LESSON 6

LESSON PREVIEW

This lesson begins by looking at format. Itemized material with subdivisions is found throughout math textbooks, in exercise sets, and in answer sections. The rules differ somewhat from those followed in a nontechnical transcription. The topic of superscripts and subscripts is presented. Superscript, subscript, and baseline indicators are introduced. The lesson ends with another look at grouping signs as they relate to level indicators.

The Nemeth Code Book

The Nemeth Braille Code for Mathematics and Science Notation will be your primary source once you complete this course. This is a good time to begin supplementing the lesson material by reading about the topic in the Nemeth code book. Cross references are identified with the prefix "NC". The code book can be downloaded here: https://www.brailleauthority.org/nemeth-code.

Format

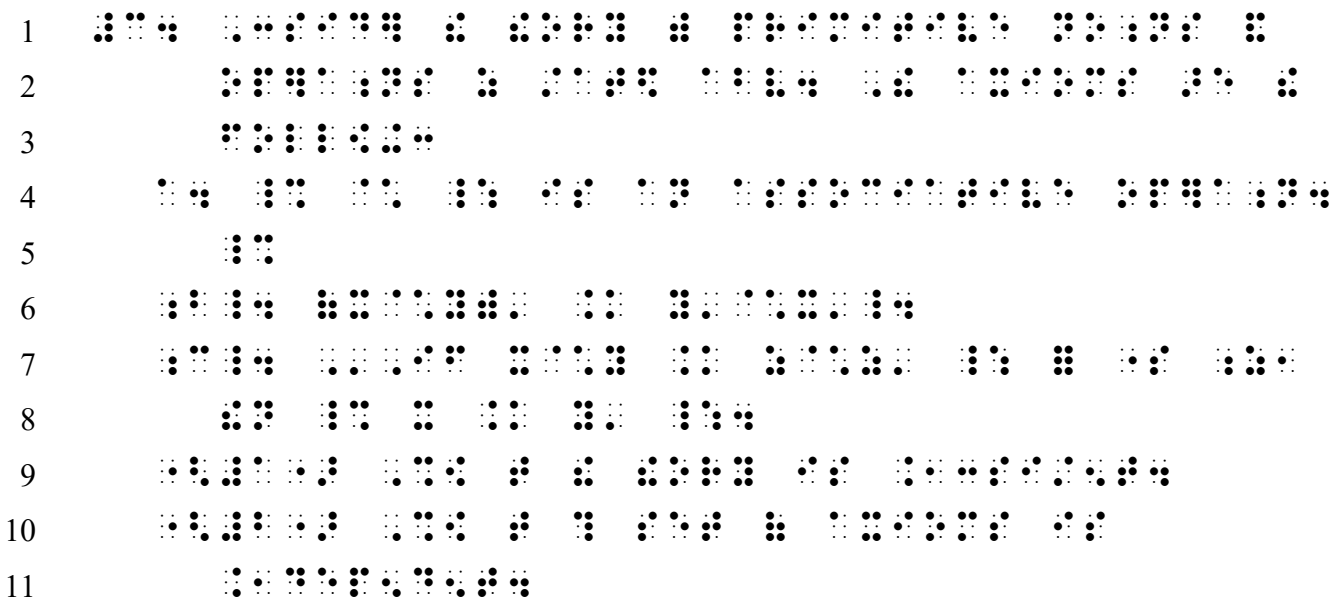
6.1 Margins for Itemized Material with Subdivisions (1-5; 3-5) [NC Rule 26]

To transcribe itemized material with lettered or numbered subdivisions, begin the main item designation in cell 1. Place runovers in cell 5. Cell 3 is reserved for the beginning of each lettered or numbered subdivision. Runovers to subdivisions also begin in cell 5. This "subdivision" format applies to all itemized sublevels regardless of the print layout. For an item with any number of subdivisions, use margins 1-5 for the first level and 3-5 for all sublevels.

Example 6-1 shows two indentation levels in the print copy. In braille, all subdivisions begin in cell 3. All runovers are in cell 5.

Example 6-1

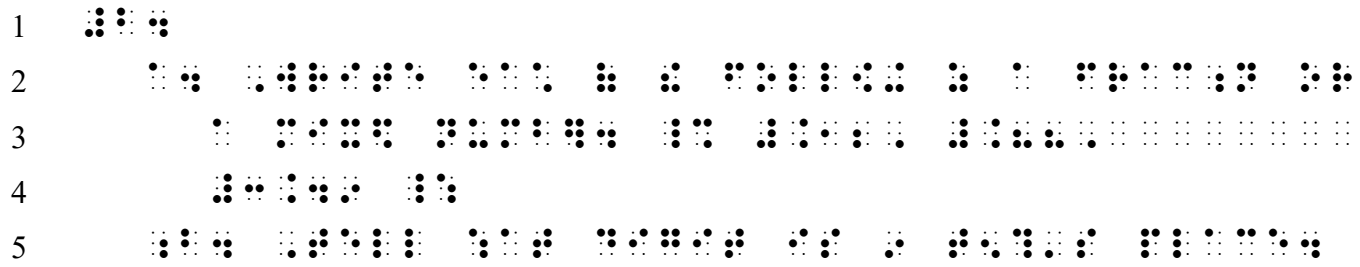
3. Consider the theory with primitive notions and operations as stated above. The axioms are the following:
   a. $\times$ is an associative operation.
   b. $(x \times y)' = y' \times x'$.
   c. If $x \times y = z \times z'$ for some z, then $x = y'$.
      (1) Show that the theory is *consistent*.
      (2) Show that this set of axioms is *dependent*.



Example 6-2 shows no text following the main item number, with subdivision a. beginning on the same line. In braille, subdivisions must begin in cell 3 on a new line.

Example 6-2

2. a. Write each of the following as a fraction or a mixed number. .12, .88, 3.49
   b. Tell what digit is in tenth's place.



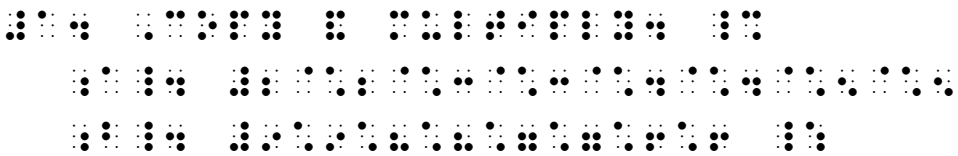
In Example 6-3, the subdivisions are printed without indentation. In braille, subdivisions must begin in cell 3.

Example 6-3

1. Copy and multiply.

a. $2 \times 2 \times 3 \times 3 \times 4 \times 4 \times 5 \times 5$

b. $9 \cdot 9 \cdot 8 \cdot 8 \cdot 7 \cdot 7 \cdot 6 \cdot 6$



Reminder: Each subdivision's identifier begins in cell 3. The opening Nemeth Code indicator is placed at the end of the line of text that precedes the identifier.

6.1.1 **Paragraphs Within Itemized Material with Subdivisions (7-5).** If a main item or a subdivision has more than one paragraph, each new paragraph begins in cell 7, and its runovers begin in cell 5.

Example 6-4

5. Does the method of creating whole number x-terms work with decimals? Consider this example.

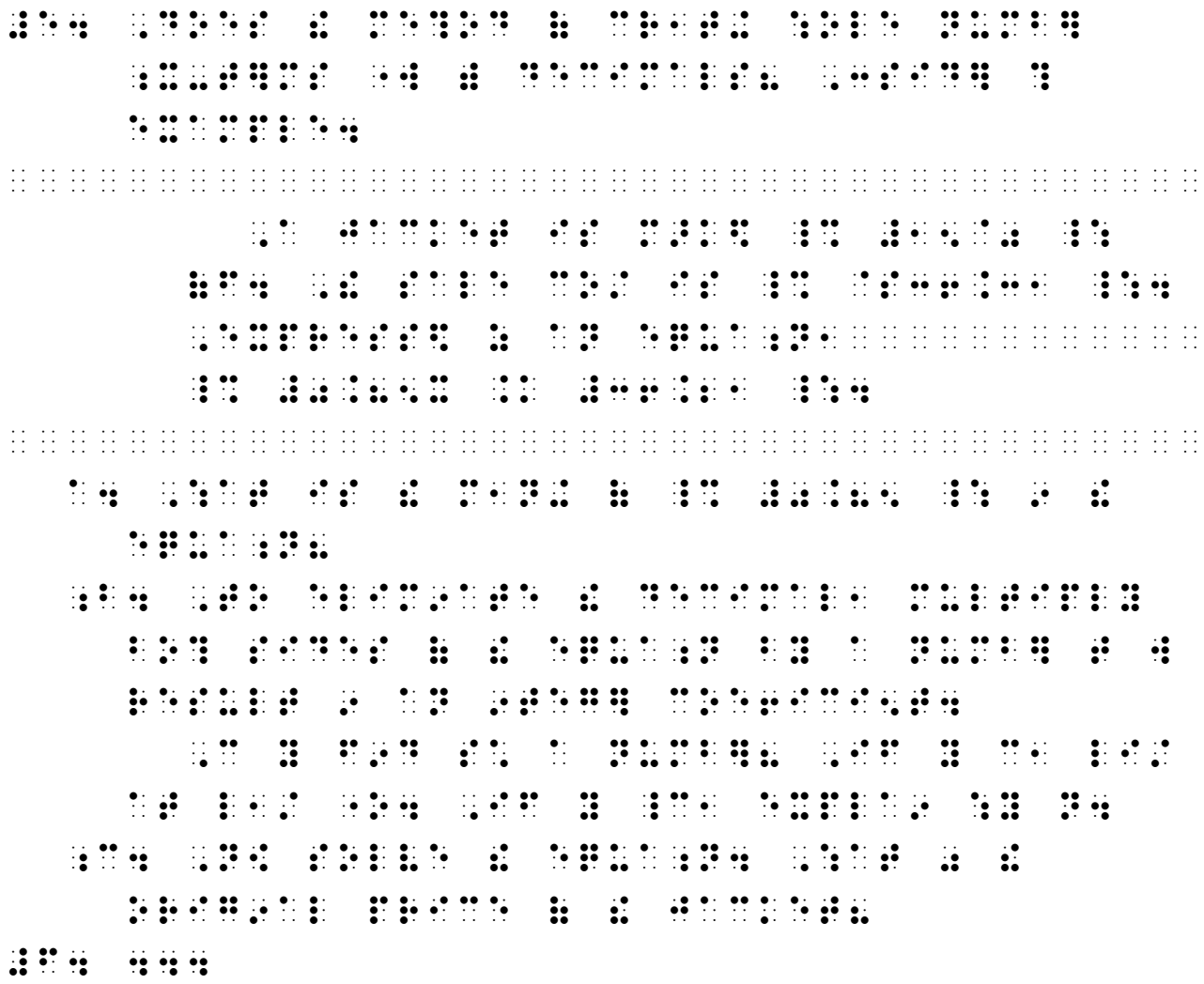
   A jacket is marked 15% off. The sale cost is $36.31. Expressed as an equation, $0.85x = 36.21$.

   a. What is the meaning of 0.85 in the equation?
   b. To eliminate the decimal, multiply both sides of the equation by a number that will result in an integer coefficient.

      Can you find such a number? If you can, list at least one. If you cannot, explain why not.

   c. Now solve the equation. What was the original price of the jacket?

6. ...



Lines 4-9: The example is displayed narrative. As directed by Braille Formats *guidelines for displayed material, a blank line precedes and follows the word problem and cell 7 is the*

adjusted left margin. The blocked paragraph form is changed to indented form in a Nemeth transcription.

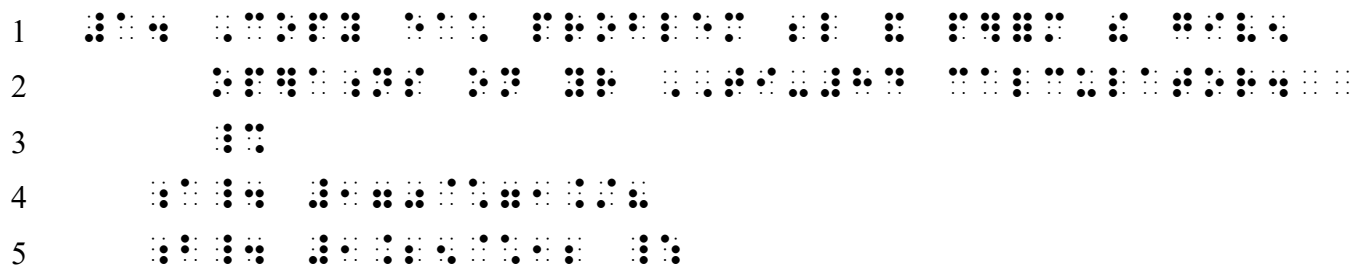
Lines 15-16: The second paragraph in subdivision b. is recognized by the beginning of a new, indented line. There are no blank lines.

6.1.2 **Side-by-Side Layout in Print.** Even when subdivisions are printed on the same line across the page, in braille each identifier must begin on a new line. (This rule does not apply to spatial material, which will be studied later in this course.)

Example 6-5

1. Copy each problem below and perform the given operations on your TI-84 calculator.

   a. $170 \times 71 \div 8$ b. 1.25×12

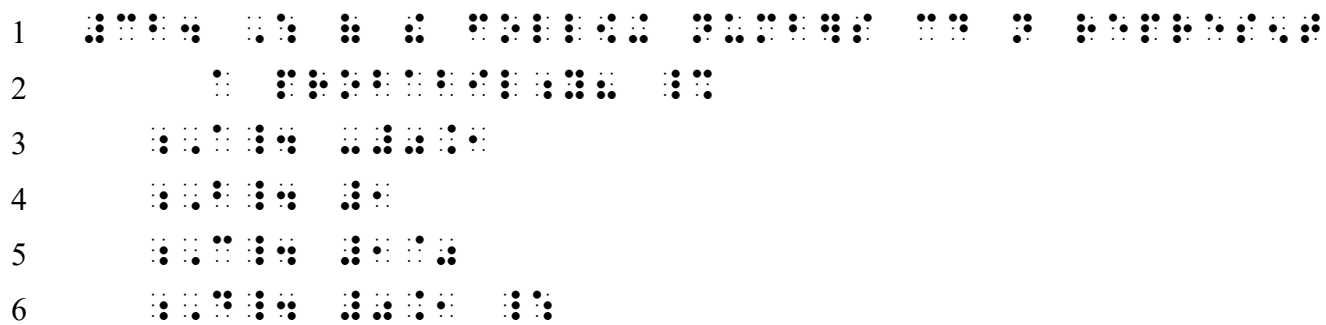


The opening Nemeth Code indicator is placed in the runover cell (cell 5) of the main entry item. Each subdivision starts in cell 3 even though they are printed side by side.

Example 6-6

32. Which of the following numbers could not represent a probability?

   A. -0.1 B. 1 C. 1% D. 0.1



Notice that, although the numeral "1" (in subdivision B) can be transcribed in either code, code-switching clutter is avoided by staying in Nemeth.

PRACTICE 6A

23. Simplify and solve each equation below for x. Show your work and check your answer.

    a. $24 = 3x + 3$ b. $2(x - 6) = x - 14$

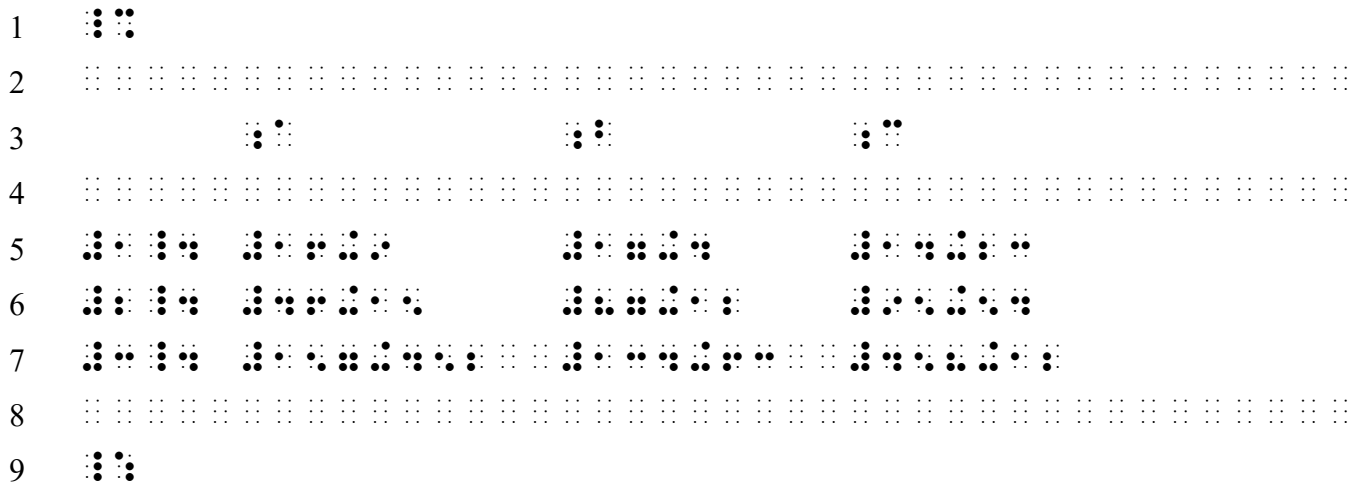
    c. $6 + 2.5x = 21$ d. $2(x + 4.5) = 32$

6.1.3 **Tabular Format.** When itemized material is arranged in tabular form so that items are numbered at the margin and subdivisions are aligned beneath lettered column headings, the material should be transcribed in one of the following ways, depending upon whether all of the columns can be accommodated across the braille page.

a. **When to Retain Column Format.** If all the columns can be accommodated across the braille page, the print columnar arrangement is followed. Each problem number begins in cell 1. The letter identifying each column is aligned with the first cell of the related column. A blank line is left above and below the lettered column headings. Two blank cells separate the columns. Guide dots are not used.

Example 6-7

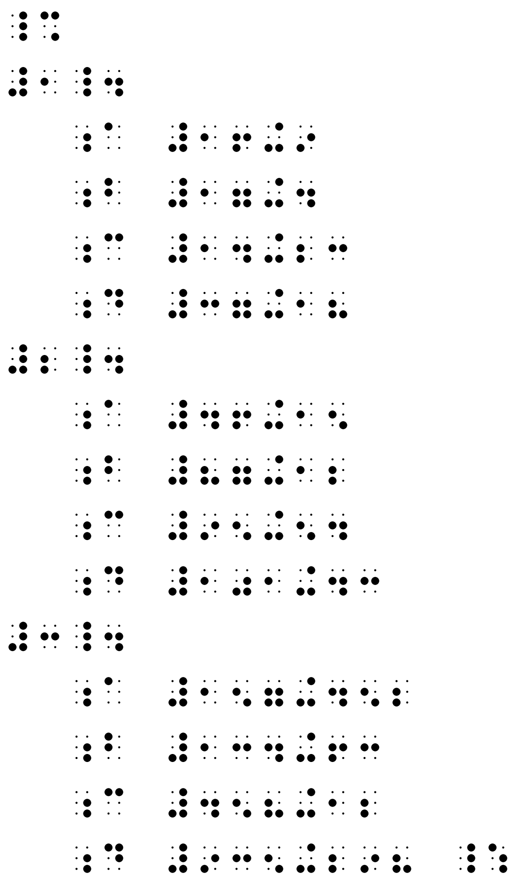
	a	b	c
1.	$16 + 9$	$17 + 4$	$14 + 23$
2.	$46 + 15$	$87 + 12$	$95 + 54$
3.	$157 + 452$	$134 + 63$	$458 + 12$



b. **When Not To Retain Column Format.** If all the columns cannot be accommodated across the braille page, each subdivision in each problem must be lettered individually and the format in Section 6.1 must be followed.

Example 6-8

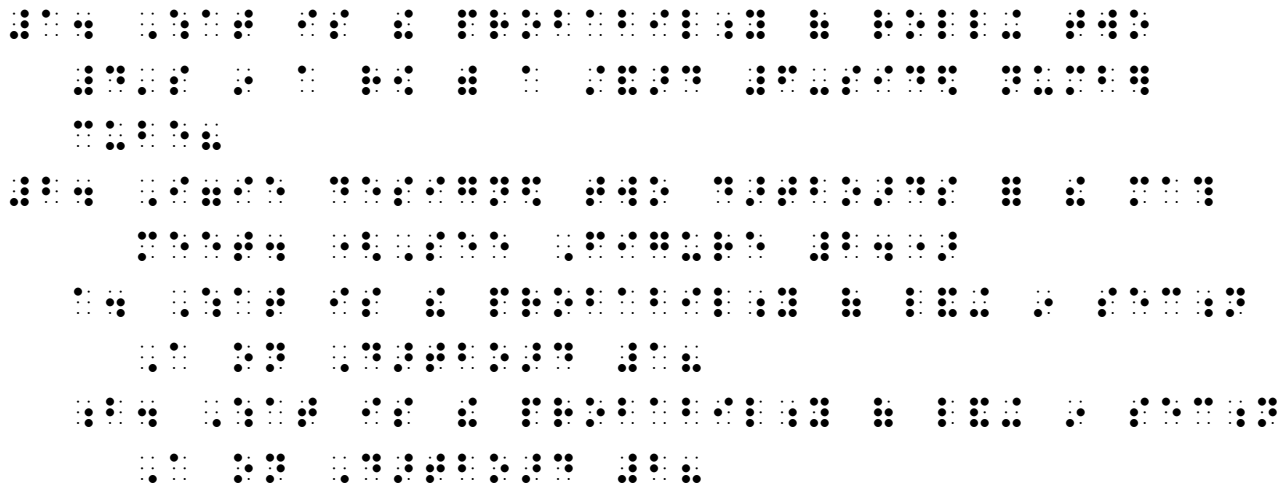
	a	**b**	**c**	**d**
1.	16 + 9	17 + 4	14 + 23	37 + 18
2.	46 + 15	87 + 12	95 + 54	101 + 43
3.	157 + 452	134 + 63	458 + 12	935 + 298



6.1.4 **Varied Margins.** Runover margins for itemized material are determined individually for each item. That is, an item with no subdivisions will be (1-3); the next item may have subdivisions and so will be (1-5; 3-5), etc.

Example 6-9

1. What is the probability of rolling two 4's in a row with a standard 6-sided number cube?
2. Iggie designed two dartboards for the math meet. (See Figure 2.)
   a. What is the probability of landing in section A on Dartboard 1?
   b. What is the probability of landing in section A on Dartboard 2?



LEVEL INDICATORS

[NC Rule 14]

6.2 Definition

A mathematical expression can contain symbols placed above or below the baseline level (the normal line of type in print). Superscripts appear above the baseline; subscripts appear below the baseline. Here are some expressions which contain superscripts and subscripts. The baseline is marked for orientation.

baseline 10^5 H_2O -4 °C πr^2 ${}^{235}_{92}U$ _baseline_

The font size is increased for most examples in this lesson to help in determining the levels.

Superscripts

6.3 Superscript Level Indicator

In braille, indicators are used to identify the level of a superscript or subscript. The superscript level indicator is used to show that the symbols immediately following it appear on the first level above the baseline of writing.

⠘	Superscript Indicator

➢ 10^3 ⠼⠂⠴⠘⠒

➢ $y=[g(x)]^n$ ⠽ ⠨⠅ ⠈⠷⠛⠷⠭⠾⠈⠾⠘⠝

The characters in the superscript are spaced according to the rules of the Nemeth code.

➢ $3^{-0.05T}$ ⠼⠒⠘⠤⠴⠨⠴⠢⠠⠞

A letter or a Roman numeral with a superscript does not need an English-letter indicator because it is not followed by a space.

➢ x^3 ⠭⠘⠒

Example 6-10

Statement ii^2

⠠⠌⠁⠞⠑⠰⠞ ⠸⠩ ⠊⠊⠘⠆ ⠸⠱

A switch to Nemeth is required because the Roman numeral is modified.
ii does not need an English-letter indicator because it is not standing alone.

Example 6-11

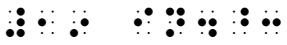
Theorem V^2

Roman numeral V does not need an English-letter indicator because it is not a "single letter" – it is modified with the superscript.

6.3.1 Abbreviations with Superscripts

When an abbreviation is modified by a superscript, observe the following rules:

a. There is no space between the abbreviation and its related level indicator.

⋙ 19 in.^{3} 

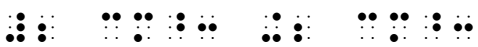
b. The English-letter indicator is used for a single-letter abbreviation.

⋙ 5.5 m^2 

c. Inside the switches, an abbreviation with a superscript is punctuated in mathematical mode.

⋙ 4 cm^3, 

d. Spacing rules for abbreviation apply—the unit is spaced away from an operation symbol.

⋙ 2 cm^3 + 2 cm^3 

The space returns the reader to the baseline, which will be discussed in the next section.

PRACTICE 6B

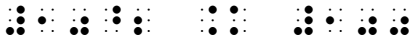
Instructions: Begin with the opening Nemeth Code indicator in cell 1. Start the three-column list on the next line, duplicating the column format shown in print. Place the Nemeth Code terminator in cell 1 on the line following the list.

$6x^2$	$24^?$	x^{2a}
π^2	$(y-k)^3$	8^{10}
n^m	$A^{(k+1)+m}$	$q^{b(w-1)}$
$k^{0.27}$	$e^{3{,}000}$	e^-

6.4 Returning to the Baseline Level

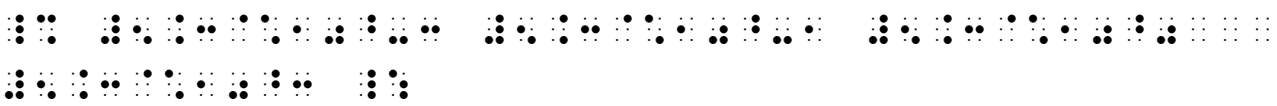
When a superscript is the last item in the expression, the following circumstances bring the reader back to the baseline level: a space or transition to a new braille line, a comma followed by a space, a punctuation indicator, or a code switch indicator.

a. **A space or transition to a new braille line** returns the reader to the baseline.

- ⋙ 10^2 10^3 10^4 
- ⋙ 10^{-2} kg 
- ⋙ $10^2 = 100$ 

Example 6-12

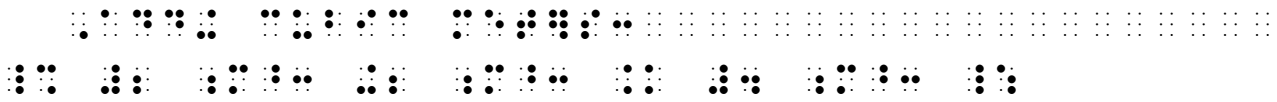
5.3×10^{-3} 5.3×10^{-1} 5.3×10^{0} 5.3×10^{3}



Each 5.3 is printed on the baseline of writing.

Example 6-13

Adding cubic meters: $2\ m^3 + 2\ m^3 = 4\ m^3$

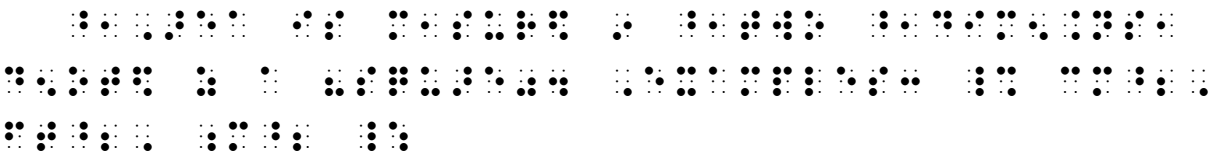


The required space which follows the abbreviation m^3 returns the reader to the baseline. Reminder: An English-letter indicator is required for a single-letter abbreviation even when it carries a superscript. See Section 6.3.1.b.

b. **A comma followed by a space** returns the reader to the baseline.

Example 6-14

Area is measured in **two dimensions**, denoted as a "square". Examples: cm^2, ft^2, m^2

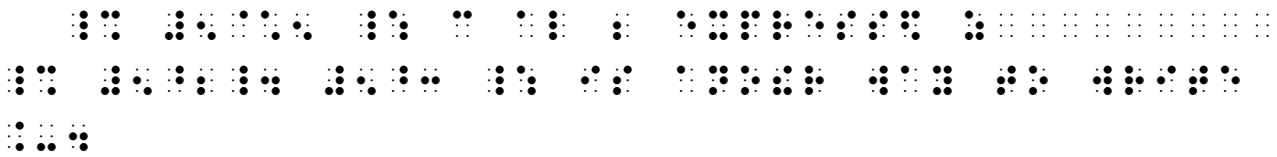


Reminder: Inside the switches, an abbreviation with a superscript is punctuated in mathematical mode. See Section 6.3.1.c.

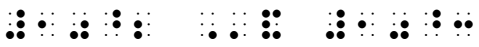
c. **A punctuation indicator** returns the reader to the baseline.

Example 6-15

5×5 can also be expressed as 5^2. 5^3 is another way to write ___.



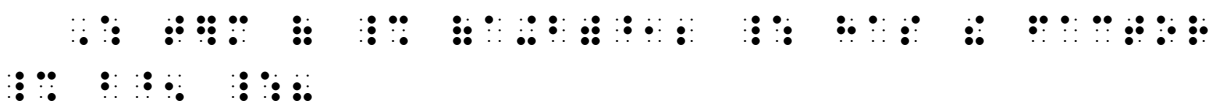
d. **A code switch indicator** returns the reader to the baseline.

⋙ 10^2 and 10^3 

The word "and" is printed on the baseline of writing.

Example 6-16

Which term of $(a + b)^{12}$ has the factor b^5 ?

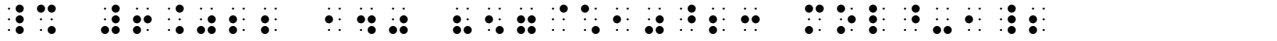


The word "has" and the question mark are printed on the baseline of writing.

Notice how the baseline level returns after each of the six superscripts in the next example.

Example 6-17

Chemistry The Avogadro constant is $6.022\ 140\ 857 \times 10^{23}\ \text{mol}^{-1}$; $2.73159734(12) \times 10^{26}(\text{lb-mol})^{-1}$, or $1.707248434(77) \times 10^{25}(\text{oz-mol})^{-1}$, expressed as pound-mole or ounce-mole.

1 
2 
3 
4 
5

The baseline is re-established as follows:
Lines 2, 3, and 4: the space before each abbreviation
Line 2: the punctuation indicator before the semicolon
Line 3: the math comma followed by a space
Line 4: the Nemeth Code terminator

6.5 Raised Hollow Dot

The hollow dot in the superscript position may be used to represent degrees of angle or degrees of temperature. Transcription of the "degrees" symbol requires a switch to Nemeth.

⠨⠡	Hollow Dot	∘
⠘⠨⠡	Raised Hollow Dot (representing degrees)	

Example 6-18

A right triangle contains one 90° angle.

⠠⠁ ⠐⠗ ⠞⠗⠊⠁⠝⠛⠇⠑ ⠒⠞⠁⠔⠎ ⠐⠕ ⠸⠩ ⠼⠔⠴⠘⠨⠡ ⠸⠱
⠁⠝⠛⠇⠑⠲

Example 6-19

Average normal body temperature is 98.6° Fahrenheit (37° Celsius).

⠠⠁⠧⠻⠁⠛⠑ ⠝⠕⠗⠍⠁⠇ ⠃⠕⠙⠽ ⠞⠑⠍⠏⠻⠁⠞⠥⠗⠑ ⠊⠎
⠸⠩ ⠼⠔⠦⠨⠖⠘⠨⠡ ⠸⠱ ⠠⠋⠁⠓⠗⠢⠓⠑⠊⠞ ⠐⠣⠸⠩ ⠼⠒⠶⠘⠨⠡ ⠸⠱
⠠⠉⠑⠇⠎⠊⠥⠎⠐⠜⠲

Reminders: The words Fahrenheit and Celsius are transcribed in UEB (See Section 3.1.1 in Lesson 3.) Paired parentheses are transcribed in the same code – UEB in this case. See Section 2.13 in Lesson 2.

PRACTICE 6C

1. Tell what number each of the following represents: 6^2, 5^{-3}, and $(3.15)^4$.
2. Which expression denotes the area of a circle?

   a. 360° b. πr^2 c. πd
3. The symbol for "feet squared" is ft^2. $1\ \text{ft} \times 1\ \text{ft} = 1\ \text{ft}^2$
4. 6.02×10^{23} is an approximation of Avogadro's number.
5. $144\ \text{ft}^2 + 144\ \text{ft}^2 = \ldots$
6. Convert 100° Fahrenheit to degrees Celsius.

Introduction to the Baseline Indicator

6.6 Function of the Baseline Indicator

In an unspaced expression, a return to the baseline level is brought about by the use of the baseline indicator. (A notable exception to this rule will be demonstrated in Section 6.11.) Notice that the baseline indicator is the same symbol as the multipurpose indicator—dot 5. The indicator's function is understood in context.

⠐	Baseline Indicator

⫸ $a^2 + b^2 + c^2$

Example 6-20

The Pythagorean equation relates the side lengths of a right triangle as $a^2 + b^2 = c^2$.

The baseline is re-established before the plus sign.

Example 6-21

Draw a 30°-60°-90° triangle.

The baseline is re-established before each hyphen.

Example 6-22

Solve. $(x^2 + y^2) - (x^2 + y^2)$

The baseline is re-established before each plus sign and before each right parenthesis.

6.6.1 **Degrees Fahrenheit and Degrees Celsius.** You will encounter different printing styles regarding the spacing of degrees F (Fahrenheit) and degrees C (Celsius). A special rule applies in this case. The transcriber is to follow print spacing and then apply appropriate Nemeth rules regarding code switching, linage, use/nonuse of the English-letter indicator, use of the baseline indicator, and punctuation mode. Practice transcribing these three samples until you can confidently apply the rules.

⫸ 100° C

Print observation: The degree symbol is unspaced from the value (100). The letter C is preceded by a space. Braille: Spaced as printed, C is an abbreviation. The degree symbol requires Nemeth. The abbreviation is transcribed in the same code as the symbol. (See Section 3.4 in Lesson 3.) An English-letter indicator is required with a single letter abbreviation. (See Section 4.21 in Lesson 4.)

⫸ 100 °C

Print observation: The degree symbol and the letter C are unspaced. The measurement unit is spaced from the value (100). Braille: Spaced as printed, °C is a unique mathematical symbol. A baseline indicator before the unspaced letter C returns the reader to the baseline level. An English-letter indicator is not needed because C is not a "single letter." (See Section 3.11.1 in Lesson 3.)

⫸ 100°C

Print observation: The degree symbol and the letter C are unspaced. The measurement unit is unspaced from the value (100). Braille: Same as the second sample above, only—spaced as printed—there is no space before the degree symbol.

Example 6-23

Expressed in degrees Celsius, normal human body temperature is 37 °C.

a. *Punctuation Mode:* As spaced abbreviations, F and C are punctuated in literary mode. (Review Section 3.4.2 in Lesson 3.) When F and C are unspaced from the degree sign the combination is mathematical. As technical symbols, they are punctuated in mathematical mode.

Example 6-24

Express normal human body temperature in °C; in °F.

A punctuation indicator is required before the semicolon because ℃ is a mathematical symbol.

PRACTICE 6D

(1) $4(x-y)^3 - 2(x-y)^3$

(2) $3a^3b + 6a^6b^2 + 9a^9b^3$

(3) Convert 10° F to °C. Express 10 °C in °F.

(4) $V = 2\pi^2 Rr^2$

(5) x^n-dimensional system

(6) $6^2 \times 6^3 = 6^{2+3} = 6^5$

(7) $2(36x^2 - 1) = 2[(6x)^2 - 1^2]$, which factors into $2(6x+1)(6x-1)$.

6.7 Higher Levels of Writing

Superscripts may carry superscripts of their own. In such cases, the superscript indicator is doubled, tripled, etc. to indicate superscripts on the second, third, or higher levels of writing.

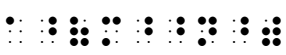
```
⠘⠘    Superscript with Superscript
           (two levels above the baseline)
⠘⠘⠘   Superscript with Superscript with Superscript
           (three levels above the baseline)
```

⋙ n^{a^b}

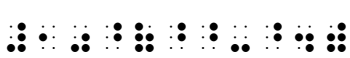
⋙ $n^{a+1^{b+1^{c+1}}}$ 

If the print copy is difficult to analyze, a straightedge and a magnifier will help to determine the levels. In general, the print font gets smaller as the level gets higher.

6.7.1 **Combinations.** Each level indicator is read as it relates to the baseline level. The effect of one level indicator is terminated by another level indicator. Keep this in mind as you read the following samples.

⋙ $a^{(m^n)}$ 

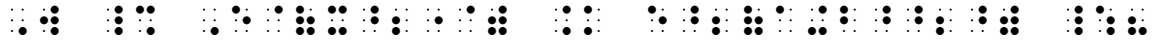
The left and right parenthesis and the letter "m" are one level above the baseline; the letter "n" is two levels above the baseline. Notice the superscript indicator before the right parenthesis.

⋙ $10^{(-4)}$ 

The left and right parenthesis and the numeral "4" are one level above the baseline; the minus sign is two levels above the baseline. Notice the superscript indicator before the number 4.

Example 6-25

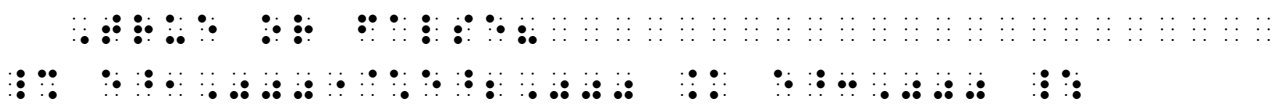
Will $E[x^2] = e^{2(a+b^2)}$?



The brackets are on the baseline level. The second superscript is $2(a + b^2)$ *which means that the final "2" is at the supersuperscript level. Notice the baseline indicator before the right bracket and the superscript indicator before the right parenthesis.*

Example 6-26

True or false? $e^{1,000} \times e^{2,000} = e^{3,000}$



When a space brings the reader back to the baseline, a baseline indicator is not needed.

6.8 Certain Raised Signs

Some signs are printed in a raised position but are not considered to be superscripts. (See Section 2.16.3 in Lesson 2 regarding the midline horizontal ellipsis.)

6.8.1 **Raised Ordinal.** *Braille Formats* states that raised ordinal endings are not considered to be superscript. This guideline is also followed in a technical transcription.

Example 6-27

Name the 3rd and 4th item in the series.

The ordinal endings are printed in the raised position.

Example 6-28

What is the $3n^{th}$ degree?

"th" is printed in the raised position.

6.8.2 **Prime Sign.** The prime sign appears to be raised in print, but it assumes the same level as the number or letter to which it applies.

⠄	Prime Sign '

⋙ m'^{2}

The prime sign belongs with the letter m. Only the number 2 is in the superscript position.

⋙ $A^{2''}$

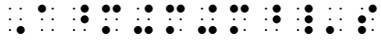
The prime signs belong with the number 2 in the superscript.

Example 6-29

plane angle $\alpha = 30°2'8''$

The prime signs are not superscripts. They apply to numbers at the baseline of writing.

6.8.3 **Apostrophe-s.** In an apostrophe-s ending, the apostrophe is at the same level as the "s". Because a punctuation indicator returns the reader to the baseline, a level indicator is inserted to maintain the level of the apostrophe-s.

⋙ $A^{m+m+m's}$ 

The apostrophe-s applies to m+m+m.

Compare to this sample where the "s" and its apostrophe are printed on the baseline level.

⋙ A^{m+m+m} 's 

The apostrophe-s applies to the entire expression A^{m+m+m}.

PRACTICE 6E

1. Use a calculator to find 9^{9^9}.
2. Find the r^{th} term of $(x+y)^n$.
3. Label the x^2's and x^3's.
4. What is the meaning of x''^3?
5. Simplify: $(x^3-y^3)^2-(x^3+y^3)^2$.
6. $x^{y^n z}$ or $x^{y^2 z}$

Subscripts

6.9 Subscript Level Indicators

Except as stated in Section 6.11, the subscript level indicator is used to show that the symbols immediately following it appear on the first level below the baseline of writing. Note that the subscript indicator is the same symbol as the English-letter indicator—dots 56. The indicator's function is understood in context.

⠰	Subscript Indicator

- f_n ⠸⠰⠝
- $a_{(k+1)}$ ⠰⠁⠰⠣⠅⠬⠂⠼⠁⠜

Subscripts may carry subscripts of their own. In such cases, the subscript level indicator is doubled, tripled, etc. to indicate subscripts on the second, third, or lower levels.

⠰⠰	Subscript with Subscript (two levels below the baseline)
⠰⠰⠰	Subscript with Subscript with Subscript (three levels below the baseline)

- n_{x_y} ⠝⠰⠭⠰⠽
- $P_{x+1_{y+1_{z+1}}}$ ⠠⠏⠰⠭⠬⠂⠼⠁⠰⠽⠬⠂⠼⠁⠰⠵⠬⠂⠼⠁

PRACTICE 6F

Note: The -?- in the second column is in the subscript position. The subscript of the second item in the fourth column is "minus two".

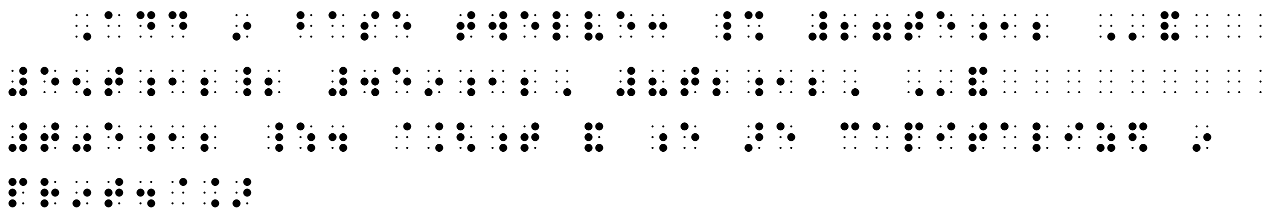
3_c	10_8	$?_3$	x_{2+k}
3_{five}	$10_{\text{-?-}}$	Ca(OH)_2	y_{-2}
y_{n_k}	P_{3n}	a_{m1}	a_{m_1}

6.10 Returning to the Baseline Level

The reader returns to the baseline level from a subscript in the same way as with a superscript: a space or transition to a new braille line, a comma followed by a space, a punctuation indicator, a code switch indicator, or a baseline indicator.

Example 6-30

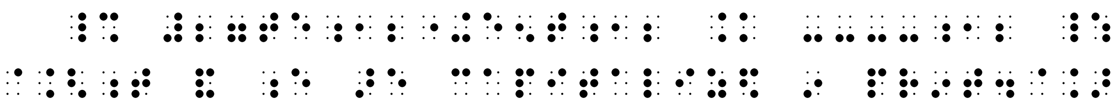
Add in base twelve: 27TE_{12} and E5T_{12} ; 4E9_{12}, 8T2_{12}, and T0E_{12}.



Line 1: The single-word switch indicator returns the reader to the baseline.
Line 2: The punctuation indicator and the comma followed by a space each initiate a return to the baseline.
Line 3: The Nemeth Code terminator initiates a return to the baseline.
Lines 3-4: Reminder: A transcriber's note is required when nondecimal numerals are printed as capital letters. See Lesson 4 to review nondecimal numeration.

Example 6-31

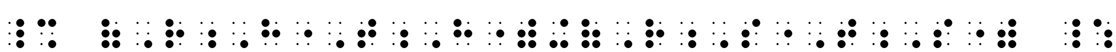
$27\text{TE}_{12} + \text{E5T}_{12} = \_\_\_\__{12}$



A baseline indicator initiates the baseline before the plus sign. A space initiates the baseline before the equals sign. Note that the subscript indicator is unspaced from the long dash to which it applies.

Example 6-32

$(R_H T_H) + (R_S T_S)$



A baseline indicator initiates the baseline throughout this unspaced expression. Letters H and S are subscripts. Because H and S are not "single letters" (they are unspaced), an English-letter indicator is not needed. Dots (56) function as a subscript indicator, not an English-letter indicator.

PRACTICE 6G

1. Name the numeral in base ten equal to:

   a. 47_8 b. 34_6 c. 1101_2

2. $C_{hex} = 12_{dec} = 14_{oct}$

3. What do we know if $P_{n_r} = (x_{n_k}, y_{n_k})$?

4. $7_8 - 4_8$

6.11 Special Case—Nonuse of the Subscript Level Indicator

A special rule applies to certain subscripts. The subscript level indicator is not used when all of the following apply:

i. the subscript is *numeric*;

ii. the numeral is a *right subscript to a letter;*

iii. the subscript is on the *first level* below the baseline of writing.

Example 6-33

Apply Definitions i_2 and I_2 .

Each numeral 2 is printed at the subscript level.

a. When a subscript does not require a subscript indicator, a return to the baseline is implied following the numeric subscript. A baseline indicator is not needed.

⋙ H_2O 

Letters H and O are on the baseline of writing. Numeral 2 is a subscript.

⋙ $a_1a_2 + b_1b_2 + c_1c_2$ 

All numerals are subscripts. A baseline indicator is not needed to show that the letters and the plus signs are on the baseline level because no subscript indicators are used.

Example 6-34

Draw the structure of cadmium nitrate, $Cd(NO_3)_2$.

Subscript 3 does not require a subscript indicator because it is a right subscript to a letter. A baseline indicator is not required to indicate that the closing parentheses is printed on the baseline. Subscript 2 requires a subscript indicator because it is not a right subscript to a letter.

6.11.1 **Further Conditions.** The definition of "numeric" and "letter" include the following.

a. **Numeric Subscript.** The numeric subscript may contain a segmenting comma or a decimal point.

⋙ $x_{1,000}$

The numeral 1,000 is a right subscript to the letter x.

⋙ $x_{5.3}$

The numeral 5.3 is a right subscript to the letter x.

b. **"Letter"**

(1) The letter may carry one or more primes.

⋙ x'_2

The numeral 2 is a right subscript to x'.

(2) The letter may be taken from any alphabet.

⋙ $\aleph_0$

Hebrew aleph, subscript zero.

(3) The letter may also carry a superscript. (See Section 6.17, *Simultaneous Superscripts and Subscripts*)

(4) The letter may be part of a two-letter chemical symbol.

⋙ Cl_4

Cl (the two-letter chemical symbol for chlorine), subscript 4.

c. **Not a Subscript.** When a number is printed on the baseline to the right of a letter, unspaced, a multipurpose indicator (dot 5) is inserted between two signs to indicate that they are printed horizontally, and that the number is not a subscript.

⋙ F1

6.11.2 **Restrictions.** Just because a numeral is a right subscript to a letter does not mean that the special rule can be applied. The subscript level indicator must be used if any of the following conditions apply:

(1) If the letter is functioning as a numeral in a nondecimal numeration system, a subscript indicator is required.

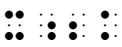
⋙ TE_{12} 

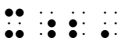
The subscript 12 means base-12. See Lesson 4 to review nondecimal numeration.

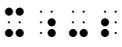
(2) If the letter is part of a word or abbreviation, a subscript indicator is required.

⋙ five_{3} 

(3) If the subscript contains any symbol other than a numeral with its comma or decimal point, a subscript indicator is required.

⋙ x_{2k} 

⋙ $x_{2'}$ 

⋙ x_{-2} 

(4) If the subscript carries a superscript or subscript of its own, a subscript indicator is required.

⋙ x_{2_n} 

(5) Numeric subscripts on the second or lower levels always require their appropriate subscript level indicators.

⋙ P_{n_1} 

6.11.3 **Summary.** The rules regarding use/nonuse of the subscript indicator are summarized below.

a. A subscript level indicator <u>is not used</u> before a numeric subscript on the first level below the baseline of writing when the numeral is a right subscript to a letter. A baseline indicator is <u>not</u> needed to return to the baseline following such a subscript. Furthermore, the following may also be true regarding the baseline letter and its numeric subscript.

- The numeric subscript may contain a mathematical comma (place value separator) or a decimal point.
- The baseline letter may carry one or more primes or a superscript.
- The baseline letter may be from any alphabet.
- The baseline "letter" may be a two-letter chemical element.

b. A subscript level indicator must be used in the following circumstances.

- A numeral on the first level below the baseline requires a subscript indicator if the subscript contains any symbol other than a numeral with its comma or decimal point.
- A numeral on the first level below the baseline requires a subscript indicator if the subscript carries a superscript or subscript of its own.
- A subscript on the second or lower level always requires the appropriate subscript level indicator.
- If the subscript is a letter that is part of a word or an abbreviation, a subscript indicator is required.
- If the subscript is a letter functioning as a numeral in a nondecimal numeration system, a subscript indicator is required.

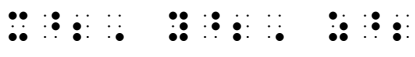
PRACTICE 6H

1) These expressions need subscript indicators: y_{-2}, x_{2+k}, a_{m1}, x_{3_n}, x_{y_2}.
2) These expressions do not need a subscript indicator: x_1, ax_2, $\mathrm{CO_2}$, $z_{.4}$, β_2.
3) Decide whether these expressions require a subscript indicator and transcribe them correctly: $\mathrm{shape_4}$, Q'_2, $\mathrm{C_6Fe_2O_{12}}$, n_k, x_{2k}, $P_{r_{s_t}}$, $\mathrm{D_{56}}$, $\mathrm{G_{9{,}999}}$, and the hexadecimal number $\mathrm{2E6B_{16}}$.
4) **Chemistry.** While $\mathrm{Na_2ZnCl_4}$ could be cooled in the normal way, $\mathrm{Na_2[CoCl_4]}$ had to be quenched in the liquid $\mathrm{N_2}$.
5) $f_1(x) = g(x) \cdot q_2(x) + f_2(x)$

6.12 Spaces Within Superscripts and Subscripts

A space usually returns the reader to the baseline. Various strategies are used to retain the level in effect when a space occurs within a superscript or a subscript.

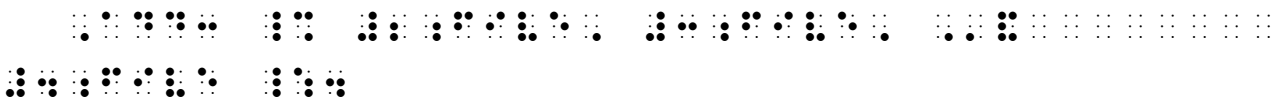
6.12.1 **Commas.** *Review:* A comma followed by a space re-establishes the baseline. The return to the baseline starts at the comma. No baseline indicator is necessary.

⋙ x^2, y^2, z^2 

⋙ (a_1, a_{1i}, a_{2i}) 

Example 6-35

Add: 2_{five}, 3_{five}, and 4_{five}.



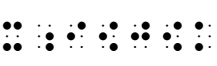
The commas re-establish the baseline of writing. Even though the subscripts are words, the mathematical comma is transcribed because the punctuation applies to the entire mathematical expression.

a. **The Contracted Comma.** When a comma (spaced or unspaced) occurs within a superscript or subscript, a special Nemeth character called a contracted comma is used. The symbol itself is unspaced within the superscript or subscript, even when it is representing a comma and a space. The level in effect continues through the contracted comma.

⠰ Contracted Comma (and optional space) ,

⋙ $x^{1,2}$ or $x^{1,2}$ 

The contracted comma represents the comma and the space or the unspaced comma in the superscript.

⋙ $x_{i,j,k}$ or $x_{i,j,k}$ 

The contracted comma represents each comma and space or each unspaced comma in the subscript.

Compare this notation to the numeric subscript that contains a segmenting comma shown in Section 6.11.1.a, reproduced below.

⋙ $x_{1,000}$ 

vs.

⋙ $x_{1,2}$ 

The contracted comma symbol is not to be used to replace a comma on the baseline of writing. A dot 2 or dot 6 comma is used for the comma that is part of the sentence structure, as appropriate.

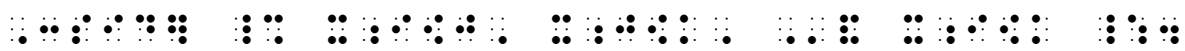
Example 6-36

If _____, then $x_{i,j,k}$, as shown below.

Contracted commas are used within the subscript; a dot 2 comma is used for the comma that is part of the sentence structure (on the baseline level) outside of the Nemeth switches.

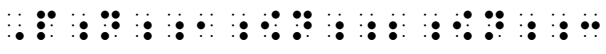
Example 6-37

Consider $x_{i,j}$, $x_{j,k}$, and $x_{i,k}$.



Contracted commas are used within each subscript; a dot 6 comma is used for the commas that are part of the sentence structure (on the baseline level).

In the next sample, the commas (and spaces) separate three terms at the subscript level, but each "n" has a subscript as well. The correct level of each comma is shown by shrewd use of level indicators.

⋙ P_{n_1, n_2, n_3} 

6.12.2 **Space Before a Word.** If a subscript or a superscript contains a space before a word (or abbreviation), the level must be restated after the space. The level indicator is unspaced from the following word (or abbreviation).

⋙ $n_{\text{obtuse angles}}$ 

The subscript indicator before the word "angles" shows that the word is in the subscript position.

The same rule applies for letters in a superscript or subscript.

⋙ $n^{\text{surface S}}$ 

Letter S does not need an English-letter indicator because it is no longer a "single letter" as defined by the Nemeth code. (See Section 3.10.1 in Lesson 3.)

⋙ $n_{\text{surface S}}$ 

Dots 56 before the letter S are acting as a subscript indicator here.

6.12.3 **Space Before and After a Comparison Sign.** The space following a superscript or a subscript returns the reader to the baseline.

> ⪢ $a^2 = a \cdot a$ ⠁⠘⠆ ⠨⠅ ⠁⠡⠁
>
> *The superscript is 2. The equals sign is on the baseline.*

Hence, when a comparison sign is <u>within</u> a superscript or a subscript, the level must be reinstated before the comparison sign. The indicator is unspaced from the comparison sign. However, the space <u>after</u> the comparison symbol preserves the level that is already in effect.

> ⪢ $S_{u=a}$ ⠠⠎⠰⠥ ⠰⠨⠅ ⠁
>
> *The subscript is u = a. The subscript level is restated before the equals sign. The subscript level continues through the space following the equals sign without the need for an explicit indicator.*

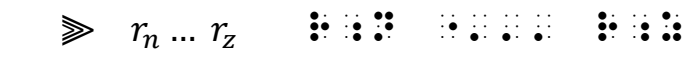
6.12.4 **Space Before and After an Ellipsis or Long Dash.** Established spacing rules for an ellipsis and a long dash apply when these symbols occur at the superscript or subscript level. <u>Within</u> a superscript or a subscript, the space which *precedes* an ellipsis or a long dash preserves the effect of a level indicator currently in force. Similarly, the space which *follows* an ellipsis or a long dash preserves the effect of any level indicator currently in force. In other words, <u>within a superscript or a subscript the space does not initiate the baseline level</u>.

> ⪢ $x^{1+3+5+\cdots+(2n-1)}$
>
> ⠭⠘⠂⠬⠒⠬⠢⠬ ⠄⠄⠄ ⠬⠷⠆⠝⠤⠂⠾
>
> *This superscript includes an ellipsis. The level in effect preceding the ellipsis is a first order superscript. That level extends through the spaces before and after the ellipsis. (See Section 2.16.3 in Lesson 2 regarding the midline ellipsis.)*

a. **A Change of Level Before or After an Ellipsis or Long Dash.** When a change of level occurs before or after an ellipsis or long dash, the following rules must be applied in order to offset the fact that such a space does not bring about a level change.

(1) When an ellipsis or a long dash is located at a different level from the material *preceding* it, the appropriate level indicator is used before the ellipsis or long dash. The level indicator is unspaced from the ellipsis or long dash. Compare the next two samples.

> ⪢ $r_{n\ \ldots}$ ⠗⠰⠝ ⠄⠄⠄
>
> *This ellipsis is in the subscript. The subscript indicator applied to the letter n continues through the space.*

⋙ $r_n \ldots r_z$ 

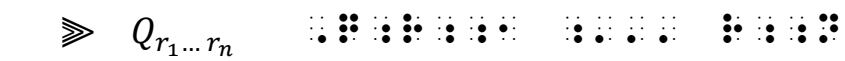
This ellipsis is on the baseline. A baseline indicator is required because otherwise the ellipsis assumes the level most recently indicated (subscript).

There is no need to indicate a return to the baseline after a numeric subscript that does not require a subscript indicator. Compare the previous sample to this one.

⋙ $r_1 \ldots r_n$ 

This ellipsis is on the baseline. Since the subscript 1 does not require a level indicator, the ellipsis assumes the level of the first letter r (baseline).

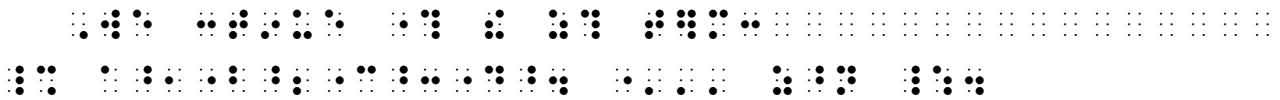
Compare the previous sample to this one.

⋙ $Q_{r_1 \ldots r_n}$ 

This ellipsis is at the subscript level. Since it follows a subsubscript, an explicit change of level indicator is necessary. The subscript level continues through the space following the ellipsis.

Example 6-38

We continue through the zth term: $a^1 b^2 c^3 d^4 \ldots z^n$.



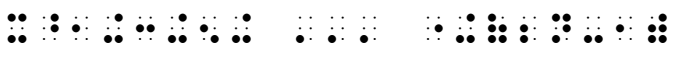
A baseline indicator is required to show that the ellipsis is on the baseline following the superscript 4.

(2) When an ellipsis or a long dash is located at a different level from the material *following* it, the appropriate level indicator is used after the space following the ellipsis or long dash unless one of the other "return to baseline" events occur. Compare:

⋙ $x^{1+3+5+\cdots+(2n-1)}$

The superscript level continues through the spaces before and after the ellipsis. (See Section 2.16.3 in Lesson 2 regarding the midline ellipsis.)

⋙ $x^{1+3+5+\cdots}+(2n-1)$



A baseline indicator is required to show that the plus sign following the ellipsis is on the baseline.

> $x^{1+3+5+\cdots} = ?$

The space followed by an equals sign initiates the baseline level. A baseline indicator is not needed.

Example 6-39

Fill in the blank: $10^{3+—}$ is equal to 10^5.

The superscript level continues through the space before the long dash. The space followed by the Nemeth Code terminator initiates the baseline level. A baseline indicator is not needed.

(3) *Summary:* As with any superscript or subscript, reading automatically returns to the baseline level if the ellipsis or long dash is followed by a sign of comparison on the baseline, by a punctuation indicator or a dot 6 comma followed by a space, or by a code switch indicator. Additionally, a Nemeth word or abbreviation following a space initiates the baseline. These circumstances are illustrated below, following a long dash in the superscript. In each case, the superscript level extends through the space *before* the dash and the baseline level is implied *following* the dash.

> $10^{7+—} = 10^{21}$

The ***comparison symbol*** *returns the reader to the baseline.*

> $10^{7+—}$. 10^{21}

The ***punctuation indicator*** *returns the reader to the baseline.*

> $10^{7+—}$, 10^{21}

The ***dot 6 comma*** *followed by a space returns the reader to the baseline.*

> $10^{7+—}$ equals 10^{21}

The ***single-word switch indicator*** *returns the reader to the baseline.*

> $10^{7+—}$ will be how we ...

The ***Nemeth Code terminator*** *returns the reader to the baseline.*

> 10^{7+}— mph ⠼⠂⠴⠘⠶⠬ ⠤⠤⠤⠤ ⠍⠏⠓

The ***space before the abbreviation*** *returns the reader to the baseline.*

6.12.5 **Space Within a Segmented Number.** The effect of a level indicator extends through the space inserted in a numeral for the purpose of dividing it into short regular groups of digits.

> $e^{3.14159\ 26535}$ ⠑⠘⠒⠨⠂⠲⠂⠢⠔ ⠆⠖⠢⠒⠢

The superscript is 3.14159 26535

PRACTICE 6I

Instructions: Translate the simulated braille into writing. Show spaces and levels clearly. Compare your translation to the print copy in the answer section.

⠸⠩

⠼⠂⠸⠲ ⠭⠰⠂⠪⠆ ⠌⠨⠅ ⠭⠘⠊⠪⠚

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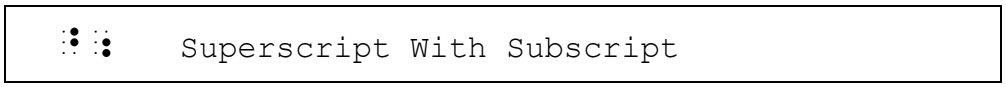
More about Superscripts and Subscripts

6.13 Superscript and Subscript Combinations

Combinations of subscripts to superscripts or of superscripts to subscripts require level indicators composed of two or more braille symbols. Keeping in mind that level indicators relate to the baseline, transcribing these expressions is an exercise in logical thinking.

6.13.1 Superscripts with Subscripts



⋙ x^{n_1} 

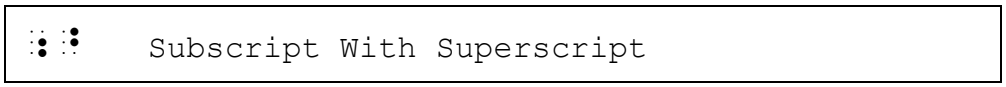
"n, subscript one" is in the superscript position. "1" is a supersubscript.

⋙ $2^{Y_0} = Y_1$ 

"Y, subscript zero" is in the superscript position. "0" is a supersubscript.

Reminder: The subscript indicator is omitted for a numeric subscript to a letter only for subscripts that are located on the first level below the baseline of writing. The super/subscript indicator is needed to show a numeric subscript in the superscript position.

6.13.2 Subscripts with Superscripts



⋙ x_{n^2} 

"n, superscript two" is in the subscript position. "2" is a subsuperscript.

⋙ P_{3^n} 

"3, superscript n" is in the subscript position. "n" is a subsuperscript.

Reminder: The subscript indicator is required when a numeric subscript to a letter carries a superscript or subscript of its own.

PRACTICE 6J

Instructions: Descriptions are included in a right-hand column for your benefit—do not transcribe the descriptions. Analyze the levels carefully as you proofread. *Formatting Guidelines:* Transcribe the bold type as centered headings.

Superscripts with Subscripts

$2^{\aleph_0} = \aleph_1$	($\aleph_0$ is in the superscript position.)
$a = 2^{k_1}$ and $b = 2^{k_2}$	(k_1 and k_2 are in the superscript position.)
$(ab)^x = 2^{k_1 x} \cdot 2^{k_2 x}$	(x, $k_1 x$, and $k_2 x$ are superscripts.)
$e^{i\theta_1}$ times $e^{i\theta_2}$ equals $e^{i(\theta_1+\theta_2)}$	($i\theta_1$, $i\theta_2$, and $i(\theta_1 + \theta_2)$ are superscripts.)

Subscripts with Superscripts

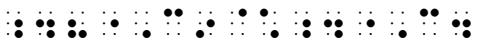
Z_{5^n}	(5^n is in the subscript position.)
$7t_{s^4}$	(s^4 is in the subscript position.)

6.14 Left Superscripts and Subscripts

The appropriate level indicator is transcribed before a subscript or superscript printed to the left of its related sign.

⋙ ${}^{14}\mathrm{C}$ 

⋙ ${}_{3}\mathrm{x}_{1}$ 

⋙ ${}_{48}\mathrm{C}_{9} \times {}_{4}\mathrm{C}_{4}$ 

The "9" and the second "4" are numeric subscripts to the right of a letter on the baseline of writing, so no subscript indicator is needed.

6.14.1 **Raised Negative Sign.** In some texts, negative numbers are shown with a raised negative sign. The raised position of the negative sign must be shown in braille. A numeric indicator is not required when the negative sign is raised.

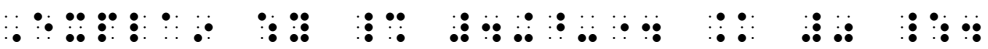
⋙ $^{-}4$

Compare: A numeric indicator is required when the negative sign is not raised.

⋙ -4

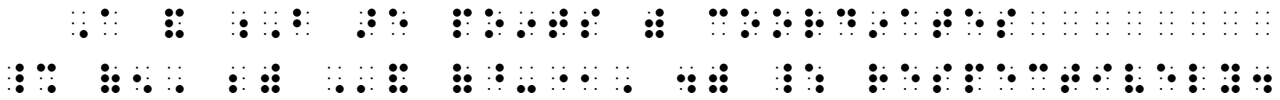
Example 6-40

Explain why $4 + {}^{-}4 = 0$.



Example 6-41

A and B are points with coordinates $(5, 2)$ and $({}^{-}1, 4)$ respectively.



Compare the subscripts in the next two samples. The first subscript is -2. A subscript indicator is required because the subscript contains a symbol other than a numeral. In the second subscript, the negative sign is raised. It is a left superscript to the subscript "2".

⋙ x_{-2}

⋙ x_{-2}

6.15 Further Combinations

The Nemeth code illustrates additional combinations of superscripts and subscripts. Due to the obscurity of such complex combinations, only a few samples are shown in this lesson manual. Proper interpretation of these characters will require reading the surrounding text in order to apply the correct indicators. (Notice that the letter on the baseline of writing is larger.)

⋙ ${}_{yx}n$ *n is on the baseline of writing and has a left subscript.*

Question: Is the subscript y^x or ${}_yx$?

Answer: Since y is smaller than x, the subscript is ${}_yx$.

Correct: This transcription shows left subscript x with a left subsubscript y:

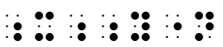
Incorrect: This transcription shows left subscript y with a subsuperscript x:

⋙ $x_y n$ *n is on the baseline of writing and has a left subscript.*

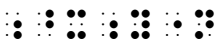
Question: Is the subscript x_y or ${}^{x}y$?

Answer: Since y is smaller than x, the subscript is x_y.

Correct: This transcription shows left subscript x with a subsubscript y:



Incorrect: This transcription shows left subscript y with a left subsuperscript x:



6.16 Consecutive Superscripts and Subscripts

When a character with a right superscript or subscript is adjacent to a character with a left superscript or subscript, each superscript or subscript has its own level indicator. A multipurpose indicator is inserted between the consecutive symbols. A space may appear in print to help visually differentiate the two super/subscripts, but no space comes between the symbols in braille.

⋙ $p^{b\,c}q$ 

(There is a small space between b and c in print.)

⋙ $P_{x\,y}Q$ 

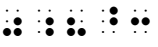
(There is a small space between x and y in print.)

⋙ $P_{1\,2}Q$ 

(There is a small space between 1 and 2 in print.) The first numeric subscript does not require a subscript indicator because it is a right subscript to a letter.

6.17 Simultaneous Superscripts and Subscripts

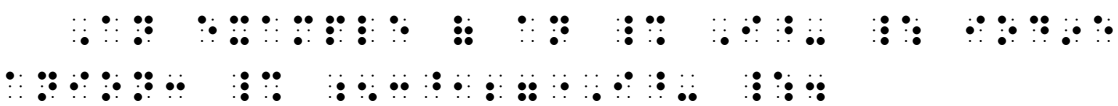
When a superscript and a subscript are printed directly above and below each other, the subscript is transcribed first.

⋙ 10^{3}_{8} 

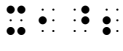
⋙ ${}^{238}_{92}\mathrm{U}$ 

Example 6-42

An example of an I^- iodine anion: $^{127}_{53}I^-$.



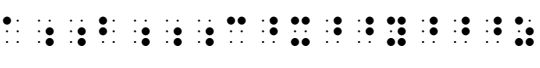
The subscript indicator is or is not transcribed, according to the rules presented in Section 6.11. Notice that simultaneous superscripts and subscripts printed next to a letter in italics may not align exactly because of the slanted aspect of the italic typeform.

⋙ x_1^2 

The numeric subscript does not require a subscript indicator because it is a right subscript to a letter.

⋙ $^n_m x$ 

The subscript is transcribed first.

⋙ $n^{x^{y^z}}_{a_{b_c}}$ 

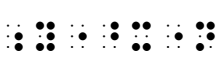
The entire subscript is transcribed before transcribing the superscript.

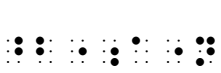
6.18 Nonsimultaneous Superscripts and Subscripts

When a mathematical expression carries both a superscript and a subscript which are not printed directly above and below each other, the superscript and subscript are transcribed in the same order as in print, and the baseline indicator is inserted between them.

⋙ $x_1{}^2$ 

⋙ $a^k{}_m$ 

⋙ ${}_y{}^x n$ 

⋙ ${}^b{}_a n$ 

A magnifier and a straightedge can help determine whether superscripts or subscripts are simultaneous or nonsimultaneous. If in doubt whether the expression shows nonsimultaneous super/subscripts or if, instead, the super/subscripts have super/subscripts of their own, compare the notation to the surrounding text for clues.

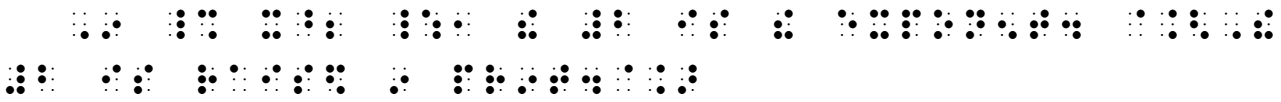
6.19 Detached Superscripts and Subscripts

When an entire superscript or subscript stands alone, it is transcribed without a level indicator. A transcriber's note explains its print position. Sample transcriber's note:

The 2 is raised in print.

Example 6-43

In x^2, the ^{2} is the exponent.

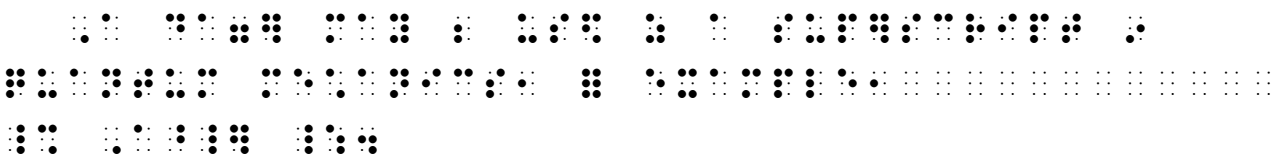


6.20 Literary Symbols and Level Indicators

If an ampersand, asterisk, crosshatch, dagger, double dagger, paragraph mark, or section mark is used mathematically and appears in a superscript or a subscript, its level must be indicated. The Nemeth symbols for these literary characters are listed in Lesson 5.

Example 6-44

A dagger may be used as a superscript in quantum mechanics, for example, $A^{\dagger}$.



Summary

Here is a summary of the difference in print among four types of superscripts and subscripts as defined in the Nemeth code.

Consecutive A right super/subscript belongs to the preceding character and a left super/subscript belongs to the next character.

Simultaneous A character has both a superscript and a subscript. The superscript is printed directly above the subscript.

Nonsimultaneous A character has both a superscript and a subscript. The two scripts are not printed directly above and below each other.

Detached A super/subscript stands alone without being associated with a letter or number. It is printed slightly above or below the baseline and is smaller than the rest of the text.

PRACTICE 6K

Note: There is no space between the subscript and the superscript in item #3.

1. Here are some expressions with left superscripts: ${}^{3}x$, ${}^{n}x$, ${}^{-}2 + {}^{-}4 = {}^{-}6$, $({}^{-}3)^{{}^{-}2\,+{}^{+}2}$.
2. ${}^{12}_{6}\mathrm{C}$ and ${}^{12}\mathrm{C}$ represent the same carbon isotope.
3. $\mathrm{D_2}\,{}^{18}\mathrm{O}$ is the doubly labeled water isotopologue!
4. In $\mathrm{CO_2}$, the subscript ${}_2$ means "two oxygen atoms".
5. ${}_nP_r = K({}_{n-1}P_{r-1})$
6. $a_1^2 + b_1^2 + c_1^2$
7. $[t]_0^4$
8. $2 \times 10_6{}^2 + 3 \times 10_6{}^1 + 2$
9. $P_{x\,y}Q$
10. $\mathrm{NH_4^+ + Cl^- + H_2O}$

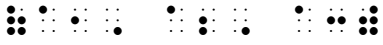
6.21 More About Grouping Symbols and Level Indicators

As noted throughout this lesson, when a grouping symbol appears on the baseline level and a level indicator is currently in effect, the baseline indicator is placed before the sign of grouping.

⋙ $(R_H T_H) + (R_S T_S)$

If no subscript indicator is used, a return to the baseline is implied.

⋙ (a_1, a_2, a_3)



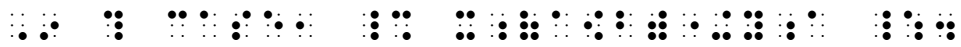
This right parenthesis does not need a baseline indicator.

Be watchful when determining the level of a grouping sign. Because the top and bottom margins of grouping signs may extend beyond the level in effect, it is better to compare the center of the symbol to the surrounding text if its printed level is in question.

a. When a grouping sign starts at a different level, the appropriate level indicator is placed before the grouping symbol to properly identify its location. Review the examples in Section 6.7.1 with this in mind.

Example 6-45

In this case, $x_{(a,\,b)} + y_a$.

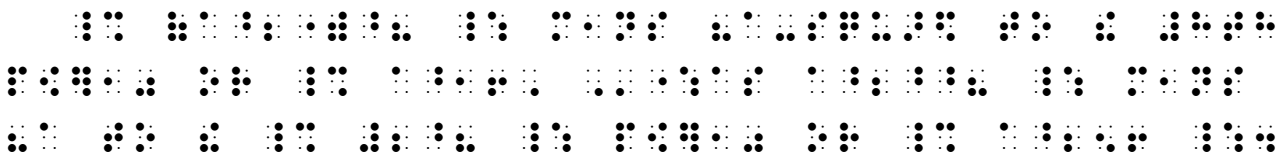


The left grouping symbol begins the subscript level.

b. When a grouping symbol is printed on the baseline of writing, an associated exponent is at the superscript level, even though it may be raised to a higher level in print. This is a visual aid, not to be mistaken for a higher-degree exponent.

Example 6-46

$(a^2)^8$ means "a-squared to the 8th power," or a^{16}, whereas a^{2^8} means "a to the 2^8 power," or a^{256}.



The first exponent 8 is a superscript to (a^2). *The second exponent 8 is a supersuperscript.*

c. Lesson 4 explained that, when a letter touches only one grouping symbol, the English-letter indicator is applied (or is not applied) as though the grouping sign were not present. This rule is illustrated below in the context of a grouping sign that has a simultaneous subscript and superscript.

⫸ $s]_a^b$ ⠎⠈⠾⠰⠁⠘⠃

Think: s_a^b ⠎⠰⠁⠘⠃

PRACTICE 6L

Instructions: Treat each vertical bar in sentence (6) as an operation sign.

(1) $\{f_n\}$

(2) $|a_m - a_n|$

(3) $(x_1 y_1 + x_2 y_2)$

(4) $([\mathrm{CH}_3]_2\mathrm{CH})$

(5) $\mathrm{I}_{\mathrm{ue}}^{2''} = (\mathrm{H}'_{44} x'_{\mathrm{ve}})^{+'}$

(6) The dagger and the asterisk are used as superscripts in quantum mechanics: $A^\dagger, \left(x^\dagger\right)^\dagger = x,\ \langle\phi|\psi\rangle^* = \langle\psi|\phi\rangle$.

For further practice, see Addendum 1—Reading Practice.

Submit Exercise 6 to your instructor.

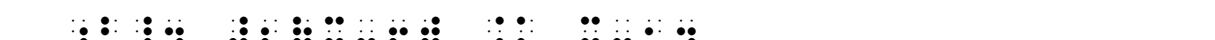
ANSWERS TO PRACTICE MATERIAL

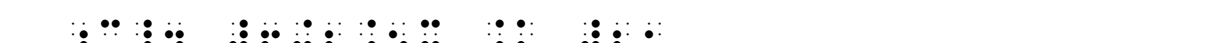
PRACTICE 6A

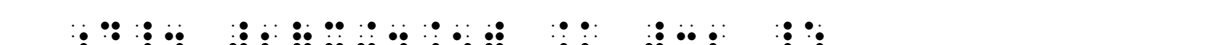
1 

2 

3 

4 

5 

6 

PRACTICE 6B

1 

2 

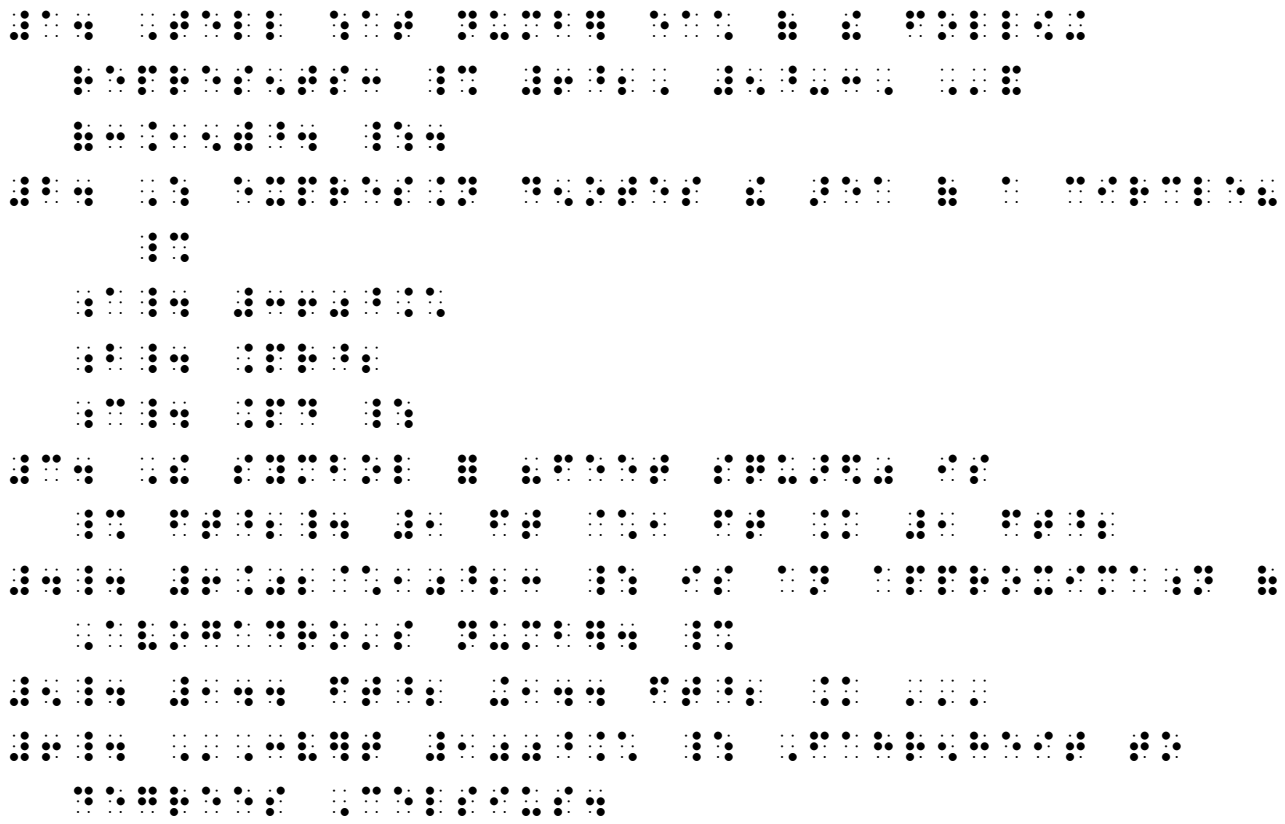
3 

4 

5 

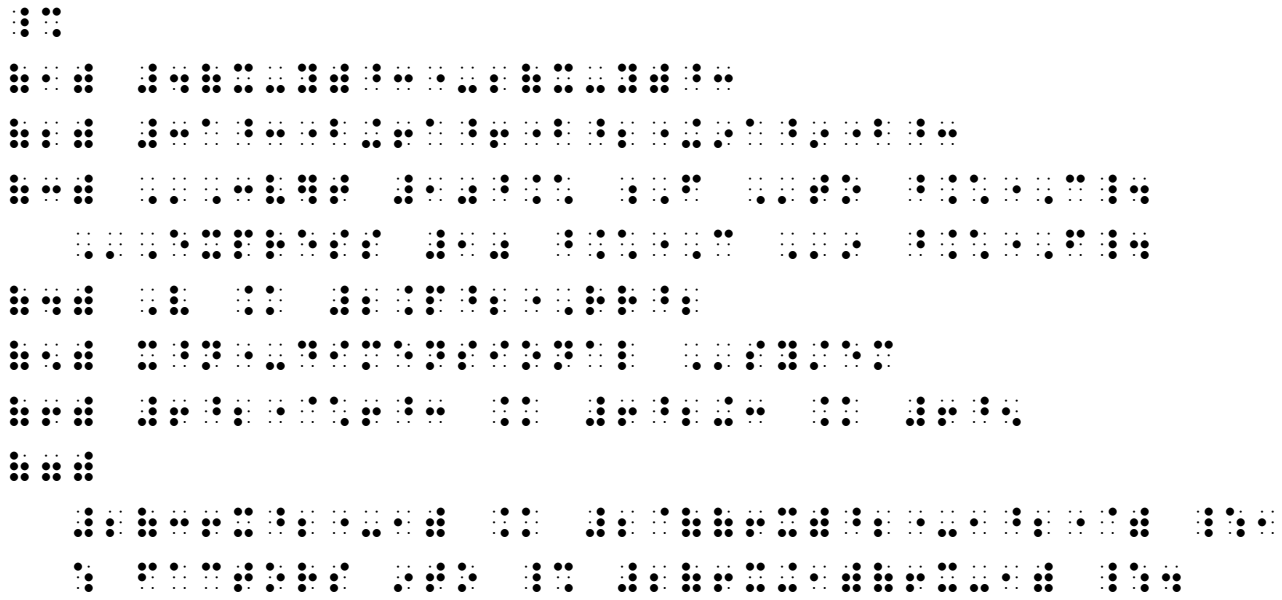
6 

PRACTICE 6C



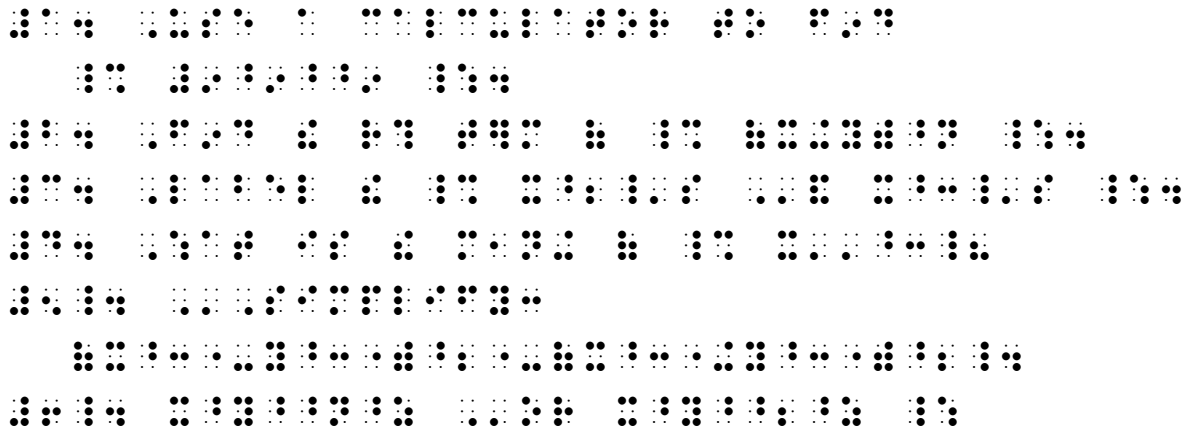
Runover margins for itemized material are determined individually for each question. Item 2 has subdivisions—its runover position (line 5) is cell 5.

PRACTICE 6D



Line 10: The equation will fit on line 9, but its related switch indicator will not. By starting the equation on line 10, in the runover position (cell 3), the equation and the Nemeth Code terminator will fit on the same line.

PRACTICE 6E



PRACTICE 6F

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PRACTICE 6G

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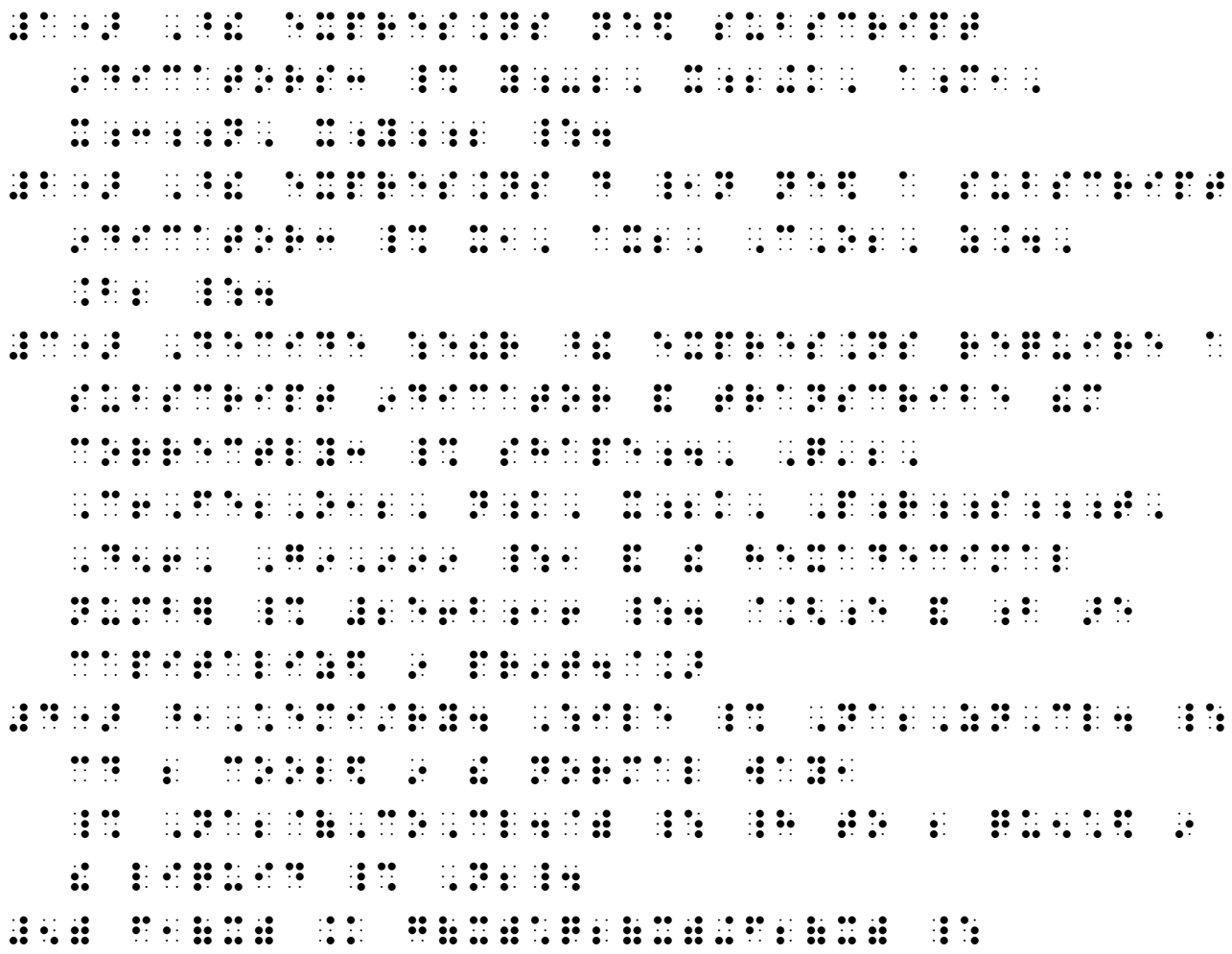
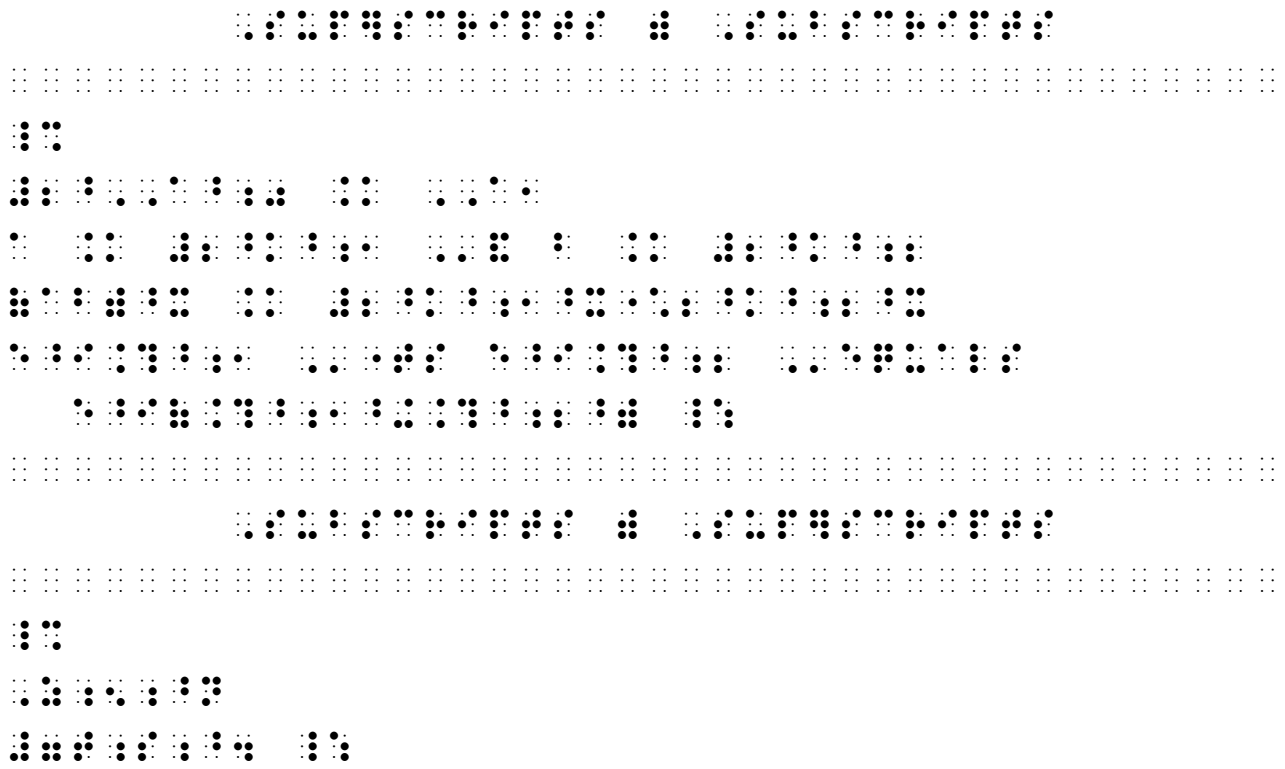
PRACTICE 6H



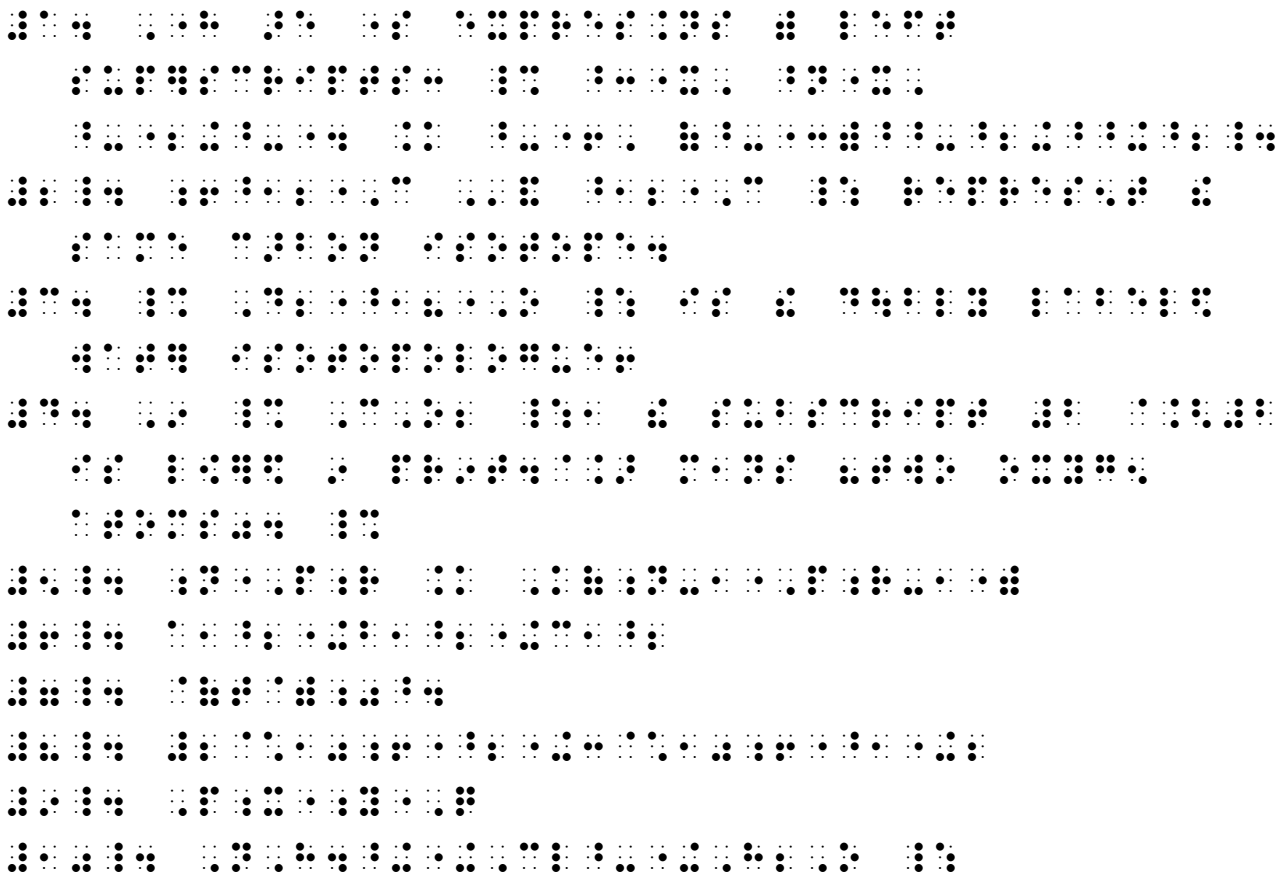
PRACTICE 6I

1. $x_{1,\,2} \neq x^{i,\,j}$
2. $x_{n-1,\,n-1}, x_{n-1,\,n}, x_{n,\,n-1}$
3. $\mathrm{A}^{\mathrm{n+n+n\ all\ n's}}$ are equal.
4. $s]_{t\,=\,a}$
5. $e^{1{,}000}$
6. $a^{m+k} \div a^{m} = a^{k}$
7. $P_{s_1 \ldots s_2}$ and $P_{q_{r,\,s}}$
8. $10_{\_?\_} = 6_8$
9. $a'_1, a'_2, \ldots, a'_n$ are the inverses.
10. $\aleph_0$ represents the cardinality of the set of all natural numbers.

PRACTICE 6J



PRACTICE 6K



PRACTICE 6L