

The Hitchhiker's Guide to UEB

Mathematics

UEB Curricula Support Writing Group

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Revised 2013

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UEB MATHS QUICK REFERENCE

Print	UEB	Print	UEB	Print	UEB
1	⠠	plus +	⠠⠠	round bracket (⠠⠠⠠
2	⠠⠠	minus -	⠠⠠	round bracket)	⠠⠠⠠
comma	⠠	multiply X	⠠⠠	equilateral triangle	⠠⠠⠠⠠
decimal point	⠠	divide ÷	⠠⠠	square	⠠⠠⠠⠠
numeric space	⠠	plus or minus ±	⠠⠠⠠	circle	⠠⠠⠠
¢	⠠⠠⠠	multiplication dot .	⠠⠠		
\$	⠠⠠⠠	ratio :	⠠	arrow indicator	⠠
%	⠠⠠⠠	=	⠠⠠	right-pointing arrow →	⠠⠠⠠
degree °	⠠⠠⠠	<	⠠⠠		
square root √	⠠⠠	>	⠠⠠	parallel //	⠠⠠⠠
fraction line /	⠠	less than or equal to ≤	⠠⠠⠠	perpendicular ⊥	⠠⠠⠠
infinity ∞	⠠⠠⠠	greater than or equal to ≥	⠠⠠⠠	general omission	⠠
angle indicator ∠	⠠⠠⠠	not equal to ≠	⠠⠠⠠⠠	tally mark	⠠
pi π	⠠⠠⠠	superscript – change level up	⠠		

Examples

$32+26 = 58$ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠ $\frac{3}{4}$ ⠠⠠⠠⠠⠠⠠ $5\frac{3}{4}$ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

$5^2 = 25$ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠ $\sqrt{4}$ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠ -3 ⠠⠠⠠⠠⠠⠠

Introduction

The Hitchhiker's Guide to UEB first edition was written in 2008 by a group of dedicated Resource Teachers Vision from the Blind and Low Vision Network New Zealand together with support from staff at the Royal New Zealand Foundation of the Blind, Accessible Format Production.

The team members gifted their time, knowledge and passion for braille, to produce a resource to support staff, learners and producers with Unified English Braille (UEB) production, as New Zealand's adoption of UEB became a reality in the education and braille worlds.

The Hitchhiker's Guide to UEB was developed to serve as a quick memory jogger. It is not a comprehensive braille instruction guide. This edition, updated in 2013, reinforces the use of the guide as a reference tool to be used by Resource Teachers Vision (RTVs), teachers, teacher aides, Whānau and parents, who find themselves needing to braille texts quickly for student use.

For more in-depth braille rules please refer to the Braille Authority of New Zealand Aotearoa Trust BANZAT website at www.banzat.org.nz from which the current editions of the manuals listed below can be downloaded.

- Unified English Braille Manual: New Zealand Edition
- Unified English Braille Guidelines for Technical Material
- The Rules of Unified English Braille

KISS Principles

(Keeping it so simple!)

For UEB

10 Very Simplified Rules

1. + - x ÷ = all take dot 5
2. money symbols take dot 4 and are followed by number sign
3. operation signs are unspaced both sides
4. comparison signs are spaced before and after
5. greater than and less than signs take dot 4
6. simple fraction line – ∷
7. mixed numerals – repeat number sign
8. superscript – change level up (∴)
9. subscript – change level down (∴)
10. square root has to open and close (∴ ... ∴)

U.E.B. What on Earth is That?

Dot 4 symbols		Dots 4, 5 symbols	Dots 4, 5, 6 symbols	Dots 4, 6		Dot 5	
⠠⠠⠠⠠ \$	<i>Money symbols</i>	⠠⠠⠠⠠ ◦	⠠⠠⠠⠠ plus or minus	⠠⠠⠠⠠ %		⠠⠠⠠⠠ + plus	<i>Operation signs</i>
⠠⠠⠠⠠ €		⠠⠠⠠⠠ ≈				⠠⠠⠠⠠ – minus	
⠠⠠⠠⠠ €			⠠⠠⠠⠠⠠ ≥ greater than or equal to	⠠⠠⠠⠠ general fraction line		⠠⠠⠠⠠ × multiply	
⠠⠠⠠⠠ @		⠠⠠⠠⠠⠠ ≤ less than or equal to			⠠⠠⠠⠠ multiplication dot		
⠠⠠⠠⠠ <		⠠⠠⠠⠠ /	⠠⠠⠠⠠ π ⠠⠠⠠⠠ α ⠠⠠⠠⠠ β		<i>Greek letters</i>	⠠⠠⠠⠠ ÷ divide	<i>Signs of Comparisons</i>
⠠⠠⠠⠠ >						⠠⠠⠠⠠ = equals	
⠠⠠⠠⠠⠠ open transcriber's note		⠠⠠⠠⠠ approximately equal to (tilde over horizontal line)	⠠⠠⠠⠠⠠ Σ capital Sigma			⠠⠠⠠⠠⠠ ≠ not equal to	
⠠⠠⠠⠠⠠ close transcriber's note		⠠⠠⠠⠠ ∠	⠠⠠⠠⠠ [square brackets ⠠⠠⠠⠠]			⠠⠠⠠⠠ * asterisk	
⠠⠠⠠⠠ line through previous item (cancellation, "not") e.g. ⠠⠠⠠⠠⠠ ≠					⠠⠠⠠⠠⠠ _____ long dash, typically used to indicate missing answer		

Dot 5 is used as the numeric space symbol to indicate when a space has been used instead of a comma e.g. 1 000 000 ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

The Hitchhiker's Guide to UEB Mathematics

In UEB each print symbol has **one and only one** braille equivalent.

UEB Maths is not a separate code. All the symbols you would meet in UEB literary material are the same when met in a maths setting.

Braille Indicators

The limitations of the 6-dot cell make it impossible to represent in braille, without duplication, the many arbitrary signs used in print mathematics. A system of braille **indicators** is therefore used. These indicators have no corresponding ink print signs but impart particular meanings to the braille symbols which precede or follow them.

Number Sign (dots 3 4 5 6)

The most common braille indicator is the number sign which signals that the following cell (or cells) forms a number. The digits one to nine and zero are shown by the letters a to j preceded by the number sign.

e.g. 1 ⠠⠠ 500 ⠠⠠⠠

Grade 1 Indicators (dots 5 6)

If a braille symbol also has a Grade 2 meaning then the **Grade 1 Indicator** must be used unless Grade 1 mode is already in force.

- ⠠ indicates the following symbol is in Grade 1
- ⠠⠠ indicates the following word is in Grade 1
- ⠠⠠⠠ indicates the following passage is in Grade 1
- ⠠⠠⠠ (dots 56, 3) terminates the Grade 1 passage.

Any algebra expression may need a **Grade 1 Word Indicator** or, if it includes spaces, a **Grade 1 Passage Indicator**. A simple arithmetic equation will not.

The Number Sign acts as a Grade 1 indicator.

Signs of Operation

The basic mathematical operations are addition, subtraction, multiplication and division. These are 2-cell signs.

plus	+		(dot 5, dots 2 3 5)
minus	-		(dot 5, dots 3 6)
multiply	×		(dot 5, dots 2 3 6)
divide	÷		(dot 5, dots 3 4)
plus or minus	±		(dots 4 5 6, dots 2 3 5)
multiplication dot	.		(dot 5, dots 2 5 6)

The signs of operation are unspaced.

e.g.	6+3,	4-2,	8×9

Signs of Comparison

In braille these are at least 2-cell signs and must be preceded and followed by a space. The most common is the equals sign. Others include the symbols for greater than >, less than <, etc.

equals	=		(dot 5, dots 2 3 5 6)
greater than	>		(dot 4, dots 3 4 5)
less than	<		(dot 4, dots 1 2 6)
not equal to	≠		(dot 5, dots 2 3 5 6, dot 4, dots 1 5 6)

e.g. 6+3 = 9

Signs of Grouping

The basic brackets are

Round brackets	()			(opening: dot 5, dots 1 2 6; closing: dot 5, dots 3 4 5)
Square brackets	[]			(opening: dots 4 6, dots 1 2 6; closing: dots 4 6, dots 3 4 5)
Curly brackets	{ }			(opening: dots 4 5 6, dots 1 2 6; closing: dots 4 5 6, dots 3 4 5)

Braille Enclosure Indicators

Braille grouping indicators are used when there are no print brackets but the symbols still need treating as an item. See the last examples in the Superscripts and Subscripts Section on the next page.

opening ⠠ (dots 1 2 6)

closing ⠨ (dots 3 4 5)

Simple Fractions

In braille, fractions are a little different from the print forms because they are written across the line. We do not talk about the top and bottom parts of a fraction; we refer to them by their correct names – numerator and denominator.

In print, simple fractions may be written either as $\frac{3}{4}$ or as $3/4$ and in both cases we would say either “three quarters” or “three over four”. Be consistent and use the same form for each case.

$\frac{3}{4}$ ⠠⠠⠠⠠⠠⠠

$5\frac{1}{2}$ ⠠⠠⠠⠠⠠⠠⠠⠠

Complex Fractions

When you have fractions with more complex numerators or denominators you will need to indicate that it is a fraction by using the **General Fraction Open and Close Indicators**.

Opening ⠠⠠ (dots 1 2 3 5 6)

closing ⠨⠨ (dots 2 3 4 5 6)

Since the **General Fraction Open Indicator** has a Grade 2 meaning the following examples use a **Grade 1 Indicator**.

$\frac{3+6}{4}$ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

$\frac{x}{2}$ ⠠⠠⠠⠠⠠⠠⠠⠠

Decimal Point

The symbol used for the decimal point is dots 2 5 6 \cdot – the same as the full stop because a decimal point looks like a full stop.

Superscripts and Subscripts (Level Indicators)

Superscripts have changed level up and are indicated by $\overset{\cdot}{\cdot}$

$$3^2 \quad \cdot\cdot\cdot\cdot\cdot\cdot$$

If letters are involved then the level indicator could be a contraction so a Grade 1 indicator is needed.

$$y^2 \quad \cdot\cdot\cdot\cdot\cdot\cdot$$

A level indicator only refers to the next item. If a superscript contains more than one symbol – e.g. y^{-2} , x^{4+5} the items -2 and 4+5 must be enclosed in braille grouping symbols.

$$y^{-2} \quad \cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot$$

$$x^{4+5} \quad \cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot$$

Notice that the Grade 1 word indicator covers all the possible contractions in this expression.

Subscripts have changed level down. They are indicated by $\underset{\cdot}{\cdot}$ and the rules are the same.

Square Roots and other Radicals

The expression inside the square root sign in print (the radicand) should be preceded by the open radical sign and followed by the close radical sign.

opening $\overset{\cdot}{\cdot}$ (dots 1 4 6)

closing $\underset{\cdot}{\cdot}$ (dots 3 4 6)

$$\sqrt{4} \quad \cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot$$

Both the opening and closing radical signs have alternative grade 2 meanings so we need the Grade 1 Indicator.

Greek Letters

Greek letters are used quite a lot in maths, for various reasons. The most famous is, of course, pi – or as the Greeks write it, π . The Greek letters usually correspond to print letters e.g. alpha is “a”, but some have no single letter equivalent e.g. θ theta.

The symbol used to indicate that the next letter is a Greek letter is dots 4 6.

e.g. α (alpha) ⠠⠠⠠
 β (beta) ⠠⠠⠠
 θ (theta) ⠠⠠⠠
 π (pi) ⠠⠠⠠
 σ (sigma) ⠠⠠⠠
 Σ (sigma – upper case) ⠠⠠⠠⠠

Note that the capital sign comes before the Greek letter symbol.

Print Symbols

If the print character looks like a letter of some kind then the braille often uses that letter, preceded by the prefix dot 4.

e.g. \$ ⠠⠠⠠ (dot 4, s)
 @ ⠠⠠⠠ (dot 4, a)

See the UEB Symbols list, or [Guidelines for Technical Materials](#), for a full set of Maths symbols.

Formatting

The normal braille line has space for 40 cells. Make sure the braille is set at this length.

Begin at the very first cell of the line. If the equation or the problem has to extend on to subsequent lines these are called “run-overs”. Run-overs go in cell 3 of the second and following lines.

In 2- or 3-step equations which overrun make sure that the equals sign stays with the answer. Normally this means that the run-over line would start with the equals sign. This makes it easy for the student to review and for the teacher to mark.

Operation signs

Print	UEB	Name	Example
+	⠠⠨	plus	9+3 ⠠⠒⠠⠓⠠⠒⠠⠓
-	⠠⠤	minus	7-2 ⠠⠒⠠⠤⠠⠒
×	⠠⠢	multiplied by	12 × 12 ⠠⠒⠠⠒⠠⠢⠠⠒⠠⠒
.	⠠⠨	multiplication dot	3.a ⠠⠒⠠⠠⠠
÷	⠠⠤⠠⠨	divided by	39 ÷ 13 ⠠⠒⠠⠨⠠⠒⠠⠓⠠⠒⠠⠓
:	⠠⠒	ratio	3 : 4 ⠠⠒⠠⠒⠠⠒⠠⠒
±	⠠⠢⠠⠤	plus or minus	$x \pm 3$ ⠠⠭⠠⠢⠠⠤⠠⠒
√	⠠⠨⠠⠨	square root	√4 ⠠⠨⠠⠒⠠⠨⠠⠒ N.B. the square root symbols enclose the number
!	⠠⠒	factorial sign	6! ⠠⠒⠠⠒

Comparison signs

Print	UEB	Name	Example
=	⠠⠨	Equals	4+5 = 9 ⠠⠒⠠⠓⠠⠒⠠⠓⠠⠨⠠⠒⠠⠓
>	⠠⠨⠠⠨	greater than	6 > 5 ⠠⠒⠠⠨⠠⠒⠠⠓
<	⠠⠨⠠⠨	less than	4 < 5 ⠠⠒⠠⠨⠠⠒⠠⠓
≥	⠠⠨⠠⠨⠠⠨	greater than or equal to	4 ≥ d ⠠⠒⠠⠨⠠⠨⠠⠨⠠⠒
≤	⠠⠨⠠⠨⠠⠨	less than or equal to	6 ≤ x ⠠⠒⠠⠨⠠⠨⠠⠨⠠⠒
≠	⠠⠨⠠⠨⠠⠨⠠⠨	not equal to	4 ≠ 8 ⠠⠒⠠⠨⠠⠨⠠⠨⠠⠨⠠⠒

Time

Print	UEB Example
5:30 pm	⠠⠒⠠⠒⠠⠒⠠⠒⠠⠒⠠⠨⠠⠒⠠⠓
5.30 am	⠠⠒⠠⠒⠠⠒⠠⠒⠠⠒⠠⠨⠠⠒⠠⠓
1300 hrs	⠠⠒⠠⠒⠠⠒⠠⠒⠠⠒⠠⠨⠠⠒⠠⠓
80 km/h	⠠⠒⠠⠒⠠⠒⠠⠒⠠⠒⠠⠨⠠⠒⠠⠓

Fractions

Print	UEB	Name	Example
/	⠂	simple numeric fraction line	$\frac{3}{4}$ or $3/4$ ⠂⠂⠂⠂⠂ $5\frac{1}{2}$ ⠂⠂⠂⠂⠂⠂⠂
	⠂⠂⠂ ⠂⠂⠂ ⠂⠂⠂	general fraction line general fraction open indicator general fraction close indicator	$\frac{a+6}{4}$ ⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂ NB Number sign must be repeated after the general fraction line.

Superscripts and Subscripts

UEB	Name	Example
⠂	superscript – change level up.	3^2 ⠂⠂⠂⠂⠂⠂⠂⠂ y^2 ⠂⠂⠂⠂⠂⠂⠂ y^{-2} ⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂ x^{4+5} ⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂
⠂	subscript – change level down.	P_1 ⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂ 100_2 ⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂⠂

Miscellaneous mathematical symbols

Print	UEB	Name
∞	⠂⠂⠂	Infinity
\sphericalangle	⠂⠂⠂	angle sign
//	⠂⠂⠂	parallel to
\perp	⠂⠂⠂	perpendicular to
\therefore	⠂⠂⠂	therefore
\because	⠂⠂⠂	since
	⠂⠂	general omission symbol

Shapes

Print	UEB	Name
	⠂⠂	shape indicator
	⠂⠂⠂⠂⠂	regular (equilateral) triangle
	⠂⠂⠂⠂⠂	square
	⠂⠂⠂⠂⠂	regular pentagon (5-sided figure)
	⠂⠂⠂	circle

Arrows

UEB	Name
⠆	arrow indicator
⠆⠆	simple right pointing arrow (east) →
⠆⠆	simple left pointing arrow (west) ←
⠆⠆	simple up pointing arrow (north) ↑
⠆⠆	simple down pointing arrow (south) ↓

And just because ...

Bullets, Barbs and Daggers!

	UEB	Name
•	⠆	bullet
→	⠆ ⠆⠆⠆⠆⠆⠆⠆⠆	regular barb, full, in line of direction double-barbed arrow
†	⠆⠆⠆	dagger