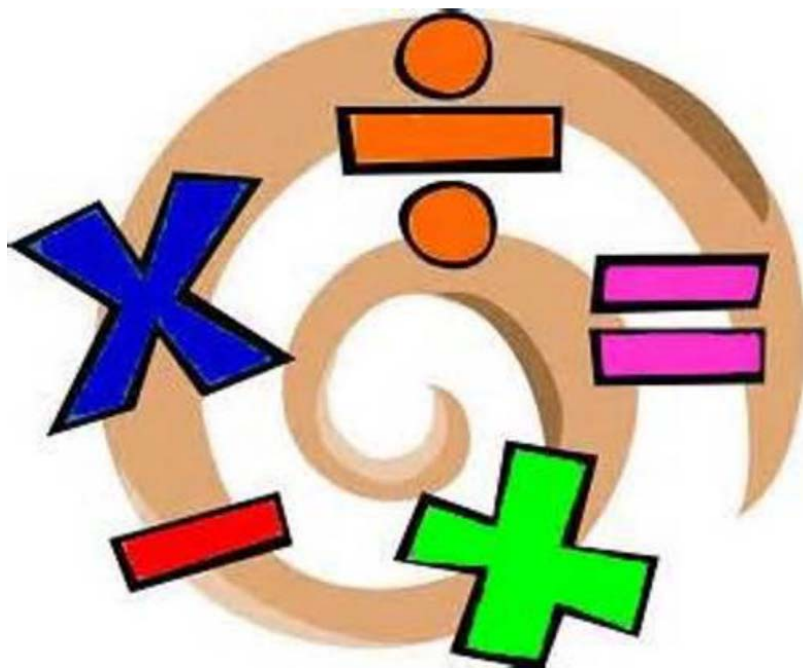


INBAF

Irish National Braille
& Alternative
Format Association



Irish UEB Technical Guidelines for Primary and Secondary Level



March 2017

These guidelines were produced with the agreement and co-operation of all the members of the UEB Maths Working Group.

National Braille Production (NBP) at ChildVision, the Media Centre at NCBI and the Braille Unit in Arbour Hill launched the Irish National Braille and Alternative Format association (INBAF) on May 3rd 2012.

Ireland officially adopted UEB as its braille code in December 2013. Since then INBAF has been working towards the implementation of the UEB code in Irish schools. The work of INBAF started straight after the launch with the formation of three working groups;

- A UEB steering group whose main focus is the development of a UEB implementation strategy for Ireland**
- An Irish braille working group to review and update the Irish braille code in line with new developments in the world of braille**
- A Maths working group reviewing how best to implement UEB maths/technical code.**

INBAF is the first Irish organisation which advises about rules, layout and best practice for the Irish and English Braille codes used in Ireland.

INBAF is fully supported by the UK Association for Alternative Formats (UKAAF) and along with UKAAF is a member of the International Council on English Braille (ICEB). Both organisations have been very helpful to their new Irish counterpart.

Our Mission:

INBAF will strive to advise and help anyone who utilises braille, large print and other alternative formats and has an interest in same, in all matters related to the Irish and English braille code and format standards as used now and into the future.

Our Tasks:

- **Represent Ireland at international level in areas specific to alternative formats**
- **Advance Unified English Braille (UEB) implementation into Ireland**
- **Review Irish braille code**
- **Provide a central point for enquiries in relation to alternative formats**
- **Low cost and inform best practice**

International Representation:

- **INBAF is a full member of the International Council of English Braille (ICEB), the global governing body**
- **INBAF chairperson is a member of ICEB Executive**
- **INBAF committee members are group members or list observers on all ICEB special purpose committees (Code Maintenance Committee, Music, Technology, Research and PR)**

International Links:

- **UK Association for Alternative Formats (UKAAF), close co-operation regarding technical braille**
- **Canute project (Bristol Brailleists)**
- **ICEB member countries' associations for the blind**

UEB Maths Working Group Members

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Definitions

Numeric indicator: formerly known as the "number sign", this sets numeric mode for the following sequence of symbols to include digits, commas, decimal point/full stops, simple fraction lines and dot 5 line continuation indicators. The numeric indicator also acts in a similar way to a grade 1 word indicator except that grade 1 mode is terminated by a hyphen or dash as well as a space.

Grade 1 symbol indicator: formerly referred to as the "letter sign", the grade 1 symbol indicator sets grade 1 for the next symbol only and is used before symbols that have another meaning in literary braille e.g. the "SH" square root symbol, the "EN"/"IN" sub and superscript signs.

Grade 1 word indicator: (two grade 1 indicators) sets grade 1 for the next sequence of symbols and is used where grade 1 mode is required on more than one symbol in a sequence. It continues over a hyphen or dash and is terminated by a space or a grade 1 terminator.

Grade 1 passage indicator: (three grade 1 indicators) is used where grade 1 mode is required in expressions that include spaces. This sets grade 1 mode until there is a grade 1 terminator. There can be a page break in the middle of a grade 1 passage, there is no need to stop the passage at the bottom of the page and restart it at the top of the next page.

Grade 1 passage terminator: (a grade 1 indicator followed by a dot 3). This does exactly what it says! It terminates grade 1 mode and is placed at the end of a grade 1 passage.

Item: an item is defined as a number, a decimal or fraction (simple or general), an enclosed square root, an arrow, a shape, an expression enclosed in print brackets or in braille grouping signs. [UUM pp vi]

Grouping signs: treat enclosed symbols as an item. They are used when there are no brackets in print but it is necessary to ensure that the preceding braille symbol or indicator applies to all the symbols enclosed by the braille grouping indicators rather than just to the symbol immediately following.

Note: This includes a modifier which applies to more than one letter and a subscript or superscript indicator which applies to more than one "item". [RUEB – pp 23]

Omission: in Guidelines for Technical Material, "omission" refers to the blanks that are used in texts and workbooks for students to fill in. UEB has different symbols for every print style of omission. We have selected one symbol and use it for all styles. This is explained in the section on Omission Symbols in the booklet.

Vinculum: [Using UEB for Mathematics pp 6]

The vinculum is the over-line used with the square root sign which indicates that everything underneath it is part of the square root.

$\sqrt{169}$ This square root has a vinculum.

This requires a terminator.

Standing Alone Rule: [ICEB Rules of UEB – pp 15]

A letter is "standing alone" if it is preceded and followed by a space, hyphen or dash. When this happens, a grade 1 indicator is required so that it won't be misread as its grade 2 meaning, i.e. a contraction or wordsign. This doesn't arise for letters a, i and o because they don't have a grade 2 meaning.

Irish UEB Technical Guidelines for Primary and Secondary Level

Abbreviations

Guidelines for Technical Material – GTM

UEB Australian Training Manual – ATM

ICEB Rules of UEB – RUEB

Using UEB for Mathematics – UUM

Topic	Ref.
<p data-bbox="108 763 528 808">Numeric indicator</p> <p data-bbox="108 860 145 904">⋮</p> <p data-bbox="108 956 783 1001">This establishes numeric mode</p> <p data-bbox="108 1050 1222 1095">The following symbols may occur in numeric mode:</p> <ul data-bbox="172 1144 810 1487" style="list-style-type: none">• the ten digits 0-9• full stop/decimal point• comma• simple numeric fraction line• line continuation indicators• omission sign <p data-bbox="108 1536 1206 1626">A space or any symbol not listed above terminates numeric mode.</p> <p data-bbox="108 1675 831 1720">Numeric passage indicator ⋮⋮</p> <p data-bbox="108 1769 815 1814">Numeric terminator ⋮⋮</p>	<p data-bbox="1342 763 1453 853">GTM pp 2</p> <p data-bbox="1342 931 1453 1021">UUM pp v</p> <p data-bbox="1321 1099 1469 1189">ATM pp 121</p> <p data-bbox="1331 1267 1465 1357">RUEB pp 59</p>

<p>Grade 1 Indicators</p> <p>Grade 1 symbol indicator ⠠</p> <p>Grade 1 word indicator ⠠⠠</p> <p>Grade 1 passage indicator ⠠⠠⠠</p> <p>Grade 1 mode passage terminator ⠠⠠</p>	<p>GTM pp 5</p> <p>UUM pp iv</p> <p>ATM pp 118, 141</p>
<p>Equals</p> <p>= ⠠⠠</p> <p>This sign is always spaced on both sides</p> <p>2 = 2 ⠠⠠ ⠠⠠ ⠠⠠</p>	<p>GTM pp 15</p> <p>ATM pp 129</p>
<p>Plus & Minus Signs</p> <p>+ ⠠⠠</p> <p>– ⠠⠠</p> <p>These signs are spaced on both sides until the end of 2nd Class</p> <p>1 + 2 = 3 ⠠⠠ ⠠⠠ ⠠⠠ ⠠⠠ ⠠⠠</p> <p>3 – 2 = 1 ⠠⠠ ⠠⠠ ⠠⠠ ⠠⠠ ⠠⠠</p> <p>They are unspaced from 3rd Class on</p> <p>1 + 2 = 3 ⠠⠠⠠⠠⠠⠠ ⠠⠠ ⠠⠠</p> <p>3 – 2 = 1 ⠠⠠⠠⠠⠠⠠ ⠠⠠ ⠠⠠</p>	<p>GTM pp 1, 15</p> <p>UUM pp 2</p> <p>ATM pp 128</p>

Less Than / Greater Than

< ⠠⠨⠶ > ⠠⠨⠸

These signs are always spaced on both sides.

2 < 5 ⠠⠨⠶ ⠠⠨⠸ ⠠⠨⠸

5 > 2 ⠠⠨⠸ ⠠⠨⠶ ⠠⠨⠸

Less Than / Greater Than or Equal To

≤ ⠠⠨⠶⠨⠸ ≥ ⠠⠨⠸⠨⠶

Always spaced on both sides.

Not Equals

≠ ⠠⠨⠸⠨⠶⠨⠸

Other Equals Signs

≈ ⠠⠨⠶⠨⠸

≡ ⠠⠨⠶⠨⠸

These are spaced on both sides as they are comparison signs.

GTM
pp 15

UUM
pp 2

GTM
pp 15

Simple Fractions

A simple fraction contains numbers only.

Simple fraction line $\frac{\quad}{\quad}$

A numeric indicator is not required in the denominator.

$$\frac{1}{2} \text{ or } \frac{1}{2} \quad \frac{1}{4} \text{ or } \frac{1}{4}$$

$$\frac{15}{20} \text{ or } \frac{15}{20}$$

$$\frac{42.5}{17} \text{ or } \frac{42.5}{17}$$

Mixed Numbers

Mixed numbers are comprised of a whole number plus a fraction.

These are brailled unspaced using the simple fraction line

$$2\frac{3}{4}$$

$$1\frac{1}{2}$$

GTM
pp 31

UUM
pp 11, 12

General Fractions

GTM
pp 32, 33

The general fraction line and general fraction indicators are used when the fraction contains something more than digits, commas or decimal points.

UUM
pp 30

General fraction line — ◌◌◌◌

This sign terminates numeric mode but not grade 1 mode.

General fraction indicators

◌◌◌◌ to open

◌◌◌◌ to close


A grade 1 symbol indicator must be inserted before the opening indicator.

Fractions that include mixed numbers must use the general fraction line:

$$\frac{1}{8} = \frac{12\frac{1}{2}}{100} = 12\frac{1}{2}\%$$


◌◌◌◌ ◌◌◌ ◌◌◌◌ ◌◌◌◌◌◌ ◌◌◌◌ ◌◌◌◌ ◌◌◌◌◌◌◌◌ ◌◌◌◌ ◌◌◌◌ ◌◌◌◌ ◌◌◌◌◌◌
 ◌◌◌◌ ◌◌◌ ◌◌◌◌ ◌◌◌◌ ◌◌◌◌◌◌

General Fractions (contd)

$$\frac{13}{b}$$



The numeric indicator sets grade 1 mode so there is no need to use a grade 1 symbol indicator with the denominator.

If the numerator is a number, grade 1 mode is set by the numeric indicator for the rest of the expression, therefore you only need a grade 1 symbol indicator before the opening general fraction indicator.

$$\frac{1}{4d}$$


The letter "d" in this fraction must have its own grade 1 symbol indicator to prevent it being read as another 4.

When there are no numbers in the fraction, or when grade 1 mode is not set in the course of the expression, the opening and closing general fraction indicators each need a grade 1 symbol indicator, in which case, use the grade 1 word indicator.

$$\frac{x}{y}$$


Choice of Grade 1 Indicators

UUM
pp 75


Unless the need for a grade 1 symbol indicator arises

(a) within the first 3 cells of a maths expression,
(as in $\frac{13}{b}$)

and / or

(b) before a single letter standing alone within the
expression, (as in $\frac{1}{4d}$)

then use a word indicator for expressions without
braille spaces (as in $\frac{x}{y}$), or a passage indicator for
expressions with braille spaces.

$$\frac{x}{y} = \frac{a}{b}$$


When using the grade 1 passage indicator, you
must use a grade 1 passage terminator to end
grade 1 mode.

<p>Percentage Sign</p> <p>% ⠠⠠⠠</p> <p>This is unspaced from the preceding number.</p> <p>15% ⠠⠠⠠⠠⠠⠠</p>	<p>GTM pp 12</p> <p>UUM pp 14</p>
<p>Ratio Sign</p> <p>: ⠠</p> <p>This is a comparison sign but it is written unspaced on both sides, regardless of print.</p> <p>2 : 4 = 6 : 12 ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠</p> <p>Use the grade 1 indicator where the ratio sign could be mistaken for the contraction "cc"</p> <p>p : q ⠠⠠⠠⠠⠠</p>	<p>GTM pp 15, 17</p> <p>UUM pp 14</p>
<p>Brackets</p> <p>Round brackets () ⠠⠠⠠⠠</p> <p>Square brackets [] ⠠⠠⠠⠠</p> <p>Curly brackets { } ⠠⠠⠠⠠</p> <p>Follow print brackets</p> <p>[2(x + y)] ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠</p>	<p>GTM pp 30</p> <p>UUM pp 9</p>

Thousands / Hundreds / Tens / Units Symbols

Use the "th" contraction for thousands.
You need the grade 1 symbol indicator so that it is not mistaken for "this".

thousands ⠠⠠⠠⠠

hundreds ⠠⠠⠠

tens ⠠⠠

units ⠠⠠

These signs are spaced on both sides.
No need for capital sign, regardless of print.

1,203

⠠⠠⠠⠠ ⠠

⠠⠠⠠ ⠠ ⠠

⠠⠠⠠

⠠⠠⠠ ⠠ ⠠ ⠠

Tally Marks

||| ⠠⠠⠠

|||| or |||/ ⠠⠠⠠⠠

These signs are spaced on both sides.

GTM
pp 25

UUM
pp 45

Length, Weight, Capacity

2 m	⠠⠨⠠⠍	2m	⠠⠨⠠⠍
3 cm	⠠⠒⠠⠆⠠⠍	3cm	⠠⠒⠠⠆⠠⠍
80 kg	⠠⠘⠠⠐⠠⠕⠠⠕⠠⠕	80kg	⠠⠘⠠⠐⠠⠕⠠⠕⠠⠕
8 g	⠠⠘⠠⠒	8g	⠠⠘⠠⠒
20 l	⠠⠒⠠⠐⠠⠕	20l	⠠⠒⠠⠐⠠⠕
15 ml	⠠⠕⠠⠑⠠⠕⠠⠕	15ml	⠠⠕⠠⠑⠠⠕⠠⠕

Up to the end of 2nd class these signs will be spaced regardless of print.

3cm ⠠⠒⠠⠆

Although UEB tells us to follow print, for consistency units will be unspaced from 3rd class.

3cm or 3 cm ⠠⠒⠠⠐⠠⠕⠠⠕

Regardless of print, only use lower case letters.

For area and volume refer to index/power signs on page 23.

GTM
pp 16

UUM
pp 15

ATM
pp 163

Time

Up to the end of 2nd class, the numeric indicator is used as the separator in times, regardless of print.

This is not in UEB but is recommended for ease of reading for younger students.

12.30 / 1230 / 12:30

are all brailled ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

From 3rd class on, follow print.

12:15 p.m. ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

1800 ⠠⠠⠠⠠⠠⠠

10.30 am ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

The grade 1 symbol indicator is not required with am (if spaced) or pm (spaced or unspaced).

10.30am ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

12:15pm ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

GTM
pp 10

UUM
pp 21

ATM
pp 127

Date

Up to 2nd class, repeat the numeric indicator and space the numbers in all dates, regardless of how it appears in print.

This is recommended for ease of reading for younger students.

29.01.2016 or 29/01/2016 or 29-01-2016
are all brailled ⠠⠨⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

Keep it all together; do not split over two lines.

From 3rd class on, follow print.

08.02.2016 ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

09/02/2016 ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

10-02-2016 ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

GTM
pp 9

UUM
pp 22

ATM
pp 127

<p>Ordinal Numbers</p> <p>Contractions are not allowed, as the numeric indicator sets grade 1 mode.</p> <p>1st ⠠⠠⠠⠠⠠ 4th ⠠⠠⠠⠠⠠</p>	<p>GTM pp 10</p>
<p>Roman Numerals</p> <p>Follow the rules for capitals and letters.</p> <p>No grade 1 indicators required for i, ii, iii, iv, XI</p> <p>⠠ ⠠⠠ ⠠⠠⠠ ⠠⠠⠠ ⠠⠠⠠⠠⠠</p> <p>v, x, V, X do require a grade 1 symbol indicator</p> <p>⠠⠠⠠ ⠠⠠⠠ ⠠⠠⠠⠠ ⠠⠠⠠⠠</p> <p>When the hyphen or dash is used, the grade 1 indicator or capital indicator must be repeated.</p> <p>v-x ⠠⠠⠠⠠⠠⠠⠠</p> <p>X-XX ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠</p> <p>Here, you need a grade 1 symbol indicator on the single capital letter, X, but not on the double XX</p>	<p>GTM p 11</p> <p>UUM pp 29</p>

Omission Symbol

Across all subjects, the "underscore" omission sign will be used, regardless of what "blank" is used in print.

_ ⠠⠠⠠

In literary text, it is spaced on both sides, like a blank space.

In maths, it is spaced on both sides up to 2nd class. From 3rd class on, follow UEB spacing guidelines.

$$2 + \square = 5$$

⠠⠠⠠ ⠠⠠⠠⠠⠠⠠⠠ ⠠⠠⠠ ⠠⠠⠠

$$2 + 3 = \underline{\quad}$$

⠠⠠⠠ ⠠⠠⠠⠠⠠⠠⠠ ⠠⠠⠠ ⠠⠠⠠

$$? + 3 = 5$$

⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠ ⠠⠠⠠ ⠠⠠⠠

$$2 + \quad = 5$$

⠠⠠⠠ ⠠⠠⠠⠠⠠⠠⠠⠠ ⠠⠠⠠ ⠠⠠⠠

Use grade 1 indicators as necessary.

$$24\text{kg} = \underline{\quad}\text{g}$$

$$2400\text{g} = \underline{\quad}\text{kg}$$

$$2400\text{g} = \underline{\quad}4\text{kg}$$

$$200\text{cm} = \underline{\quad}\text{m} \text{ but } 2\text{m} = \underline{\quad}\text{cm}$$

⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠ ⠠⠠⠠ ⠠⠠⠠⠠⠠⠠ ⠠⠠⠠ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

GTM
pp 19

GTM
pp 1
1.1.2

RUEB
pp 51-57

Omission Symbol in Equivalent Fractions

For simple fractions with blanks in them, the simple fraction line will be used.

Where the denominator is the blank space, numeric mode continues across the line and the underscore is inserted as usual.

$$\frac{6}{12} = \frac{1}{\quad}$$

$$\frac{6}{\quad} = \frac{1}{2}$$

Where the numerator is the blank space, the numeric indicator precedes the omission symbol.

$$\frac{6}{12} = \frac{\quad}{2}$$

$$\frac{\quad}{12} = \frac{1}{2}$$

Omission Sign in Improper Fractions

$$\frac{18}{12} = \frac{\quad}{2} = 1\frac{\quad}{2}$$

$$\frac{18}{12} = \frac{\quad}{2} = 1\frac{\quad}{2}$$

Patterns / Sequences

Up to the end of 2nd class use tactile diagrams.



Shape Indicators

⠫ followed by the relevant braille symbol.

This needs a grade 1 symbol indicator unless you are already in numeric or grade 1 mode.

triangle ⠫⠠⠠⠠⠠⠠

pentagon ⠫⠠⠠⠠⠠⠠

hexagon ⠫⠠⠠⠠⠠⠠

circle ⠫⠠⠠⠠

semi-circle ⠫⠠⠠⠠

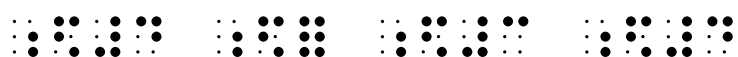
square ⠫⠠⠠⠠⠠

rectangle ⠫⠠⠠⠠⠠⠠

parallelogram ⠫⠠⠠⠠⠠⠠

shape terminator ⠫⠠

From 3rd class on, use the shape indicators.



GTM
pp 65

UUM
pp 36

Grouping Signs / Indicators

Grouping signs are used when there are no brackets in print but the braille needs to be grouped or highlighted. Grouping signs treat the enclosed symbols as an item.

Open grouping sign ⠐

Close grouping sign ⠑

Highlighted / Emphasised Numbers

Up to 2nd class grouping signs can be used instead of typeform indicators (e.g. bold/underline/ colour) to highlight one or more digits within a number.

This is not in UEB but is recommended for ease of reading for younger students.

Up to the end of 2nd Class:

12567 ⠠⠠⠠⠠⠠⠠⠠⠠

12**5**67 ⠠⠠⠠⠠⠠⠠⠠⠠

12567 ⠠⠠⠠⠠⠠⠠⠠⠠

The numeric indicator should always be outside the open grouping sign, even when the first number is highlighted.

12567 ⠠⠠⠠⠠⠠⠠⠠⠠

GTM
pp 30

UUM
pp 10

RUEB
pp 23

GTM
pp 11
2.7

Highlighted / Emphasised Numbers (contd)

From 3rd class on follow print to emphasise numbers using the correct typeform indicators.

12567 ⠠⠠⠠⠠⠠⠠⠠⠠

12**5**67 ⠠⠠⠠⠠⠠⠠⠠⠠

For colours or italics use the bold symbol.

12**5**67 ⠠⠠⠠⠠⠠⠠⠠⠠

12567 ⠠⠠⠠⠠⠠⠠⠠⠠

When the first digit is the highlighted digit, then the typeform indicator goes before the numeric indicator.

12567 ⠠⠠⠠⠠⠠⠠⠠⠠

When there is more than one form of print highlight (bold, underline and coloured) only use one typeform indicator.

When in doubt use the bold indicator.

12567 ⠠⠠⠠⠠⠠⠠⠠⠠

1**2**567 ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

When two or more consecutive numbers are highlighted, the appropriate word indicator is used before the first highlighted digit with a terminator placed after the last highlighted digit.

12567 ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

RUEB
pp 91-97

ATM
pp 146

Index / Power Signs

Superscript ⠠⠨⠠

Subscript ⠠⠨⠠

These have another meaning in literary braille, therefore unless they are preceded by a numeric indicator, they will require a grade 1 symbol indicator.

cm^2 ⠠⠠⠠⠠⠠⠠⠠⠠

x^3 ⠠⠠⠠⠠⠠

The numeric indicator sets grade 1 mode, so there is no need for a grade 1 symbol indicator.

2^2 ⠠⠠⠠⠠

2^b ⠠⠠⠠⠠

When the superscript is a fraction:

$9^{\frac{1}{2}}$ ⠠⠠⠠⠠⠠⠠⠠⠠

$a^{1/2}$ ⠠⠠⠠⠠⠠⠠⠠⠠

$a^{p/q}$ or $a^{\frac{p}{q}}$ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

GTM
pp 34

UUM
pp 5, 75

Index / Power Signs (contd)

The same rule applies for subscripts:

3_2 ⠠⠨⠠⠨⠠⠨⠠⠨⠠⠨

x_1 ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

The super/subscript level change refers only to the next item.

x^2y ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

If there is more than one item or symbol in the super/subscript, grouping signs must be used to enclose it.

x^2y ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

Because both the superscript sign and the grouping sign need a grade 1 symbol indicator, a grade 1 word indicator is used.

Where you have superscripts and subscripts simultaneously, the subscript is brailled first, followed by the superscript.

x^2_1 ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

In this example the subscript sign needs a grade 1 symbol indicator; however, the superscript sign doesn't need one as grade 1 mode has been set by the preceding unspaced numeric indicator.

Root Sign

Regardless of how it appears in print, always use the square root sign "with vinculum".

$\sqrt{\quad}$ or $\sqrt{\quad}$ use ⠠⠠⠠⠠⠠⠠

Root Terminator

⠠⠠⠠⠠

Because we are using the "with vinculum" sign, the root must always be terminated.

$\sqrt{9} = 3$ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

$\sqrt{9} = 3$ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

The square root sign has another meaning in literary braille, therefore the grade 1 symbol indicator must precede it.

$\sqrt{x + y} + 3$ $\text{⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠}$

nth Root Sign

$\sqrt[5]{6}$ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

$\sqrt[a]{x} = b$ $\text{⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠}$

GTM
pp 40

UUM
pp 6

UUM
pp 7

Positive & Negative Numbers

These are sometimes written as superscripts to highlight the +/- values.

$$-2^{++} 3^{+-} 7$$



When it is not superscripted the operation signs are spaced to emphasise the plus and minus values.

$$-2 + +3 + -7$$



GTM
pp 18, 37

UUM
pp 3

Degrees / Minutes / Seconds

° degree ⠠⠨⠠

' minute ⠠⠨ " second ⠠⠨⠠

These signs are brailled unspaced.

0°C ⠠⠠⠠⠠⠠⠠⠠⠠ or 32°F ⠠⠠⠠⠠⠠⠠⠠⠠

25° 13'52" ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

Feet and inches are brailled and spaced the same way.

' feet ⠠⠨

" inches ⠠⠨⠠

6'4" ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

GTM
pp 12

RUEB
pp 27-30

<p>Line Through Symbol</p> <p>This sign applies to the immediately preceding item.</p> <p>⠠⠠⠠ ≠ ⠠⠠⠠⠠⠠ 15 ⠠⠠⠠⠠⠠</p>	<p>GTM pp 24, 57</p> <p>UUM pp 35</p>
<p>Parallel / Perpendicular Sign</p> <p>∥ ⠠⠠⠠</p> <p>⊥ ⠠⠠⠠</p> <p>These signs are unspaced on both sides.</p> <p>A ∥ B ⠠⠠⠠⠠⠠⠠⠠</p> <p>A ⊥ B ⠠⠠⠠⠠⠠⠠⠠</p>	<p>GTM pp 50</p> <p>UUM pp 38</p>
<p>Therefore Sign</p> <p>∴ ⠠⠠⠠</p> <p>This sign is spaced on both sides.</p> <p>A ∥ B ∴ B ∥ A ⠠⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠⠠</p>	
<p>Arrows (Simple)</p> <p>Arrows are comparison signs and are spaced on both sides.</p> <p>arrow indicator ⠠⠠</p> <p>→ ⠠⠠⠠</p> <p>← ⠠⠠⠠</p> <p>⇒ ⠠⠠⠠⠠⠠</p> <p>Unless you are already in numeric or grade 1 mode, these need a grade 1 symbol indicator.</p>	<p>GTM pp 60</p> <p>UUM pp 34</p>

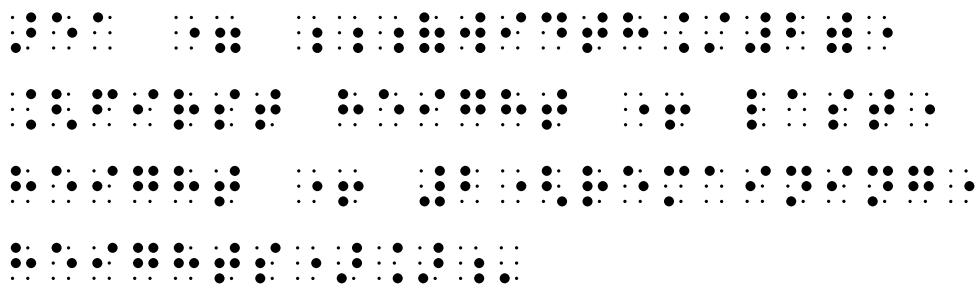
Long expressions/rules containing words

For clarity between functions and words always space operational signs.

Refer to page 11 for **Choice of Grade 1 Indicators**

Trapezoidal rule:

$$\text{Area} = \frac{\text{width}}{2} [\text{first height} + \text{last height} + 2(\text{remaining heights})]$$

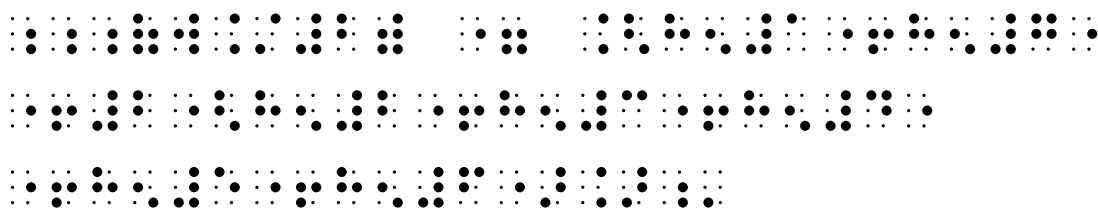


Dividing long mathematical expressions

Where possible, long equations should be split before comparison or relation signs.

Where this is not possible, then the dot 5 is inserted at the most logical splitting point in the expression to make it clear that the next line is a continuation of the current one.

$$\frac{w}{2} = [h_1 + h_7 + 2(h_2 + h_3 + h_4 + h_5 + h_6)]$$



UUM
pp 76

GTM
pp 3-4
1.4

UUM
pp 74

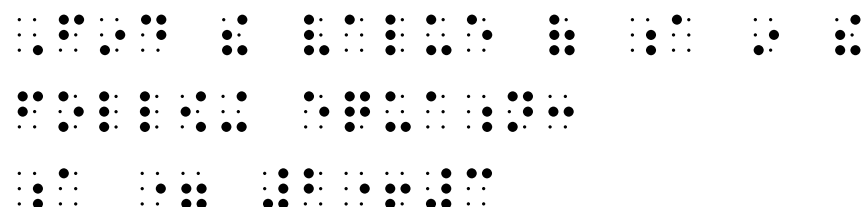
Algebra

Letters

Where necessary, letters standing alone should be preceded by the grade 1 symbol indicator. This includes "a" where it could be misread as the indefinite article.

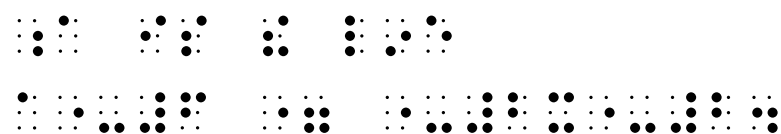
Find the value of a in the following equation:

$$a = 2 + 3$$



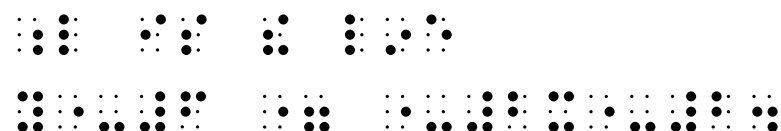
Braille representation of the equation $a = 2 + 3$. The equation is written in Braille as follows: $\mathbb{1} a = 2 + 3$. The grade 1 symbol indicator is used before the letter 'a'.

a is the line $a - 6 = -2x - 2$.



Braille representation of the equation $a - 6 = -2x - 2$. The equation is written in Braille as follows: $\mathbb{1} a - 6 = -2x - 2$. The grade 1 symbol indicator is used before the letter 'a'.

l is the line $y - 6 = -2x - 2$.



Braille representation of the equation $y - 6 = -2x - 2$. The equation is written in Braille as follows: $\mathbb{1} y - 6 = -2x - 2$. The grade 1 symbol indicator is used before the letter 'y'.

Whereas:

$$2p \leq 18$$



Braille representation of the inequality $2p \leq 18$. The inequality is written in Braille as follows: $2p \leq 18$.

GTM
pp 17

UUM
pp 32

Trigonometry

Space all functions regardless of print.

$$\text{Cos}30^\circ$$

$$\text{Tan}30^\circ$$

$$y \cos 60^\circ = 5.41$$

$$y \cos 60^\circ = 5.41$$

Always spell out the word Sin.

$$\text{Sin}30^\circ$$

$$\frac{1}{2} ab \sin C$$

$$X = \sin^{-1}\left(\frac{5}{12}\right)$$

$$X = \sin^{-1}\left(\frac{5}{12}\right)$$

GTM
pp 44

UUM
pp 37

Geometry

In geometry always space shape expressions, regardless of print.

$\triangle ABC$ ⠠⠗⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

$\square ABCD$ ⠠⠗⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

Vertical bar (open or close) ⠠⠠⠠

$|AB|$ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

$|\angle A|$ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

$A \perp B$ ⠠⠠⠠⠠⠠⠠⠠⠠

$A \square B$ ⠠⠠⠠⠠⠠⠠⠠⠠

$\triangle ABC \equiv \triangle DEF$

⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

[BA ⠠⠠⠠⠠⠠⠠⠠⠠

$$\frac{|DE|}{|AB|} = \frac{|DF|}{|AC|} = \frac{|EF|}{|BC|}$$

⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

$$|AB| = \sqrt{(x_1 + x_2)^2 + (y_1 + y_2)^2}$$

⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

GTM
pp 66

UUM
pp 37-38

UUM
pp 9

Embellishments

These affect the previous item.

line through \neq
(unspaced because it is all one symbol, not a comparison)

Use the grade 1 indicator as necessary.

hat over \hat{x}

bar under \underline{x}

bar over \bar{x}

$\hat{A}BC$ is also written $\angle ABC$, and will be transcribed as such, regardless of how it appears in print.

$\hat{A}BC$

simple right arrow over \overrightarrow{AB}

\overrightarrow{AB}

GTM
pp 57

UUM
pp 35

Set Notation Brackets

Curly "set notation" brackets are used and commas between the elements are shown.

$A = \{1, 2, -3\}$

$A = \{1, 2, -3\}$

Always insert commas and spaces in sets regardless of print.

Follow whatever brackets are used in print.

Set Theory

GTM
pp 48, 50

Universal Set U ⠠⠠⠠⠠⠠⠠

Cardinal number $\#$ ⠠⠠⠠⠠

UUM
pp 48, 67

Operation Signs

Union \cup ⠠⠠⠠⠠⠠⠠

Intersection \cap ⠠⠠⠠⠠⠠⠠

Comparison Signs

Subset \subset ⠠⠠⠠⠠⠠⠠

Not a Subset $\not\subset$ ⠠⠠⠠⠠⠠⠠⠠⠠

Superset \supset ⠠⠠⠠⠠⠠⠠

Element \in ⠠⠠⠠⠠⠠⠠

Not an element of \notin ⠠⠠⠠⠠⠠⠠⠠⠠

Other Signs

Null/Empty Set \emptyset ⠠⠠⠠⠠ or $\{\}$ ⠠⠠⠠⠠ ⠠⠠⠠⠠

Less / Not \setminus ⠠⠠⠠⠠⠠⠠

Not Equal To \neq ⠠⠠⠠⠠⠠⠠⠠⠠

<p>Prime or Complement</p> <p>' ⠠⠠⠠</p> <p>" ⠠⠠⠠⠠</p> <p>$P' \cap Q'$ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠</p> <p>$(PQ)'$ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠</p>	<p>GTM pp 48, 50</p> <p>UUM pp 16, 29</p>
<p>Matrices</p> <p>These are laid out vertically as in the text. The dot 6 at the beginning and end of each bracketed section shows that it is a long bracket (over more than one line).</p> <p>$A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$</p> <p>⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠⠠⠠</p> <p> ⠠⠠⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠⠠⠠</p> <p>Brackets and numeric indicators are aligned, even if this gives rise to unusual spacing.</p> <p>$\bar{p} = \begin{pmatrix} -2 \\ 13 \end{pmatrix}$</p> <p>⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠</p> <p> ⠠⠠⠠⠠⠠⠠ ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠</p>	<p>GTM pp 69</p> <p>UUM pp 44</p>

Calculus

GTM
pp 34

expression directly below 

expression directly above 

$$\lim_{x \rightarrow 5} f(x)$$



GTM
pp 39, 46
& 50

$$\lim_{x \rightarrow a} f(x) = 1$$



UUM
pp 35

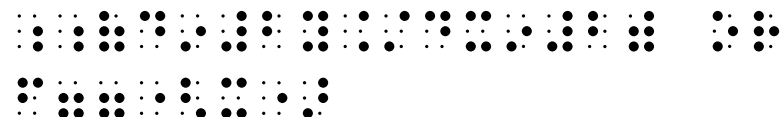
$$\frac{dy}{dx}$$

$$\frac{\partial y}{\partial x} \quad \text{this is called "curly d"}$$



$$\frac{\Delta y}{\Delta x}$$

$$\frac{d^2 y}{dx^2} \quad \text{or } f''(x)$$



Binomial Theorem

GTM
pp 53, 68

Permutations and Combinations

These are laid out in a linear fashion so use the vertical juxtaposition symbol to indicate the fact that this is a vertical print layout.

vertical juxtaposition symbol ⋮

nPr ⋮

$${}^n P_r = \frac{n!}{(n-r)!}$$

⋮

nCr ⋮

$$\binom{n}{r} \text{⋮}$$

$${}^n C_r = \binom{n}{r} = \frac{n!}{r!(n-r)!}$$

⋮

Transcriber's Note Indicators

Open ⠠⠠⠠⠠

Close ⠠⠠⠠⠠

These are useful for giving additional information that is not in the print version.

They are used and spaced in the same way as brackets. Wordsigns and contractions may be used as usual within them.

GTM
pp 66

UUM
pp 69

ATM
pp 116

Greek Letters

GTM
pp 56

Greek letter modifier is ⠠

and the capital Greek letter modifier is ⠠⠠

These apply to the next letter only.

UUM
pp 39

Lower case Greek letters

⠠⠠ α Greek alpha

⠠⠠ β Greek beta

⠠⠠ γ Greek gamma

⠠⠠ δ Greek delta

⠠⠠ θ Greek theta

⠠⠠ λ Greek lambda

⠠⠠ μ Greek mu

⠠⠠ π Greek pi

⠠⠠ ρ Greek rho

⠠⠠ ς or σ Greek sigma

⠠⠠ ω Greek omega

Capital Greek letters

⠠⠠⠠ Δ capital Greek delta

⠠⠠⠠ Σ capital Greek sigma

⠠⠠⠠ Ω capital Greek omega

Maths Symbols for Primary Classes

Topic	J.I	S.I	1st	2nd	3rd	4th	5-6th	GTM Page
Numbers	*	*	*	*	*	*	*	2
Plus Sign		*	*	*	*	*	*	15
Equals		*	*	*	*	*	*	15
Less Than		*	*	*	*	*	*	15
Greater Than		*	*	*	*	*	*	15
Omission Symbol		*	*	*	*	*	*	19
Minus Sign			*	*	*	*	*	15
Simple Fractions			*	*	*	*	*	31
Tens and Units Symbol			*	*	*	*	*	
Length, weight, capacity			*	*	*	*	*	16
Euro Symbol			*	*	*	*	*	13
Cent Symbol			*	*	*	*	*	13
Left Round Bracket			*	*	*	*	*	30
Right Round Bracket			*	*	*	*	*	30
Date, Time and Calendars			*	*	*	*	*	9-10
Ordinal and Roman Numbers			*	*	*	*	*	10-11
Decimal Point				*	*	*	*	9
Degree Sign					*	*	*	12
Fractions 2					*	*	*	31-33
Multiplication Sign						*	*	15
Division Sign						*	*	15
Multiplication Dot						*	*	15
Index / Power Sign						*	*	34-39
Ratio Sign						*	*	17
Percentage Sign						*	*	12
Positive Numbers							*	18

Topic	J.I	S.I	1st	2nd	3rd	4th	5-6th	GTM Page
Negative Numbers							*	18
Square Root Sign							*	40
Square Root Terminator Sign							*	40
Dollar Sign							*	12
Pound Sign							*	12
Not Equal To Sign							*	15
Square Brackets: left and right							*	30
Degree/Minute/Second Signs							*	12
Triangle Sign							*	65
Shapes Signs							*	65
Parallel Lines Sign							*	50
Perpendicular Sign							*	50
Calculator Keys Symbols							*	18
Arrows (Simple)							*	60-63