L2/06-124

ISO / IEC JTC 1 / SC 2 / WG 2 N3085

PROPOSAL SUMMARY FORM TO ACCOMPANY SUBMISSIONS FOR ADDITIONS TO THE REPERTOIRE OF ISO/IEC 10646[1]

Please fill all the sections A, B and C below.

Please read Principles and Procedures Document (P & P) from http://www.dkuug.dk/JTC1/SC2/WG2/docs/principles.html **for guidelines and details before filling this form.**

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A. Administrative

1. **Title:** *Arabic Mathematical Alphabetic Symbols*
2. Requester's name: *Azzeddine LAZREK*
3. Requester type (Member body/Liaison/Individual contribution): *Member body*
   Cadi Ayyad University Marrakech-Morocco
4. Submission date: *2006-03-30*
5. Requester's reference (if applicable): *lazrek@ucam.ac.ma*
6. Choose one of the following:
   This is a complete proposal: http://www.ucam.ac.ma/fssm/rydarab/doc/unicode/amasl.pdf
   (or) More information will be provided later:

B. Technical – General

1. Choose one of the following:
   a. This proposal is for a new script (set of characters):
      Proposed name of script:
   b. The proposal is for addition of character(s) to an existing block: *addition of characters to existing blocks*
      Name of the existing block: *Letterlike symbols, Mathematical alphanumeric symbols*
      As there is not enough room in these blocks, we should ask for new blocks
2. Number of characters in proposal: *142*
3. Proposed category (select one from below - see section 2.2 of P&P document):
   A-Contemporary X B.1-Specialized (small collection) B.2-Specialized (large collection)
   C-Major extinct D-Attested extinct E-Minor extinct
   F-Archaic Hieroglyphic or Ideographic G-Obscure or questionable usage symbols
4. Proposed Level of Implementation (1, 2 or 3) (see Annex K in P&P document): *1*
   Is a rationale provided for the choice? *Yes*
   If Yes, reference:
5. Is a repertoire including character names provided? *Yes*
   a. If YES, are the names in accordance with the "character naming guidelines" in Annex L of P&P document? *Yes*
   b. Are the character shapes attached in a legible form suitable for review? *Yes*
6. Who will provide the appropriate computerized font (ordered preference: True Type, or PostScript format) for publishing the standard? *True Type and LaTeX package*
   If available now, identify source(s) for the font (include address, e-mail, ftp-site, etc.) and indicate the tools used: http://www.ucam.ac.ma/fssm/rydarab/doc/unicode/ramzarab.ttf
   http://www.ucam.ac.ma/fssm/rydarab/system/zip/ramzarab.zip
7. References:
   a. Are references (to other character sets, dictionaries, descriptive texts etc.) provided? *Yes*
   b. Are published examples of use (such as samples from newspapers, magazines, or other sources) of proposed characters attached? *Yes*
8. Special encoding issues:
   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*

9. Additional Information:

Submitters are invited to provide any additional information about Properties of the proposed Character(s) or Script that will assist in correct understanding of and correct linguistic processing of the proposed character(s) or script. Examples of such properties are: Casing information, Numeric information, Currency information, Display behaviour information such as line breaks, widths etc., Combining behaviour, Spacing behaviour, Directional behaviour, Default Collation behaviour, relevance in Mark Up contexts, Compatibility equivalence and other Unicode normalization related information. See the Unicode standard at http://www.unicode.org for such information on other scripts. Also see http://www.unicode.org/Public/UNIDATA/UCD.html and associated Unicode Technical Reports for information

[1] Form number: N3002-F (Original 1994-10-14; Revised 1995-01, 1995-04, 1996-04, 1996-08, 1999-03, 2001-05, 2001-09, 2003-11, 2005-01, 2005-09, 2005-10)

needed for consideration by the Unicode Technical Committee for inclusion in the Unicode Standard.

C. Technical - Justification

1. Has this proposal for addition of character(s) been submitted before? *No*
   If YES explain
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? *W3C Math Interest Group – IUC 27 – Kingdom of Saudi Arabia*
   If YES, available relevant documents: http://www.w3.org/TR/arabic-math/ http://www.ucam.ac.ma/fssm/rydarab/doc/communic/unicodem.pdf
   Fayez Alhargan, King Abdulaziz City for Science and Technology, alhargan@kacst.edu.sa *and AbdulMalik Al-Salman, King Saud University,* salman@ccis.ksu.edu.sa
3. Information on the user community for the proposed characters (for example: size, demographics, information technology use, or publishing use) is included? *About 500 million of people*
   Reference: *Arabic alphabet based scripts as Arabic, Persian, …*
4. The context of use for the proposed characters (type of use; common or rare) *common*
   Reference:
5. Are the proposed characters in current use by the user community? Yes
   If YES, where? Reference: *In mathematical handbooks at Arabic countries*
6. After giving due considerations to the principles in the P&P document must the proposed characters be entirely in the BMP? *No*
   If YES, is a rationale provided?
   If YES, reference:
7. Should the proposed characters be kept together in a contiguous range (rather than being scattered)? *No*
8. Can any of the proposed characters be considered a presentation form of an existing character or character sequence? *No*
   If YES, is a rationale for its inclusion provided?
   If YES, reference:
9. Can any of the proposed characters be encoded using a composed character sequence of either existing characters or other proposed characters? *No*
   If YES, is a rationale for its inclusion provided?
   If YES, reference:
10. Can any of the proposed character(s) be considered to be similar (in appearance or function) to an existing character? *No*
    If YES, is a rationale for its inclusion provided?
    If YES, reference:
11. Does the proposal include use of combining characters and/or use of composite sequences? *No*
    If YES, is a rationale for such use provided?
    If YES, reference:
    Is a list of composite sequences and their corresponding glyph images (graphic symbols) provided?
    If YES, reference:
12. Does the proposal contain characters with any special properties such as control function or similar semantics? *No*
    If YES, describe in detail (include attachment if necessary)
13. Does the proposal contain any Ideographic compatibility character(s)? *No*
    If YES, is the equivalent corresponding unified ideographic character(s) identified?
    If YES, reference:

Arabic Mathematical Alphabetic Symbols,

Additional characters proposed to Unicode

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Contents

1 Overview

The Unicode Standard provides a quite complete set of conventional mathematical alphabetic symbols to support publication of mathematics in a Latin script based writing. Standard Arabic letters as well as some ligatures and

composed characters, used for general text, are already present in the Unicode Standard. Arabic alphabet based scripts make use of local ways for writing mathematics. Even though some local symbols can be obtained via mirroring of already existing symbols, there are many symbols found in Arabic mathematical handbooks that are not yet part of the Unicode Standard and can't be obtained readily through a simple mirroring.

In Arabic presentation, *Arabic mathematical expressions* use *special symbols* and flow *from right to left*. Most of these symbols had been adopted through official international conventions such as *The Amman's 1987 convention* [11]. *The Amman's convention* abstract the conference under the topic *Scientific symbols and method of their use in Arabic language* gathering the *Union of the Arab scientific linguistic groupings* at Amman, Jordan in 1987.

Arabic mathematical alphabetic symbols constitute a widely used version of the Arabic alphabet, used over many centuries and in many contexts (e.g. epigraphical, manuscript and manual books, traditional printed editions). This way of writing expressions corresponds to the standards and conventions adopted in languages using Arabic alphabet based scripts, such as Arabic or Persian. The majority of the handbooks of mathematics in use in Middle East, Libya, Algeria, ... are typeset according to this way of putting mathematics into type. Before the adoption of the French mathematical notation, used Moroccan handbooks respect this way of typesetting symbols. Up till now, the symbols are written by hand or, at best, with a typewriter. They are printed then directly with the tools of traditional printing works without assistance of the computer. Generally, the use of computers never goes beyond processing the literal part of the document.

Some examples in [4] show both modern printed editions (with the **RyDArab** system [6]) and old ones in the same page.

In some cases, both types of presentations of mathematics, Arabic and Latin, may be required in the same text.

Therefore, the addition of those characters is necessary for the correct and accurate representation of ancient and current Arabic mathematical expressions [10]. It is also necessary in order to complement the Arabic alphabet based scripts which already exists in the Unicode Standard.

This proposal is restricted to *Arabic mathematical alphabetic symbols*, presented by the character code tables and list of character names, to be added into the Unicode Standard [5]. Some other proposals can be found in [4].

The addition of these characters can be done to the existing blocks: Letterlike symbols and Mathematical alphanumeric symbols. As there is not enough room in these existing blocks, we should ask for new blocks.

The **RamzArab** font available, includes all these characters. It's in OpenType format, for publication of the standard [9]. The shapes of the reference glyphs used are not frozen. They are continually being improved in *Multilingual scientific e-document processing* Project at Al-khawarizmi Atelier.

Several samples presented are very poor visual quality. They are scanned from old handbooks. Some boxes are add to some symbols in Figures in order to emphases them and understand the purpose of the samples.

2 Basic mathematical alphabetic symbols

In mathematics, style variations are very important semantically [2]. One reason for using mathematical alphabetic symbols in Latin based script texts, is that they are typeset in a different way from that in ordinary text. For example, the character spacing is different in mathematic mode than in text mode (e.g., let n a number in the set N part of the natural number set $\mathbb{N}$ in the context $\mathcal{N}$). For right-to-left Arabic math text, the usual shaping, or ligaturing, of Arabic letters is omitted in mathematical mode except for abbreviations or units entities like trigonometric function names.

The basic mathematical alphabetic letterlike symbols used in Arabic mathematical handbooks are of six forms [3]: *isolated*, *initial*, *tailed*, *stretched*, *looped*, and *double-struck* (see Table 1).

With a close variation to the shapes, certain forms of these characters already exist in the Unicode standard. In particular, the isolated and the initial forms of the Arabic letters are codified in "Arabic Presentation Forms-B" block but used in natural text. As we consider used them in mathematical mode, we can propose them here to be include in the Unicode Standard. That will facilitate the use of MathML for Arabic mathematical presentation [3].

For some characters in the basic set of Arabic characters, more than one variant of the same character are asked for inclusion. This is because they can appear in the same mathematical document with different meanings, even though they would have the same meaning in Arabic text. This is what happen with Latin and Greek characters [2].

The isolated form is the form most frequently used. In absence of specification of form, the isolated form is that which will be considered. It should be noted that the tailed form is not contained in the Amman's convention (see Figure 2) but is commonly present in the handbooks.

There are two alphabetic orders in Arabic. The one used in mathematics or alphabetic numeration list is the *a, b, j, d, ...* (namely ا, ب, ج , د, ...) order (see Figure 2). It differs from the *a, b, t, th, ...* (namely ا, ب, ت, ث,

ج	MATHEMATICAL JEEM
	≈ <font> 062C ج Arabic letter jeem
جـ	MATHEMATICAL INITIAL JEEM
	≈ <font> <initial> 062C ج Arabic letter jeem
	≈ <font> FE9F جـ Arabic letter jeem initial form
ـجـ	MATHEMATICAL TAILED JEEM
	≈ <font> FE9F جـ 06C1 ہ
جـا	MATHEMATICAL STRETCHED JEEM
	≈ <font> FE9F جـ FE8E ا
ڿ	MATHEMATICAL LOOPED JEEM
	≈ <font> 062C ج Arabic letter jeem
𞋢	MATHEMATICAL DOUBLE-STRUCK JEEM
	≈ <font> 062C ج Arabic letter jeem

Table 1: Example of mathematical alphabetic symbols

. . .) order usually adopted in modern dictionaries.

The glyphs of the letters ALEF[1], DAL, WAW, ZAIN, TAH, REH, THAL and ZAH (namely ا, د, و, ز, ط, ر, ذ and ظ respectively), in isolated form, are the same as in initial form. So, these symbols will appear in the isolated form set only.

The glyphs of the letters ALEF, DAL, WAW, ZAIN, REH and THAL (namely ا, د, و, ز, ر and ذ respectively), in the tailed and stretched forms, are composed with two elements. They won't appear in these forms.

In the Table 2, the mathematical alphabetic symbols are presented with dots in the *a-b-j-d* order.

3 Particular mathematical alphabetic symbols

Some glyphs used in Arabic mathematical presentation are not really Arabic letters but particular forms of mathematical alphabetic symbols used in Arabic mathematical handbooks (see Figure 2 and Figure 3, Table 3 and Table 4).

The glyph of the letter ALEF ا can be confused with the Arabic-Indic

[1]All along this paper, Arabic characters are named according to the Unicode Standard way, in spite of the non conformity for some letters. In fact, the letter ز generally pronounced ZAY instead of ZAIN.

ISOLATED	INITIAL	TAIL	STRETCHED	LOOPED	DOUBLE-STRUCK
ا					
ب	بـ	ـبـ	بـا	ـبـ	
ج	جـ	ـجـ	جـا	ـجـ	
د					
ه	هـ	ـهـ	هـا	ـهـ	
و					
ز					
ح	حـ	ـحـ	حـا	ـحـ	
ط		ـطـ	طـا	ـطـ	
ي	يـ	ـيـ	يـا	ـيـ	
ك	كـ	ـكـ	كـا	ـكـ	
ل	لـ	ـلـ		ـلـ	
م	مـ	ـمـ	مـا	ـمـ	
ن	نـ	ـنـ	نـا	ـنـ	
س	سـ	ـسـ	سـا	ـسـ	
ع	عـ	ـعـ	عـا	ـعـ	
ف	فـ	ـفـ	فـا	ـفـ	
ص	صـ	ـصـ	صـا	ـصـ	
ق	قـ	ـقـ	قـا	ـقـ	
ر					
ش	شـ	ـشـ	شـا	ـشـ	
ت	تـ	ـتـ	تـا	ـتـ	
ث	ثـ	ـثـ	ثـا	ـثـ	
خ	خـ	ـخـ	خـا	ـخـ	
ذ					
ض	ضـ	ـضـ	ضـا	ـضـ	
ظ		ـظـ	ظـا	ـظـ	
غ	غـ	ـغـ	غـا	ـغـ	

Table 2: Mathematical basic alphabetic symbols

digit ONE ١. Thus, it's replaced by ٱ. The glyph of the letter HEH ه can be confused with the Arabic-Indic digit FIVE ٥ in the isolated and double-struck forms. Thus, it's replaced by ھ. The glyph of the letter KAF ك is composed with two elements in the isolated and double-struck forms. Thus, it's replaced by either ك or ک. The glyph of the letter NOON can be found in different orientation and styles, with and without dot, (ں ن, ڼ ڼ, ڹ ڼ, ڽ ڼ) according to the local area (see Figure 14 and Figure 15).

ٱ	MATHEMATICAL ALEF ALHISAB
	≈ <font> 0627 ا Arabic letter alef
؞	MATHEMATICAL SHARAT KAF
ھ	MATHEMATICAL HEH MASHQUQAT
	≈ <font> FEEB ھ FE73 ـ
ك	MATHEMATICAL KAF RUQAAT
م	MATHEMATICAL MEEM MURSALAT
	≈ <font> 0645 م Arabic letter meem
ڽ	MATHEMATICAL INVERTED NOON
	≈ <font> 0646 ن Arabic letter noon
ڑ	MATHEMATICAL REH MODGHAMAT
	≈ <font> 0631 ر Arabic letter reh
ڒ	MATHEMATICAL ZAIN MODGHAMAT
	≈ <font> 0632 ز Arabic letter zain
ی	MATHEMATICAL LOOPED ALEF MAKSURA
	≈ <font> 0649 ى Arabic letter alef maksura

Table 3: Mathematical particular alphabetic symbols

𞸀	MATHEMATICAL DOUBLE-STRUCK ALEF ALHISAB ≈ <font> 0627 ا Arabic letter alef
𞸁	MATHEMATICAL DOUBLE-STRUCK SHARAT KAF
𞸂	MATHEMATICAL DOUBLE-STRUCK HEH MASHQUQAT ≈ <font> FEEB ھ FE73 ـ
𞸃	MATHEMATICAL DOUBLE-STRUCK YEH RAJIAT ≈ <font> 06D2 ے Arabic letter yeh barree
𞸄	MATHEMATICAL DOUBLE-STRUCK KAF RUQAAT
𞸅	MATHEMATICAL DOUBLE-STRUCK KAF ZIDANY ≈ <font> 06AA ک Arabic letter swash kaf
𞸇	MATHEMATICAL DOUBLE-STRUCK LAMALEF ≈ <font> FEFB لا Arabic ligature lam with alef
𞸉	MATHEMATICAL DOUBLE-STRUCK MEEM MURSALAT ≈ <font> 0645 م Arabic letter meem
𞸋	MATHEMATICAL DOUBLE-STRUCK INVERTED NOON ≈ <font> 0646 ن Arabic letter noon
𞸌	MATHEMATICAL DOUBLE-STRUCK REH MODGHAMAT ≈ <font> 0631 ر Arabic letter reh
𞸍	MATHEMATICAL DOUBLE-STRUCK ZAIN MODGHAMAT ≈ <font> 0632 ز Arabic letter reh
𞸎	MATHEMATICAL DOUBLE-STRUCK ALEF MAKSURA ≈ <font> 0649 ى Arabic letter alef maksura
𞸏	MATHEMATICAL DOUBLE-STRUCK HAMZA ≈ <font> 0621 ء Arabic letter hamza

Table 4: Mathematical double-struck particular alphabetic symbols

4 Special mathematical alphabetic symbols

In order to avoid ambiguities, the Arabic character types used in mathematics are frequently based on dotless letters (see Figure 18). As some Arabic letters differ only by the addition of dots below or above basic symbols, the basic *dotless* symbols list is smaller than the complete list of the alphabet. Moreover, care should be taking in naming the ambiguous dotless letterlike symbols (see Table 5).

On the other hand, in order to provide a big amount of symbols in use, to satisfy both local area using dotless characters and those using characters with dots, mathematical alphabetic symbols are to be proposed with and without dots. The proposition remains so in the philosophy of the Unicode Standard that recommends representing the symbol not the glyph. Actually, in the following table (see Table 6), the special mathematical alphabetical symbols without dots are presented.

Letter		**Pronunciation**
ب	ـبـ	BEH, it comes before the letter TEH and THEH
ح	ـحـ	JEEM, it comes before HAH and KHAH
ر		REH, though it comes after the letter ZAIN
ف	ـفـ	FEH, instead of QAF
ق		QAF

Table 5: Dotless letterlike symbols ambiguous names

ـٮـ	MATHEMATICAL TAILED DOTLESS BEH ≈ <font> FBE8 د 06C1 ـٮـ
ـٯـ	MATHEMATICAL STRETCHED DOTLESS BEH ≈ <font> FBE8 د FE8E ـٯـ
ـٻـ	MATHEMATICAL LOOPED DOTLESS BEH ≈ <font> 066E ـب Arabic letter dotless beh
ـٻـ	MATHEMATICAL DOUBLE-STRUCK DOTLESS BEH ≈ <font> 066E ـب Arabic letter dotless beh
ـڡـ	MATHEMATICAL TAILED DOTLESS FEH
ـڡـ	MATHEMATICAL STRETCHED DOTLESS FEH
ـڦـ	MATHEMATICAL LOOPED DOTLESS FEH ≈ <font> 066F ـف Arabic letter dotless feh
ـڦـ	MATHEMATICAL DOUBLE-STRUCK DOTLESS FEH ≈ <font> 066F ـف Arabic letter dotless feh
ـڼـ	MATHEMATICAL DOTLESS INVERTED NOON ≈ <font> 06BA ـں Arabic letter noon ghunna
ـڼـ	MATHEMATICAL DOUBLE-STRUCK DOTLESS INVERTED NOON ≈ <font> 06BA ـں Arabic letter noon ghunna

Table 6: Mathematical dotless alphabetic symbols

5 Exceptional mathematical alphabetic symbols

Some glyphs used in Arabic mathematical presentation are not really Arabic letters but symbols used in physics or in Arabic alphabetical based like scripts as Persian (see Figure 4 and Table 7).

﮶	MATHEMATICAL LOOPED PEH ≈ <font> 067E ﭘ Arabic letter peh
ﯓ	MATHEMATICAL LOOPED TCHEH ≈ <font> 0686 ﭽ Arabic letter tcheh
ﯖ	MATHEMATICAL LOOPED VEH ≈ <font> 06A4 ﭤ Arabic letter veh
ﯟ	MATHEMATICAL LOOPED GHEH ≈ <font> 06A0 ﭠ Arabic letter ain with tree dots above

Table 7: Mathematical exceptional alphabetic symbols

6 Large mathematical alphabetic symbols

The Arabic n-ary summation operator is denoted by either $\sum$ and مجـ symbols according to the local area (see Figure 7 and Table 8).

The Arabic n-ary product operator is denoted by either $\prod$ and جـد symbols according to the local area (see Figure 8 and Table 8).

The Arabic limit operator is denoted by نهـا symbol (see Table 8).

The Arabic factorial operator is denoted by either ! and لـ symbols according to the local area (see Figure 9 and Table 8).

Those mathematical operators derived from Arabic characters are proposed to proper encodings because they are used differently than the corresponding letters. These operators may occasionally occur in context with Arabic-letter variables. Those characters are large operators that take limit expressions [2].

The symbols Summation, Product and Limit can be denoted with dots (مجـ, جـد and نهـا) or without dots (محـ, حـد and هـا).

We propose to add the *large*, or less supported *alphabetic*, or the least supported *conventional*, adjective attribute in there names for those symbols.

Obviously, some software tools, such as TEX or MathML, can be help to combine any text string with any symbols as needed. WG 2 has resolved in Resolution M38.12 not to add any more Arabic presentation forms to the

ﷺ	ARABIC LARGE N-ARY SUMMATION
	≈ <font> FCCE ﷺ Arabic ligature meem with jeem initial form
ﷻ	ARABIC LARGE N-ARY PRODUCT
	≈ <font> FE9F ﷟ FEAA ﷪ Arabic ligature jeem with thal
﷼	ARABIC LARGE LIMIT
	≈ <font> FCD6 ﳖ FEBE ﺎ
﷽	ARABIC LARGE FACTORIAL
	≈ <font> FEDF ﻟ Arabic letter lam initial form

Table 8: Mathematical large symbols

ﷺ	ARABIC DOTLESS LARGE N-ARY SUMMATION
	≈ <font> FCCF ﷺ Arabic ligature meem with hah initial form
ﷻ	ARABIC DOTLESS LARGE N-ARY PRODUCT
	≈ <font> FEA3 ﷟ FEAA ﷪
﷼	ARABIC DOTLESS LARGE LIMIT

Table 9: Mathematical dotless large symbols

standard and suggests users to employ appropriate input methods, rendering and font technologies to meet the user requirements. We propose those *large operators* for addition to the Unicode Standard even though they don't have similar entities in Latin. The shape of those ligatures is unusual compared to the layout in regular text. Moreover, the size of these ligatures symbols varies according to the covered expressions (see Figure 1).

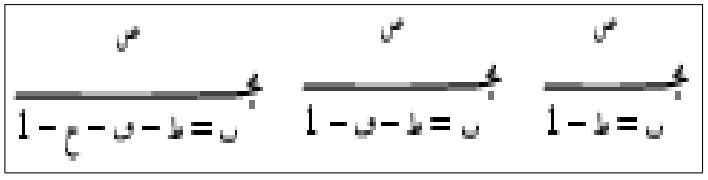


Figure 1: Variable-sized conventional summation operator

The n-ary operators like summation and integration may expand in size to fit with their associated expressions. The stretching can be performed by some software such as CurExt [7] [10]. These operators generally also take limits. As in the Latin alphabet based notation, the place of the limits in an operator is not the same in-line with text as in displayed expression alone in-line.

7 Added basic character names

The list of character names of *Arabic mathematical alphabetic symbols*, proposed to be added into the Unicode Standard is presented below:

- Arabic mathematical tailed alphabetic symbols (see Table 13);
- Arabic mathematical stretched alphabetic symbols (see Table 14);
- Arabic mathematical looped alphabetic symbols (see Table 15);
- Arabic mathematical double-struck alphabetic symbols (see Table 16).

8 Unified others character names

The initial and isolated characters and all the other characters from existing characters, from the presentation forms blocks are supposed to retain their shape during rendering, exactly as is required by mathematical use. Therefore, they will be unified.

The list of character names of *Arabic mathematical alphabetic symbols*, proposed to be unified into the Unicode Standard is presented below:

- Arabic mathematical isolated alphabetic symbols (see Table 10);
- Arabic mathematical initial alphabetic symbols (see Table 11);
- Arabic mathematical others alphabetic symbols (see Table 12).

References

[1] `http://www.linux.org.sa`.

[2] Unicode Technical Report ♯25, *Unicode Support for Mathematics*, `http://www.unicode.org/reports/tr25/`.

[3] W3C Math Interest Group Note, *Arabic Mathematical Notation*, `http://www.w3.org/TR/arabic-math/`.

[4] Azzeddine Lazrek, *Arabic mathematical symbols for Unicode*, `http://www.ucam.ac.ma/fssm/rydarab/english/unicode.htm`.

[5] Mohamed Jamal Eddine Benatia, Azzeddine Lazrek and Khalid Sami, *Arabic mathematical symbols in Unicode*, Internationalization and Unicode Conference (IUC), IUC 27, Berlin, Germany, April 6-8, 2005, `http://www.ucam.ac.ma/fssm/rydarab/doc/communic/unicodem.pdf`.

[6] Mustapha Eddahibi and Azzeddine Lazrek, *Arabic scientific document composition*, International Conference on Information Technology and Natural Sciences (ICITNS 2003, Amman, Jordan), 2003, `http://www.ucam.ac.ma/fssm/rydarab/doc/communic/ammsys.pdf`.

[7] Azzeddine Lazrek, *CurExt, Typesetting variable-sized curved symbols*, EuroTEX'2003: 14th European TEX Conference (Brest, France), 2003, `http://www.ucam.ac.ma/fssm/rydarab/doc/communic/curext.pdf`, pp. 47–71.

[8] Arabic mathematical symbols font RamzArab in OpenType, `http://www.ucam.ac.ma/fssm/rydarab/doc/unicode/ramzarab.ttf`.

[9] Arabic mathematical symbols font RamzArab as package for LATEX, `http://www.ucam.ac.ma/fssm/rydarab/system/zip/ramzarab.zip`.

[10] Mostafa Banouni, Mohamed Elyaakoubi and Azzeddine Lazrek, *Dynamic Arabic mathematical fonts*, LNCS **3130** (2004), 149–157, International Conference on TEX, XML and Digital Typography, TUG2004, Xanthi, Greece, `http://www.springerlink.com/index/URHRT2EYKYHH1RPA`.

[11] Union of the Arab scientific linguistic groupings, *Scientific symbols and method of their use in Arabic language*, Amman, Jordan, in Arabic, 1987.

ا	MATHEMATICAL ALEF
	Unified with 0627 ا Arabic letter alef
ب	MATHEMATICAL BEH
	Unified with 0628 ب Arabic letter beh
ج	MATHEMATICAL JEEM
	Unified with 062C ج Arabic letter jeem
د	MATHEMATICAL DAL
	Unified with 062F د Arabic letter dal
ه	MATHEMATICAL HEH
	Unified with 0647 ه Arabic letter heh
و	MATHEMATICAL WAW
	Unified with 0648 و Arabic letter waw
ز	MATHEMATICAL ZAIN
	Unified with 0632 ز Arabic letter zain
ح	MATHEMATICAL HAH
	Unified with 062D ح Arabic letter hah
ط	MATHEMATICAL TAH
	Unified with 0637 ط Arabic letter tah
ي	MATHEMATICAL YEH
	Unified with 064A ي Arabic letter yeh
ك	MATHEMATICAL KAF
	Unified with 0643 ك Arabic letter kaf
ل	MATHEMATICAL LAM
	Unified with 0644 ل Arabic letter lam
م	MATHEMATICAL MEEM
	Unified with 0645 م Arabic letter meem
ن	MATHEMATICAL NOON
	Unified with 0646 ن Arabic letter noon
س	MATHEMATICAL SEEN
	Unified with 0634 س Arabic letter seen
ع	MATHEMATICAL AIN
	Unified with 0639 ع Arabic letter ain
ف	MATHEMATICAL FEH
	Unified with 0641 ف Arabic letter feh
ص	MATHEMATICAL SAD
	Unified with 0635 ص Arabic letter sad
ق	MATHEMATICAL QAF
	Unified with 0642 ق Arabic letter qaf
ر	MATHEMATICAL REH
	Unified with 0631 ر Arabic letter reh
ش	MATHEMATICAL SHEEN
	Unified with 0634 ش Arabic letter sheen
ت	MATHEMATICAL TEH
	Unified with 062A ت Arabic letter teh
ث	MATHEMATICAL THEH
	Unified with 062B ث Arabic letter theh
خ	MATHEMATICAL KHAH
	Unified with 062E خ Arabic letter khah
ذ	MATHEMATICAL THAL
	Unified with 0630 ذ Arabic letter thal
ض	MATHEMATICAL DAD
	Unified with 0636 ض Arabic letter dad
ظ	MATHEMATICAL ZAH
	Unified with 0638 ظ Arabic letter zah
غ	MATHEMATICAL GHAIN
	Unified with 063A غ Arabic letter ghain

Table 10: Mathematical isolated alphabetic symbols

بـ	MATHEMATICAL INITIAL BEH Unified with <initial> 0628 ب Arabic letter beh Unified with FE91 بـ Arabic letter beh initial form
جـ	MATHEMATICAL INITIAL JEEM Unified with <initial> 062C ج Arabic letter jeem Unified with FE9F جـ Arabic letter jeem initial form
هـ	MATHEMATICAL INITIAL HEH Unified with <initial> 0647 ه Arabic letter heh Unified with FEEB هـ Arabic letter heh initial form
حـ	MATHEMATICAL INITIAL HAH Unified with <initial> 062D ح Arabic letter hah Unified with FEA3 حـ Arabic letter hah initial form
يـ	MATHEMATICAL INITIAL YEH Unified with <initial> 064A ي Arabic letter yeh Unified with FEF3 يـ Arabic letter yeh initial form
كـ	MATHEMATICAL INITIAL KAF Unified with <initial> 0643 ك Arabic letter kaf Unified with FEDB كـ Arabic letter kaf initial form
لـ	MATHEMATICAL INITIAL LAM Unified with <initial> 0644 ل Arabic letter lam Unified with FEDF لـ Arabic letter lam initial form
مـ	MATHEMATICAL INITIAL MEEM Unified with <initial> 0645 م Arabic letter meem Unified with FEE3 مـ Arabic letter meem initial form
نـ	MATHEMATICAL INITIAL NOON Unified with <initial> 0646 ن Arabic letter noon Unified with FEE7 نـ Arabic letter noon initial form
سـ	MATHEMATICAL INITIAL SEEN Unified with <initial> 0634 س Arabic letter seen Unified with FEB3 سـ Arabic letter seen initial form
عـ	MATHEMATICAL INITIAL AIN Unified with <initial> 0639 ع Arabic letter ain Unified with FECB عـ Arabic letter ain initial form
فـ	MATHEMATICAL INITIAL FEH Unified with <initial> 0641 ف Arabic letter feh Unified with FED3 فـ Arabic letter feh initial form
صـ	MATHEMATICAL INITIAL SAD Unified with <initial> 0635 ص Arabic letter sad Unified with FEBB صـ Arabic letter sad initial form
قـ	MATHEMATICAL INITIAL QAF Unified with <initial> 0642 ق Arabic letter qaf Unified with FED7 قـ Arabic letter qaf initial form
شـ	MATHEMATICAL INITIAL SHEEN Unified with <initial> 0634 ش Arabic letter sheen Unified with FEB7 شـ Arabic letter sheen initial form
تـ	MATHEMATICAL INITIAL TEH Unified with <initial> 062A ت Arabic letter teh Unified with FE97 تـ Arabic letter teh initial form
ثـ	MATHEMATICAL INITIAL THEH Unified with <initial> 062B ث Arabic letter theh Unified with FE9B ثـ Arabic letter theh initial form
خـ	MATHEMATICAL INITIAL KHAH Unified with <initial> 062E خ Arabic letter khah Unified with FEA7 خـ Arabic letter khah initial form
ضـ	MATHEMATICAL INITIAL DAD Unified with <initial> 0636 ض Arabic letter dad Unified with FEBF ضـ Arabic letter dad initial form
غـ	MATHEMATICAL INITIAL GHAIN Unified with <initial> 063A غ Arabic letter ghain Unified with FECF غـ Arabic letter ghain initial form

Table 11: Mathematical initial alphabetic symbols

ے	MATHEMATICAL YEH RAJIAT
	Unified with 06D2 ے Arabic letter yeh barree
ک	MATHEMATICAL KAF ZIDANY
	Unified with 06AA ک Arabic letter swash kaf
لا	MATHEMATICAL LAMALEF
	Unified with FEFB لا Arabic ligature lam with alef
ى	MATHEMATICAL ALEF MAKSURA
	Unified with 0649 ى Arabic letter alef maksura
ء	MATHEMATICAL HAMZA
	Unified with 0621 ء Arabic letter hamza
ب	MATHEMATICAL DOTLESS BEH
	Unified with 066E ب Arabic letter dotless beh
ـد	MATHEMATICAL INITIAL DOTLESS BEH
	Unified with FBE8 ـد Arabic letter Uighur Kazakh Kirghiz alef maksura initial form
ف	MATHEMATICAL DOTLESS FEH
	Unified with 066F ف Arabic letter dotless feh
ـف	MATHEMATICAL INITIAL DOTLESS FEH
پ	MATHEMATICAL PEH
	Unified with 067E پ Arabic letter peh
چ	MATHEMATICAL TCHEH
	Unified with 0686 چ Arabic letter tcheh
ڤ	MATHEMATICAL VEH
	Unified with 06A4 ڤ Arabic letter veh
ڠ	MATHEMATICAL GHEH
	Unified with 06A0 ڠ Arabic letter ain with tree dots above

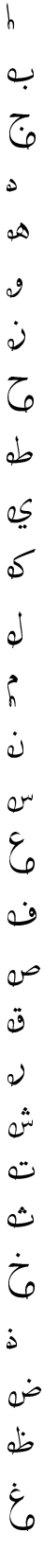
Table 12: Mathematical others alphabetic symbols

ـبـ	MATHEMATICAL TAILED BEH ≈ <font> 0628 ب 06C1 ∼
ـجـ	MATHEMATICAL TAILED JEEM ≈ <font> 062C ج 06C1 ∼
ـهـ	MATHEMATICAL TAILED HEH ≈ <font> 0647 ه 06C1 ∼
ـحـ	MATHEMATICAL TAILED HAH ≈ <font> 062D ح 06C1 ∼
ـطـ	MATHEMATICAL TAILED TAH ≈ <font> 0637 ط 06C1 ∼
ـيـ	MATHEMATICAL TAILED YEH ≈ <font> 064A ي 06C1 ∼
ـكـ	MATHEMATICAL TAILED KAF ≈ <font> 0643 ك 06C1 ∼
ـلـ	MATHEMATICAL TAILED LAM ≈ <font> 0644 ل 06C1 ∼
ـمـ	MATHEMATICAL TAILED MEEM ≈ <font> 0645 م 06C1 ∼
ـنـ	MATHEMATICAL TAILED NOON ≈ <font> 0646 ن 06C1 ∼
ـسـ	MATHEMATICAL TAILED SEEN ≈ <font> 0634 س 06C1 ∼
ـعـ	MATHEMATICAL TAILED AIN ≈ <font> 0639 ع 06C1 ∼
ـفـ	MATHEMATICAL TAILED FEH ≈ <font> 0641 ف 06C1 ∼
ـصـ	MATHEMATICAL TAILED SAD ≈ <font> 0635 ص 06C1 ∼
ـقـ	MATHEMATICAL TAILED QAF ≈ <font> 0642 ق 06C1 ∼
ـشـ	MATHEMATICAL TAILED SHEEN ≈ <font> 0634 ش 06C1 ∼
ـتـ	MATHEMATICAL TAILED TEH ≈ <font> 062A ت 06C1 ∼
ـثـ	MATHEMATICAL TAILED THEH ≈ <font> 062B ث 06C1 ∼
ـخـ	MATHEMATICAL TAILED KHAH ≈ <font> 062E ح 06C1 ∼
ـضـ	MATHEMATICAL TAILED DAD ≈ <font> 0636 ض 06C1 ∼
ـظـ	MATHEMATICAL TAILED ZAH ≈ <font> 0638 ظ 06C1 ∼
ـغـ	MATHEMATICAL TAILED GHAIN ≈ <font> 063A غ 06C1 ∼

Table 13: Mathematical tailed alphabetic symbols

بـا	MATHEMATICAL STRETCHED BEH STRETCHED ≈ <font> 0628 ب 0627 ـا
جـا	MATHEMATICAL STRETCHED JEEM ≈ <font> 062C ج 0627 ـا
هـا	MATHEMATICAL STRETCHED HEH ≈ <font> 0647 ه 0627 ـا
حـا	MATHEMATICAL STRETCHED HAH ≈ <font> 062D ح 0627 ـا
طـا	MATHEMATICAL STRETCHED TAH ≈ <font> 0637 ط 0627 ـا
يـا	MATHEMATICAL STRETCHED YEH ≈ <font> 064A ي 0627 ـا
كـا	MATHEMATICAL STRETCHED KAF ≈ <font> 0643 ك 0627 ـا
مـا	MATHEMATICAL STRETCHED MEEM ≈ <font> 0645 م 0627 ـا
نـا	MATHEMATICAL STRETCHED NOON ≈ <font> 0646 ن 0627 ـا
سـا	MATHEMATICAL STRETCHED SEEN ≈ <font> 0634 س 0627 ـا
عـا	MATHEMATICAL STRETCHED AIN ≈ <font> 0639 ع 0627 ـا
فـا	MATHEMATICAL STRETCHED FEH ≈ <font> 0641 ف 0627 ـا
صـا	MATHEMATICAL STRETCHED SAD ≈ <font> 0635 ص 0627 ـا
قـا	MATHEMATICAL STRETCHED QAF ≈ <font> 0642 ق 0627 ـا
شـا	MATHEMATICAL STRETCHED SHEEN ≈ <font> 0634 ش 0627 ـا
تـا	MATHEMATICAL STRETCHED TEH ≈ <font> 062A ت 0627 ـا
ثـا	MATHEMATICAL STRETCHED THEH ≈ <font> 062B ث 0627 ـا
خـا	MATHEMATICAL STRETCHED KHAH ≈ <font> 062E خ 0627 ـا
ضـا	MATHEMATICAL STRETCHED DAD ≈ <font> 0636 ض 0627 ـا
ظـا	MATHEMATICAL STRETCHED ZAH ≈ <font> 0638 ظ 0627 ـا
غـا	MATHEMATICAL STRETCHED GHAIN ≈ <font> 063A غ 0627 ـا

Table 14: Mathematical stretched alphabetic symbols



MATHEMATICAL LOOPED ALEF
≈ <font> 0627 ا Arabic letter alef
MATHEMATICAL LOOPED BEH
≈ <font> 0628 ب Arabic letter beh
MATHEMATICAL LOOPED JEEM
≈ <font> 062C ج Arabic letter jeem
MATHEMATICAL LOOPED DAL
≈ <font> 062F د Arabic letter dal
MATHEMATICAL LOOPED HEH
≈ <font> 0647 ه Arabic letter heh
MATHEMATICAL LOOPED WAW
≈ <font> 0648 و Arabic letter waw
MATHEMATICAL LOOPED ZAIN
≈ <font> 0632 ز Arabic letter zain
MATHEMATICAL LOOPED HAH
≈ <font> 062D ح Arabic letter hah
MATHEMATICAL LOOPED TAH
≈ <font> 0637 ط Arabic letter tah
MATHEMATICAL LOOPED YEH
≈ <font> 064A ي Arabic letter yeh
MATHEMATICAL LOOPED KAF
≈ <font> 0643 ك Arabic letter kaf
MATHEMATICAL LOOPED LAM
≈ <font> 0644 ل Arabic letter lam
MATHEMATICAL LOOPED MEEM
≈ <font> 0645 م Arabic letter meem
MATHEMATICAL LOOPED NOON
≈ <font> 0646 ن Arabic letter noon
MATHEMATICAL LOOPED SEEN
≈ <font> 0634 س Arabic letter seen
MATHEMATICAL LOOPED AIN
≈ <font> 0639 ع Arabic letter ain
MATHEMATICAL LOOPED FEH
≈ <font> 0641 ف Arabic letter feh
MATHEMATICAL LOOPED SAD
≈ <font> 0635 ص Arabic letter sad
MATHEMATICAL LOOPED QAF
≈ <font> 0642 ق Arabic letter qaf
MATHEMATICAL LOOPED REH
≈ <font> 0631 ر Arabic letter reh
MATHEMATICAL LOOPED SHEEN
≈ <font> 0634 ش Arabic letter sheen
MATHEMATICAL LOOPED TEH
≈ <font> 062A ت Arabic letter teh
MATHEMATICAL LOOPED THEH
≈ <font> 062B ث Arabic letter theh
MATHEMATICAL LOOPED KHAH
≈ <font> 062E خ Arabic letter khah
MATHEMATICAL LOOPED THAL
≈ <font> 0630 ذ Arabic letter thal
MATHEMATICAL LOOPED DAD
≈ <font> 0636 ض Arabic letter dad
MATHEMATICAL LOOPED ZAH
≈ <font> 0638 ظ Arabic letter zah
MATHEMATICAL LOOPED GHAIN
≈ <font> 063A غ Arabic letter ghain

Table 15: Mathematical looped alphabetic symbols

ا	MATHEMATICAL DOUBLE-STRUCK ALEF ≈ <font> 0627 ا Arabic letter alef
ب	MATHEMATICAL DOUBLE-STRUCK BEH ≈ <font> 0628 ب Arabic letter beh
ج	MATHEMATICAL DOUBLE-STRUCK JEEM ≈ <font> 062C ج Arabic letter jeem
د	MATHEMATICAL DOUBLE-STRUCK DAL ≈ <font> 062F د Arabic letter dal
ه	MATHEMATICAL DOUBLE-STRUCK HEH ≈ <font> 0647 ه Arabic letter heh
و	MATHEMATICAL DOUBLE-STRUCK WAW ≈ <font> 0648 و Arabic letter waw
ز	MATHEMATICAL DOUBLE-STRUCK ZAIN ≈ <font> 0632 ز Arabic letter zain
ح	MATHEMATICAL DOUBLE-STRUCK HAH ≈ <font> 062D ح Arabic letter hah
ط	MATHEMATICAL DOUBLE-STRUCK TAH ≈ <font> 0637 ط Arabic letter tah
ي	MATHEMATICAL DOUBLE-STRUCK YEH ≈ <font> 064A ي Arabic letter yeh
ك	MATHEMATICAL DOUBLE-STRUCK KAF ≈ <font> 0643 ك Arabic letter kaf
ل	MATHEMATICAL DOUBLE-STRUCK LAM ≈ <font> 0644 ل Arabic letter lam
م	MATHEMATICAL DOUBLE-STRUCK MEEM ≈ <font> 0645 م Arabic letter meem
ن	MATHEMATICAL DOUBLE-STRUCK NOON ≈ <font> 0646 ن Arabic letter noon
س	MATHEMATICAL DOUBLE-STRUCK SEEN ≈ <font> 0634 س Arabic letter seen
ع	MATHEMATICAL DOUBLE-STRUCK AIN ≈ <font> 0639 ع Arabic letter ain
ف	MATHEMATICAL DOUBLE-STRUCK FEH ≈ <font> 0641 ف Arabic letter feh
ص	MATHEMATICAL DOUBLE-STRUCK SAD ≈ <font> 0635 ص Arabic letter sad
ق	MATHEMATICAL DOUBLE-STRUCK QAF ≈ <font> 0642 ق Arabic letter qaf
ر	MATHEMATICAL DOUBLE-STRUCK REH ≈ <font> 0631 ر Arabic letter reh
ش	MATHEMATICAL DOUBLE-STRUCK SHEEN ≈ <font> 0634 ش Arabic letter sheen
ت	MATHEMATICAL DOUBLE-STRUCK TEH ≈ <font> 062A ت Arabic letter teh
ث	MATHEMATICAL DOUBLE-STRUCK THEH ≈ <font> 062B ث Arabic letter theh
خ	MATHEMATICAL DOUBLE-STRUCK KHAH ≈ <font> 062E خ Arabic letter khah
ذ	MATHEMATICAL DOUBLE-STRUCK THAL ≈ <font> 0630 ذ Arabic letter thal
ض	MATHEMATICAL DOUBLE-STRUCK DAD ≈ <font> 0636 ض Arabic letter dad
ظ	MATHEMATICAL DOUBLE-STRUCK ZAH ≈ <font> 0638 ظ Arabic letter zah
غ	MATHEMATICAL DOUBLE-STRUCK GHAIN ≈ <font> 063A غ Arabic letter ghain

Table 16: Mathematical double-struck alphabetic symbols

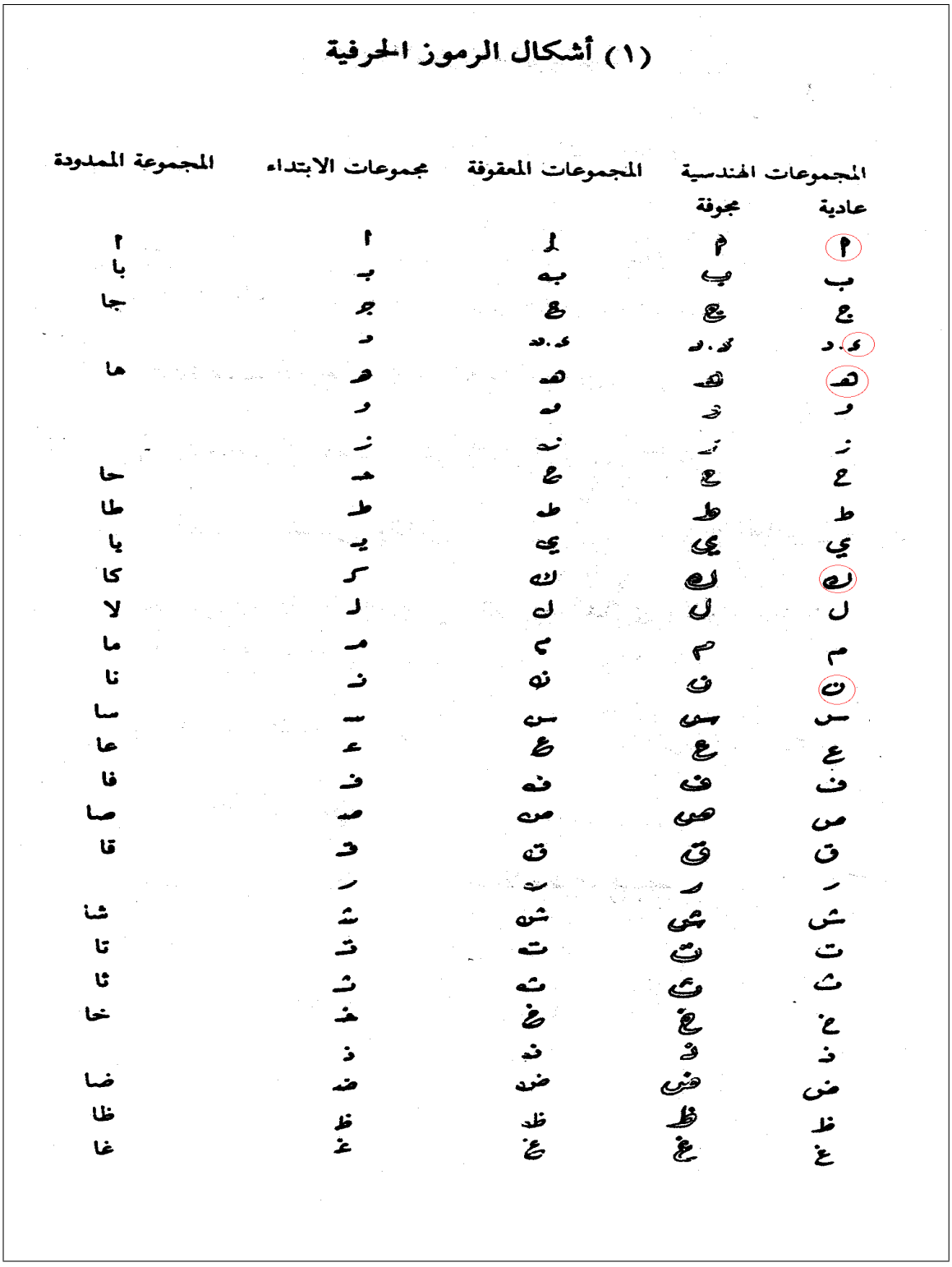


Figure 2: Basic mathematical alphabetic symbols in Amman Convention [1.1]

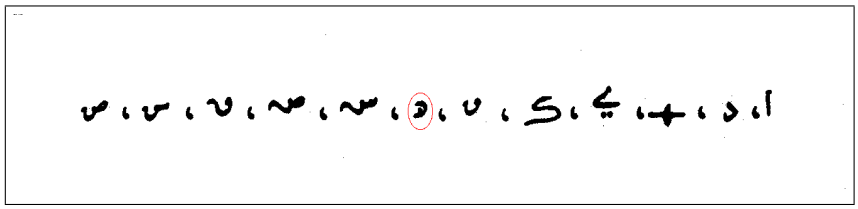


Figure 3: Particular mathematical alphabetic symbols in Amman Convention [1.1]

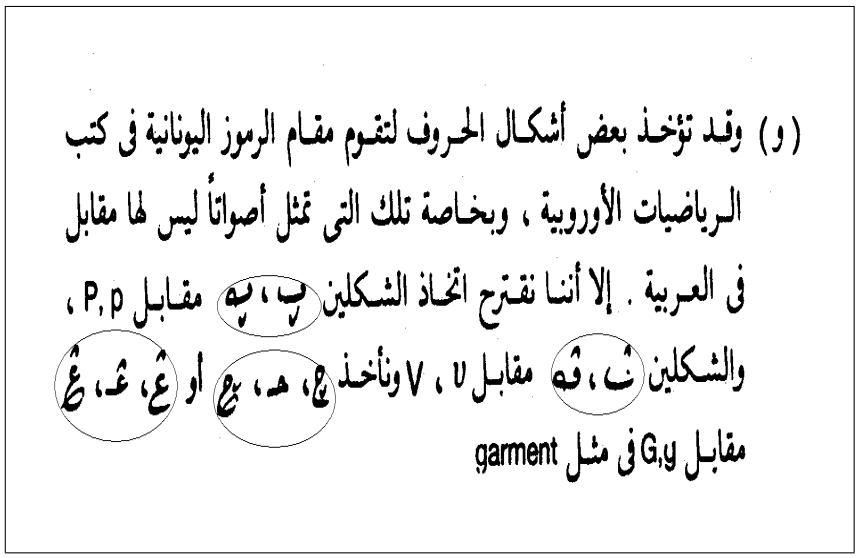


Figure 4: Exceptional mathematical alphabetic symbols in Amman Convention [1.1]

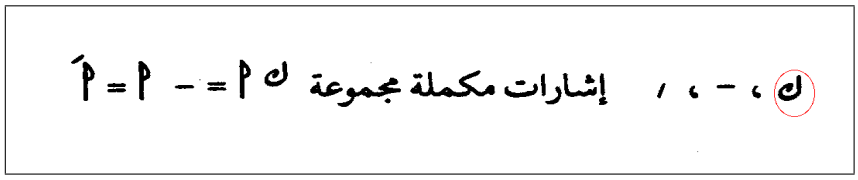


Figure 5: Complement symbol in Amman Convention [1.1]

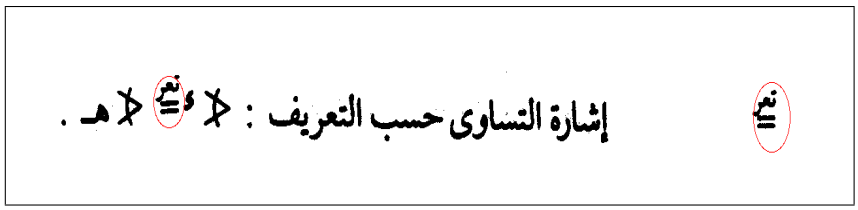


Figure 6: Equal by definition symbol in Amman Convention [1.1]

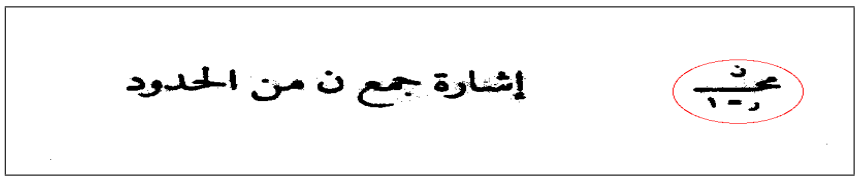


Figure 7: Conventional summation operator in Amman Convention [1.1]

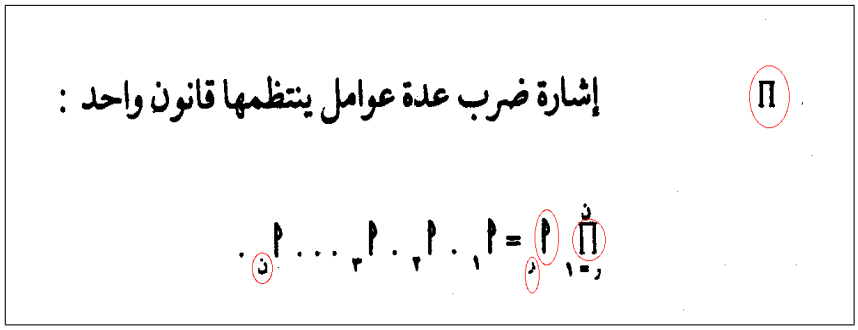


Figure 8: Product operator

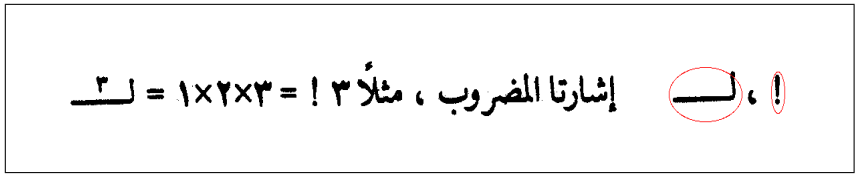


Figure 9: Conventional factorial symbol in Amman Convention [1.1]

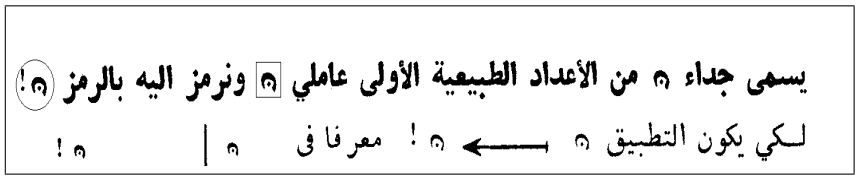


Figure 10: Factorial symbol in Handbook [3.12]

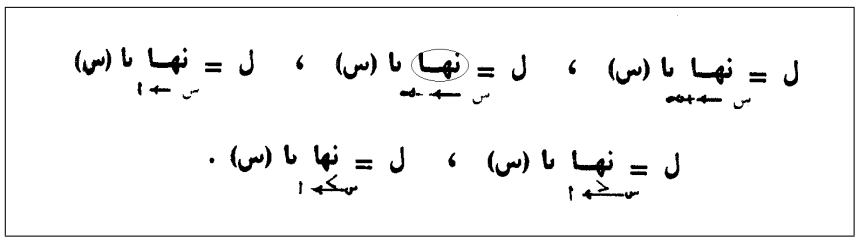


Figure 11: Conventional limit symbol in Handbook [3.12]

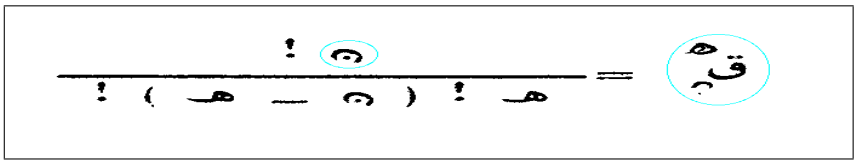


Figure 12: Heh symbol in Handbook [3.12]

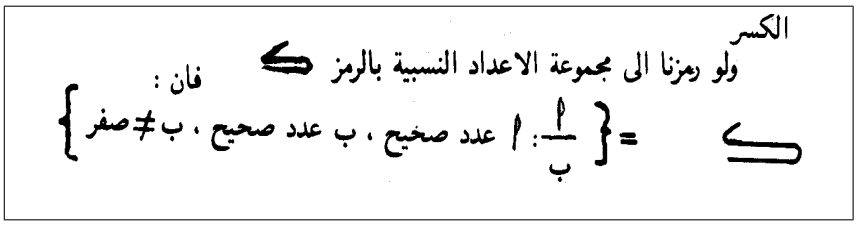


Figure 13: Swash kaf symbol in Handbook [3.11]

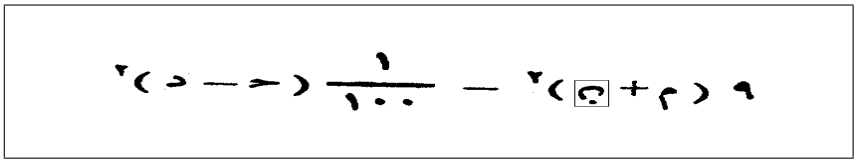


Figure 14: Inverted noon symbol in Handbook [3.2]

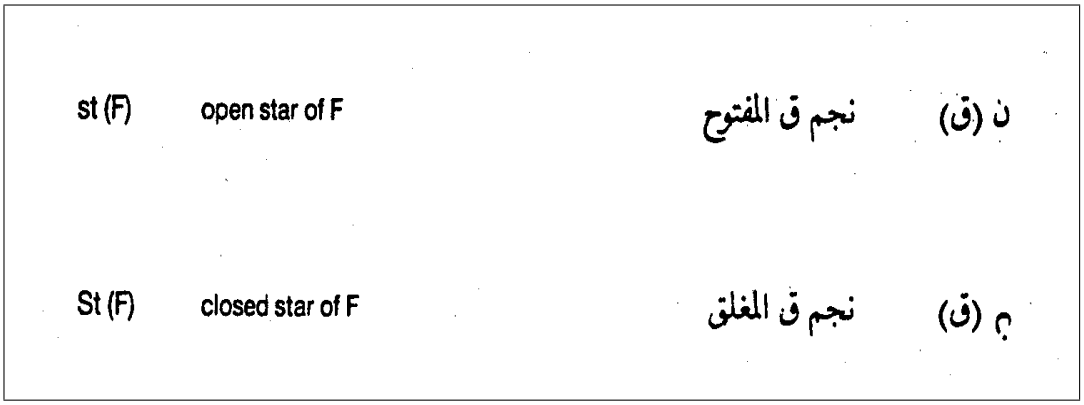
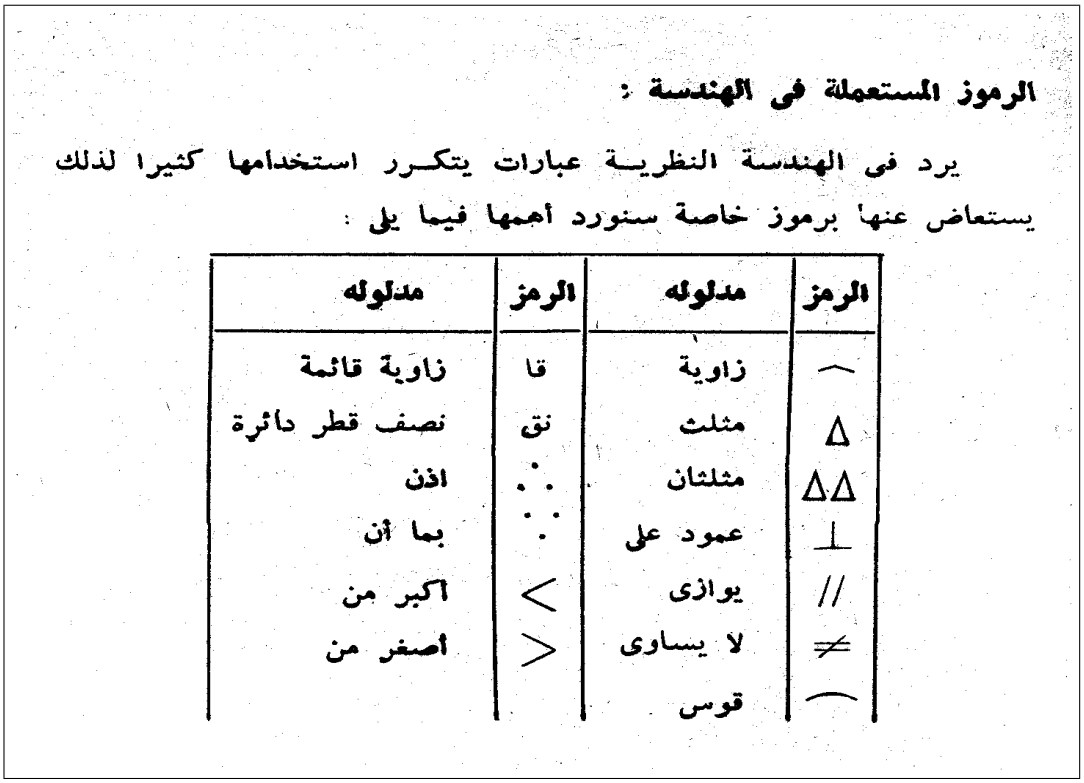


Figure 15: Noon and inverted noon symbol in Amman convention [1.1]



الرموز المستعملة فى الهندسة :

يرد فى الهندسة النظريـة عبارات يتكـرر استخدامها كثيرا لذلك يستعاض عنها برموز خاصة سنورد أهمها فيما يلى :

الرمز	مدلوله	الرمز	مدلوله
⌒	زاوية	قا	زاوية قائمة
Δ	مثلث	نق	نصف قطر دائرة
ΔΔ	مثلثان	∴	اذن
⊥	عمود على	∵	بما أن
//	يوازى	<	أكبر من
≠	لا يساوى	>	أصغر من
⌒	قوس		

Figure 16: Some symbols in Handbook [3.2]

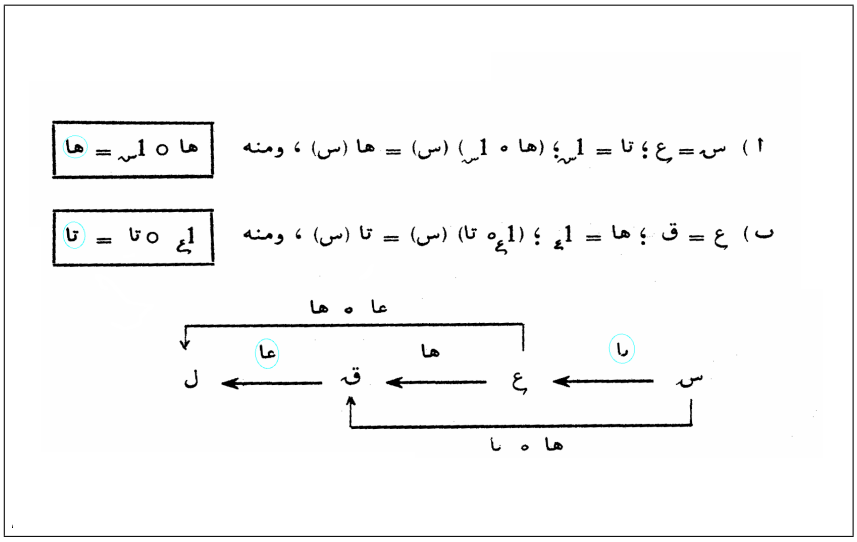


Figure 17: Stretched symbols in Handbook [3.12]

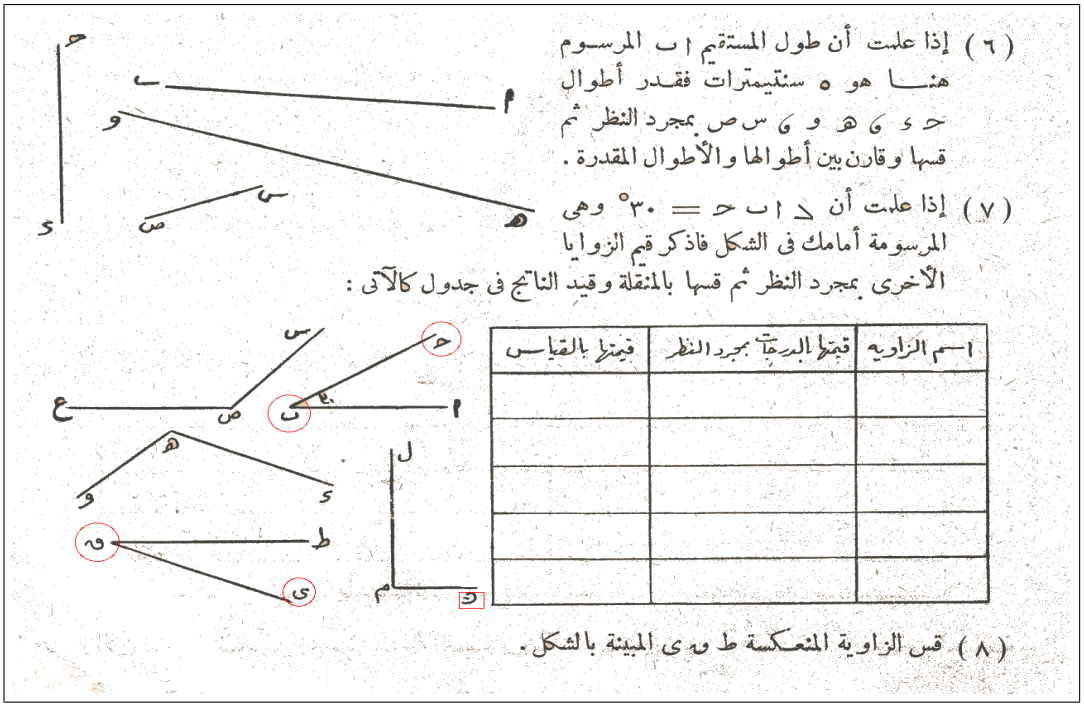


Figure 18: Dot-less symbols in Handbook [3.12]

27 — المقدار الجبرى :

عندما ترتبط مجموعة من الأعداد بعملية أو أكثر من عمليات الجمع والطرح والضرب و . . . يقال أنها تكون « مقداراً جبرياً » ، وهذه الأعداد قد تكون كلها أو بعضها مجهول القيمة ، ولذا يرمز لها بحروف هجائية . فمثلا :

$$8 \text{ س ص}^2 \quad ، \quad \frac{5 \text{ س}^2 - 3 \text{ ص}^2}{\text{س}^2 - 4 \text{ ص}} \quad ، \quad \text{س}^2 - 5 \text{ س ص} + 7 \text{ ع}$$

$$2 \text{ س} - \sqrt{\text{س}^2 - 5}$$

عبارة عن مقادير جبرية . أى أن :

« المقدار الجبرى عبارة عن مجموعة من الأعداد — المعبر عن بعضها أو كلها بحروف — مرتبطة من بعضها بعملية أو أكثر . »

كل حرف يدخل فى تكوين المقدار الجبرى يمثل عدداً واحداً وإن تكرر فيه أكثر من مرة ، أما إذا اشتمل المقدار الجبرى على حرف واحد فى صورتين مختلفتين كما فى القانون الذى نستخدمه فى إيجاد مساحة الحلقة الدائرية :

$$\text{ح} = \text{ط} \left(\text{سه}^2 - \text{ش}^2 \right)$$

حيث ح المساحة ، سه شعاع (نصف قطر) الدائرة الخارجية ، ش شعاع الدائرة الداخلية .

فإنه يكون لكل منها قيمة تختلف عن الآخر .

ملاحظة : كثيراً ما ترمز للمقدار الجبرى بحرف واحد لا يكون ضمن المقدار ،

Figure 19: Alphabetical symbols in Handbook [3.5]

كتابة التضعيفات بالنسبة لليتر وقراءتها :

نُلاحظ مما تقدم ان تضعيفات الليتر تكبر الوحدة الاساسية بعشر مرات او بمئة مرة او بالف مرة، وان اجزاء الليتر تصغر الوحدة الاساسية بعشر مرات او بمئة مرة او بالف مرة ، اي انها تتبع في نظامها النظام العشري . وهي لذلك لا تختلف في كتابتهـــا وقراءتها عن كتابة الاعداد الصحيحة والعشرية وقراءتها . مثال ذلك : ٧ هكل ٦ دكل ٣ ل ٥ سل ٥ ملل .

تكتب :

ملل	سل	دسل	فواصل	ل	دكل	هكل
٤	٥	٠	,	٣	٦	٧

وتُقرأ :
سبعمئة وثلاثة وستين ليتراً
واربعة وخمسين من الف.

Figure 20: Liter unites symbols in Handbook [3.6]

(197) قطعة من القماش طولها 36 م ، بيع منها 13,5 م ، فما نسبة طول القطعة الباقية إلى طول القطعة كلها ؟

(198) قطعة أرض مساحتها 3 هكتار و 72 آر و 25 سنتى آر ، بيع منها جزء قدره 14754 م^2 . أوجد النسبة بين مساحة الجزء الباقى والمساحة الأصلية .

(199) زاويتان قيمتاهما 30َ 25^0 ، 43,25 جراد . فما نسبة الثانية إلى الأولى ؟

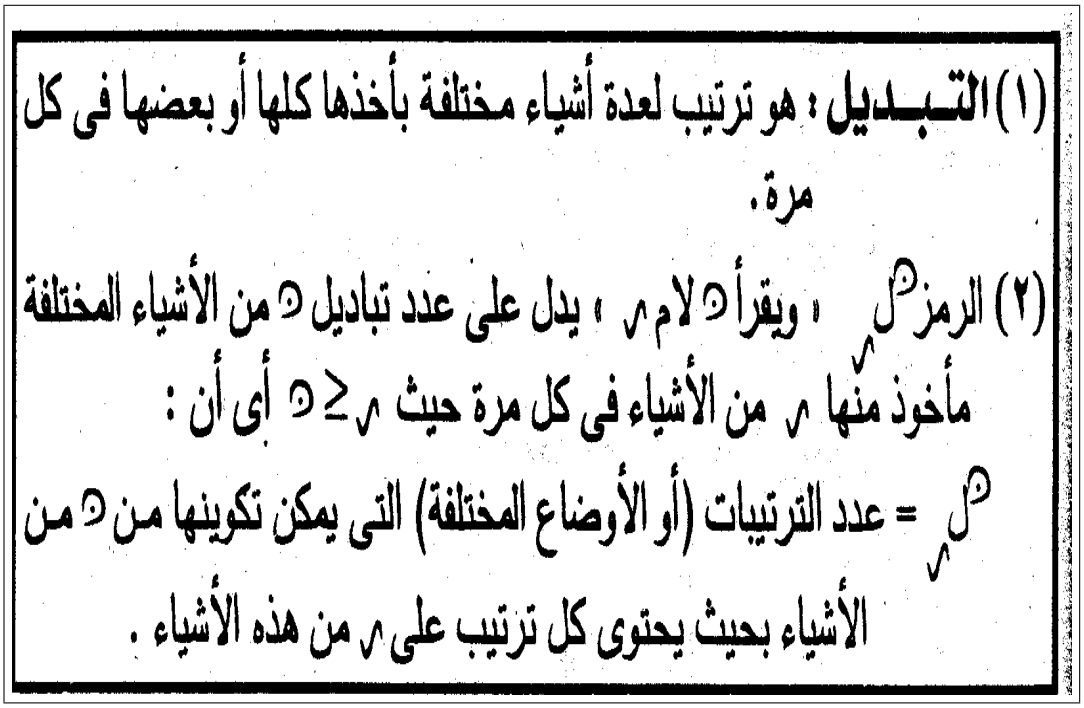
(200) قطاران أولهما سرعته 50 كلم/س والثانى يقطع 450 كلم فى 7 س و 25 د . فما النسبة بين سرعتيهما ؟

(201) مخروط وأسطوانة متساويان فى شعاع (نصف قطر) القاعدة والارتفاع . أوجد النسبة بين حجم المخروط (ح) وحجم الأسطوانة (حَ) .

Figure 21: Length unites symbols in Handbook [3.6]

^n_rل عدد تباديل ر أشياء مأخوذة من ن أشياء ^nP_r

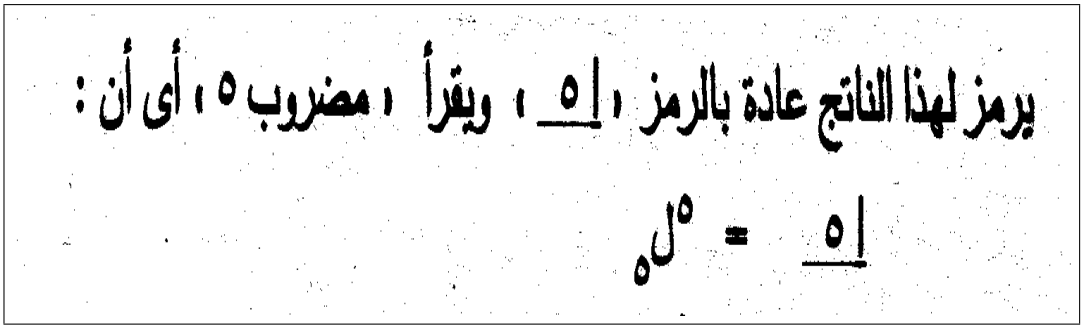
Figure 22: Arrangement symbol in Amman Convention [1.1]


(١) التبديل : هو ترتيب لعدة أشياء مختلفة بأخذها كلها أو بعضها فى كل مرة.

(٢) الرمز $ل^{ن}_{ر}$ ، ويقرأ ن لام ر ، يدل على عدد تباديل ن من الأشياء المختلفة مأخوذ منها ر من الأشياء فى كل مرة حيث $ر \leq ن$ أى أن :

$ل^{ن}_{ر}$ = عدد الترتيبات (أو الأوضاع المختلفة) التى يمكن تكوينها من ن من الأشياء بحيث يحتوى كل ترتيب على ر من هذه الأشياء .

Figure 23: Arrangement symbol in Handbook


يرمز لهذا الناتج عادة بالرمز $|\underline{ه}$ ، ويقرأ ه مضروب ، أى أن :

$$|\underline{ه} = ل^{ه}_{ه}$$

Figure 24: Factorial symbol in Handbook