



Guidance on Transcribing Mathematics and Science in UEB

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1. Introduction

The following guidelines, intended for use in the US and Canada, supplement the rules and guidance presented in the international publications *Rules of Unified English Braille, 2024, 3rd edition* (RUEB) and *Unified English Braille Guidelines for Technical Material* (GTM) authorized by the International Council on English Braille (ICEB). The purpose of this document is to provide additional clarification and practical suggestions for the transcription of “technical” (that is, mathematics and science) texts transcribed using Unified English Braille, so as to achieve a reasonable level of standard transcription.

These guidelines primarily apply to UEB math and science braille transcriptions, particularly for materials that would benefit from consistent practice such as standardized tests or transcriptions created without information about the classroom or student. Different approaches may be needed to match mandated curriculum or to support classroom practice. Examples of such approaches include the spacing of signs for beginning learners (see GTM 1.1.2) and the presentation of spatial problems for instructional purposes. Similarly, the guidelines stated here, such as the spacing of signs or the choice of grade 1 indicators, would not necessarily be applied in non-mathematical contexts. (See, for example, RUEB 11.2.1) As is BANA's practice, outlined in the BANA *Formats* guidelines, a transcriber's note may be needed to let the reader know when print formats are not followed; general readability and clarity of presentation take precedence.

2. Spacing of signs (RUEB §11.2.2; GTM §1.1, GTM §1.1.3)

Follow the general rule to leave a space on either side of comparison or relation signs and place operation signs unspaced from their adjacent terms.

Example 2-1

$$6 = 1 \times 2 \times 3 = 1 + 2 + 3$$

However, the GTM allows spaces around signs of operation for beginning readers, so follow agency decision about how signs are presented.

Example 2-2

Use the number line to find the difference.

1. $6 - 3 = \underline{\quad}$ 2. $4 - 2 = \underline{\quad}$ 3. $7 - 1 = \underline{\quad}$

A 3x3 grid of dots representing a 3x3 magic square. The dots are arranged in a pattern that corresponds to the numbers 1 through 9 in a 3x3 grid, with the center dot being the only one with four neighbors.

Follow GTM preference to leave a comparison sign unspaced where doing so would avoid dividing a complex expression between lines in a complicated mathematical argument.

Follow GTM preference to leave a comparison sign unspaced when the comparison sign is not on the baseline (for example sigma notation, where i equals 1 is in a small font directly below).

3. General format

Follow *Braille Formats: Principles of Print-to-Braille Transcription, 2016* for the format of displayed literary text except for paragraph format, which is never blocked.

Particularly relevant sections of *Formats* are highlighted below:

- Paragraphs: §1.9.2-1.9.3
- Displayed material: §9.2
- Exercise directions: §10.3
- Exercise questions: §10.4
- Glossaries: §21.6

4. Dividing technical expressions over braille lines (GTM §1.4.1-3)

As stated in the GTM, when an expression cannot be kept on one braille line, the choice of a line break site should follow the structure of the technical expression:

- Before comparison signs
- Before operation signs (unless they are within one of the units below)
- Before a unit such as:
 - Fractions (and within the fraction consider the numerator and denominator as units)
 - Functions
 - Radicals
 - Items with modifiers such as superscripts or bars
 - Shapes or arrows
 - Anything enclosed in print or braille grouping symbols
 - A number and its abbreviation or coordinates
 - A molecule
 - A chemical bond

This guidance applies to both displayed and embedded material.

Example 4-1

$$\frac{[(2x \times x) + (2x \times 6)] - [(-3 \times x) + (-3 \times 2)]}{2x(x + 6) - 3(x - 2)} \stackrel{?}{=} 1$$

Figure 1: A 4x10 grid of 40 small square plots, each containing a 10x10 grid of dots. The dots are arranged in a pattern that resembles a stylized 'X' or a cross, with the center of the grid being the most densely populated. The pattern is symmetric across both horizontal and vertical axes.

Avoid breaking an expression between the braille pages.

For consistency, if the expression does not fit on one line, use a continuation indicator (dot 5) unless the runover line starts with a sign of operation or comparison.

Example 4-2

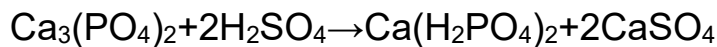


Figure 1 displays a sequence of 40 small plots arranged in a 4x10 grid, illustrating the evolution of a 2D density field over time. The top row shows the initial state with a central peak. The second row shows the peak moving and spreading. The third row shows the peak further spreading and the field becoming more uniform. The bottom row shows the final state with a very uniform distribution.

(Chemical expression divided before an arrow and before plus signs.)

Example 4-3

b) $\log_5(2x - 2) - \log_5(x^2 + 2x - 3)$

$$= \log_5 \frac{2x-2}{x^2+2x-3}$$

$$= \log_5 \frac{1}{\frac{2(x-1)}{(x+3)(x-1)}} = \log_5 \frac{1}{\frac{2}{x+3}}$$

$$= \log_5 \frac{2}{x+3}$$

[illegible]

Note that, in the case of an expression that is divided over more than one line, the end of a braille line counts as a braille space unless the dot 5 continuation indicator is used.

The continuation indicator is needed in example 4-4 where the runover lines do not begin with a sign of operation or comparison.

Example 4-4

$$\begin{aligned} 8x^3 + 125y^3 &= (2x)^3 + (5y)^3 \\ &= (2x + 5y)[(2x)^2 - (2x)(5y) + (5y)^2] \\ &= (2x + 5y)(4x^2 - 10xy + 25y^2) \end{aligned}$$

[illegible]

5. Preference on grade 1 indicators with technical expressions (RUEB §5.9; GTM §1.7 - 2025 update)

In accordance with the provisions in GTM section 1.7, approved 2025, the following guidelines are recommended. UEB allows different approaches for the use of grade 1 indicators. Therefore, several approaches can be correct.

For fuller guidance on the use of grade 1 indicators, see GTM §1.7, 2025 update. The following examples are based on the rules given in section 1.7.

5.1 No grade 1 indicators needed

Example 5-1

$$x + y = 6$$

[illegible]

(RUEB §2.6 and §10.1.1)

Example 5-2

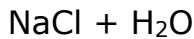
$$\text{Surface area} = 2lh + 2lw + 2wh$$

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

(RUEB §5.6 and §6.5.2)

5.2 Grade 1 symbol indicators needed

Example 5-3



(RUEB §3.24.1 and §6.5.2)

Example 5-4

$$\frac{5x^2}{y^3z}$$

(RUEB §11.3.4 and §6.5.2)

Example 5-5

$$\begin{pmatrix} a & b & c \\ -1 & 2 & -3 \end{pmatrix}$$

The figure shows a 3x15 grid of dots. The dots are arranged in three rows and fifteen columns. The first row has dots in columns 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15. The second row has dots in columns 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15. The third row has dots in columns 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15. The dots are arranged in a pattern that suggests a Latin square, with some dots missing in certain positions.

(RUEB §2.6.1)

Example 5-6

$$\begin{bmatrix} a & b \\ -x & 2y \end{bmatrix}$$

A 3x15 grid of dots. The dots are arranged in three rows and fifteen columns. The following dots are highlighted in black:

- Row 1: Column 2, Column 3, Column 8, Column 10, Column 11, Column 12, Column 13, Column 14, Column 15.
- Row 2: Column 2, Column 3, Column 4, Column 5, Column 6, Column 7, Column 8, Column 9, Column 10, Column 11, Column 12, Column 13, Column 14, Column 15.
- Row 3: Column 1, Column 2, Column 3, Column 4, Column 5, Column 6, Column 7, Column 8, Column 9, Column 10, Column 11, Column 12, Column 13, Column 14, Column 15.

(RUEB §2.6.3)

Example 5-7

$$x^2 + y^2 = C$$

(RUEB §11.4.2 and §2.6.1; GTM §1.7.3 - 2025 update)

Example 5-8

$$\log_2 x + \log x$$

(RUEB §11.4.2 and §2.6.1; GTM §1.7.3 - 2025 update)

Example 5-9

24. The slope of l_1 is $\frac{3}{5}$ and $l_1 \parallel l_2$.

(RUEB §11.4.2)

5.3 Grade 1 word indicators

Sometimes a combination of symbols is needed to make the meaning clear for the braille reader.

Example 5-10

$$\frac{a}{b} + \frac{c}{d}$$

(GTM §1.7.3 and RUEB §11.3.4)

Example 5-11

$$\frac{a}{b}$$

(GTM §1.7.3 and RUEB §11.3.4)

Example 5-12

$$\overrightarrow{AB}$$

(GTM §12)

Example 5-13

$$x^{-1} = \frac{1}{x}$$



(GTM §1.7 - 2025 update)

Example 5-14

$$a^n \times a^m = a^{n+m}$$

(GTM §1.7 - 2025 update and GTM §5)

5.4 Grade 1 passages

Example 5-15

$$P = VI = I^2R = \frac{V^2}{R}$$

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

(RUEB §5.6 and §5.8; GTM §1.7.3 - 2025 update)

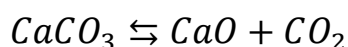
If there is more than one separate math expression following one after the other (e.g., several equations), the grade 1 passage indicator and terminator can be used. In that case, the whole group can be treated as a passage rather than using separate indicators for each expression. Intervening punctuation would be included within the passage. To retain contractions in the text, terminate the passage before the words and begin a new passage at the beginning of the next set of math expressions.

An entire set of exercises can be treated as a passage. When a series of expressions can be presented in a grade 1 passage as in an exercise, it is appropriate to do so. See GTM §1.7.4 - 2025 update.

Note that a grade 1 passage continues onto a new braille page until the passage terminator; if an expression is split over braille pages you do not need to restart the passage indicator on the new page.

Where a math expression is treated as a passage, punctuation at the end of the expression (e.g., a period at the end of the last symbols-sequence) should normally be included before the grade 1 terminator, even though not part of the expression itself. See GTM §1.7.3b - 2025 update.

Example 5-16



(RUEB §11.4 and GTM §1.7.3 - 2025 update)

6. Spatial problems

For the sake of consistency in textbooks and standardized test situations, follow print formatting of spatial problems.

The use of numeric passage mode for a series of similar spatial problems is preferred. Be sure to apply the numeric passage terminator at the end of the series.

Example 6-1

Add the following. The first one is done for you.

$$\begin{array}{r} 2 \quad 3 \quad 6 \quad 5 \\ +7 \quad +5 \quad +2 \quad +1 \\ \hline 9 \end{array}$$

Braille representation of the equation above, showing the first problem completed and the remaining three problems in a series.

Example 6-2

$$\begin{array}{r} 2 \quad 10 \quad 11 \\ \cancel{3} \quad \cancel{1} \quad \cancel{1} \\ -1 \quad 6 \quad 7 \\ \hline 1 \quad 4 \quad 4 \end{array}$$

Braille representation of the equation above, showing the first problem completed and the remaining three problems in a series.

Several display options are allowed in UEB for spatial math problems. (See GTM §4.) Some of these options do not match the print shown in textbooks or standardized tests, but may provide easier understanding of mathematical

procedures and concepts for new braille readers. These methods are suitable for instructional purposes.

7. Additional Examples

The following are provided to further illustrate the guidance issued in this document.

Example 7-1

$$V = \lim_{\Delta x \rightarrow 0} \sum_{i=1}^n \pi [f(x_i)]^2 \Delta x$$

.....

.....

Example 7-2

$$x = \frac{6\sqrt{36-4(9)+3(12)}}{18}$$

$$= \frac{6\sqrt{36-36+36}}{18}$$

$$= \frac{6(6)}{18}$$

$$= \frac{36}{18}$$

$$= \frac{1}{2} = 0.5$$

Figure 1 shows a 3x4 grid of dot patterns. The first three columns each contain a 3x2 grid of dots, where the middle dot in the second column is filled. The fourth column contains a 3x2 grid of dots, where the middle dot in the second column is empty.

.....

[illegible]

.....

Example 7-3

$$x = 54 + 7 - 111 \times 2 + 8,000 + 1,000 - 42$$

• • • • •

[illegible]

8. Resources

- [*Rules of Unified English Braille, 2024*](#)
- [*Guidelines for Technical Material*](#)
 - including [*§1.7 update*](#)
- [*Additional Guidance for UEB Mathematics \(UKAAF\)*](#)
- [*Braille Formats: Principles of Print-to-Braille Transcription, 2016*](#)