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STANDARD

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6862

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**Information and documentation —
Mathematical coded character set for
bibliographic information interchange**

*Information et documentation — Jeu de caractères codés mathématiques
pour les échanges d'informations bibliographiques*



Reference number
ISO 6862:1996(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 6862 was prepared by Technical Committee ISO/TC 46, *Information and documentation*, Subcommittee SC 4, *Computer applications in information and documentation*.

Annex A of this International Standard is for information only.

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Information and documentation — Mathematical coded character set for bibliographic information interchange

1 Scope

1.1 This International Standard specifies a set of 188 graphic characters with their coded representations. It consists of code tables and a legend showing each graphic together with its name or meaning. Explanatory notes are also included.

1.2 These characters, together with characters in the international reference version of ISO 646 (ISO escape sequence ESC 2/8 4/0), in the extension of the Latin alphabet coded character set for bibliographic information interchange [ISO 5426¹⁾] and in the Greek alphabet coded character set for bibliographic information interchange [ISO 5428²⁾] constitute a character set for the international exchange of bibliographic records including their annotations, incorporating symbols mainly from the following disciplines:

- Algebra
- Arithmetic
- Calculus
- Cybernetics
- Geometry
- Hyperbolic functions
- Logic
- Mechanics
- Probability studies
- Set theory
- Statistics
- Topology
- Trigonometry
- Vectors

1.3 This International Standard is concerned with the transmission of mathematical characters in bibliographic records, not with their use in source documents: the descriptions and comments in the legend are therefore neither prescriptive nor exhaustive. This means that there is no restriction against the use of a particular symbol in interchange of information in the form in which it appears in the data to be transmitted, even if its name or meaning as given in this International Standard does not cover its use in that particular context.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 2022:1994, *Information technology — Character code structure and extension techniques*.

ISO 2375:1985, *Data processing — Procedure for registration of escape sequences*.

-
- 1) Escape sequences:
 - G0: ESC 2/8 5/0
 - G1: ESC 2/9 5/0
 - G2: ESC 2/10 5/0
 - G3: ESC 2/11 5/0
 - 2) Escape sequences:
 - G0: ESC 2/8 5/3
 - G1: ESC 2/9 5/3
 - G2: ESC 2/10 5/3
 - G3: ESC 2/11 5/3

3 Implementation

3.1 The implementation of this coded character set in physical media and for transmission, taking into account the need for error checking, is the subject of other International Standards (see annex A).

3.2 The implementation of this International Standard is in accordance with the provisions of ISO 2022 and is identified by the escape sequences ESC (in accordance with ISO 2375).³⁾

3.3 The unassigned positions in the code tables are not to be utilized in the international exchange of bibliographic information.

3) The Registration Authority.

4 Code tables of mathematical coded characters

The mathematical character set is given in tables 1 and 2.

Table 1 — Basic set G0

					b ₇	0	0	0	0	1	1	1	1
					b ₆	0	0	1	1	0	0	1	1
					b ₅	0	1	0	1	0	1	0	1
						0	1	2	3	4	5	6	7
b ₄	b ₃	b ₂	b ₁										
0	0	0	0	0					×	÷	+	−	'
0	0	0	1	1				/	±	∓	⊂	⊃	"
0	0	1	0	2					~	≈	⊆	⊇	'''
0	0	1	1	3				·	≈	≅	∈	∋	∨
0	1	0	0	4				−	≡	≅	∪	∩	^
0	1	0	1	5				○	≦	≧	∇	∃	┌
0	1	1	0	6				⊙	≦	≧	⊂	∅	h
0	1	1	1	7				⊙	≈	≈	↑	↓	└
1	0	0	0	8				↩	≪	≫	←	→	∫
1	0	0	1	9				·	∥	⊥	↶	↷	∫∫
1	0	1	0	10				¨	⊥	∠	↔	↕	∫∫∫
1	0	1	1	11				←	Δ	∇	↔	↔	∂
1	1	0	0	12				ˆ	°	‰	→	↕	h
1	1	0	1	13				˘	<	>	↑	↓	ℵ
1	1	1	0	14				→	[]	←	⇒	○
1	1	1	1	15				↷	Σ	Π	∞	√	

Table 2 — Extension of basic set G1

					b ₇	0	0	0	0	1	1	1	1
					b ₆	0	0	1	1	0	0	1	1
					b ₅	0	1	0	1	0	1	0	1
						0	1	2	3	4	5	6	7
b ₄	b ₃	b ₂	b ₁										
0	0	0	0	0	⊠	⊡	⊢	≠	≈	∥		≡	
0	0	0	1	1	⊕	⊖	⊗	≡	::	/	\	∴	
0	0	1	0	2	⊖	⌈	⌋	⊖	⌈	⌋	⊥	∞	
0	0	1	1	3	⊗	⊥	⊥	∩	∪	∩	∪	}	
0	1	0	0	4	⊙	⊙	⊙	:	⊕	∩	∪	⊥	
0	1	0	1	5	⊙	⊙	⊙	∴	⌈	⌋	⊂	⊃	⊥
0	1	1	0	6	⊙	⊙	⊙	∴	⊥	⊥	∈	∉	⊥
0	1	1	1	7	⊙	⊙	⊙	⊥	⊥	⊥	↗	↖	⊥
1	0	0	0	8	⊙	⊙	⊙	⊥	⊥	⊥	↗	↖	↔
1	0	0	1	9	⊙	⊙	⊙	⊙	⊥	⊥	↗	↖	↔
1	0	1	0	10	⊙	⊙	⊙	⊙	⊥	⊥	↗	↖	↔
1	0	1	1	11	⊙	⊙	⊙	⊙	⊥	⊥	↗	↖	↔
1	1	0	0	12	⊙	⊙	⊙	⊙	⊥	⊥	⊙	●	⊙
1	1	0	1	13	⊙	⊙	⊙	⊙	⊥	⊥	⊥	⊥	⊙
1	1	1	0	14	⊙	⊙	⊙	⊙	⊥	⊥	⊥	⊥	ℝ
1	1	1	1	15	⊙	⊙	⊙	⊙	⊥	⊥	⊥	⊥	⊙

5 Legend

A legend for tables 1 and 2 is given in table 3.

Table 3 — Legend

Position in table 1	Graphics	Name or meaning	Comments	Coding
2/1	/	Negation: oblique	Overlay character	nego or /
2/2		Negation: long bar	Overlay character	negl or
2/3	'	Negation: short bar	Overlay character	negs or '
2/4	-	Negation: horizontal	Overlay character	negh or —
2/5	○	Circle, overlay	Overlay character for integral, etc.	ciro
2/6	⦶	Circle, anti-clockwise arrow	Overlay character for integral	ciroa
2/7	⦷	Circle, clockwise arrow	Overlay character for integral	ciroc
2/8	↶	Anti-clockwise arrow	Overlay character	arroa
2/9	·	Superior dot	Overlay character	dots
2/10	··	Superior double dot	Overlay character	ddots
2/11	←	Superior vector left	Overlay character	arls
2/12	^	Superior hat	Overlay character	checkas
2/13	∨	Superior V	Overlay character	ckackas
2/14	→	Superior vector right	Overlay character	arrs
2/15	↷	Clockwise arrow	Overlay character	arroc
3/0	×	Multiply		times or ×
3/1	±	Plus or minus		plmin
3/2	~	Equivalent to	Also: negation, or proportional to	sim
3/3	≈	Asymptotic to	Also: approximately equal to	dsim
3/4	≡	Identical with		iden
3/5	≤	Less than or equal to		lto
3/6	≧	Less than or greater than		lessgrt

Table 3 (continued)

Position in table 1	Graphics	Name or meaning	Comments	Coding
3/7	\lesssim	Less than or equivalent to		lessim
3/8	\ll	Much less than		less2
3/9	\parallel	Parallel to	See also table 2 5/0: norm of a matrix	parr
3/10	\perp	Right angle	Also: factorial	rang
3/11	Δ	Increment		incre
3/12	$^\circ$	Degree		deg
3/13	$<$	Left angle bracket		labrak or <
3/14	$[$	Left open bracket		lobrak or [
3/15	Σ	Sum of		sum
4/0	\div	Divide	Alternative to ISO 646	div or /
4/1	\mp	Minus or plus		minpl
4/2	\approx	Asymptotically equal to		simeq
4/3	\cong	Similar to		congr
4/4	\doteq	Approximately equal to		libra
4/5	\gtrsim	Greater than or equal to		gto
4/6	\gtrless	Greater than or less than		grtrless
4/7	\gtrsim	Greater than or equivalent to		grtrsimeq
4/8	\gg	Much greater than		grtr2
4/9	\perp	Orthogonal to	Also: bottom element	perp
4/10	\sphericalangle	Angle		ang
4/11	∇	Backward finite difference operator	Also: nabla operators	nabla
4/12	‰	Per mille		perk
4/13	$>$	Angle bracket, right		rabrak or >
4/14	$]$	Open bracket, right		robrak or]
4/15	Π	Product		prod

Table 3 (continued)

Position in table 1	Graphics	Name or meaning	Comments	Coding
5/0	+	Plus		plus or +
5/1	\subset	Proper inclusion in set		lhook
5/2	\subseteq	Identity or inclusion in set	Also: identity	lkkeq
5/3	\in	Set membership		mem
5/4	\cup	Union of sets between limits		cup
5/5	\forall	For all		inva
5/6	\complement	Complement		longc
5/7	\uparrow	Increases; exponent		arru
5/8	\leftarrow	Left arrow		arll
5/9	\curvearrowright	Anti-clockwise		arrac
5/10	\leftrightarrow	Mutually implies		arrlr
5/11	$\overrightarrow{\leftarrow}$	Left arrow over right arrow		lrarr
5/12	\rightarrow	Functional relationship		bararr
5/13	\Uparrow	Double arrow, upward		darru or ^
5/14	\Leftarrow	Is implied by		darrl
5/15	∞	Infinity		infin
6/0	-	Minus		minus or -
6/1	\supset	Properly includes in set	Also: identical with	rhook
6/2	\supseteq	Contains as subset		rhkeq
6/3	\ni	Contains		cont
6/4	\cap	Intersection of classes or sets between limits		hat
6/5	\exists	There exists		reve
6/6	\emptyset	Empty set		bararc
6/7	\downarrow	Decreases		arrd
6/8	\rightarrow	Approaches		arr

Table 3 (continued)















Position in table 1	Graphics	Name or meaning	Comments	Coding
6/9		Clockwise		arrcc
6/10		Vertical relationship		arrud
6/11		Right arrow over left arrow		rlarr
6/12		Anti-parallel		udarr
6/13		Double arrow, downward		darrd
6/14		Implies		darr
6/15		Radical	Also: square root	rad
7/0	'	Prime	Also: minutes, feet	prime or '
7/1	"	Double prime	Also: seconds, inches	dprime or "
7/2	'''	Triple prime		trprime
7/3		Logical or	Also: disjunction	checkd
7/4		Logical and	Also: conjunction	checku
7/5		Logical not		lognot
7/6	<i>h</i>	Planck constant		planck
7/7		Implies		imply
7/8		Integral		int
7/9		Double integral		dint
7/10		Triple integral		trint
7/11	\hat{c}	Partial differentiation		prtl
7/12	<i>h</i>	Planck constant divided by 2 π		plan2pi
7/13	\aleph	Aleph		aleph
7/14	\circ	Composite function	Also: small circle	cirsm

Table 3 (continued)

Position in table 2	Graphics	Name or meaning	Comments	Coding
2/1	\oplus	Direct sum		crplus
2/2	\ominus	Symmetric difference		crmin
2/3	\otimes	Tensor product	Also: Dyadic product, or Plethysm operator	crtimes
2/4	\odot	Inner product	Used with tensors	crdot
2/5	\therefore	Therefore		thrf
2/6	\because	Because		beca
2/7	\sqsubset	Image of		imbox
2/8	\sqsupset	Original of		origbox
2/9	$\bullet \rightarrow$	Image of		imline
2/10	$\leftarrow \bullet$	Original of		origline
2/11	\dagger	Hermitian conjugate matrix		herm
2/12	\oplus	Direct sum		dirsum
2/13	\succ	Most positive		mpos
2/14	\sim	Homothetic		homot
2/15	\prec	Element precedes under relation		elrel
3/0	\neq	Not equal to		nequ
3/1	\parallel	Has an image		hasim
3/2	\lrcorner	Open angle bracket, left		accbrale
3/3	\lfloor	Left floor	Paired with right floor, 4/3	lfloor
3/4	\vdots	Triple colon		tripcol
3/5	\lceil	Left ceiling	Paired with right ceiling, 4/5	lceil
3/6	\sqsubseteq	Square subset		sqsub
3/7	\sqcup	Least upper bound	Used for lattices	lub
3/8	\triangleright	Long triangle		ltril
3/9	\succcurlyeq	Is dominated by		cyrsim

Table 3 (continued)

























Position in table 2	Graphics	Name or meaning	Comments	Coding
3/10		Has a lower rank than		cyless
3/11		Is contained in or equal to		clyto
3/12		Symmetric difference		simdif
3/13		Estimates	Also: corresponds to	ests
3/14		Implied by	Graphic positioned above base line	ltriagl
3/15		Triangle	Graphic positioned above base line	triagl
4/0		Asymptotically equal to		dsimeq
4/1		Ratio		ratio
4/2		Open angle bracket, right		aocbrak
4/3		Right floor	Paired with left floor, 3/3	rfloor
4/4		Geometrically equivalent to		dlibra
4/5		Right ceiling	Paired with left ceiling, 3/5	rceil
4/6		Square superset		sqsup
4/7		Greatest upper bound	Used for lattices	glb
4/8		Long triangle, underlined		ltrilb
4/9		Dominance	Also: contained in or equivalent to	cylsim
4/10		Has a higher rank than		cygrtr
4/11		Has rank higher than or equal to		cygto
4/12		Approaches the limit		limeq
4/13		Equiangular		heq
4/14		Implies	Graphic positioned above base line	rtriagl
4/15		Hamilton operator	Also: curl of a vector; graphic positioned above base line	itriagl
5/0		Norm of a matrix		nmat
5/1		Diagonal rule, to left		diagl

Table 3 (continued)

Position in table 2	Graphics	Name or meaning	Comments	Coding
5/2	\top	Top element		top
5/3	\vee	Vector or sum		checkd2
5/4	\cup	Sum or union of classes or sets		bcup
5/5	\subset	Is included in set		rcup
5/6	\in	Is an element of		rbcup
5/7	\nearrow	Arrow, N.W.		arnnw
5/8	\swarrow	Arrow, S.W.		arrsw
5/9	\uparrow	Half upward arrow		hrru
5/10	\rightarrow	Crossed arrow, right		narr
5/11	\curvearrowright	Curved arrow, right	Also : one to one map	cyarr
5/12	\circ	Circle, spacing	Used with overlays	circ
5/13	\square	Square	Also: D'Alembertain operator, or end of proof	squ
5/14	\square	Rectangle		rect
5/15	\diamond	Lozenge		loz
6/0	$ $	Magnitude of		sline
6/1	\diagdown	Diagonal rule, to right		diagr
6/2	\diagdown	Difference		diff
6/3	\wedge	Vector product	Also: conjunction sign	checku2
6/4	\cap	Product of intersection of classes or sets		bhat
6/5	\supset	Includes in set		lcup
6/6	\ni	Such that	Also: contains	lbcup
6/7	\nearrow	Arrow, N.E.	Also : grows	arnne
6/8	\searrow	Arrow, S.E	Also : decays	arrse
6/9	\rightsquigarrow	Functional relationship, to right		zagarr
6/10	\rightarrow	On to map		arr2

Table 3 (concluded)

Position in table 2	Graphics	Name or meaning	Comments	Coding
6/11		Curved arrow, left		cyarl
6/12		Dark circle		bcir
6/13		End of proof		bsqu
6/14		Parallelogram		parlgr
6/15		Spherical angle		spharg
7/0		Approximately equal to ; is the image of		image
7/1		Geometric properties		prop
7/2		Varies as	Also: proportional to	varies
7/3		Curly vertical line		cline
7/4		Statement is true	Also : result in	true
7/5		Assertion	Also : reduced to	assrt
7/6		Not parallel to		npar
7/7		Crossed vertical bar		nsline
7/8		Crossed arrow, to left		narl
7/9		Functional relationship, to left		zagarl
7/10		Equivalence	Also: if and only if	darrlr
7/11		Double arrow, up and down		darrud
7/12		Inverted iota		iiota
7/13		Weierstrass elliptic function		weirp
7/14		Cross ratio		xrat

6 Explanatory notes

6.1 In general, separate shapes are considered to be individual characters. However, different font designs are not considered to require separate characters: where the shape, size or positioning of a character is meaningful within the citation, this will be specified by control characters.

6.2 Since characters have been assigned to the set on the grounds of shape rather than meaning, the absence of an appropriate definition by a symbol, or appearance of such a definition by another symbol, does not imply a restriction against the use of that symbol in interchange of information in the form in which it appears in the data to be transmitted.

6.3 Names were chosen based on a commonly accepted term describing a character's shape or function.

For bibliographic mathematical characters that represent several functions, a term describing their

shape was preferred. References from alternative names, such as those provided in ISO 31-11, have been given in the "Comments" column.

6.4 Characters already appearing in an established character set are not generally repeated in the mathematical character set. Exceptions are, in table 1 the characters 2/9, 2/10, 2/12, 2/13 (non-spacing), 3/1, 3/13, 4/13 (also found in IRV), 7/0, 7/1 (also found in ISO 5426), 5/0 and 6/0 (used as minus only) (also found in IRV), 3/15 and 4/15 (in smaller form in ISO 5428), and in table 2, 6/0 (used as magnitude only) (also found in IRV).

6.5 Negative and other modified symbols may be constructed by combining symbols from this and/or other character sets by the use of non-spacing overlay facilities in table 1, column 2 of this set or in other sets.

6.6 The codings given for each character in the legends are those recommended for use in environments, such as teleprinter, which do not have access to the full character set.

Annex A (informative)

Bibliography

- [1] ISO 31-11:1992, *Quantities and units — Part 11: Mathematical signs and symbols for use in the physical sciences and technology.*
- [2] ISO 646:1983, *Information processing — ISO 7-bit coded character set for information interchange.*
- [3] ISO 962:1974, *Information processing — Implementation of the 7-bit coded character set and its 7-bit and 8-bit extensions on 9-track 12,7 mm (0.5 in) magnetic tape.*
- [4] ISO 1113:1979, *Information processing — Representation of the 7-bit coded character set on punched tape.*
- [5] ISO 1155:1978, *Information processing — Use of longitudinal parity to detect errors in information messages.*
- [6] ISO 1177:1985, *Information processing — Character structure for start/stop and synchronous character oriented transmission.*
- [7] ISO 1745:1975, *Information processing — Basic mode control procedures for data communication systems.*
- [8] ISO 5426:1983, *Extension of the Latin alphabet coded character set for bibliographic information interchange.*
- [9] ISO 5428:1984, *Greek alphabet coded character set for bibliographic information interchange.*
- [10] ISO 6586:1980, *Data processing — Implementation of the ISO 7-bit and 8-bit coded character sets on punched cards.*

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Descriptors: documentation, bibliographies, data processing, information interchange, graphic characters, character sets, coded character sets, mathematics.

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