

## LESSON 7

### TYPEFORM

- [The Five Mathematical Typeform Indicators](#)
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*Format*

### DISPLAYED FORMATS

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### LESSON PREVIEW

This lesson begins by defining displayed mathematical material and illustrating the format in braille. The rest of the lesson discusses the topic of typeform in mathematical context.

## **DISPLAYED FORMATS**

### **7.1 Displayed Mathematical Material [NC 26.4]**

Up to this point in the lesson material, mathematical expressions in the examples have appeared in line with the narrative. This is referred to as an *embedded expression*. When mathematical material is set apart from the body of the text in the print copy, it is referred to as a *displayed expression*. Various layouts in the print copy are used to set the material apart, for example, skipped lines, centering or other indentation, or off to the side. In braille, margins for displayed mathematical material depend upon the margins of the surrounding text and are transcribed in one of the following formats.

- In unitemized explanatory portions of the text (3-1), displayed mathematical material begins in cell 3. Runovers begin in cell 5. **(3-5)**
- In itemized text without subdivisions (1-3), displayed mathematical material begins in cell 5. Runovers begin in cell 7. **(5-7)**
- In itemized text with subdivisions (1-5; 3-5), displayed mathematical material begins in cell 7. Runovers begin in cell 9. **(7-9)**
- Within or following instructions (5-3), displayed mathematical material begins in cell 5. Runovers begin in cell 7. **(5-7)**

Notice that in all four layouts, the first cell of the displayed material is indented two cells to the right of the runover cell of the preceding material. These margins apply regardless of the presence or absence of a runover in the preceding material.

Displayed mathematical material is not preceded or followed by a blank line unless it has a spatial component or unless the preceding or following material requires a blank line. We will begin looking at spatial mathematical material in Lesson 9.

*A note regarding pagination:* A displayed expression using more than one line may span a braille page turn. It is not necessary to keep it all together on one page unless other pagination rules apply.

**7.1.1 Placement of Code Switch Indicators.** There is not one formula that can be applied to all situations when it comes to judicious placement of code switch indicators. Use the following points as guidelines and strive for consistency.

- a. When displayed mathematical material is preceded and followed by UEB text, the following layouts are recommended.

—Begin the displayed material with the opening Nemeth Code indicator only if the displayed math and its two switch indicators will fit on one braille line. See [Example 7-1](#).

—If the displayed math and its two switch indicators will not fit on one braille line, it is preferable to start the displayed material with a Nemeth symbol, not with a switch indicator. This is accomplished by placing the opening Nemeth Code indicator at the end of the









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**PRACTICE 7A****Polynomials**

Solve this polynomial using basic algebra. *Hint:* First factor out "x" to make it a quadratic equation.

$$x^3 + 2x^2 - x = x(x^2 + 2x - 1)$$

Do you notice a familiar pattern?

**Sequences**

A sequence  $a_1, a_2, a_3, \dots, a_n$  is said to *converge* if there exists a positive number  $M$  such that, for each  $h > 0$ ,

$$|a_n - A| < h, \text{ for all } n > M.$$

A sequence that does not converge is said to *diverge*.

**Inequalities**

Now we will use number lines to illustrate the following inequalities.

$$-6 < -5 \quad 0 < +6 \quad -8 < +2 \quad -1 > -5$$

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**PRACTICE 7C**

*Use the Pythagorean formula to answer the questions.*

$$a^2 + b^2 = c^2$$

3. Emma is flying a kite. The kite is 14 feet in front of her (distance  $a$ ).
- a. How high is the kite (distance  $b$ ) if she has let out 39 feet of line (distance  $c$ )?

$$\text{Solve for } b: 14^2 + b^2 = 39^2$$

- b. How many feet of line is let out (distance  $c$ ) if the kite is only 12 feet in the air (distance  $b$ )?

$$\text{Solve for } c: 14^2 + 12^2 = c^2$$

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**7.2 Displayed Material with Labels [NC 26.4.4]**

Displayed mathematical expressions may be labeled in print with a unique number or letter printed in a location that is visually conspicuous, often in the right margin. That label is then used in place of the actual expression later in an example or in the narrative. This allows for compact presentation of a problem.

- 7.2.1 **Braille Layout and Code Switching.** When a number or letter is used to identify a displayed mathematical expression, the label is transcribed as an identifier and is placed at the left of the expression regardless of the location of the label in the print copy. The label (identifier) begins in the appropriate cell for displayed material in accordance with the margin rules presented in this lesson.

The label may be transcribed in either Nemeth or UEB at the transcriber's discretion, depending upon the surrounding text. Nonstandard typeform is disregarded. When the label is referred to in discussion, it may be transcribed in Nemeth or UEB, as appropriate, and need not be in the same code as the original label.





*Lines 1 and 5: According to Nemeth rules, the first line of each paragraph is indented two cells from the paragraph's left margin.*

*Lines 4 and 8: According to Braille Formats guidelines, displayed literary material is preceded and followed by a blank line.*

*Lines 5-7: According to Braille Formats guidelines, cell 3 is the adjusted left margin for this displayed narrative. In print, the paragraph is blocked; in braille, the first line of the paragraph is indented.*

*Line 9: The 3-1 paragraph that started on line 1 continues in the runover cell (cell 1).*

## PRACTICE 7D

*Instructions:* First, create a Transcriber's Notes page as follows. On line 1, center the heading TRANSCRIBER'S NOTES. On line 3, transcribe this statement in 3-1 paragraph format:

Mathematical content is transcribed according to *The Nemeth Braille Code for Mathematics and Science Notation 2022*.

The next paragraph should state: "Identifying numbers printed to the right of mathematical expressions are transcribed to the left." Number this page t1 on line 25. Then start a new page with the centered heading TRIANGLES on line 1. Include the print page number 7–14. Number the braille page 1 on line 25.

## TRIANGLES

This is the quadratic equation, where  $x$  is the variable and  $a$ ,  $b$ , and  $c$  are constants ( $a \neq 0$ ).

$$ax^2 + bx + c = 0 \quad (1)$$

This is the Pythagorean Theorem:

$$a^2 + b^2 = c^2 \quad (2)$$

Which equation, (1) or (2), is used to find the length of the sides of a right triangle?

**TYPEFORM****[NC Rule 7]**

In this lesson, we look at typeform as it applies to letters, numbers, and mathematical symbols. Typeform applied to words in mathematical context will be addressed in Lesson 11.

**7.4 General Guidelines Regarding Typeform**

When the typeform of a letter or number has mathematical significance, a typeform indicator of the Nemeth code is used. This rule applies regardless of the existence of a similar typeform indicator in UEB.

When such a letter or number is referred to within narrative, a switch to Nemeth is required in order to show the letter or number associated with its appropriate Nemeth typeform indicator. Note that UEB typeform indicators are not used inside the switches and that Nemeth typeform indicators are not used outside the switches.

**7.4.1 Determining Significance of a Variant Typeform.** The decision whether to retain a variant typeform can be difficult. The transcriber needs to determine if the typeform has mathematical meaning (i.e., for "distinction"), if the typeform is for instructional purposes (i.e., for "emphasis"), or whether the typeform does not add any information or is merely decorative. The general rule of thumb is that, when technical material is printed in nonregular type that has no mathematical or instructional significance, the variant typeform is disregarded in the transcription.

**a. Typeform Showing Distinction**

- **Significant:** Various fonts often have fixed meanings in particular areas of mathematics and science. Such letters, numbers, and symbols must retain their significant typeform in the braille transcription and must be transcribed following Nemeth rules.

*Examples:*      $\mathbb{R}$  signifies the set of real numbers.  
                       The null vector is denoted with a boldface **0**.  
                        $\mathcal{S}$  represents a system's action in physics.

- **Insignificant:** It is standard print practice to show math variables using an italic font throughout a publication. This use of italics is not mathematically significant and so is not retained in the braille transcription.

*Examples:*     The variables  $x$ ,  $y$ , and  $z$  are real numbers.  
                        $\pi$  is used to determine the circumference of a circle:  $2\pi r$ .

## b. Typeform Showing Emphasis

- **Significant:** An author may use a variant typeform to focus on a teaching point or topic. Such letters or numbers may lose their meaning if their significant typeform is not retained in the braille transcription. If the typeform is mentioned in the narrative, it should either be retained or explained in a transcriber's note.

*Example:* Are the boldface numbers even or odd? 19, **28**, 37, **44**, 51, 67, **72**, **80**.

- **Insignificant:** A variant typeform is often used for the sole purpose of attracting the reader's attention. This is particularly common at the lower grade levels. Such variant typeforms are disregarded in the braille transcription.

*Examples:* Let **x** be the smaller number, and **9** + **x** be the larger number.  
A function with degree **5** has **5** zeros.

## 7.5 The Five Mathematical Typeform Indicators

Specific provision is made in the Nemeth code for the transcription of five print typeforms: barred, boldface, italic, sans serif, and script. (In other publications, the barred font may be called blackboard bold or double struck.) The various typeforms may be applied to the letters of the English, German, Greek, Hebrew, and Russian alphabets as well as to numerals and mathematical symbols. (Note that underlining is not a typeform in the Nemeth code.)

⠠⠠⠠	Barred Type
⠠⠠	Boldface Type
⠠⠠	Italic Type
⠠⠠⠠	Sans Serif Type
⠠⠠	Script Type

*Notes: Sans serif typeform is recognized by the lack of small lines or serifs at the ends of the letter parts. Only the English alphabet has a sans serif style of type. Script typeform looks like cursive handwriting. Publishers have different styles for this font. See samples in [Section 7.6.a](#).*

## 7.6 Typeform of Letters

Certain specific mathematical letters are identifiable by their variant typeform. Common examples include the letter  $\mathbb{R}$  for "the set of real numbers" and boldfaced letters that represent vectors. In this lesson, after practicing the application of the rules regarding typeform of letters, only the variant letters in common practice will be studied.

Typeform applied to a mathematical letter is considered to be a modification. A switch to Nemeth is required when such a letter appears in the narrative, even if UEB has a typeform

indicator for the font. A Nemeth typeform indicator applied to a letter must always be followed by an alphabetic indicator.

- a. **Typeform Indicators with One Letter.** Here is the capital English letter R in regular type.

R     ⠠⠠⠠⠠⠠     (English capital R)

Here is the capital English letter R in each of the five Nemeth typeforms. Note the order of indicators. The first indicator names the *typeform*; the second indicator names the *alphabet*; a capital letter then shows a *capitalization* indicator; and, finally, *the letter* is identified.

℞     ⠠⠠⠠⠠⠠⠠⠠     (barred English capital R)

**R**     ⠠⠠⠠⠠⠠⠠⠠     (boldface English capital R)

*R*     ⠠⠠⠠⠠⠠⠠⠠     (italic English capital R)

R     ⠠⠠⠠⠠⠠⠠⠠⠠     (sans serif English capital R)

*℞*     ⠠⠠⠠⠠⠠⠠⠠     (script English capital R)

Here are isolated samples of capital and lowercase letters from the other four alphabets, in various typeforms. You may wish to review the five alphabetic indicators of the Nemeth code in Lessons 3 and 4.

**α**     ⠠⠠⠠⠠⠠     (boldface Greek alpha, lowercase)

**Ш**     ⠠⠠⠠⠠⠠⠠⠠     (boldface Russian capital Sha)

Σ̄     ⠠⠠⠠⠠⠠⠠⠠     (barred Greek capital Sigma)

*c*     ⠠⠠⠠⠠⠠     (italic German tseh, lowercase)

*ℓ*     ⠠⠠⠠⠠⠠⠠     (script Hebrew alef)



- b. **Typeform Indicators with More Than One Letter.** The effect of a typeform indicator extends only to the letter which immediately follows it. Thus, in a sequence of unspaced letters, a typeform indicator must be used before each letter that is not in regular type. Here are some isolated samples.

$\mathbb{A}\mathbb{B}$	⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠	(barred English A and B)
$\mathbf{AB}$	⠠⠠⠠⠠⠠⠠⠠⠠	(boldface English A and B)
$\mathbf{ab}$	⠠⠠⠠⠠⠠⠠	(boldface English a and b)
$\mathbf{\alpha\beta}$	⠠⠠⠠⠠⠠⠠	(boldface Greek alpha and beta)
$\mathcal{AB}$	⠠⠠⠠⠠⠠⠠⠠⠠	(script English A and B)

In a sequence of unspaced letters, an English letter in regular type does not need an alphabetic indicator.

$\beta b$	⠠⠠⠠	(Greek beta, English b)
$\mathbb{B}\mathbb{B}$	⠠⠠⠠⠠⠠⠠⠠⠠	(English B, barred English B)
$\text{HH}$	⠠⠠⠠⠠⠠⠠⠠⠠	(sans serif English H, English H)
$p\mathbf{qrs}$	⠠⠠⠠⠠⠠⠠⠠⠠⠠	(English letters: p, boldface q, boldface r, s)
$x\mathbf{iyj}$	⠠⠠⠠⠠⠠⠠⠠⠠⠠	(English letters: x, boldface i, y, boldface j)

## PRACTICE 7F

*Instructions:* Practice applying typeform to English and Greek unspaced letter groupings. No italics are used in this list. Only English letters are showing a sans serif and a script typeform.

$\mathbf{M}\mathbf{M}\mathcal{M}\mathbf{M}\mathbf{M}$

$\gamma\psi\mathbf{y}\mathbf{yy}$

$\Sigma\Sigma\Sigma$

$\text{III}\pi\pi$

$\Delta\mathbf{d}\mathbf{d}\mathbf{D}\lambda\mathcal{N}$





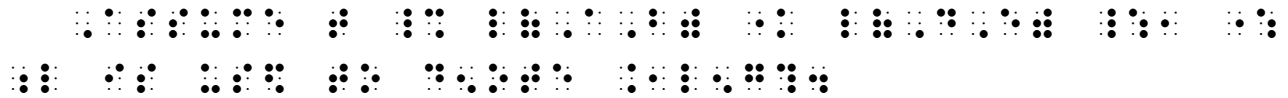




- a. **Script Letter "ell"**. Print publishers often use the script form of the lowercase English letter "ell" simply to differentiate it visually from the numeral 1 (one). Since the letter and the numeral cannot be confused in braille, there is no reason to retain the script typeform.

*Example 7-24*

Assume that  $\ell(AB) < \ell(DE)$ , where  $\ell$  is used to denote *length*.



*The letter l is printed with a script font.*

- b. **Partial Derivative Symbol**. The symbol for "partial derivative",  $\partial$ , is its own symbol. This is not a script letter d. This symbol will be discussed in Lesson 13.

### PRACTICE 7G

- i. The perimeter of a rectangle is obtained by adding the measurements of the sides—two lengths and two widths—expressed as
- $$P = 2\ell + 2w.$$
- What is  $P$  if  $\ell = 5.5$  mi and  $w = 3.2$  mi?
- ii. The 1-D coordinate system is denoted by  $\mathcal{R}$ . The 2-D coordinate system is often denoted by  $\mathcal{R}^2$ . A general  $n$ -dimensional coordinate system can be denoted by  $\mathcal{R}^n$ .
- iii. Use  $\alpha_1, \beta_1, \gamma_1$  and  $\alpha_2, \beta_2, \gamma_2$  to denote the direction vectors  $\mathbf{k}_1$  and  $\mathbf{k}_2$ .
- iv. **Two Number Sets**.  $\mathbb{N}$  denotes the set of *natural numbers* — that is, the set of nonnegative integers  $\{0, 1, 2, \dots\}$ . The set of all integers is denoted by  $\mathbb{Z}$ .









## PRACTICE 7I

- (1) For vectors  $(\mathbf{a}, \mathbf{b}, \mathbf{c})$ , can it be said that  $(\mathbf{a} + (\mathbf{b} + \mathbf{c})) = (\mathbf{a} + \mathbf{b}) + \mathbf{c}$  ?
- (2)  $c(\mathbf{a}, \mathbf{b}) = (c\mathbf{a}, \mathbf{b})$  as well as  $(\mathbf{a}, c\mathbf{b})$ .  $\mathbf{a}$  and  $\mathbf{b}$  are vectors. Define  $\mathbf{ab}$ .

## 7.9 Boldface Mathematical Symbols [NC 7.5]

Dots 456 can be applied only to certain specific math symbols. Each symbol consists of dots 456 followed by the appropriate symbol. (456) is considered to be an actual part of the symbol and must not be considered to be a boldface typeform indicator. As such, do not use dots 456 with any sign other than those shown in this section.

- 7.9.1 **Signs of Operation in Boldface Type.** The signs of operation listed in the box below are to be used to show boldface type only when the distinction between the regular and the boldface forms of the same sign has mathematical significance. The surrounding text should be examined to determine if this is the case.

⠠⠠⠠⠠⠠⠠	Boldface Plus	<b>+</b>
⠠⠠⠠⠠⠠⠠	Boldface Minus	<b>-</b>
⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠	Bold Plus Followed by Bold Minus	<b>+ -</b>
⠠⠠⠠⠠⠠⠠⠠⠠	Bold Plus Followed by Regular Minus	<b>+ -</b>
⠠⠠⠠⠠⠠⠠⠠⠠	Regular Plus Followed by Bold Minus	<b>+ -</b>
⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠	Bold Minus Followed by Bold Plus	<b>- +</b>
⠠⠠⠠⠠⠠⠠⠠⠠	Bold Minus Followed by Regular Plus	<b>- +</b>
⠠⠠⠠⠠⠠⠠⠠⠠	Regular Minus Followed by Bold Plus	<b>- +</b>

- 7.9.2 **Equals Sign in Boldface Type.** When it is necessary to show that an equals sign is printed in boldface type, dots 456 are placed before the equals symbol. Boldface equals signs are used only when the distinction between the regular and boldface forms of the same sign has mathematical significance. The surrounding text should be examined to determine if this is the case.

⠠⠠⠠⠠⠠⠠	Boldface Equals	<b>=</b>
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Boldface signs are used in vector notation to emphasize the distinction between vector and scalar mathematical operations, as [Examples 7-32](#) and [7-33](#) illustrate.



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**PRACTICE 7J**

*Instructions:* Following the recommended placement of code switch indicators given in Lesson 2, place the opening Nemeth Code indicator in cell 1. On the next line, begin the first row of the 3-column list in cell 1. After the third row, place the Nemeth Code terminator on the next line in cell 1. A blank line follows. Sentence A will then begin on the next line.

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=      + -   - +
+      + -   - +
-      + -   - +

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- A. In older texts, the greatest integer function may be notated with a bold bracket: **[x]**.
- B. **||Y||** means "the norm of Y".
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**7.10 Barred Grouping Symbols and Other Signs of Grouping [NC Rule 19]**

While we are on the topic of barred typeform, this is a good time to introduce the rest of the grouping signs for which the Nemeth code has devised symbols, since four of them are barred.

- 7.10.1 **Barred Brackets and Barred Braces.** Use the symbols in the box below when barred brackets or barred braces are encountered. Notice that the barred grouping symbols are formed by inserting dots 456 before the second cell of the normal grouping symbol.

⠠⠠⠠⠠⠠⠠	Left Barred Bracket	⠠⠠
⠠⠠⠠⠠⠠⠠	Right Barred Bracket	⠠⠠
⠠⠠⠠⠠⠠⠠	Left Barred Brace	{
⠠⠠⠠⠠⠠⠠	Right Barred Brace	}

➤ **[x]**      ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

➤ **{abc}**      ⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠





## 7.11 Further Details Regarding Typeform of Letters and Numerals

7.11.1 **Typeform with Subscripts.** Regarding the special subscript rule where the subscript indicator is not used for a numeral that is a right subscript to a letter, the letter may be in any typeform. (Review Section 6.11 in Lesson 6.)

➤  $i_1$      ⠠⠠⠠⠠⠠     (Bold English letter i, subscript one)

7.11.2 **Typeform with Unspaced Mathematical Expressions.** An English-letter indicator is not used in an unspaced mathematical expression. (See Section 3.13.3 in Lesson 3.) The rule applies only to an English letter in regular type, or an italicized letter when the italics are disregarded in braille. If an English letter is printed in a mathematically significant typeform, an alphabetic indicator is always required.

Compare these transcriptions of the letter "i" in regular type and bold type.

➤	$3i$	(Spoken: three i)	⠠⠠⠠⠠⠠
➤	$3\mathbf{i}$	(Spoken: three bold i)	⠠⠠⠠⠠⠠⠠⠠⠠
➤	$3_i$	(three, subscript i)	⠠⠠⠠⠠⠠⠠⠠
➤	$3_{\mathbf{i}}$	(three, subscript bold i)	⠠⠠⠠⠠⠠⠠⠠⠠⠠
➤	$\delta_{ij}$	(delta, subscript bold i bold j)	⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

7.11.3 **Underlining and Other Typeforms.** There is no underline indicator in the Nemeth code. Underlining of letters, numbers, and mathematical symbols will be discussed in Lesson 12.

Typeforms for which there are no provisions in the Nemeth code may use one of the five typeform indicators that is not used elsewhere in the document. A transcriber's note should explain the substitution. Sample transcriber's note:

⠠⠠ indicates red numbers. ⠠⠠⠠ indicates blue numbers.

Here is Nate's sock drawer again, substituting the script and sans serif typeform indicators for the colored type.

*Note to students reading from a monochrome printout: Colored type appears in the next example. Some numbers are blue and some are red. The word "red" is also red.*





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**PRACTICE 7L**

Assume that the first pair to be repeated is  $(r_k, r_{k+1})$  for  $k \geq 0$ . In the sequence of pairs, there is a later pair  $(r_n, r_{n+1})$  equal to  $(r_k, r_{k+1})$  with  $m^2 + 1 \geq n + 1 > k + 1$ . But, *since the pairs are equal*,  $r_k = r_n$  and  $r_{k+1} = r_{n+1}$ .

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*For further practice, see Addendum 1—Reading Practice.*

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Submit Exercise 7 to your instructor.
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