

Monarch UEB Technical Braille Cheat Sheet

(for use with all APH/Humanware notetaking devices
that utilize the UEB Technical braille code for math input and output)

Note: All UEB rules and page numbers that are referenced here correspond to *Unified English Braille Guidelines for Technical Material*, 2008 version/2014 updated. This document can be downloaded in PDF format from the International Council on English Braille (ICEB) website at https://iceb.org/guidelines_for_technical_material_2014.pdf. For further guidance on the use of UEB Technical, see *Provisional Guidance on Transcribing Mathematics in UEB*, available in PDF and BRF formats at <https://www.brailleauthority.org/unified-english-braille-ueb>. Information on the UEB code that applies in mathematical contexts can be accessed in PDF and BRF formats on the ICEB website at <https://www.iceb.org/ueb.html>.

Indicators and Punctuation (Rule 1.7, page 5; Rule 4, page 20; Rule 11, page 50)

See pages 5-7 for an explanation regarding the use of grade 1 indicators with mathematical expressions. See pages 20-25 for guidance on the use of numeric indicators with spatial calculations.

Name	Braille Symbol	Braille Dot Numbers
Grade 1 symbol indicator	⠨	5-6
Grade 1 word indicator	⠨⠨	5-6, 5-6
Grade 1 passage indicator	⠨⠨⠨	5-6, 5-6, 5-6
Grade 1 passage terminator	⠨⠨	5-6, 3
Numeric indicator	⠼	3-4-5-6
Numeric passage indicator	⠼⠼	3-4-5-6, 3-4-5-6
Numeric passage terminator	⠼⠼	3-4-5-6, 3
Underscore (blank space)	⠨⠨	4-6, 3-6

Name	Braille Symbol	Braille Dot Numbers
Ellipsis	⠠⠠⠠	2-5-6, 2-5-6, 2-5-6
Decimal point	⠠	2-5-6
Forward slash	⠠⠠	4-5-6, 3-4
Backslash	⠠⠠	4-5-6, 1-6

Signs of Operation (Rule 3, page 15; Rule 10, page 48; Rule 11, page 50)

Typically, signs of operation are brailled unspaced from other symbols that precede or follow them.

Name	Print Symbol	Braille Symbol	Braille Dot Numbers
Plus	+	⠠⠠	5, 2-3-5
Minus	-	⠠⠠	5, 3-6
Multiplication cross	x	⠠⠠	5, 2-3-6
Multiplication dot	•	⠠⠠	5, 2-5-6
Division	÷	⠠⠠	5, 3-4
Plus or minus	±	⠠⠠	4-5-6, 2-3-5
Minus or plus	∓	⠠⠠	4-5-6, 3-6
Asterisk	*	⠠⠠	5, 3-5
Crosshatch/pound sign	#	⠠⠠	4-5-6, 1-4-5-6
Hollow dot	◦	⠠⠠	5, 3-5-6
Union	∪	⠠⠠	4-6, 2-3-5
Intersection	∩	⠠⠠	4-6, 2-3-6
Vertical bar		⠠⠠	4-5-6, 1-2-5-6

Comparison Symbols and Arrows (Rule 3, page 15; Rule 10, page 48; Rule 11, page 50; Rule 13, page 60)

Signs of comparison, including arrows, are typically preceded and followed by a blank space. A grade 1 indicator (dots 56) is added before an arrow when it is preceded by a space. See pages 61-64 for examples that show the use of different kinds of arrows.

Name	Print Symbol	Braille Symbol	Braille Dot Numbers
Equals	=	⠨⠶	5, 2-3-5-6
Not equal to	≠	⠨⠶⠨⠶	5, 2-3-5-6, 4, 1-5-6
Approximately equal	≈	⠨⠶⠨⠶	4-5, 3-5
Similar	~	⠨⠶	4, 3-5
Greater than	>	⠨⠶	4, 3-4-5
Greater than or equal to	≥	⠨⠶⠨⠶	4-5-6, 4, 3-4-5
Less than	<	⠨⠶	4, 1-2-6
Less than or equal to	≤	⠨⠶⠨⠶	4-5-6, 4, 1-2-6
Proportion	∞	⠨⠶⠨⠶	4-5-6, 5, 2-3-5-6
Ratio	:	⠨⠶	2-5
Contained in	⊂	⠨⠶	4-5, 1-2-6
Contains	⊃	⠨⠶	4-5, 3-4-5
Intersection	∩	⠨⠶	4-6, 2-3-6
Membership (element)	∈	⠨⠶	4-5, 1-5
Parallel	∥	⠨⠶	3-4-5-6, 1-2-3
Perpendicular	⊥	⠨⠶	3-4-5-6, 3-6
Tilde	~	⠨⠶	4, 3-5
Vertical bar		⠨⠶	4-5-6, 1-2-5-6

Name	Print Symbol	Braille Symbol	Braille Dot Numbers
Left arrow	←	⠠⠠	1-2-5-6, 2-4-6
Right arrow	→	⠡⠠	1-2-5-6, 1-3-5
Left/right arrow	↔	⠠⠠⠠⠠	1-2-5-6, 2-4-5-6, 1-2-3-5, 1-3-5
Up arrow	↑	⠠⠠	1-2-5-6, 3-4-6
Down arrow	↓	⠡⠠	1-2-5-6, 1-4-6
Up and right arrow	↗	⠠⠠	1-2-5-6, 2-3-4
Down and right arrow	↘	⠡⠠	1-2-5-6, 1-2-6
Up and left arrow	↖	⠠⠠	1-2-5-6, 1-5-6
Down and left arrow	↙	⠡⠠	1-2-5-6, 3-4-5
Right over left arrow	⇒	⠠⠠⠠⠠	1-2-5-6, 1-3-5, 1-2-4-5-6, 1-2-5-6, 2-4-6

Grouping Symbols (Rule 5, page 30)

Name	Print Symbol	Braille Symbol	Braille Dot Numbers
Opening Parenthesis	(⠠⠠	5, 1-2-6
Closing Parenthesis)	⠡⠠	5, 3-4-5
Opening Square Bracket	[⠠⠠	4-6, 1-2-6
Closing Square Bracket]	⠡⠠	4-6, 3-4-5
Opening Brace	{	⠠⠠	4-5-6, 1-2-6
Closing Brace	}	⠡⠠	4-5-6, 3-4-5
Opening Angle Bracket	<	⠠⠠	4, 1-2-6
Closing Angle Bracket	>	⠡⠠	4, 3-4-5
Vertical Bar		⠠⠠	4-5-6, 1-2-5-6

Fractions and Fraction Indicators (Rule 6, page 31)

See pages 31-33 for some examples of different types of fractions and how to braille them.

Name	Braille Symbol	Braille Dot Numbers
Simple fraction line	⠨	3-4
General fraction line	⠨⠨	4-6, 3-4
General fraction open indicator	⠨⠨	1-2-3-5-6
General fraction close indicator	⠨⠨	2-3-4-5-6
Forward slash	⠨⠨	4-5-6, 3-4

Superscripts and Subscripts (Rule 7, page 34)

See pages 35-39 for some examples of superscript/subscript level changes and how to braille them.

Name	Braille Symbol	Braille Dot Numbers
Level change down (subscript)	⠨	2-6
Level change up (superscript)	⠨	3-5
Expression directly below	⠨⠨	4-6, 2-6
Expression directly above	⠨⠨	4-6, 3-5
Braille grouping open	⠨	1-2-6
Braille grouping close	⠨	3-4-5

Square Roots and Radical Indicators (Rule 8, page 40)

The radical is the symbol that houses the radicand, or number whose root is being taken. The vinculum is the horizontal line on the radical symbol. See pages 40-41 for some examples that show how to braille square and other roots.

Name	Braille Symbol	Braille Dot Numbers
Open radical (root)	⠫	1-4-6
Close radical (root)	⠬	3-4-6
Square root sign without viniculum	⠫⠫	5, 1-4-6

Shape Indicators and Symbols (Rule 11, page 50; Rule 14, page 65)

The grade 1 indicator (dots 56) is added before any arrow that is preceded by a space, or any shape that begins with the shape indicator (dots 1246) and is preceded by a space. See pages 66-68 for some examples that show how to braille shapes.

Name	Print Symbol	Braille Symbol	Braille Dot Numbers
Shape indicator	n/a	⠫	1-2-4-6
Filled/solid shape indicator	n/a	⠫⠫	4-5-6, 1-2-4-6
Shaded shape indicator	n/a	⠫⠫	4-6, 1-2-4-6
Transcriber-assigned shape indicator	n/a	⠫⠫	4, 1-2-4-6
Transcriber-assigned filled/solid shape indicator	n/a	⠫⠫⠫	4, 4-5-6, 1-2-4-6
Transcriber-assigned shaded shape indicator	n/a	⠫⠫⠫	4, 4-6, 1-2-4-6
Shape terminator	n/a	⠫	1-5-6
Angle	∠	⠫⠫	4-5-6, 2-4-6
Circle	○	⠫⠫	1-2-4-6, 1-2-3-4-5-6
Hexagon (regular)	⬡	⠫⠫⠫	1-2-4-6, 3-4-5-6, 1-2-4
Octagon (regular)	⬢	⠫⠫⠫	1-2-4-6, 3-4-5-6, 1-2-5
Parallel	∥	⠫⠫	3-4-5-6, 1-2-3
Parallelogram	▭	⠫⠫⠫⠫	1-2-4-6, 4, 3-4-5-6, 1-4-5

Name	Print Symbol	Braille Symbol	Braille Dot Numbers
Perpendicular	⊥	⠠⠵	3-4-5-6, 3-6
Pentagon (regular)	⬠	⠠⠠⠠⠠⠠	1-2-4-6, 3-4-5-6, 1-5
Square	⬡	⠠⠠⠠⠠	1-2-4-6, 3-4-5-6, 1-4-5
Triangle (equilateral)	⬤	⠠⠠⠠	1-2-4-6, 3-4-5-6, 1-4

Symbols That are Printed Over or Under Mathematical Expressions (Rule 12, page 57)

See pages 58-59 for some examples of how to braille symbols that are printed above or below mathematical expressions.

Name	Braille Symbol	Braille Dot Numbers
Bar over previous item	⠠⠤	1-5-6
Bar under previous item	⠠⠨	6, 1-5-6
Line through previous item (cancellation)	⠠⠠⠠	4, 1-5-6
Right arrow over previous item	⠠⠠⠠	4-5, 1-5-6
Right arrow under previous item	⠠⠠⠠⠠	6, 4-5, 1-5-6
Dot over previous item	⠠⠠⠠	4-5, 2-5-6
Dot under previous item	⠠⠠⠠⠠	6, 4-5, 2-5-6
Tilde over previous item	⠠⠠⠠	4-5-6, 1-5-6
Tilde under previous item	⠠⠠⠠⠠	6, 4-5-6, 1-5-6
Hat (caret) over previous item	⠠⠠⠠	5, 1-5-6
Hat (caret) under previous item	⠠⠠⠠⠠	6, 5, 1-5-6
Arc over previous item	⠠⠠⠠⠠	4-6, 4-5-6, 1-5-6

Miscellaneous Symbols (Rule 2, page 12; Rule 4, page 25; Rule 10, page 48; Rule 11, page 50)

Name	Print Symbol	Braille Symbol	Braille Dot Numbers
Cent	¢	⠠⠠	4, 1-4
Dollar	\$	⠠⠨	4, 2-3-4
Degree	°	⠠⠨⠠	4-5, 2-4-5
Percent	%	⠠⠠⠠	4-6, 3-5-6
Prime	′	⠠⠠⠠	2-3-5-6
Caret	^	⠠⠠⠠	4, 2-6
Null set	∅	⠠⠠⠠	4, 2-4-5
Factorial	!	⠠⠠⠠	2-3-5
Infinity	∞	⠠⠠⠠⠠	3-4-5-6, 1-2-3-4-5-6
Integral	∫	⠠⠠⠠	2-3-4-6
Ditto mark	“	⠠⠠⠠	5, 2
At sign	@	⠠⠠⠠	4, 1
Therefore	∴	⠠⠠⠠⠠	6, 1-6
Tally mark		⠠⠠⠠	4-5-6

Greek Letters (Rule 11.7, page 56)

The Greek letter indicator is dots 46. All letters in the following table are lowercase (the uppercase print symbols for Delta, Sigma, and Omega are also included in parentheses). To capitalize a letter, add a capital indicator (dot 6) before the Greek letter indicator. (*Example*: Lowercase Alpha is dots 46, 1. Capital Alpha is dots 6, 46, 1.)

Name	Print Symbol	Braille Symbol	Braille Dot Numbers
Alpha	α	⠠⠠	4-6, 1
Beta	β	⠠⠡	4-6, 1-2
Gamma	γ	⠠⠢	4-6, 1-2-4-5
Delta	δ (Δ)	⠠⠣ ⠠⠠⠠	4-6, 1-4-5 (6, 4-6, 1-4-5)
Epsilon	ε	⠠⠤	4-6, 1-5
Zeta	ζ	⠠⠥	4-6, 1-3-5-6
Theta	θ	⠠⠦	4-6, 1-4-5-6
Lambda	λ	⠠⠬	4-6, 1-2-3
Mu	μ	⠠⠭	4-6, 1-3-4
Nu	ν	⠠⠮	4-6, 1-3-4-5
Pi	π	⠠⠰	4-6, 1-2-3-4
Sigma	σ (Σ)	⠠⠠⠠ ⠠⠠⠠⠠	4-6, 2-3-4 (6, 4-6, 2-3-4)
Tau	τ	⠠⠴	4-6, 2-3-4-5
Chi	χ	⠠⠸	4-6, 1-2-3-4-6
Omega	ω	⠠⠠⠢ ⠠⠠⠠⠠	4-6, 2-4-5-6 (6, 4-6, 2-4-5-6)

Typeforms/Use of Emphasis (Rule 1.5, page 4; Rule 2.7, page 11)

See page 11 for information about using typeforms with algebraic expressions. See also *Rules of Unified English Braille*, 2013 edition, Section 9 (pages 91-101) for more information about the use of UEB typeforms.

Name	Braille Symbol	Braille Dot Numbers
Italic symbol indicator	⠠⠠	4-6, 2-3
Italic word indicator	⠠	4-6, 2
Italic passage indicator	⠠⠠⠠	4-6, 2-3-5-6
Italic terminator	⠠	4-6, 3
Boldface symbol indicator	⠡⠡	4-5, 2-3
Boldface word indicator	⠡	4-5, 2
Boldface passage indicator	⠡⠡⠡	4-5, 2-3-5-6
Boldface terminator	⠡	4-5, 3
Underline symbol indicator	⠢⠢	4-5-6, 2-3
Underline word indicator	⠢	4-5-6, 2
Underline passage indicator	⠢⠢⠢	4-5-6, 2-3-5-6
Underline terminator	⠢	4-5-6, 3