ 2A56 ⩖ two intersecting logical or
2A09 ⨉ N-ARY TIMES OPERATOR

Summations and integrals

2A0A ∑ MODULO TWO SUM
2A0B ⨋ SUMMATION WITH INTEGRAL
2A0C ⨌ QUADRUPLE INTEGRAL OPERATOR
≈ 222B ∫ 222B ∫ 222B ∫ 222B ∫
2A0D ⨍ FINITE PART INTEGRAL
2A0E ⨎ INTEGRAL WITH DOUBLE STROKE
2A0F ⨏ INTEGRAL AVERAGE WITH SLASH
2A10 ⨐ CIRCULATION FUNCTION
2A11 ⨑ ANTICLOCKWISE INTEGRATION
2A12 ⨒ LINE INTEGRATION WITH RECTANGULAR
PATH AROUND POLE
2A13 ⨓ LINE INTEGRATION WITH SEMICIRCULAR
PATH AROUND POLE
2A14 ⨔ LINE INTEGRATION NOT INCLUDING THE
POLE
2A15 ⨕ INTEGRAL AROUND A POINT OPERATOR
2A16 ⨖ QUATERNION INTEGRAL OPERATOR
2A17 ⨗ INTEGRAL OPERPRINTED WITH LEFTWARDS
ARROW WITH HOOK
2A18 ⨘ INTEGRAL OVERPRINTED WITH TIMES SIGN
2A19 ⨙ INTEGRAL OVERPRINTED WITH CAP
2A1A ⨚ INTEGRAL OVERPRINTED WITH CUP
2A1B ⨛ UPPER INTEGRAL WITH OVERBAR
2A1C ⨜ LOWER INTEGRAL WITH UNDERBAR

Miscellaneous operators

2A1D ⋈ JOIN
= large bowtie
• relational database theory
2A1E ◁ LARGE LEFT TRIANGLE OPERATOR
• relational database theory
2A1F ⨟ Z NOTATION SCHEMA COMPOSITION
→ 2A3E ⨾ z notation relational composition
2A20 ≫ Z NOTATION SCHEMA PIPING
→ 226B   much greater-than

2A21 ↾ Z NOTATION SCHEMA PROJECTION
→ 21BE   upwards harpoon with bar rightwards

Plus and minus sign operators

2A22 ∔ PLUS SIGN WITH SMALL CIRCLE ABOVE
2A23 ⨣ PLUS SIGN WITH CIRCUMFLEX ACCENT
ABOVE
2A24 ⨤ PLUS SIGN WITH TILDE ABOVE
2A25 ⨥ PLUS SIGN WITH DOT BELOW
2A26 ⨦ PLUS SIGN WITH TILDE BELOW
2A27 ⨧ PLUS SIGN WITH SUBSCRIPT TWO
= nim-addition
2A28 ⨨ FILLED TRIANGLE WITH PLUS
2A29 ⨩ MINUS SIGN WITH COMMA ABOVE
2A2A ⨪ MINUS SIGN WITH DOT BELOW
2A2B ⨫ FALLING DOTS MINUS
2A2C ⨬ RISING DOTS MINUS
2A2D ⨭ PLUS SIGN IN LEFT HALF CIRCLE
2A2E ⨮ PLUS SIGN IN RIGHT HALF CIRCLE

Multiplication and division sign operators

2A2F ⨯ VECTOR OR CROSS PRODUCT
→ 00D7 × multiplication sign
2A30 ⨰ MULTIPLICATION SIGN WITH DOT ABOVE
2A31 ⨱ MULTIPLICATION SIGN WITH UNDERBAR
2A32 ⨲ SEMIDIRECT PRODUCT MULTIPLICATION
SIGN WITH BOTTOM CLOSED
2A33 ⨳ SMASH PRODUCT
2A34 ⨴ MULTIPLICATION SIGN IN LEFT HALF
CIRCLE
2A35 ⨵ MULTIPLICATION SIGN IN RIGHT HALF
CIRCLE
2A36 ⨶ CIRCLED MULTIPLICATION SIGN WITH
CIRCUMFLEX ACCENT
2A37 ⨷ MULTIPLICATION SIGN IN DOUBLE CIRCLE
2A38 ⨸ CIRCLED DIVISION SIGN

Miscellaneous math operators

2A39 ⨹ PLUS IN TRIANGLE
2A3A ⨺ MINUS IN TRIANGLE
2A3B ⨻ MULTIPLICATION SIGN IN TRIANGLE
2A3C ⨼ INTERIOR PRODUCT
2A3D ⨽ RIGHTHAND INTERIOR PRODUCT
→ 2319   turned not sign
2A3E ⨾ Z NOTATION RELATIONAL COMPOSITION
→ 2A1F ⨟ z notation schema composition
2A3F ⨿ AMALGAMATION OR COPRODUCT
→ 2210   n-ary coproduct

Intersections and unions

2A40 ⩀ INTERSECTION WITH DOT
2A41 ⩁ UNION WITH MINUS
= z notation bag subtraction
2A42 ⩂ UNION WITH OVERBAR
2A43 ⩃ INTERSECTION WITH OVERBAR
2A44 ⩄ INTERSECTION WITH LOGICAL AND
2A45 ⩅ UNION WITH LOGICAL OR
2A46 ⩆ UNION ABOVE INTERSECTION
2A47 ⩇ INTERSECTION ABOVE UNION

2A48 ⩈ UNION ABOVE BAR ABOVE INTERSECTION
2A49 ⩉ INTERSECTION ABOVE BAR ABOVE UNION
2A4A ⩊ UNION BESIDE AND JOINED WITH UNION
2A4B ⩋ INTERSECTION BESIDE AND JOINED WITH INTERSECTION
2A4C ⩌ CLOSED UNION WITH SERIFS
2A4D ⩍ CLOSED INTERSECTION WITH SERIFS
2A4E   DOUBLE SQUARE INTERSECTION
2A4F   DOUBLE SQUARE UNION
2A50 ⩐ CLOSED UNION WITH SERIFS AND SMASH PRODUCT

Logical ands and ors

2A51   LOGICAL AND WITH DOT ABOVE
2A52   LOGICAL OR WITH DOT ABOVE
2A53 ⩓ DOUBLE LOGICAL AND
2A54 ⩔ DOUBLE LOGICAL OR
2A55 ⩕ TWO INTERSECTING LOGICAL AND
     → 2A07 ⩇ two logical and operator
2A56 ⩖ TWO INTERSECTING LOGICAL OR
     → 2A08 ⩈ two logical or operator
2A57 ⩗ SLOPING LARGE OR
2A58 ⩘ SLOPING LARGE AND
2A59 ⩙ LOGICAL OR OVERLAPPING LOGICAL AND
2A5A ⩚ LOGICAL AND WITH MIDDLE STEM
2A5B ⩛ LOGICAL OR WITH MIDDLE STEM
2A5C   LOGICAL AND WITH HORIZONTAL DASH
2A5D   LOGICAL OR WITH HORIZONTAL DASH
2A5E ⩞ LOGICAL AND WITH DOUBLE OVERBAR
     → 2306   perspective
2A5F ⩟ LOGICAL AND WITH UNDERBAR
2A60 ⩠ LOGICAL AND WITH DOUBLE UNDERBAR
     → 2259   estimates
2A61 ⩡ SMALL VEE WITH UNDERBAR
2A62 ⩢ LOGICAL OR WITH DOUBLE OVERBAR
2A63 ⩣ LOGICAL OR WITH DOUBLE UNDERBAR
     → 225A   equiangular to

Miscellaneous math operators

2A64   Z NOTATION DOMAIN ANTIRESTRICTION
2A65   Z NOTATION RANGE ANTIRESTRICTION

Relational operators

2A66   EQUAL SIGN WITH DOT BELOW
2A67   IDENTICAL WITH DOT ABOVE
2A68   TRIPLE HORIZONTAL BAR WITH DOUBLE VERTICAL STROKE
     = identical and parallel to
2A69   TRIPLE HORIZONTAL BAR WITH TRIPLE VERTICAL STROKE
2A6A ∼ TILDE OPERATOR WITH DOT
2A6B   TILDE OPERATOR WITH RISING DOTS
     → 223B   homothetic
2A6C ≊ SIMILAR MINUS SIMILAR
2A6D ⩭ CONGRUENT WITH OVERDOT
2A6E ⩮ REVERSED CONGRUENT
2A6F   DOUBLE TILDE OPERATOR WITH CIRCUMFLEX ACCENT
2A70   APPROXIMATELY EQUAL OR EQUAL TO

2A71 EQUAL ABOVE PLUS
2A72 PLUS ABOVE EQUAL
2A73 EQUAL ABOVE TILDE OPERATOR
2A74 DOUBLE COLON EQUAL
2A75 TWO CONSECUTIVE EQUAL SIGNS
2A76 THREE CONSECUTIVE EQUAL SIGNS
2A77 EQUAL SIGN WITH TWO DOTS ABOVE AND TWO DOTS BELOW
2A78 EQUIVALENT WITH FOUR DOTS ABOVE
2A79 LESS-THAN WITH CIRCLE INSIDE
2A7A GREATER-THAN WITH CIRCLE INSIDE
2A7B LESS-THAN WITH QUESTION MARK ABOVE
2A7C GREATER-THAN WITH QUESTION MARK ABOVE
2A7D LESS-THAN OR SLANTED EQUAL TO
2A7E GREATER-THAN OR SLANTED EQUAL TO
2A7F LESS-THAN OR SLANTED EQUAL TO WITH DOT INSIDE
2A80 GREATER-THAN OR SLANTED EQUAL TO WITH DOT INSIDE
2A81 LESS-THAN OR SLANTED EQUAL TO WITH DOT ABOVE
2A82 GREATER-THAN OR SLANTED EQUAL TO WITH DOT ABOVE
2A83 LESS-THAN OR SLANTED EQUAL TO WITH DOT ABOVE RIGHT
2A84 GREATER-THAN OR SLANTED EQUAL TO WITH DOT ABOVE LEFT
2A85 LESS-THAN OR APPROXIMATE
2A86 GREATER-THAN OR APPROXIMATE
2A87 LESS-THAN AND NOT ONE-LINE EQUAL TO
2A88 GREATER-THAN AND NOT ONE-LINE EQUAL TO
2A89 LESS-THAN AND NOT APPROXIMATE
2A8A GREATER-THAN AND NOT APPROXIMATE
2A8B LESS-THAN ABOVE TWO-LINE EQUAL ABOVE GREATER-THAN
2A8C GREATER-THAN ABOVE TWO-LINE EQUAL ABOVE LESS-THAN
2A8D LESS-THAN ABOVE SIMILAR OR EQUAL
2A8E GREATER-THAN ABOVE SIMILAR OR EQUAL
2A8F LESS-THAN ABOVE SIMILAR ABOVE GREATER-THAN
2A90 GREATER-THAN ABOVE SIMILAR ABOVE LESS-THAN
2A91 LESS-THAN ABOVE GREATER-THAN ABOVE TWO-LINE EQUAL
2A92 GREATER-THAN ABOVE LESS-THAN ABOVE TWO-LINE EQUAL
2A93 LESS-THAN ABOVE SLANTED EQUAL ABOVE GREATER-THAN ABOVE SLANTED EQUAL
2A94 GREATER-THAN ABOVE SLANTED EQUAL ABOVE LESS-THAN ABOVE SLANTED EQUAL
2A95 SLANTED EQUAL TO OR LESS-THAN
2A96 SLANTED EQUAL TO OR GREATER-THAN
2A97 SLANTED EQUAL TO OR LESS-THAN WITH DOT INSIDE

2A98	SLANTED EQUAL TO OR GREATER-THAN WITH DOT INSIDE
2A99	TWO-LINE EQUAL TO OR LESS-THAN
2A9A	TWO-LINE EQUAL TO OR GREATER-THAN
2A9B	TWO-LINE SLANTED EQUAL TO OR LESS-THAN
2A9C	TWO-LINE SLANTED EQUAL TO OR GREATER-THAN
2A9D	SIMILAR OR LESS-THAN
2A9E	SIMILAR OR GREATER-THAN
2A9F	SIMILAR ABOVE LESS-THAN ABOVE EQUAL
2AA0	SIMILAR ABOVE GREATER-THAN ABOVE EQUAL
2AA1	DOUBLE NESTED LESS-THAN SIGN
	= absolute continuity
2AA2	DOUBLE NESTED GREATER-THAN SIGN
2AA3	DOUBLE LESS-THAN WITH UNDERBAR
2AA4	GREATER-THAN OVERLAPPING LESS-THAN
2AA5	GREATER-THAN BESIDE LESS-THAN
2AA6	LESS-THAN CLOSED BY CURVE
2AA7	GREATER-THAN CLOSED BY CURVE
2AA8	LESS-THAN CLOSED BY CURVE ABOVE SLANTED EQUAL
2AA9	GREATER-THAN CLOSED BY CURVE ABOVE SLANTED EQUAL
2AAA	SMALLER THAN
2AAB	LARGER THAN
2AAC	SMALLER THAN OR EQUAL
2AAD	LARGER THAN OR EQUAL
2AAE	BUMPY ABOVE TWO-LINE EQUAL
2AAF	PRECEDES ABOVE ONE-LINE EQUAL
2AB0	SUCCEEDS ABOVE ONE-LINE EQUAL
2AB1	PRECEDES ABOVE NOT ONE-LINE EQUAL
2AB2	SUCCEEDS ABOVE NOT ONE-LINE EQUAL
2AB3	PRECEDES ABOVE TWO-LINE EQUAL
2AB4	SUCCEEDS ABOVE TWO-LINE EQUAL
2AB5	PRECEDES ABOVE NOT TWO-LINE EQUAL
2AB6	SUCCEEDS ABOVE NOT TWO-LINE EQUAL
2AB7	PRECEDES ABOVE DOUBLE TILDE OPERATOR
2AB8	SUCCEEDS ABOVE DOUBLE TILDE OPERATOR
2AB9	PRECEDES ABOVE NOT DOUBLE TILDE OPERATOR
2ABA	SUCCEEDS ABOVE NOT DOUBLE TILDE OPERATOR
2ABB	DOUBLE PRECEDES
2ABC	DOUBLE SUCCEEDS

Subset and superset relations

2ABD	SUBSET WITH DOT
2ABE	SUPERSET WITH DOT
2ABF	SUBSET WITH PLUS BELOW
2AC0	SUPERSET WITH PLUS BELOW
2AC1	SUBSET WITH MULTIPLICATION SIGN BELOW
2AC2	SUPERSET WITH MULTIPLICATION SIGN BELOW
2AC3	SUBSET OF OR EQUAL TO WITH DOT ABOVE

2AC4	SUPERSET OF OR EQUAL TO WITH DOT ABOVE
2AC5	SUBSET OF OR TWO-LINE EQUAL
2AC6	SUPERSET OF OR TWO-LINE EQUAL
2AC7	SUBSET OF ABOVE TILDE OPERATOR
2AC8	SUPERSET OF ABOVE TILDE OPERATOR
2AC9	SUBSET OF ABOVE DOUBLE TILDE OPERATOR
2ACA	SUPERSET OF ABOVE DOUBLE TILDE OPERATOR
2ACB	SUBSET OF OR NOT TWO-LINE EQUAL
2ACC	SUPERSET OF OR NOT TWO-LINE EQUAL
2ACD	SQUARE LEFT OPEN BOX OPERATOR
2ACE	SQUARE RIGHT OPEN BOX OPERATOR
2ACF	CLOSED SUBSET
2AD0	CLOSED SUPERSET
2AD1	CLOSED SUBSET OR EQUAL
2AD2	CLOSED SUPERSET OR EQUAL
2AD3	SUBSET ABOVE SUPERSET
2AD4	SUPERSET ABOVE SUBSET
2AD5	SUBSET ABOVE SUBSET
2AD6	SUPERSET ABOVE SUPERSET
2AD7	SUPERSET BESIDE SUBSET
2AD8	SUPERSET BESIDE AND JOINED BY DASH WITH SUBSET

Forks

2AD9	ELEMENT OF OPENING DOWNWARDS
2ADA	PITCHFORK WITH TEE TOP
2ADB	TRANSVERSAL INTERSECTION
	→ 22D4 pitchfork
2ADC	FORKING
	• symbol is slashed although positive
2ADD	NONFORKING
	• negative symbol with no slash

Tacks

2ADE	SHORT LEFT TACK
2ADF	SHORT DOWN TACK
2AE0	SHORT UP TACK
2AE1	PERPENDICULAR WITH S
2AE2	VERTICAL BAR TRIPLE RIGHT TURNSTILE
	= ordinarily satisfies
2AE3	DOUBLE VERTICAL BAR LEFT TURNSTILE
2AE4	VERTICAL BAR DOUBLE LEFT TURNSTILE
2AE5	DOUBLE VERTICAL BAR DOUBLE LEFT TURNSTILE
2AE6	LONG DASH FROM LEFT MEMBER OF DOUBLE VERTICAL
	→ 22A9 forces
2AE7	SHORT DOWN TACK WITH OVERBAR
	→ 22A4 down tack
2AE8	SHORT UP TACK WITH UNDERBAR
	→ 22A5 up tack
2AE9	SHORT UP TACK ABOVE SHORT DOWN TACK
2AEA	DOUBLE DOWN TACK

Annex 3

Excerpts from L2/00-02

	AX0	AX1	AX2
0	⊖	⊡	❄
1		ⅅ	⊽
2	∈	ⅆ	⊼
3	∋	ℇ	∕
4	⚲	ⅈ	∖
5	℘	ⅉ	⌐
6	℧	⃛	⌣
7	⌐		⊟
8	⌙		⅋
9	⅄		
A	⅄		
B	⅁	∗	
C	⅀	⁗	
D	Σ		
E	⃬	⁏	
F	⌽	⁚	

	BX0	BX1	BX2	BX3	BX4	BX5	BX6	BX7	BX8
0	⇕	⇔	↣	↗	↝	⇄	→	⇑	⇜
1	⇉	↦	↠	↘	↝	⇄	⊤	⇒	⇝
2	↤	⟷	↣	↙	↵	↢	⊥	⇓	⇈
3	↠	⇒	↣	⤨	↳	↮	⊢	⇌	≤
4	↤	↨	↣	⤧	⤷	↔	⊣	⇋	∉
5	↤	↨	↢	⤪	↫	↥	⊤	⇌	≥
6	↠	⇑	↢	⤰	↶	⊥	⊥	⇌	⊊
7	↤	⇓	↢	✕	↷	↩	↤	⇐	∈
8	⤳	↢	↢	⤫	↻	↪	↦	⇐	⊋
9	←	⇢	↤	⤨	↺	∫	⊥	⇐	⊢
A	→	⇠	→	⤪	↝	∫	⊤	⇒	⊣
B	↔	⇢	↤	⤬	↪	↪	↤	⇕	⊤
C	↠	⇾	↦	⤯	↻	↾	↦	⇕	⊥
D	↠	⇢	↘	⤩	↻	↳	∫	⊃	
E	⇎	↟	↗	⤭	⇄	↿	∫	⇛	
F	⇏	↡	↖	↝	↢	↤	⇐	⇝	

Letter-like symbols; combining diacritics; punctuation

```
AX00    N GREEK THETA SYMBOL WITH STRAIGHT BAR
            → 0472  cyrillic capital letter fita
            → 04E8  cyrillic capital letter barred o
AX01        [removed: 03D2]
AX02    N GREEK SYMBOL STRAIGHT EPSILON
```

```
AX03   N GREEK SYMBOL REVERSED STRAIGHT EPSILON
AX04   N GREEK LETTER Q-KOPPA
AX05   N GREEK SMALL LETTER Q-KOPPA
AX06   N TURNED SANS SERIF CAPITAL G
          = game
AX07   N TURNED SANS SERIF CAPITAL L
AX08   N REVERSED SANS SERIF CAPITAL L
AX09   N INVERTED SANS SERIF CAPITAL Y
AX0A   N OPEN-FACE GREEK SMALL LETTER GAMMA
AX0B   N OPEN-FACE GREEK CAPITAL GAMMA
AX0C   N OPEN-FACE GREEK CAPITAL PI
AX0D   L OPEN-FACE SUM
AX0E   D COMBINING REVERSE SOLIDUS OVERLAY
AX0F   D COMBINING DOUBLE VERTICAL STROKE OVERLAY
          = Z NOTATION FINITE FUNCTION
AX10   D ANNUITY SYMBOL
          = actuarial bend
AX11   N CAPITAL DIFFERENTIAL D
AX12   N DIFFERENTIAL D
AX13   N EXPONENTIAL E
AX14   N IMAGINARY I
AX15   N IMAGINARY J
AX16   D TRIPLE UNDERDOT
AX17     [removed]
 ...
AX1A     [removed]
AX1B     LOW ASTERISK
AX1C   N QUADRUPLE PRIME
          [composed: U+2032 + U+2032 + U+2032 + U+2032]
AX1D     [removed]
AX1E     REVERSED SEMI-COLON
AX1F   P EM LEADER
AX20   N TWO ASTERISKS ALIGNED VERTICALLY
AX21     SOLIDUS OVERBAR
AX22     REVERSE SOLIDUS WITH HORIZONTAL STROKE
AX23   B BIG SOLIDUS
AX24   B BIG REVERSE SOLIDUS
          = Z NOTATION SCHEMA HIDING
          . visually distinguishably bigger than set minus
AX25     TOP SQUARE BRACKET
AX26     BOTTOM SQUARE BRACKET
AX27     BOTTOM ABOVE TOP SQUARE BRACKET
AX28   N TURNED AMPERSAND
AX29     [removed]
AX2A     [removed]
AX2B   N MEDIUM MATH SPACE
          . four-eighteenths of an em
AX2C     [removed: 2423]
A@XD     FUNCTION APPLICATION
A@XE     INVISIBLE TIMES
A@XF     VARIATION SELECTOR
```

Arrows and harpoons, combinations, fishtails

```
BX00   R DOWNWARDS ARROW LEFTWARDS OF UPWARDS ARROW
BX01   R THREE RIGHTWARDS ARROWS
BX02   R LEFTWARDS ARROW WITH VERTICAL STROKE
BX03   R RIGHTWARDS ARROW WITH VERTICAL STROKE
          = Z NOTATION PARTIAL FUNCTION
BX04   R LEFT RIGHT ARROW WITH VERTICAL STROKE
          = Z NOTATION PARTIAL RELATION
BX05   R LEFTWARDS ARROW WITH DOUBLE VERTICAL STROKE
BX06   R RIGHTWARDS ARROW WITH DOUBLE VERTICAL STROKE
          = Z NOTATION FINITE FUNCTION
BX07   R LEFT RIGHT ARROW WITH DOUBLE VERTICAL STROKE
          = Z NOTATION FINITE RELATION
BX08     RULE-DELAYED
          = colon right arrow
BX09   R LEFTWARDS OPEN-HEADED ARROW
BX0A   R RIGHTWARDS OPEN-HEADED ARROW
BX0B   R LEFT RIGHT OPEN-HEADED ARROW
BX0C   R RIGHTWARDS TWO-HEADED ARROW WITH VERTICAL STROKE
          = Z NOTATION PARTIAL SURJECTION
BX0D   R RIGHTWARDS TWO-HEADED ARROW WITH DOUBLE VERTICAL STROKE
          = Z NOTATION FINITE SURJECTION
BX0E   R LEFTWARDS DOUBLE ARROW WITH VERTICAL STROKE
BX0F   R RIGHTWARDS DOUBLE ARROW WITH VERTICAL STROKE
BX10   R LEFT RIGHT DOUBLE ARROW WITH VERTICAL STROKE
BX11   R RIGHTWARDS TWO-HEADED ARROW FROM BAR
          = maps to
BX12   R LEFTWARDS DOUBLE ARROW FROM BAR
          = maps from
BX13   R RIGHTWARDS DOUBLE ARROW FROM BAR
          = maps to
BX14   R DOWNWARDS ARROW WITH HORIZONTAL STROKE
BX15   R UPWARDS ARROW WITH HORIZONTAL STROKE
BX16   R UPWARDS TRIPLE ARROW
BX17   R DOWNWARDS TRIPLE ARROW
BX18   R LEFTWARDS BROKEN ARROW
BX19   R RIGHTWARDS BROKEN ARROW
BX1A   R LEFTWARDS DOUBLY BROKEN ARROW
BX1B   R RIGHTWARDS DOUBLY BROKEN ARROW
BX1C   R RIGHTWARDS TWO-HEADED BROKEN ARROW
BX1D   R RIGHTWARDS ARROW WITH DOTTED STEM
BX1E   R UPWARDS ARROW TO BAR
BX1F   R DOWNWARDS ARROW TO BAR
BX20   R RIGHTWARDS ARROW WITH TAIL WITH VERTICAL STROKE
          = Z NOTATION PARTIAL INJECTION
BX21   R RIGHTWARDS ARROW WITH TAIL WITH DOUBLE VERTICAL STROKE
          = Z NOTATION FINITE INJECTION
BX22   R RIGHTWARDS TWO-HEADED ARROW WITH TAIL
          = bijective mapping
          = Z NOTATION BIJECTION
BX23   R RIGHTWARDS TWO-HEADED ARROW WITH TAIL WITH VERTICAL STROKE
          = Z NOTATION SURJECTIVE INJECTION
```

```
BX24   R RIGHTWARDS TWO-HEADED ARROW WITH TAIL WITH DOUBLE VERTICAL STROKE
         = Z NOTATION FINITE SURJECTIVE INJECTION
BX25   R LEFTWARDS ARROW-TAIL
BX26   R RIGHTWARDS ARROW-TAIL
BX27   R LEFTWARDS DOUBLE ARROW-TAIL
BX28   R RIGHTWARDS DOUBLE ARROW-TAIL
BX29   R LEFTWARDS ARROW TO FILLED DIAMOND
BX2A   R RIGHTWARDS ARROW TO FILLED DIAMOND
BX2B   R LEFTWARDS ARROW FROM BAR TO FILLED DIAMOND
BX2C   R RIGHTWARDS ARROW FROM BAR TO FILLED DIAMOND
BX2D   R NORTH WEST-SOUTH EAST ARROW
BX2E   R NORTH EAST-SOUTH WEST ARROW
BX2F   R NORTH WEST ARROW WITH HOOK
BX30   R NORTH EAST ARROW WITH HOOK
BX31   R SOUTH EAST ARROW WITH HOOK
BX32   R SOUTH WEST ARROW WITH HOOK
BX33   R NORTH WEST AND NORTH EAST ARROWS
BX34   R NORTH EAST AND SOUTH EAST ARROWS
BX35   R SOUTH EAST AND SOUTH WEST ARROWS
BX36   R SOUTH WEST AND NORTH WEST ARROWS
BX37   N RISING DIAGONAL CROSSING FALLING DIAGONAL
BX38   N FALLING DIAGONAL CROSSING RISING DIAGONAL
BX39   N SOUTH EAST ARROW CROSSING NORTH EAST ARROW
BX3A   N NORTH EAST ARROW CROSSING SOUTH EAST ARROW
BX3B   N FALLING DIAGONAL CROSSING NORTH EAST ARROW
BX3C   N RISING DIAGONAL CROSSING SOUTH EAST ARROW
BX3D   N NORTH EAST ARROW CROSSING NORTH WEST ARROW
BX3E   N NORTH WEST ARROW CROSSING NORTH EAST ARROW
BX3F   R WAVE ARROW POINTING DIRECTLY TO THE RIGHT
         → 219D rightwards wave arrow
BX40     RIGHTWARDS ARROW CURVING UP
         . Japanese request
BX41     RIGHTWARDS ARROW CURVING DOWN
         . Japanese request
BX42   R DOWNWARDS ARROW CURVING LEFTWARDS
BX43   R DOWNWARDS ARROW CURVING RIGHTWARDS
BX44   R RIGHT-SIDE ARC CLOCKWISE ARROW
BX45   R LEFT-SIDE ARC ANTICLOCKWISE ARROW
BX46   R TOP ARC ANTICLOCKWISE ARROW
BX47   R BOTTOM ARC ANTICLOCKWISE ARROW
BX48   R TOP ARC CLOCKWISE ARROW WITH MINUS
BX49   R TOP ARC ANTICLOCKWISE ARROW WITH PLUS
BX4A   R LOWER RIGHT SEMICIRCULAR CLOCKWISE ARROW
BX4B   R LOWER LEFT SEMICIRCULAR ANTICLOCKWISE ARROW
BX4C   R ANTICLOCKWISE CLOSED CIRCLE ARROW
         → 20DA combining anticlockwise ring overlay
BX4D   R CLOCKWISE CLOSED CIRCLE ARROW
         → 20D9 combining clockwise ring overlay
BX4E   R RIGHTWARDS ARROW ABOVE SHORT LEFTWARDS ARROW
BX4F   R LEFTWARDS ARROW ABOVE SHORT RIGHTWARDS ARROW
BX50   R SHORT RIGHTWARDS ARROW ABOVE LEFTWARDS ARROW
BX51   R RIGHTWARDS ARROW WITH PLUS BELOW
BX52   R LEFTWARDS ARROW WITH PLUS BELOW
BX53   R RIGHTWARDS ARROW THROUGH X
```

```
BX54   R SMALL CIRCLE WITH SUPERIMPOSED LEFT RIGHT ARROW
BX55   R UPWARDS TWO-HEADED ARROW FROM SMALL CIRCLE
BX56     RIGHT ANGLE WITH DOWNWARDS ZIG-ZAG ARROW
BX57   R LEFT-UP-RIGHT-DOWN HARPOON
BX58   R LEFT-DOWN-RIGHT-UP HARPOON
BX59   R UP-RIGHT-DOWN-LEFT HARPOON
BX5A   R UP-LEFT-DOWN-RIGHT HARPOON
BX5B   R LEFT-UP-RIGHT-UP HARPOON
BX5C   R UP-RIGHT-DOWN-RIGHT HARPOON
BX5D   R LEFT-DOWN-RIGHT-DOWN HARPOON
BX5E   R UP-LEFT-DOWN-LEFT HARPOON
BX5F   R LEFTWARDS HARPOON-UP TO BAR
BX60   R RIGHTWARDS HARPOON-UP TO BAR
BX61   R UPWARDS HARPOON-RIGHT TO BAR
BX62   R DOWNWARDS HARPOON-RIGHT TO BAR
BX63   R LEFTWARDS HARPOON-DOWN TO BAR
BX64   R RIGHTWARDS HARPOON-DOWN TO BAR
BX65   R UPWARDS HARPOON-LEFT TO BAR
BX66   R DOWNWARDS HARPOON-LEFT TO BAR
BX67   R LEFTWARDS HARPOON-UP FROM BAR
BX68   R RIGHTWARDS HARPOON-UP FROM BAR
BX69   R UPWARDS HARPOON-RIGHT FROM BAR
BX6A   R DOWNWARDS HARPOON-RIGHT FROM BAR
BX6B   R LEFTWARDS HARPOON-DOWN FROM BAR
BX6C   R RIGHTWARDS HARPOON-DOWN FROM BAR
BX6D   R UPWARDS HARPOON-LEFT FROM BAR
BX6E   R DOWNWARDS HARPOON-LEFT FROM BAR
BX6F   R LEFTWARDS HARPOON-UP ABOVE LEFTWARDS HARPOON-DOWN
BX70   R UPWARDS HARPOON-LEFT BESIDE UPWARDS HARPOON-RIGHT
BX71   R RIGHTWARDS HARPOON-UP ABOVE RIGHTWARDS HARPOON-DOWN
BX72   R DOWNWARDS HARPOON-LEFT BESIDE DOWNWARDS HARPOON-RIGHT
BX73   R LEFTWARDS HARPOON-UP ABOVE RIGHTWARDS HARPOON-UP
BX74   R LEFTWARDS HARPOON-DOWN ABOVE RIGHTWARDS HARPOON-DOWN
BX75   R RIGHTWARDS HARPOON-UP ABOVE LEFTWARDS HARPOON-UP
BX76   R RIGHTWARDS HARPOON-DOWN ABOVE LEFTWARDS HARPOON-DOWN
BX77   R LEFTWARDS HARPOON-UP ABOVE LONG DASH
BX78   R LEFTWARDS HARPOON-DOWN BELOW LONG DASH
BX79   R RIGHTWARDS HARPOON-UP ABOVE LONG DASH
BX7A   R RIGHTWARDS HARPOON-DOWN BELOW LONG DASH
BX7B   R UPWARDS HARPOON-LEFT BESIDE DOWNWARDS HARPOON-RIGHT
BX7C   R DOWNWARDS HARPOON-LEFT BESIDE UPWARDS HARPOON-RIGHT
BX7D   R RIGHT DOUBLE ARROW WITH ROUNDED HEAD
          . looks like thin superset
BX7E   R EQUAL ABOVE RIGHTWARDS ARROW
BX7F   R TILDE OPERATOR ABOVE RIGHTWARDS ARROW
BX80   R LEFTWARDS ARROW ABOVE TILDE OPERATOR
BX81   R RIGHTWARDS ARROW ABOVE TILDE OPERATOR
BX82   R RIGHTWARDS ARROW ABOVE DOUBLE TILDE OPERATOR
BX83   R LESS THAN ABOVE LEFTWARDS ARROW
BX84   R LEFTWARDS ARROW THROUGH LESS-THAN
BX85   R GREATER-THAN ABOVE RIGHTWARDS ARROW
BX86   R SUBSET ABOVE RIGHTWARDS ARROW
BX87   R LEFTWARDS ARROW THROUGH SUBSET
BX88   R SUPERSET ABOVE LEFTWARDS ARROW
```

```
BX89    R LEFT FISH TAIL
BX8A    R RIGHT FISH TAIL
BX8B    R UP FISH TAIL
BX8C    R DOWN FISH TAIL
```

	CX0	CX1	CX2	CX3	CX4	CX5	CX6	CX7	CX8	CX9	CXA	CXB	CXC	CXD	CXE	CXF
0	∈	∍	⩟	∮	✦	⊗̂	∩̄		△		≙	≷				
1	⊟	∍	✕	∮	⊡	⊚	⌒	⊽	△		≈	≶				
2	⊟	∍	∑	∮	∸	⊕	⊍	⩯	⩒	∾	≋	⪍	≹	≸		≳
3	∊		∱	∫	÷	⧊	∪̆	∿	V̄			⩾	≩	≶		≲
4	∈̄		⨌	∫	⩊	△	∪	⩓	⩒	⩰		⪕		⩽	⪿	≪
5	∈		∫	⋈		⩟	⊍	⩔	⊲			⩾		⪖	⪾	≫
6	∈		∫	⊲		⌆	⊖	⩕	⊳		∓	⪑		⪓	⫁	⪡
7		⊑	∫	⊙₉	⅁	⌐	∪	⩙	≑	≊	±	⪒		≷	⩾	
8		⊙	∮	≫	⊕		⌢	⩛			≡	⪝		≦	⪹	
9		⊕	∲	⌈	✕		⋀				⩴	≻̇		≧	⩾	
A		⊗	∮	⌊	⋆	⊙₉	⩜				==	⪜		≶		
B		⊍	∮	⌃	⊠		⊌	⩚	≐	===				≷		
C	∈	⊎	∮	≈̃	⋊	⊔	⊓	⩡			÷	⪍				
D		⊓	∮	∔	※	⌒	⊓	⩟	⊞		≡	⪎				
E	∋	⊔	∮	±	⊛	⊎	⊍	∀	⊞	≒	⪦	≴		⪡	≴	
F	∍	⩜	∱	+₂	⊘	⊽		⩟			⪧	≳		≫	≴	

Large operators, binary operators; relational operators

```
CX00    R ELEMENT OF WITH LONG HORIZONTAL STROKE
CX01    R ELEMENT OF WITH VERTICAL BAR AT END OF HORIZONTAL STROKE
CX02    R SMALL ELEMENT OF WITH VERTICAL BAR AT END OF HORIZONTAL STROKE
CX03    R ELEMENT OF WITH DOT ABOVE
```

```
CX04   R ELEMENT OF WITH OVERBAR
CX05   R SMALL ELEMENT OF WITH OVERBAR
CX06   R ELEMENT OF WITH UNDERBAR
CX0C   R ELEMENT OF WITH TWO HORIZONTAL STROKES
CX0E   R CONTAINS WITH LONG HORIZONTAL STROKE
CX0F   R CONTAINS WITH VERTICAL BAR AT END OF HORIZONTAL STROKE
CX10   R SMALL CONTAINS WITH VERTICAL BAR AT END OF HORIZONTAL STROKE
CX11   R CONTAINS WITH OVERBAR
CX12   R SMALL CONTAINS WITH OVERBAR
CX17   R Z NOTATION BAG MEMBERSHIP
CX18   L N-ARY CIRCLED DOT OPERATOR
```
          → 2299 circled dot operator
```
CX19   L N-ARY CIRCLED PLUS OPERATOR
```
          → 2295 circled plus
```
CX1A   L N-ARY CIRCLED TIMES OPERATOR
```
          → 2297 circled times
```
CX1B   L N-ARY UNION OPERATOR WITH DOT
CX1C   L N-ARY UNION OPERATOR WITH PLUS
```
          → 228E multiset union
```
CX1D   L N-ARY SQUARE INTERSECTION OPERATOR
```
          → 2293 square cap
```
CX1E   L N-ARY SQUARE UNION OPERATOR
```
          → 2294 square cup
```
CX1F   L TWO LOGICAL AND OPERATOR
```
          = merge
          → CX76 two intersecting logical and
```
CX20   L TWO LOGICAL OR OPERATOR
```
          → CX77 two intersecting logical or
```
CX21   L N-ARY TIMES OPERATOR
CX22   L MODULO TWO SUM
CX23   L SUMMATION WITH INTEGRAL
CX24   L QUADRUPLE INTEGRAL OPERATOR
```
          [composed: U+222B + U+222B + U+222B + U+222B]
```
CX25   L FINITE PART INTEGRAL
CX26   L INTEGRAL WITH DOUBLE STROKE
CX27   L INTEGRAL AVERAGE WITH SLASH
CX28   L CIRCULATION FUNCTION
CX29   L ANTICLOCKWISE INTEGRATION
CX2A   L LINE INTEGRATION WITH RECTANGULAR PATH AROUND POLE
CX2B   L LINE INTEGRATION WITH SEMICIRCULAR PATH AROUND POLE
CX2C   L LINE INTEGRATION NOT INCLUDING THE POLE
CX2D   L INTEGRAL AROUND A POINT OPERATOR
CX2E   L QUATERNION INTEGRAL OPERATOR
CX2F   L INTEGRAL OVERPRINTED WITH LEFTWARDS ARROW WITH HOOK
CX30   L INTEGRAL OVERPRINTED WITH TIMES SIGN
CX31   L INTEGRAL OVERPRINTED WITH CAP
CX32   L INTEGRAL OVERPRINTED WITH CUP
CX33   L UPPER INTEGRAL WITH OVERBAR
CX34   L LOWER INTEGRAL WITH UNDERBAR
CX35   L JOIN
```
          = large bowtie (relational database theory)
          → 22C8 BOWTIE
```
CX36   L LARGE LEFT TRIANGLE OPERATOR
```
          . relational database theory

```
CX37   L Z NOTATION SCHEMA COMPOSITION
            → CX5A Z notation relational composition
CX38   L Z NOTATION SCHEMA PIPING
            → 226B much greater-than
CX39   L Z NOTATION SCHEMA PROJECTION
            → 21BE upwards harpoon with barb rightwards
CX3A   B PLUS SIGN WITH SMALL CIRCLE ABOVE
CX3B   B PLUS SIGN WITH CIRCUMFLEX ACCENT ABOVE
CX3C   B PLUS SIGN WITH TILDE ABOVE
CX3D   B PLUS SIGN WITH DOT BELOW
CX3E   B PLUS SIGN WITH TILDE BELOW
CX3F   B PLUS SIGN WITH SUBSCRIPT TWO
            = nim-addition
CX40   B FILLED TRIANGLE WITH PLUS
CX41   B MINUS SIGN WITH COMMA ABOVE
CX42   B MINUS SIGN WITH DOT BELOW
CX43   B FALLING DOTS MINUS
CX44   B RISING DOTS MINUS
CX47   B PLUS SIGN IN LEFT HALF CIRCLE
CX48   B PLUS SIGN IN RIGHT HALF CIRCLE
CX49   B VECTOR OR CROSS PRODUCT
            → 00D7 multiplication sign
CX4A   B MULTIPLICATION SIGN WITH DOT ABOVE
CX4B   B MULTIPLICATION SIGN WITH UNDERBAR
CX4C   B SEMIDIRECT PRODUCT MULTIPLICATION SIGN WITH BOTTOM CLOSED
CX4D   B SMASH PRODUCT
CX4E   B MULTIPLICATION SIGN IN LEFT HALF CIRCLE
CX4F   B MULTIPLICATION SIGN IN RIGHT HALF CIRCLE
CX50   B CIRCLED MULTIPLICATION SIGN WITH CIRCUMFLEX ACCENT
CX51   B MULTIPLICATION SIGN IN DOUBLE CIRCLE
CX52   B CIRCLED DIVISION SIGN
CX53   B PLUS IN TRIANGLE
CX54   B MINUS IN TRIANGLE
CX55   B MULTIPLICATION SIGN IN TRIANGLE
CX56   B INTERIOR PRODUCT
CX57   B RIGHTHAND INTERIOR PRODUCT
            → 2319 turned not sign
CX5A   B Z NOTATION RELATIONAL COMPOSITION
            → CX37 Z notation schema composition
CX5B     [removed: 2040]
CX5C   B AMALGAMATION OR COPRODUCT
            → 2210 n-ary coproduct
CX5D   B INTERSECTION WITH DOT
CX5E   B UNION WITH MINUS
            = Z NOTATION BAG SUBTRACTION
CX5F   B UNION WITH OVERBAR
CX60   B INTERSECTION WITH OVERBAR
CX61   B INTERSECTION WITH LOGICAL AND
CX62   B UNION WITH LOGICAL OR
CX63   B UNION ABOVE INTERSECTION
CX64   B INTERSECTION ABOVE UNION
CX65   B UNION ABOVE BAR ABOVE INTERSECTION
CX66   B INTERSECTION ABOVE BAR ABOVE UNION
CX67   B UNION BESIDE AND JOINED WITH UNION
```

```
CX68   B INTERSECTION BESIDE AND JOINED WITH INTERSECTION
CX6B   B CLOSED UNION WITH SERIFS
CX6C   B CLOSED INTERSECTION WITH SERIFS
CX6D   B DOUBLE SQUARE INTERSECTION
CX6E   B DOUBLE SQUARE UNION
CX71   B CLOSED UNION WITH SERIFS AND SMASH PRODUCT
CX72   B LOGICAL AND WITH DOT ABOVE
CX73   B LOGICAL OR WITH DOT ABOVE
CX74   B DOUBLE LOGICAL AND
CX75   B DOUBLE LOGICAL OR
CX76 * B TWO INTERSECTING LOGICAL AND
          → CX1F two logical and operator
CX77 * B TWO INTERSECTING LOGICAL OR
          → CX20 two logical or operator
CX78   B SLOPING LARGE OR
CX79   B SLOPING LARGE AND
CX7A   R LOGICAL OR OVERLAPPING LOGICAL AND
CX7B   B LOGICAL AND WITH MIDDLE STEM
CX7C   B LOGICAL OR WITH MIDDLE STEM
CX7D   B LOGICAL AND WITH HORIZONTAL DASH
CX7E   B LOGICAL OR WITH HORIZONTAL DASH
CX7F   B LOGICAL AND WITH DOUBLE OVERBAR
          → 2306 perspective
CX80   B LOGICAL AND WITH UNDERBAR
CX81   B LOGICAL AND WITH DOUBLE UNDERBAR
          → 2259 estimates
CX82   B SMALL VEE WITH UNDERBAR
CX83   B LOGICAL OR WITH DOUBLE OVERBAR
CX84   B LOGICAL OR WITH DOUBLE UNDERBAR
          → 225A equiangular to
CX85   B Z NOTATION DOMAIN ANTIRESTRICTION
CX86   B Z NOTATION RANGE ANTIRESTRICTION
CX87   R EQUAL SIGN WITH DOT BELOW
CX8B   R IDENTICAL WITH DOT ABOVE
CX8D   R TRIPLE HORIZONTAL BAR WITH DOUBLE VERTICAL STROKE
          = identical and parallel to
CX8E   R TRIPLE HORIZONTAL BAR WITH TRIPLE VERTICAL STROKE
CX92   R TILDE OPERATOR WITH DOT
CX94   R TILDE OPERATOR WITH RISING DOTS
          → 223B homothetic
CX97   R SIMILAR MINUS SIMILAR
CX9E   R CONGRUENT WITH OVERDOT
CXA0   R REVERSED CONGRUENT
CXA1   R DOUBLE TILDE OPERATOR WITH CIRCUMFLEX ACCENT
CXA2   R APPROXIMATELY EQUAL OR EQUAL TO
CXA6   B EQUAL ABOVE PLUS
CXA7   B PLUS ABOVE EQUAL
CXA8   R EQUAL ABOVE TILDE OPERATOR
CXA9   R DOUBLE COLON EQUAL
CXAA   R TWO CONSECUTIVE EQUAL SIGNS
CXAB   R THREE CONSECUTIVE EQUAL SIGNS
CXAC   R EQUAL SIGN WITH TWO DOTS ABOVE AND TWO DOTS BELOW
CXAD   R EQUIVALENT WITH FOUR DOTS ABOVE
CXAE   R LESS-THAN WITH CIRCLE INSIDE
```

```
CXAF   R GREATER-THAN WITH CIRCLE INSIDE
CXB0   R LESS-THAN WITH QUESTION MARK ABOVE
CXB1   R GREATER-THAN WITH QUESTION MARK ABOVE
CXB2   R LESS-THAN OR SLANTED EQUAL TO
CXB3   R GREATER-THAN OR SLANTED EQUAL TO
CXB4   R LESS-THAN OR SLANTED EQUAL TO WITH DOT INSIDE
CXB5   R GREATER-THAN OR SLANTED EQUAL TO WITH DOT INSIDE
CXB6   R LESS-THAN OR SLANTED EQUAL TO WITH DOT ABOVE
CXB7   R GREATER-THAN OR SLANTED EQUAL TO WITH DOT ABOVE
CXB8   R LESS-THAN OR SLANTED EQUAL TO WITH DOT ABOVE RIGHT
CXB9   R GREATER-THAN OR SLANTED EQUAL TO WITH DOT ABOVE LEFT
CXBC   R LESS-THAN OR APPROXIMATE
CXBD   R GREATER-THAN OR APPROXIMATE
CXBE   R LESS-THAN AND NOT ONE-LINE EQUAL TO
CXBF   R GREATER-THAN AND NOT ONE-LINE EQUAL TO
CXC2   R LESS-THAN AND NOT APPROXIMATE
CXC3   R GREATER-THAN AND NOT APPROXIMATE
CXD2   R LESS-THAN ABOVE TWO-LINE EQUAL ABOVE GREATER-THAN
CXD3   R GREATER-THAN ABOVE TWO-LINE EQUAL ABOVE LESS-THAN
CXD4   R LESS-THAN ABOVE SIMILAR OR EQUAL
CXD5   R GREATER-THAN ABOVE SIMILAR OR EQUAL
CXD6   R LESS-THAN ABOVE SIMILAR ABOVE GREATER-THAN
CXD7   R GREATER-THAN ABOVE SIMILAR ABOVE LESS-THAN
CXD8   R LESS-THAN ABOVE GREATER-THAN ABOVE TWO-LINE EQUAL
CXD9   R GREATER-THAN ABOVE LESS-THAN ABOVE TWO-LINE EQUAL
CXDA   R LESS-THAN ABOVE SLANTED EQUAL ABOVE GREATER-THAN ABOVE SLANTED EQUAL
CXDB   R GREATER-THAN ABOVE SLANTED EQUAL ABOVE LESS-THAN ABOVE SLANTED EQUAL
CXDE   R SLANTED EQUAL TO OR LESS-THAN
CXDF   R SLANTED EQUAL TO OR GREATER-THAN
CXE4   R SLANTED EQUAL TO OR LESS-THAN WITH DOT INSIDE
CXE5   R SLANTED EQUAL TO OR GREATER-THAN WITH DOT INSIDE
CXE6   R TWO-LINE EQUAL TO OR LESS-THAN
CXE7   R TWO-LINE EQUAL TO OR GREATER-THAN
CXE8   R TWO-LINE SLANTED EQUAL TO OR LESS-THAN
CXE9   R TWO-LINE SLANTED EQUAL TO OR GREATER-THAN
CXEE   R SIMILAR OR LESS-THAN
CXEF   R SIMILAR OR GREATER-THAN
CXF2   R SIMILAR ABOVE LESS-THAN ABOVE EQUAL
CXF3   R SIMILAR ABOVE GREATER-THAN ABOVE EQUAL
CXF4   R DOUBLE NESTED LESS-THAN SIGN
          = absolute continuity
CXF5   R DOUBLE NESTED GREATER-THAN SIGN
CXF6   R DOUBLE LESS-THAN WITH UNDERBAR
```

	DX0	DX1	DX2	DX3	DX4	DX5	DX6	DX7	DX8	DX9	DXA	DXB	DXC	DXD	DXE	DXF
0																
1																
2																
3																
4																
5																
6																
7																
8																
9																
A																
B																
C																
D																
E																
F																

The two white and two black squares shown as DXEC, DXED, DXF0 and DXF1 are meant to form a size-graded sequence with the present Unicode squares 25A0, 25A1, 25AA and 25AB. Ideally, the largest should be just a bit larger than 25A0 (but not as large as 2588), and the smallest, just a bit smaller than 25AA (but not quite as small as the dot operator, 22C5). These are used ad hoc to define various operations, with different sizes often indicating the degree of conformity to a particular notion. (Several different geometric shapes are used in this manner, the most common being squares and circles.)

More relations

```
DX00    R GREATER-THAN OVERLAPPING LESS-THAN
DX01    R GREATER-THAN BESIDE LESS-THAN
DX02    R LESS-THAN CLOSED BY CURVE
DX03    R GREATER-THAN CLOSED BY CURVE
DX04    R LESS-THAN CLOSED BY CURVE ABOVE SLANTED EQUAL
DX05    R GREATER-THAN CLOSED BY CURVE ABOVE SLANTED EQUAL
DX06    R SMALLER THAN
DX07    R LARGER THAN
DX08    R SMALLER THAN OR EQUAL
DX09    R LARGER THAN OR EQUAL
DX0E    R BUMPY ABOVE TWO-LINE EQUAL
DX0F    R PRECEDES ABOVE ONE-LINE EQUAL
DX10    R SUCCEEDS ABOVE ONE-LINE EQUAL
DX11    R PRECEDES ABOVE NOT ONE-LINE EQUAL
DX12    R SUCCEEDS ABOVE NOT ONE-LINE EQUAL
DX13    R PRECEDES ABOVE TWO-LINE EQUAL
DX14    R SUCCEEDS ABOVE TWO-LINE EQUAL
DX15    R PRECEDES ABOVE NOT TWO-LINE EQUAL
DX16    R SUCCEEDS ABOVE NOT TWO-LINE EQUAL
DX17    R PRECEDES ABOVE DOUBLE TILDE OPERATOR
DX18    R SUCCEEDS ABOVE DOUBLE TILDE OPERATOR
DX19    R PRECEDES ABOVE NOT DOUBLE TILDE OPERATOR
DX1A    R SUCCEEDS ABOVE NOT DOUBLE TILDE OPERATOR
DX25    R DOUBLE PRECEDES
DX26    R DOUBLE SUCCEEDS
DX29    R SUBSET WITH DOT
DX2A    R SUPERSET WITH DOT
DX2B    R SUBSET WITH PLUS BELOW
DX2C    R SUPERSET WITH PLUS BELOW
DX2D    R SUBSET WITH MULTIPLICATION SIGN BELOW
DX2E    R SUPERSET WITH MULTIPLICATION SIGN BELOW
DX31    R SUBSET OF OR EQUAL TO WITH DOT ABOVE
DX32    R SUPERSET OF OR EQUAL TO WITH DOT ABOVE
DX33    R SUBSET OF OR TWO-LINE EQUAL
DX34    R SUPERSET OF OR TWO-LINE EQUAL
DX35    R SUBSET OF ABOVE TILDE OPERATOR
DX36    R SUPERSET OF ABOVE TILDE OPERATOR
DX37    R SUBSET OF ABOVE DOUBLE TILDE OPERATOR
DX38    R SUPERSET OF ABOVE DOUBLE TILDE OPERATOR
DX3B    R SUBSET OF OR NOT TWO-LINE EQUAL
DX3C    R SUPERSET OF OR NOT TWO-LINE EQUAL
DX45    R SQUARE LEFT OPEN BOX OPERATOR
DX46    R SQUARE RIGHT OPEN BOX OPERATOR
DX47    R CLOSED SUBSET
DX48    R CLOSED SUPERSET
DX49    R CLOSED SUBSET OR EQUAL
DX4A    R CLOSED SUPERSET OR EQUAL
DX4B    R SUBSET ABOVE SUPERSET
DX4C    R SUPERSET ABOVE SUBSET
DX4D    R SUBSET ABOVE SUBSET
DX4E    R SUPERSET ABOVE SUPERSET
DX4F    R SUPERSET BESIDE SUBSET
```

```
DX50   R SUPERSET BESIDE AND JOINED BY DASH WITH SUBSET
DX51   R ELEMENT OF OPENING DOWNWARDS
DX52   R PITCHFORK WITH TEE TOP
DX53   R TRANSVERSAL INTERSECTION
            → 22D4 proper intersection
DX54   R FORKING
            . symbol is slashed although positive
DX55   R NONFORKING
            . negative symbol - has no slash
DX56   R SHORT LEFT TACK
DX57   R SHORT DOWN TACK
DX58   R SHORT UP TACK
DX59   R PERPENDICULAR WITH S
DX5A   R VERTICAL BAR TRIPLE RIGHT TURNSTILE
            = ordinarily satisfies
DX5B   R DOUBLE VERTICAL BAR LEFT TURNSTILE
DX5C   R VERTICAL BAR DOUBLE LEFT TURNSTILE
DX5D   R DOUBLE VERTICAL BAR DOUBLE LEFT TURNSTILE
DX5E   R LONG DASH FROM LEFT MEMBER OF DOUBLE VERTICAL
            → 22A9 forces
DX61   R SHORT DOWN TACK WITH OVERBAR
            → 22A4 down tack
            → 2351 apl functional symbol up tack overbar
DX62   R SHORT UP TACK WITH UNDERBAR
            → 22A5 up tack
            → 234A apl functional symbol down tack underbar
DX63   R SHORT UP TACK ABOVE SHORT DOWN TACK
DX64   R DOUBLE DOWN TACK
DX65   R DOUBLE UP TACK
            = independence (probability theory)
DX66   R NOT WITH TWO HORIZONTAL STROKES
DX67   R REVERSED NOT WITH TWO HORIZONTAL STROKES
DX68   F TRIPLE VERTICAL BAR DELIMITER
            → DX8B triple vertical bar binary relation
DX69   F Z NOTATION SPOT
            . medium-sized filled circle
DX6A   F Z NOTATION TYPE COLON
DX6B   O LEFT WHITE BRACE
DX6C   C RIGHT WHITE BRACE
DX6D   O LEFT WHITE ANGULAR BRACKET
            → 3108 left white tortoise shell bracket
DX6E   C RIGHT WHITE ANGULAR BRACKET
            → 3109 right white tortoise shell bracket
DX6F   O Z NOTATION LEFT IMAGE BRACKET
DX70   C Z NOTATION RIGHT IMAGE BRACKET
DX71   O Z NOTATION LEFT BINDING BRACKET
DX72   C Z NOTATION RIGHT BINDING BRACKET
DX73   O LEFT BRACKET UNDERBAR
DX74   C RIGHT BRACKET UNDERBAR
DX75   O LEFT BRACKET WITH REVERSE SOLIDUS TOP CORNER
DX76   C RIGHT BRACKET WITH REVERSE SOLIDUS BOTTOM CORNER
DX77   O LEFT BRACKET WITH SOLIDUS BOTTOM CORNER
DX78   C RIGHT BRACKET WITH SOLIDUS TOP CORNER
DX79   O LEFT ANGLE BRACKET WITH DOT
```

```
DX7A   C RIGHT ANGLE BRACKET WITH DOT
DX7B   O LEFT ARC LESS-THAN BRACKET
DX7C   C RIGHT ARC GREATER-THAN BRACKET
DX7D     DOUBLE LEFT ARC GREATER-THAN BRACKET
DX7E     DOUBLE RIGHT ARC LESS-THAN BRACKET
DX7F     RIGHT MOUSTACHE
DX80     LEFT MOUSTACHE
DX81     [removed: AX25]
DX82     [removed: AX26]
DX83   R DOES NOT DIVIDE WITH REVERSED NEGATION SLASH
DX84   R CIRCLE WITH VERTICAL LINE BELOW
DX85   R VERTICAL LINE WITH CIRCLE BELOW
DX86   N TOP WITH CIRCLE BELOW
DX87   B PARALLEL WITH HORIZONTAL STROKE
DX88   R PARALLEL WITH OVERPRINTED TILDE OPERATOR
DX89     [removed]
DX8A     [removed]
DX8B   B TRIPLE VERTICAL BAR BINARY RELATION
           = interleave
           → DX68 triple vertical bar delimiter
DX8C     [removed]
DX8D   B TRIPLE VERTICAL BAR WITH HORIZONTAL STROKE
DX8E     [removed: 2506]
DX8F   B TRIPLE COLON
           . logic
DX90   F DOTTED FENCE
           . four close dots vertical
DX91     VERTICAL ZIG-ZAG LINE
DX92     MEASURED ANGLE OPENING LEFT
DX93     RIGHT ANGLE VARIANT WITH SQUARE
DX94     MEASURED RIGHT ANGLE WITH DOT
DX95     ANGLE WITH S INSIDE
DX96     ACUTE ANGLE
DX97     SPHERICAL ANGLE OPENING LEFT
DX98     SPHERICAL ANGLE OPENING UP
DX99     TURNED ANGLE
DX9A     REVERSED ANGLE
DX9B     ANGLE WITH UNDERBAR
DX9C     REVERSED ANGLE WITH UNDERBAR
DX9D     [removed]
DX9E     LARGE DOWNWARDS POINTING ANGLE
DX9F     LARGE UPWARDS POINTING ANGLE
DXA0     MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING UP AND TO THE RIGHT
DXA1     MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING UP AND TO THE LEFT
DXA2     MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING DOWN AND TO THE RIGHT
DXA3     MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING DOWN AND TO THE LEFT
DXA4     MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING RIGHT AND UP
DXA5     MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING LEFT AND UP
DXA6     MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING RIGHT AND DOWN
DXA7     MEASURED ANGLE WITH OPEN ARM ENDING IN ARROW POINTING LEFT AND DOWN
DXA8     [removed: 2205]
DXA9   N REVERSED EMPTY SET
           → 2349 APL functional symbol circle backslash
DXAA   N EMPTY SET OVERBAR
```

```
DXAB   N EMPTY SET WITH SMALL CIRCLE ABOVE
DXAC   N EMPTY SET RIGHT ARROW ABOVE
DXAD   N EMPTY SET LEFT ARROW ABOVE
DXAE     CIRCLE WITH HORIZONTAL BAR
DXB0   B CIRCLED VERTICAL BAR
DXB1   B CIRCLED PARALLEL
DXB2   B CIRCLED FALLING DIAGONAL
DXB3   B CIRCLED PERPENDICULAR
DXB4     CIRCLE DIVIDED BY HORIZONTAL BAR AND TOP HALF DIVIDED BY VERTICAL
DXB5     CIRCLE WITH SUPERIMPOSED X
DXB6     CIRCLED ANTICLOCKWISE-ROTATED DIVISION SIGN
DXB7     UP ARROW THROUGH CIRCLE
DXB8     CIRCLED LARGE CIRCLE
```
   → 233E APL functional symbol circle jot
```
DXB9     CIRCLED FILLED CIRCLE
DXBA     CIRCLED LESS-THAN
DXBB     CIRCLED GREATER-THAN
DXBC     CIRCLE WITH SMALL CIRCLE TO THE RIGHT
DXBD     CIRCLE WITH TWO HORIZONTAL STROKES TO THE RIGHT
DXBE     SQUARED RISING DIAGONAL SLASH
```
   → 2341 APL functional symbol quad slash
```
DXBF     SQUARED FALLING DIAGONAL SLASH
```
   → 2342 APL functional symbol quad backslash
```
DXC0     SQUARED ASTERISK
DXC1     SQUARED SMALL CIRCLE
```
   → 233B APL functional symbol quad circle
```
DXC2   B SQUARED SQUARE
DXC3     TWO JOINED SQUARES
DXC4     TRIANGLE WITH DOT OVER
DXC5     TRIANGLE WITH UNDERBAR
DXC6     S IN TRIANGLE
DXC7   B TRIANGLE WITH SERIFS AT BOTTOM
DXCA   R RIGHT TRIANGLE ABOVE LEFT TRIANGLE
DXCB   R LEFT TRIANGLE BESIDE VERTICAL BAR
DXCC   R VERTICAL BAR BESIDE RIGHT TRIANGLE
DXCF   R LEFT FILLED BOWTIE
DXD0   R RIGHT FILLED BOWTIE
DXD1   R FILLED BOWTIE
DXD2   R LEFT FILLED TIMES
```
   → 22C9 left normal factor semidirect product
```
DXD3   R RIGHT FILLED TIMES
```
   → 22CA right normal factor semidirect product
```
DXD4     WHITE HOURGLASS
```
  . vertical bowtie
```
DXD5     FILLED HOURGLASS
DXD6     MOST POSITIVE
DXD7     CONGRUENCE SIGN WITH LAZY S
DXD8     REVERSED MOST POSITIVE WITH LINE BELOW
DXD9     MOST POSITIVE WITH TWO LINES BELOW
DXDA     [removed: 221D]
DXDB   N INFINITY SIGN WITH TOP RIGHT QUADRANT OMITTED
DXDC   N TIE OVER INFINITY
DXDD   N INFINITY NEGATED WITH VERTICAL BAR
DXDE   R DOUBLE-ENDED MULTIMAP
```

```
DXDF   N SQUARE WITH CONTOURED OUTLINE
          = D'Alembertian
DXE0   R INCREASES AS
DXE1     SHUFFLE PRODUCT
DXE2   R SLANTED PARALLEL SUPERIMPOSED ON EQUAL
          = homothetically congruent to
DXE3   R TILDE ABOVE SLANTED PARALLEL SUPERIMPOSED ON EQUAL
DXE4   R SLANTED PARALLEL SUPERIMPOSED ON THREE-LINE EQUAL
          = congruent and parallel
DXE5   R TOP ARC ABOVE BOTTOM ARC
DXE6   N THERMODYNAMIC
          . vertical bar crossed by two horizontals
DXE7   N DOWN-POINTING TRIANGLE WITH LEFT HALF BLACK
DXE8   N DOWN-POINTING TRIANGLE WITH RIGHT HALF BLACK
DXE9     UPPER LEFT TRIANGLE
DXEA     UPPER RIGHT TRIANGLE
DXEB     LOWER LEFT TRIANGLE
DXEC   N WHITE MEDIUM SQUARE
DXED   N BLACK MEDIUM SQUARE
DXEE     [removed]
DXEF     [removed]
DXF0   N WHITE VERY SMALL SQUARE
DXF1   N BLACK VERY SMALL SQUARE
DXF2   N WHITE DIAMOND WITH CENTERED DOT
DXF3   N FILLED DIAMOND WITH DOWN ARROW
DXF4     FILLED LOZENGE
DXF5     [removed]
DXF6     [removed: 2736]
DXF7   N CIRCLE WITH DOWN ARROW
DXF8   N FILLED CIRCLE WITH DOWN ARROW
DXF9   N ERROR-BARRED WHITE SQUARE
DXFA   N ERROR-BARRED FILLED SQUARE
DXFB   N ERROR-BARRED WHITE DIAMOND
DXFC   N ERROR-BARRED FILLED DIAMOND
DXFD   N ERROR-BARRED WHITE CIRCLE
DXFE   N ERROR-BARRED FILLED CIRCLE
```

Symbol variants defined using a Variation Selector (VS)

- 2268 $\lneqq$ + VS → $\lneqq$ less-than and not double equal - with vertical stroke
- 2269 $\gneqq$ + VS → $\gneqq$ greater-than and not double equal - with vertical stroke

- 22DA $\lesseqgtr$ + VS → $\lesseqgtr$ less-than above slanted equal above greater-than
- 22DB $\gtreqless$ + VS → $\gtreqless$ greater-than above slanted equal above less-than
- 2272 $\lesssim$ + VS → $\lesssim$ less-than or similar - following the slant of the lower leg
- 2273 $\gtrsim$ + VS → $\gtrsim$ greater-than or similar - following the slant of the lower leg
- 2A9D $\lesssim$ + VS → $\lesssim$ similar - following the slant of the upper leg - or less-than
- 2A9E $\gtrsim$ + VS → $\gtrsim$ similar - following the slant of the upper leg - or greater-than
- 2AAC $\leqslant$ + VS → $\leqslant$ smaller than or slanted equal
- 2AAD $\geqslant$ + VS → $\geqslant$ larger than or slanted equal

- 228A $\subsetneqq$ + VS → $\subsetneqq$ subset not equals - variant with stroke through bottom members
- 228B $\supsetneqq$ + VS → $\supsetneqq$ superset not equals - variant with stroke through bottom members
- 2ACB $\subsetneqq$ + VS → $\subsetneqq$ subset not two-line equals - variant with stroke through bottom members
- 2ACC $\supsetneqq$ + VS → $\supsetneqq$ superset not two-line equals - variant with stroke through bottom members

- 2A3B $\sqcap$ + VS → $\rfloor$ interior product - tall variant with narrow foot
- 2A3C $\sqcup$ + VS → $\llcorner$ righthand interior product - tall variant with narrow foot

- 2295 $\oplus$ + VS → $\oplus$ circled plus with white rim
- 2297 $\otimes$ + VS → $\otimes$ circled times with white rim
- 229C $\circleddash$ + VS → $\circleddash$ equal sign inside and touching a circle

- 2225 $\|$ + VS → $\sslash$ slanted parallel
-         $\sslash$ + VS + 20E5 $\backslash$ → $\sslash\!\!\!\backslash$ slanted parallel with reverse slash

** - 222A $\cup$ + VS → $\cup$ union with serifs
** - 2229 $\cap$ + VS → $\cap$ intersection with serifs
** - 2293 $\sqcap$ + VS → $\sqcap$ square intersection with serifs
** - 2294 $\sqcup$ + VS → $\sqcup$ square union with serifs

Notes:

** The shape is incorrect, owing to unavailability of a suitable font; the correct shape will be provided as soon as possible. The associated text correctly describes the desired shape.

Martin Luther Universität Halle – Wittenberg, D-06099 Halle (Saale)

March 13, 2000

Ms. Barbara Beeton
American Mathematical Society
201 Charles Street
Providence, RI 02904 2297
USA
Fax No. 001/401/331-3842

Ihre Zeichen	Ihr Schreiben vom	Unsere Zeichen	Datum

Dear Barbara Beeton:

In addition to disseminating mathematics electronically and in print, the German Mathematical Society (DMV) is actively involved in various activities concerning the presentation of mathematics on the Web. We are very unhappy about the current situation with regard to the encoding of mathematical symbols. In order for mathematics to be communicated effectively and accurately on the Web, there is a vital need for unambiguous encoding of mathematical notation so that there is no confusion to the reader as to what a text might mean. Mathematics, with its highly condensed symbolism and its trend to irredundant presentations, needs a very precise symbolism. The German Mathematical Society hopes that UNICODE can provide encoding that eliminates the ambiguity of the current schemes.

By glancing through the UNICODE proposals, my colleagues and I noticed that many symbols used in mathematical publishing do not occur in UNICODE, and thus, cannot be represented directly in many Web-based documents. We do hope that this situation can be changed so that mathematics can be communicated fluently on the Web.

I am writing this letter to you with the hope that you will be able to distribute it to the committees and persons involved and to make the position of the German Mathematical Society known to those responsible for the development of UNICODE. The German Mathematical Society would appreciate consideration of our point of view.

Sincerely

Gernot Stroth
President of the German Mathematical Society

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06099 Halle (Saale)	Tel (03 45) 55-2 46 10	mathematik.uni-halle.de
Hausanschrift:	Fax (03 45) 55-2 70 02	Internet: coxeter.mathematik.

March 15, 2000

Mr. Mike Ksar
1501 Page Mill Road
MS: 5UL
Palo Alto, CA 94304

Dear Mr. Ksar:

The mathematically-oriented scientific community uses various styles of letters and symbols to concisely represent functions, variables, operations and other mathematical objects that comprise the language of mathematics. This presents an especially subtle problem because two different styles of the same letter or symbol can have completely different meanings. Thus it is very important to the community that there is a universally accepted standard encoding for the various styles of letters and symbols it uses in its publications. If multiple versions of these were being used in the literature, rather than a universally accepted version, it would significantly complicate the communication between researchers, especially in the Web environment.

It is for this reason that the American Mathematical Society has devoted significant resources to gathering the documentation for alpha/numeric and mathematical symbols and submitting it to the Unicode Technical Committee for its acceptance. Now that this has been accomplished we hope very much that they will be accepted by WG2.

Sincerely yours,

John Ewing