LESSON 19

This is the final lesson but in no way is it the end of your training. As this book's title states, this is an introduction to the Nemeth braille code. In your work you will encounter symbols and usage that will require creative and consistent application of the rules. Each new assignment will present challenges. As you research answers, your understanding of the rules and guidelines will develop.

19.1 Preparing for the Certification Test

The topics addressed in this lesson are offered to help the transcriber who is preparing for the certification test. A combination of textbook format guidelines from *Braille Formats* as well as Nemeth formats are to be applied to the practice material. Students can gauge their readiness by checking their work in the Answers section. There is no exercise to turn in for this lesson.

19.2 The Nemeth Code Book

The Nemeth Braille Code For Mathematics and Science Notation should become your primary source for transcribing technical materials. Subject matter from several of the lessons in this training manual may be grouped into one section in the code book, giving new perspective and understanding of a topic or rule.

To get started, read the following "use/nonuse" sections in the Nemeth code book. Review the rules, study the examples, and follow the cross references.

	Use of	Nonuse of
Capitalization indicator	5.1	5.2
Complex fraction indicator	13.6	13.5
English-letter indicator	6.3, 10.3	6.4
Enlarged grouping symbol	19.6	19.7

	Use of	Nonuse of
Hypercomplex fraction indicator	13.8	13.7
Level indicator	14.9	14.10
Multipurpose indicator	Rule 24	24.1.b
Nemeth code	1.4.2, 4.3	1.4.1, 1.4.6, 4.3
Numeric indicator	3.3	3.4
Punctuation indicator	8.2	8.3
Simple fraction indicator	13.2	13.3
Typeform indicator	7.2, 7.3	7.4

Review situations when we do not follow print layout

Here is a sampling of situations for which the Nemeth code has specific rules regarding spacing and arrangement on the braille line. *Centering*: cancellation, spatially arranged fractions. *Spacing*: abbreviations, factors in math expressions, math symbols, functions, alignment of items in spatial arrangements. *Linage*: "keep together" rules (an abbreviation and its associated numeral or letter, abbreviated function names, hyphenated expressions, signs of shape), division of long math expressions, side-by-side arrangements (itemized, unitemized, displayed, spatial). *Margins*: formal proofs, instructions, itemized material, mathematical statements, linked expressions, paragraphing.

Revisit rules which you find to be troublesome

For example, review the various forms of fractions, the many uses of the multipurpose indicator, correct assessment of ambiguous mathematical signs, and the use of literary punctuation for words and abbreviations in mathematical context.

Back matter

Familiarize yourself with Appendix D of *The Nemeth Braille Code for Mathematics and Science Notation* which offers a useful index of braille symbols.

Review code switching guidelines

The only time Nemeth symbols and indicators may be used is within the switch indicators. Review guidelines regarding when code switching is optional and when it is required, as well as considerations concerning placement of the switch indicators in embedded material, displayed material, spatial material, and at page turns. A summary appears in Addendum 3 of this course ("Nemeth Format Summaries").

19.3 Beyond the Nemeth Code

Every aspect of the Nemeth code has been introduced in this course. Certification in this code implies that you are prepared to transcribe a textbook which contains mathematical notation. This requires knowledge of the structure of a braille textbook as well as how the Nemeth code cooperates with textbook formatting and the rules of UEB. Format guidelines which apply to the structuring of a textbook are in the BANA publication *Braille Formats: Principles of Print-to-Braille Transcription.* The transcriber should be thoroughly familiar with that resource as well as the other sources listed below. These documents are available online at www.brailleauthority.org and https://iceb.org/ueb.html. Keep up to date as newer editions or updates are posted.

The editions listed below are current at the time of this writing. The Practice answers and commentary in this lesson may become outdated when future editions of these resources become available. Please contact us at transcribers@nfb.org if you find this lesson manual is not up to date.

The Rules of Unified English Braille, Third Edition 2024

Braille Formats: Principles of Print-to-Braille Transcription 2016

The Nemeth Braille Code for Mathematics and Science Notation 2022

This course does not address topics regarding creating a tactile graphic. A thorough reading of *Guidelines and Standards for Tactile Graphics* is recommended before undertaking a technical transcription that contains diagrams. Strategies presented in this resource include 2-D and 3-D drawings, clocks (analog and digital), complex geometric shapes, counting symbols, graphs (circle graphs, bar graphs, line graphs, histograms, Cartesian graphs, pictographs, pie charts, scatter plots, line or dot plots, box-and-whisker plots), measurement tools, money, nets, number lines, orthographic drawings, spinners, tessellations, thermometers, and Venn diagrams.

This course does not address topics pertaining to chemistry notation and chemical diagrams. Refer to *Chemical Notation Using the Nemeth Braille Code* when transcribing a chemistry assignment.

Symbols, arrangements, and structures not covered in the code books are frequently encountered when preparing assignments. Many excellent materials have been shared and distributed by transcriber organizations. Professional development resources and online forums can be an excellent way to familiarize yourself with the finer points of code switching, formatting, division of expressions, and other topics for which experience is the best teacher. However, be aware that workshop materials and webinars may be outdated or may contain errors. They may contain strategies that are not supported by rules of the braille codes. For these reasons workshop materials should not be used or referenced as sources of information when preparing your certification test.

19.4 Transcriber-Generated Pages and Front Matter

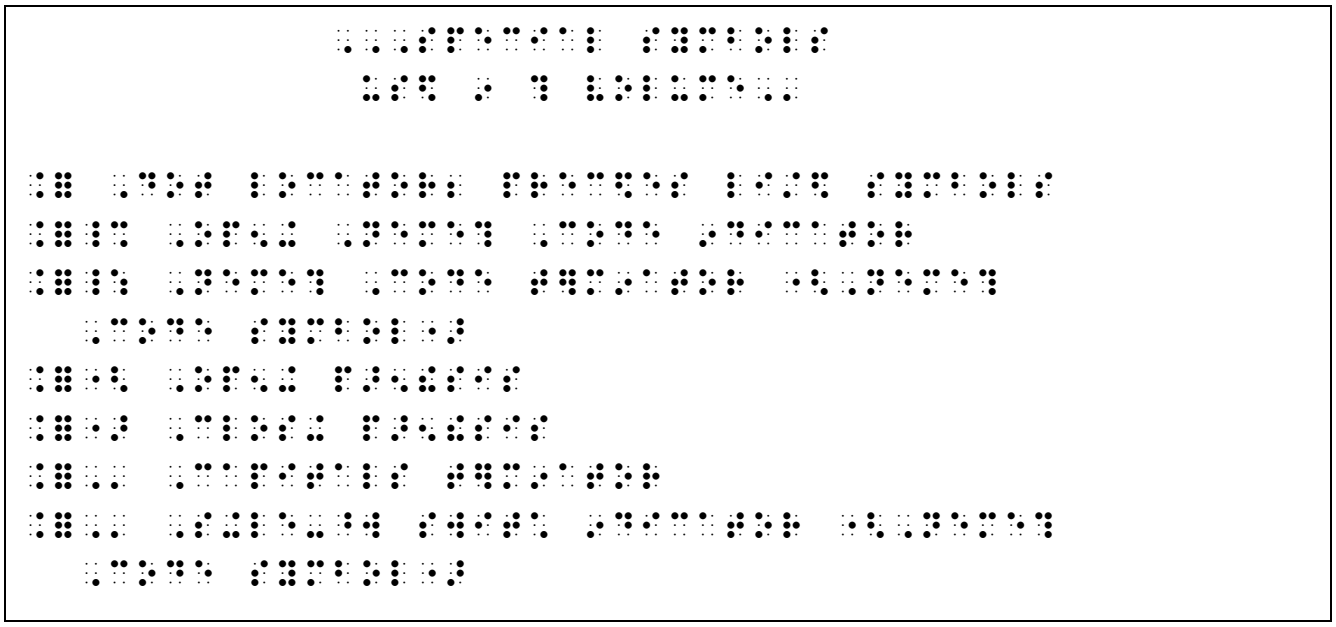
Before transcribing the first page of text, certain transcriber-generated and front matter pages are required. Review the guidelines for the transcriber-generated pages (title pages, special symbols page, and transcriber's notes page) in Section 2 of *Braille Formats*. You may also wish to review the lesson on "Braille Book Format" in the most recent edition of the *Instruction Manual for Braille Transcribing – UEB Edition.*

19.4.1 **Title Page.** Use the following statement in the Transcriber/Transcription segment: "Transcribed ___(year) into Unified English Braille with Nemeth by ___(Your Name)"

19.4.2 **Special Symbols Page.** The heading for this "t" page is SPECIAL SYMBOLS USED IN THIS VOLUME. Follow the guidelines in Appendix G of *Braille Formats* to select UEB symbols that should be included. Disregard the UEB math symbols given in that list since UEB math symbols are not used in a Nemeth transcription. List the UEB symbols that appear throughout the volume, including any that may occur on the title page.

The Nemeth code switch indicators are to be included in the list, following braille order, as explained in Section 1.1.2 of *The Rules of Unified English Braille*. The phrase "(Nemeth Code symbol)" should follow the definition of both the Nemeth Code terminator and the single-word switch indicator. Other Nemeth symbols are not listed on the Special Symbols page unless they are symbols devised by the transcriber. (See Section 18.10 in Lesson 18 regarding the special symbols used in a number line.)

Here is a model, showing a few UEB symbols as well as the three switch indicators. Additional symbols will be inserted into the model as needed in each braille volume. Note that, because the UEB capitals terminator uses the same dot configuration as the Nemeth single-word switch indicator, both definitions are listed.



19.4.3 **Transcriber's Notes Page.** The heading for this "t" page is TRANSCRIBER'S NOTES. The purpose of this page is to cite sources and to identify special formats or usage found throughout a braille volume. When Nemeth is used in a transcription, the Transcriber's Notes page should include the following note: "Mathematical content is transcribed according to *The Nemeth Braille Code for Mathematics and Science Notation 2022*." You can find items that require explanation listed throughout *Braille Formats*. In addition to those requirements, the Nemeth code identifies the following as items which require explanation either at the point in the transcription where they appear or on the Transcriber's Notes page:

- Use of capitalized letters in the print copy for digits in nondecimal bases
- Use of alternative forms of Greek letters in the print copy
- Omission of vector arrows which appear in the print copy
- Description of the shapes used in print to depict calculator or computer keys
- When identifiers to labeled displayed expressions are moved to the left in the braille edition
- Changing the column format of a formal proof to an itemized list in the braille edition
- Placement of author's remarks and conditions
- Cite *Guidelines and Standards for Tactile Graphics 2022* when a number line occurs in the volume

PRACTICE 19A

Instructions: Prepare transcriber-generated pages and one contents page according to the guidelines in Section 2 of *Braille Formats*. Do not use a running head.

Title Page: Use the following information to prepare a title page.

- Book title: *ADVENTURES IN Y2K MATHEMATICS*
- Book subtitle: *Math in the New Millennium*
- Authors: Monica and Matías Cruz
- Publisher information: Math4You Publications, Inc., Antelope Valley, CA, www.M4YPub.edu
- Copyright information: ©2018 by M&M Publishers
- ISBN: 9-6230-99228x
- Transcriber segment: Use your name, your city, and your state
- Volume Information segment: Assume this is the second volume of a three-volume transcription. The braille page designation is "t1-t3, p1, and 1-120" and the print page designation is "v and 87-a123"

Special Symbols Page: A list of UEB symbols to be included on the Special Symbols page can be found in Appendix G of *Braille Formats.* Except for the capitals terminator mentioned in Section 19.4.2, do not include items from the "may be included" list. List the symbols which appear in all of the Practices in this lesson, as well as symbols from your title page: acute accent (on the title page); end of proof icon; Nemeth code switch indicators; opening and closing parentheses; typeform indicators for boldface passage, boldface terminator, boldface word, italic passage, italic terminator, italic word, underlined passage, and underlined terminator. Arrange the symbols in braille order as explained in Section 1.1.2 of *The Rules of Unified English Braille.* To get started with your Special Symbols page, use the model on page 19–4 of this lesson.

Transcriber's Notes Page: In addition to the required statement citing the use of the Nemeth code, write a description of the change made to the column format of the formal proof which appears in Practice 19E.

Front Matter: Include a transcription of the contents page shown below.

19.5 Body of Text

The entire transcription follows a collaborative pattern between *Braille Formats* and the formats provided in the Nemeth braille code. When a format is specified in the Nemeth code, those rules are applied not only to the technical material but also to the UEB material.

19.5.1 **Follow Nemeth Formatting Rules.** The following matters are governed by Nemeth format and apply both to the technical material and to UEB portions of text.

- Paragraph margins: Blocked paragraphing is not allowed. (A continued paragraph may appear to be blocked. Review Section 7.1.4 in Lesson 7.)
- Margins of itemized material and their subparagraphs follow Nemeth rules.
- Runover margins for itemized material are determined individually for each item. That is, a problem with no subdivisions will be (1-3); the next problem in the same exercise set may have subdivisions and so will be (1-5; 3-5), etc. (Review Section 6.1.4 in Lesson 6.)
- Instructions preceding itemized material begin in cell 5 and run over in cell 3. “Directions” which are not followed by itemized material are formatted as a regular paragraph.
- "Keep together" rules apply to hyphenated expressions and to abbreviations and the numeral or letter associated with it.
- Mathematical statements: Nemeth rules apply regarding paragraphing, blank lines, and typeface.
- Special rules apply to margins of displayed math (Lesson 7), identifiers printed to the right of a displayed math expression (7.2.2), a formal proof (12.16), and instructional commentary (16.11 and 17.10.5).

19.5.2 **Follow Braille Formats Guidelines.** Items which are not addressed in the Nemeth code rely on *Braille Formats* for positioning. Some items governed by *Braille Formats* include:

- Content and structure of the transcriber-generated pages and front matter
- Page numbering
- Headings
- Blank lines
- Box lines
- Displayed literary text
- Pagination of exercise sets
- Nested list format for nontechnical text (e.g., table of contents)
- Margins for captions, notes, sidebars, and transcriber’s notes
- Table layout

19.5.3 Context-Dependent Formats

These formats occur only in Nemeth context.

- Margins for displayed mathematical expressions
- Division of mathematical expressions
- Blank lines with spatial arrangements

In tables, these items follow Nemeth formatting between the switches and follow *Braille Formats* outside of the switches.

- Omissions in table entries
- Keying
- Tables consisting only of numbers

Final Word

Thank you for making the extra effort to learn the Nemeth braille code. We hope you have noticed your transcribing and proofreading skills improve over the course of the lessons. Information regarding how to apply for the certification test can be found on the NFB website: https://nfb.org/programs-services/braille-certification/mathematics-braille-transcribing or by asking your grader.

As you take on assignments, check the NFB website periodically for errata to this lesson manual and check the BANA website for updates to the braille codes. We also encourage you to take advantage of opportunities to stay informed and connected to other transcribers. The National Braille Association (NBA) publishes a quarterly Bulletin and hosts several learning opportunities—an online forum "Ask An Expert", monthly webinars, and professional development conferences. Local groups offer similar support, for example, the California Transcribers and Educators for the Blind and Visually Impaired (CTEBVI), and the Visual Aid Volunteers of Florida (VAVF). The American Printing House (APH) offers many helpful videos and products for transcribers, teachers, and braille users, as well as links to other organizations that can give you different perspectives on the topic of UEB with Nemeth.

We wish you success and satisfaction providing much-needed mathematics and science materials for braille readers.

This course concludes with four practices which are characteristic of K-12 grade level topics.

FOUR PRACTICES

Instructions: Use a 40-cell line and a 25-line page. Do not use a running head. Show print and braille page numbers on every page. Use the number shown in the upper right corner as the print page number. (Disregard the running page number at the bottom of each print page.) A dashed line in print shows where a new print page begins.

Begin numbering with braille page 1, showing the book title at the top of the page as required according to *Braille Formats*.

Begin each Practice on a new braille page, but within each Practice do not force a new braille page unless a rule supports doing so. Do not include the PRACTICE headings in your transcription.

Even though the print page numbers of the Practices are not consecutive, number the braille pages consecutively throughout the four Practices.

Practice 19E: Because you included the statement about the proof format on the Transcriber's Notes page in Practice 19A, you do not need to repeat the note here.

Please revisit Section 19.3 regarding the editions of UEB and *Braille Formats* used in the transcription of these Practice answers.

PRACTICE 19B

ADVENTURES IN Y2K MATHEMATICS 1

ADDING AND SUBTRACTING

53	14	33	98	2	456
+36	+44	+21	+1	+2	+13
4	23	71	33	150	9
+84	+32	+1	−22	−40	−6
826	55	77	420	95	93
−16	−2	−27	+519	−62	+6

ADVENTURES IN Y2K MATHEMATICS 2

COMPARING FRACTIONS

Directions: Write the correct comparison symbol (>, <, or =) in each box.

1) $\frac{1}{6} \square \frac{3}{4}$ 2) $\frac{1}{2} \square \frac{3}{6}$ 3) $\frac{2}{4} \square \frac{1}{3}$

4) $\frac{2}{5} \square \frac{2}{3}$ 5) $\frac{9}{10} \square \frac{4}{5}$ 6) $\frac{1}{6} \square \frac{2}{12}$

PRACTICE 19C

Exercise Set 18-6

1. **Home Economics** The cost of using a 60-watt light bulb is given by the function $y = 0.0036x$. The cost is in dollars, and x represents the number of hours the bulb is lit.
   a. How much does it cost to use a 60-watt light bulb 8 hours a day for a week?
   b. If the total cost of using a 60-watt bulb is \$1.98, for how many hours can it be used?
2. **What's the Question?** The following set of points defines a function: $\{(3, 6), (-4, 1), (5, -5), (9, -6), (10, -2), (-2, 10)\}$. If the answer is 6, 1, -5, -6, -2, and 10, what is the question?
3. **Physics** Ohm's law can be described by the simple formula

   $$\mathrm{I} = \frac{\mathrm{V}}{\mathrm{R}}$$

   where I = current (in amps, A), V = voltage (in volts, V), and R = resistance (in ohms, Ω). Which equation would you use to solve for voltage?
   a. $\mathrm{V} = \mathrm{I}/\mathrm{R}$
   b. $\mathrm{V} = \mathrm{IR}$
   c. $\mathrm{V} = \mathrm{R}/\mathrm{I}$

ADDING, SUBTRACTING, MULTIPLYING, AND DIVIDING INTEGERS

Find the sum, product, or quotient as indicated by the signs $+, \times, \div$.

1) $-6 + -5 =$ ____
2) $-2 \times -1 =$ ____
3) $35 \div -5 =$ ____
4) $5 + -19 =$ ____
5) $-24 \div 4 =$ ____
6) $-132 \div -11 =$ ____
7) $9 \times 9 \times -5 =$ ____

PRACTICE 19D

UNIT 6 REVIEW

Fill in the correct answers.

1. If $7n = 0$, then $n =$ ____.
2. Replace the ☐ with a numeral to make a true sentence: $(4 + 8) + ☐ = 4 + (8 + 3)$.
3. $\left(\frac{1}{3} + \frac{5}{6}\right) - \frac{5}{12} = ?$
4. $5 \times 5 \times 5 = 5^{?}$

Study the equivalencies.

5. To find the mixed-number name for $\frac{154}{9}$, divide 9 into 154.

$$\begin{array}{r} 17\ \text{R}1 \\ 9\overline{)154} \\ \underline{9} \\ 64 \\ \underline{63} \\ 1 \end{array}$$

$$\frac{154}{9} = 17\frac{1}{7}$$

6. Multiply $4\frac{2}{3}$ by $\frac{3}{14}$. $4\frac{2}{3} = \frac{12+2}{3} = \frac{14}{3}$.

$$\frac{14}{3} \times \frac{3}{14} = 1$$

PRACTICE 19D, continued

Review these topics.

7. If $R = \{a, b, c, d\}$ and $S = \{a, c, e, g, h\}$, then the intersection of sets R and S is $\{a, c\}$.
8. Only the following pairs of Roman numeral symbols may occur out of the natural order: I before V or X, X before L or C, C before D or M. For example, XL = L−X = 50−10 = 40.
9. Use the distributive property to multiply 14 by 3.

$$\begin{aligned} 3 \cdot 14 &= 3\,(10 + 4) \\ &= 3 \cdot 10 + 3 \cdot 4 \\ &= 30 + 12 = 42 \end{aligned}$$

10. "$24_{(\text{five})}$" is read "two four, base five."
11. A gain of 5 yd followed by a loss of 2 yd gives a total gain of 3 yd. Expressed mathematically, $(^{+}5) + (^{-}2) = {}^{+}3$.

Explain the relationships.

12. $\overline{AB}$ is congruent to $\overline{DE}$.
13. $\overline{RS} \approx \overline{EF}$; $\overline{RS} \neq \overline{LK}$.
14. $\overrightarrow{DA} \cup \overrightarrow{DB} = \overleftrightarrow{AB}$
15. $\frac{7}{\cancel{12}\,6} \times \frac{\overset{11}{\cancel{22}}}{5} = \frac{77}{30}$

Simplify each radical expression.

16. $\sqrt[4]{x} \cdot \sqrt{x}$ 17. $\sqrt[5]{\sqrt[3]{a^2}}$ 18. $\frac{\sqrt{36x}}{\sqrt[3]{8x^2}}$

PRACTICE 19E

THEOREM The sum of the angles in a triangle is 180 degrees.

Given: △ABC

Prove: $\angle a + \angle b + \angle c = 180°$

STATEMENT	REASON
1. Let BD be a line through B parallel to AC.	1. Parallel postulate.
2. $\angle a = \angle d$.	2. Corresponding angles are equal.
3. $\angle b = \angle b$.	3. Identity.
4. $\angle c = \angle e$.	4. Alternate-interior angles are equal.
5. $\angle a + \angle b + \angle c = \angle d + \angle b + \angle e$.	5. Sum of equal quantities are equal.
6. $\angle d + \angle b + \angle c = 180°$.	6. A straight angle equals 180°.
7. $\therefore \angle a + \angle b + \angle c = 180°$.	7. Quantities equal to the same quantity are equal to each other. ■

Use $\pi/12 = \pi/3 - \pi/4$ and the identity for the tangent of a difference to solve $\tan\left(\frac{\pi}{12}\right)$.

$$\tan\left(\frac{\pi}{12}\right) = \tan\left(\frac{\pi}{3} - \frac{\pi}{4}\right) = \frac{\tan\frac{\pi}{3} - \tan\frac{\pi}{4}}{1 + \tan\frac{\pi}{3} - \tan\frac{\pi}{4}} = \frac{\sqrt{3} - 1}{1 + \sqrt{3} \cdot 1} = \frac{\left(\sqrt{3} - 1\right)\left(\sqrt{3} - 1\right)}{\left(\sqrt{3} + 1\right)\left(\sqrt{3} - 1\right)} =$$

$$\frac{3 - 2\sqrt{3} + 1}{2} = \frac{4 - 2\sqrt{3}}{2} = 2 - \sqrt{3}$$

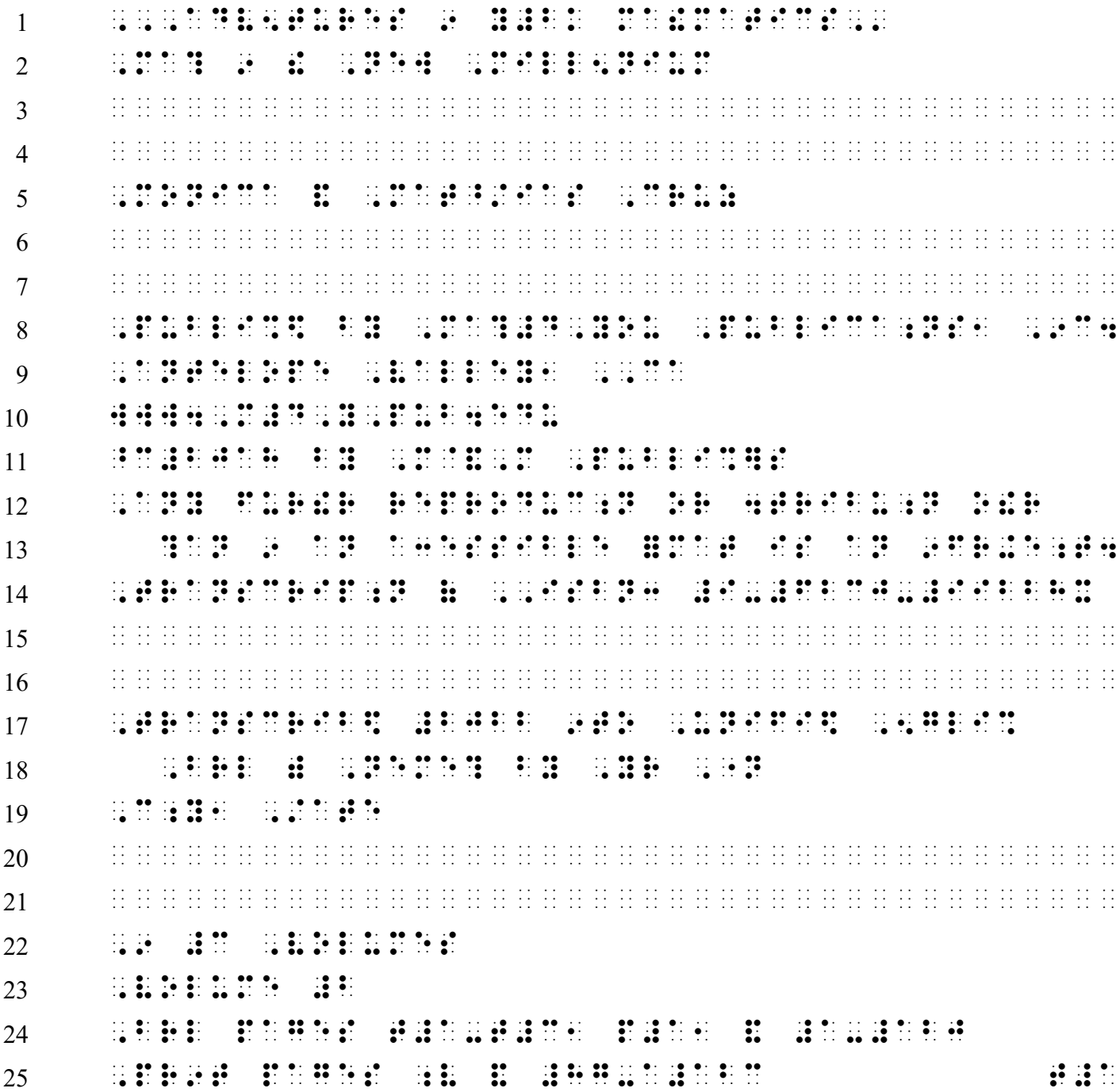
The answer is $\tan\left(\frac{\pi}{12}\right) = 2 - \sqrt{3}$.

ANSWERS TO PRACTICE MATERIAL

Answers observe guidelines in the 2016 edition of *Braille Formats*. See the resource list on page 19–3.

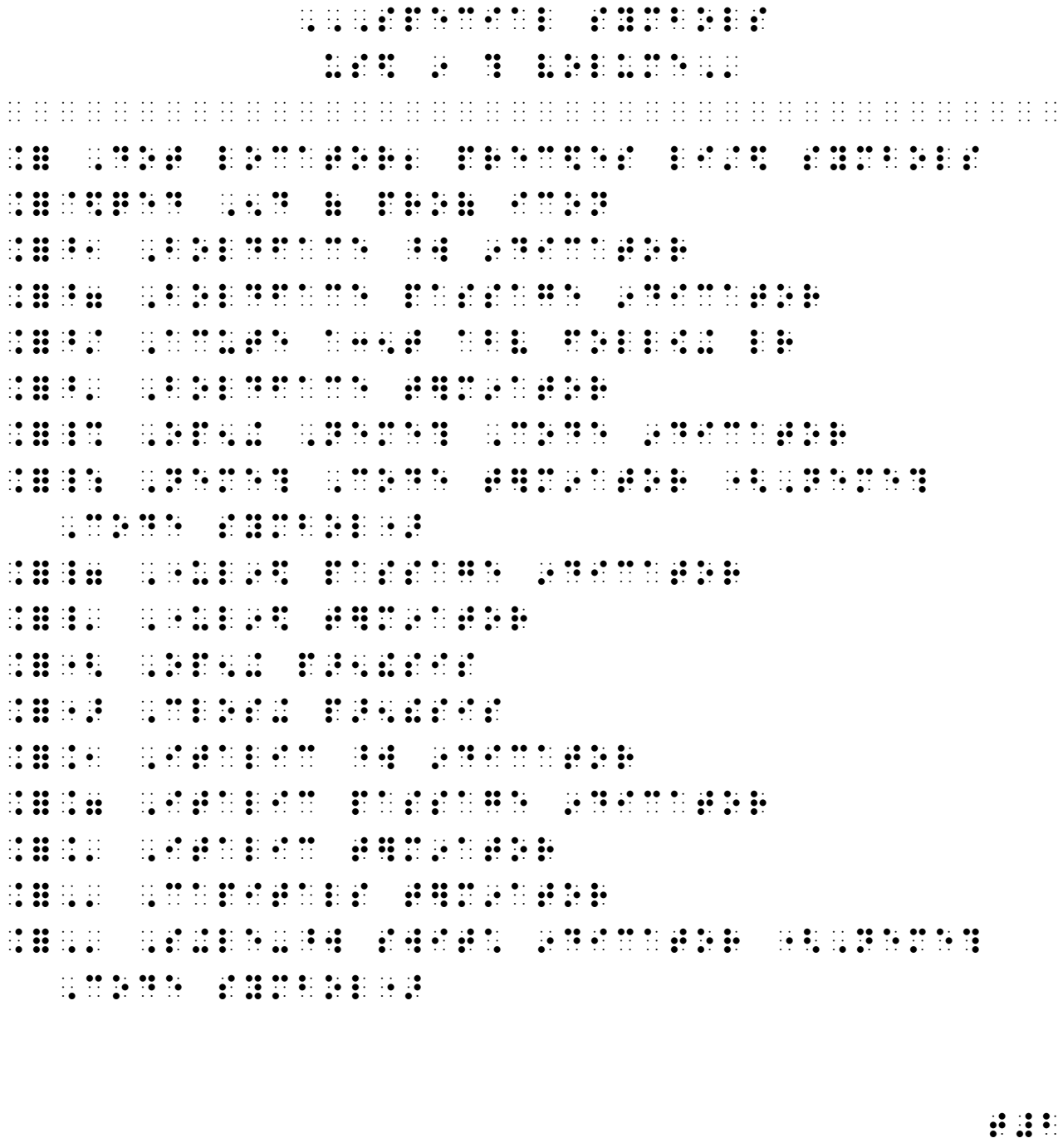
PRACTICE 19A

Title Page



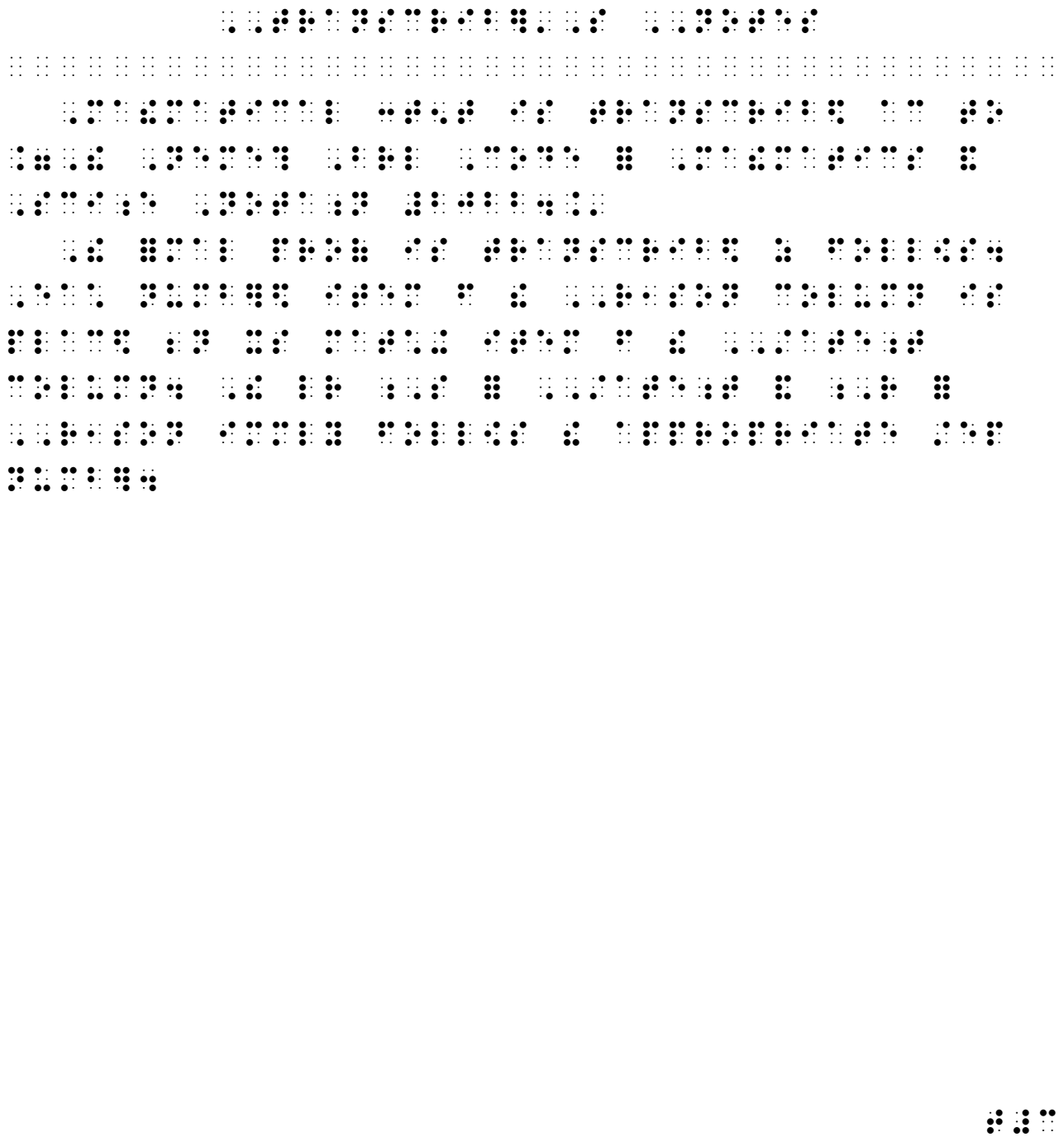
PRACTICE 19A, cont.

Special Symbols Page



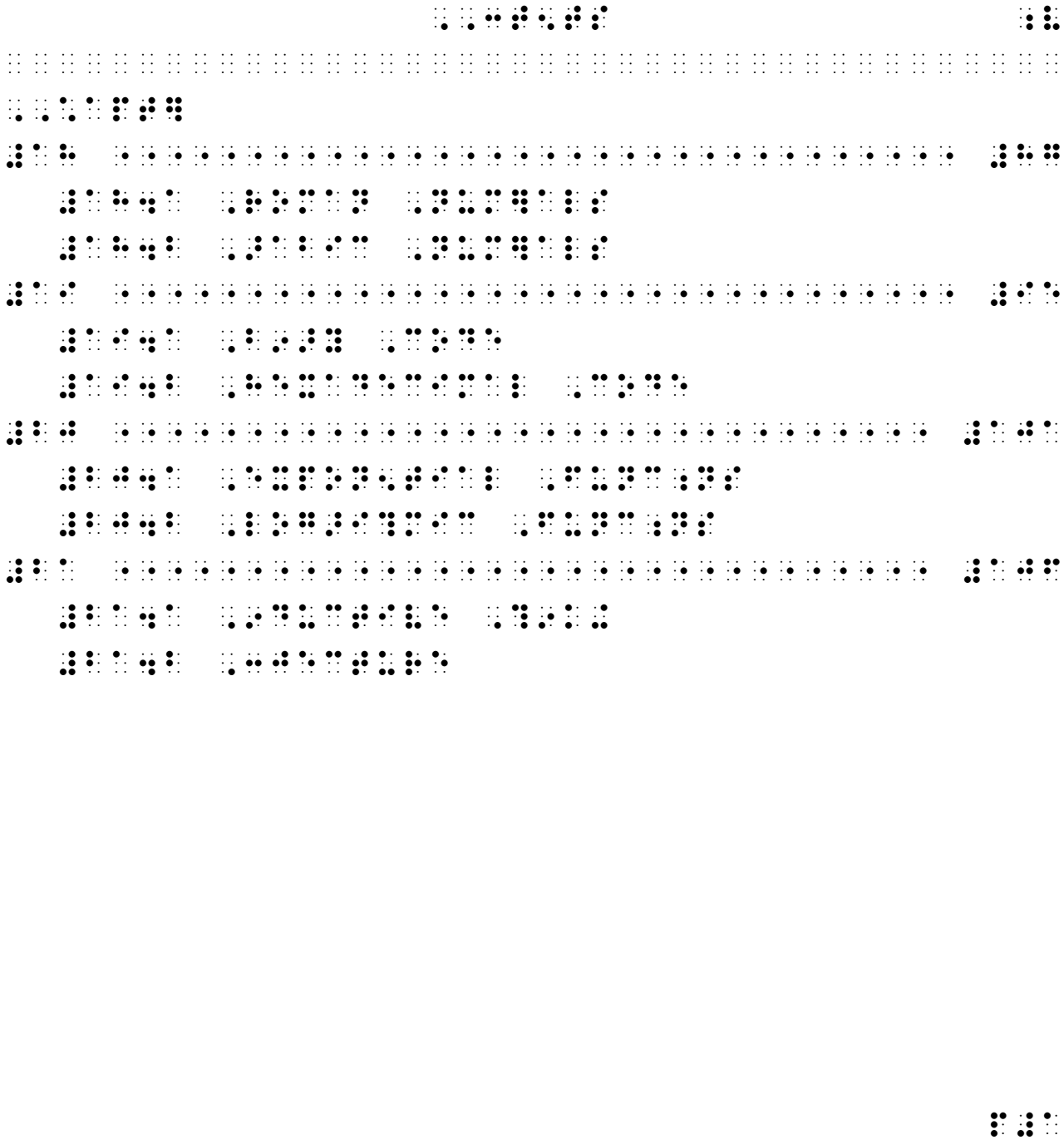
PRACTICE 19A, cont.

Transcriber's Notes Page



PRACTICE 19A, cont.

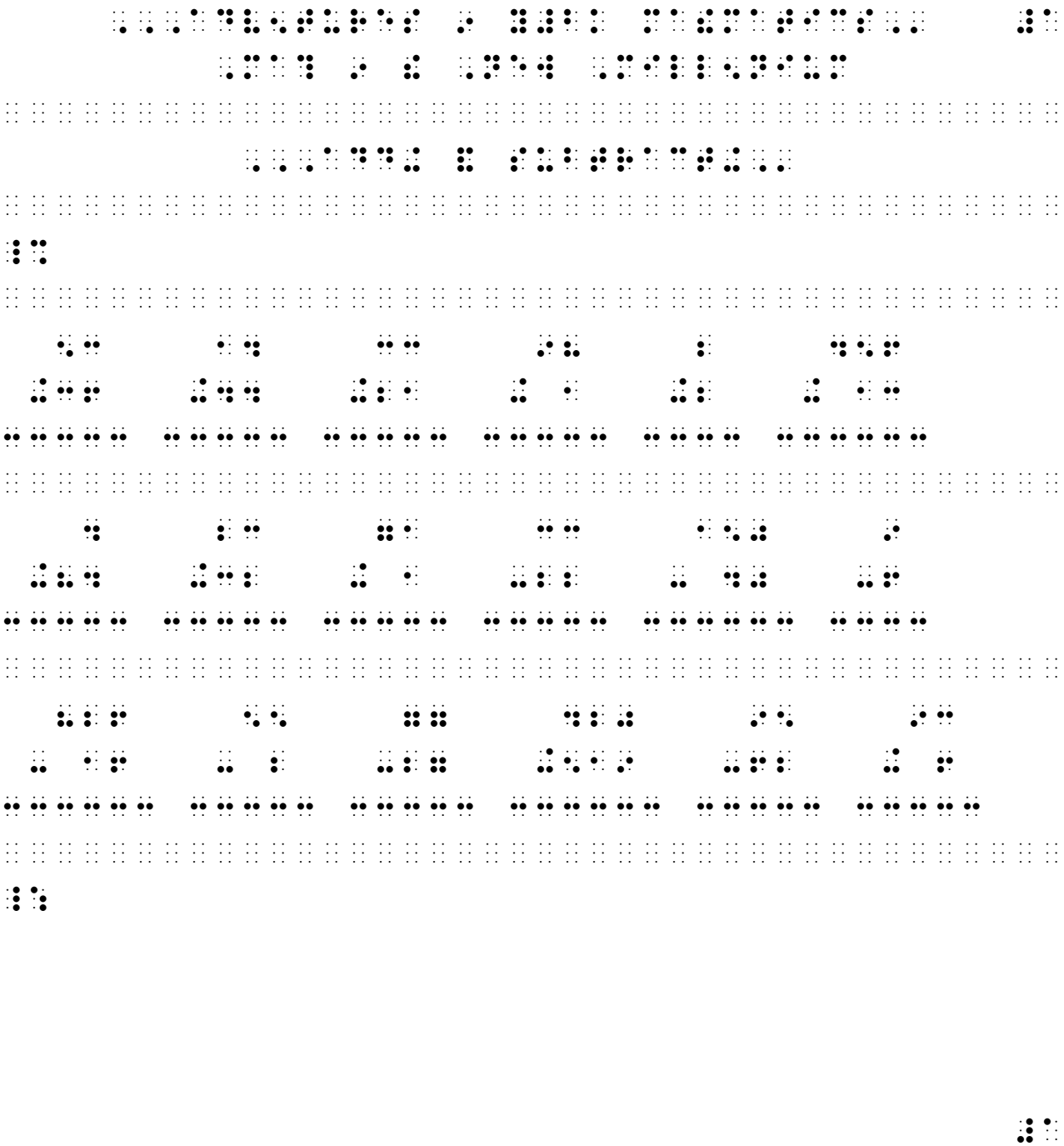
Contents Page



Line 1: Instructions for this page say to assume this is the second volume of a transcription. Implied page numbers i-iv are transcribed in Volume 1 only. See Section 2.7.1 of *Braille Formats*.

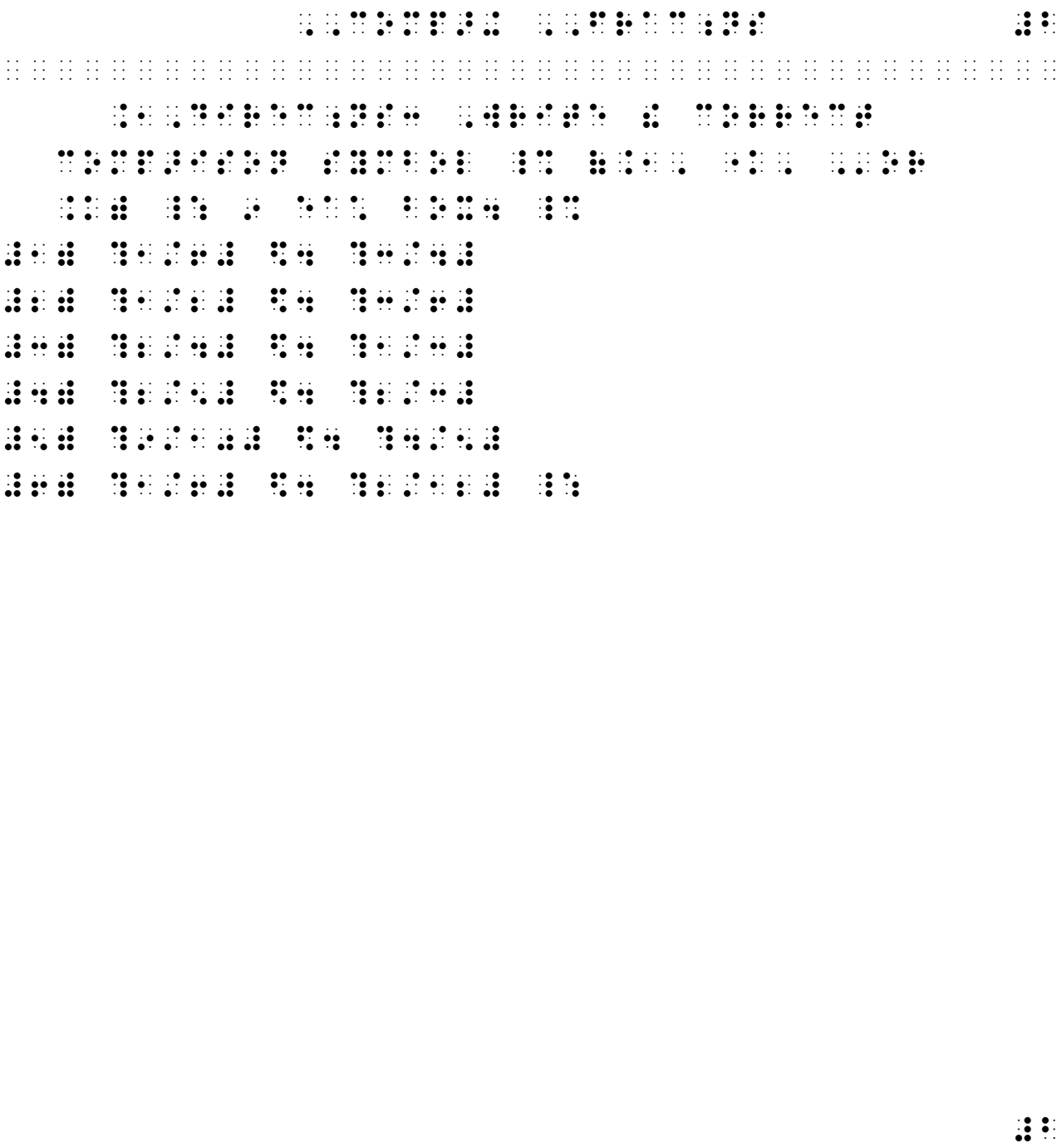
PRACTICE 19B

Braille Page 1



Format Comment: The switch indicators do not take the place of required blank lines. A blank line precedes and follows the centered heading; a blank line precedes and follows the spatial material.

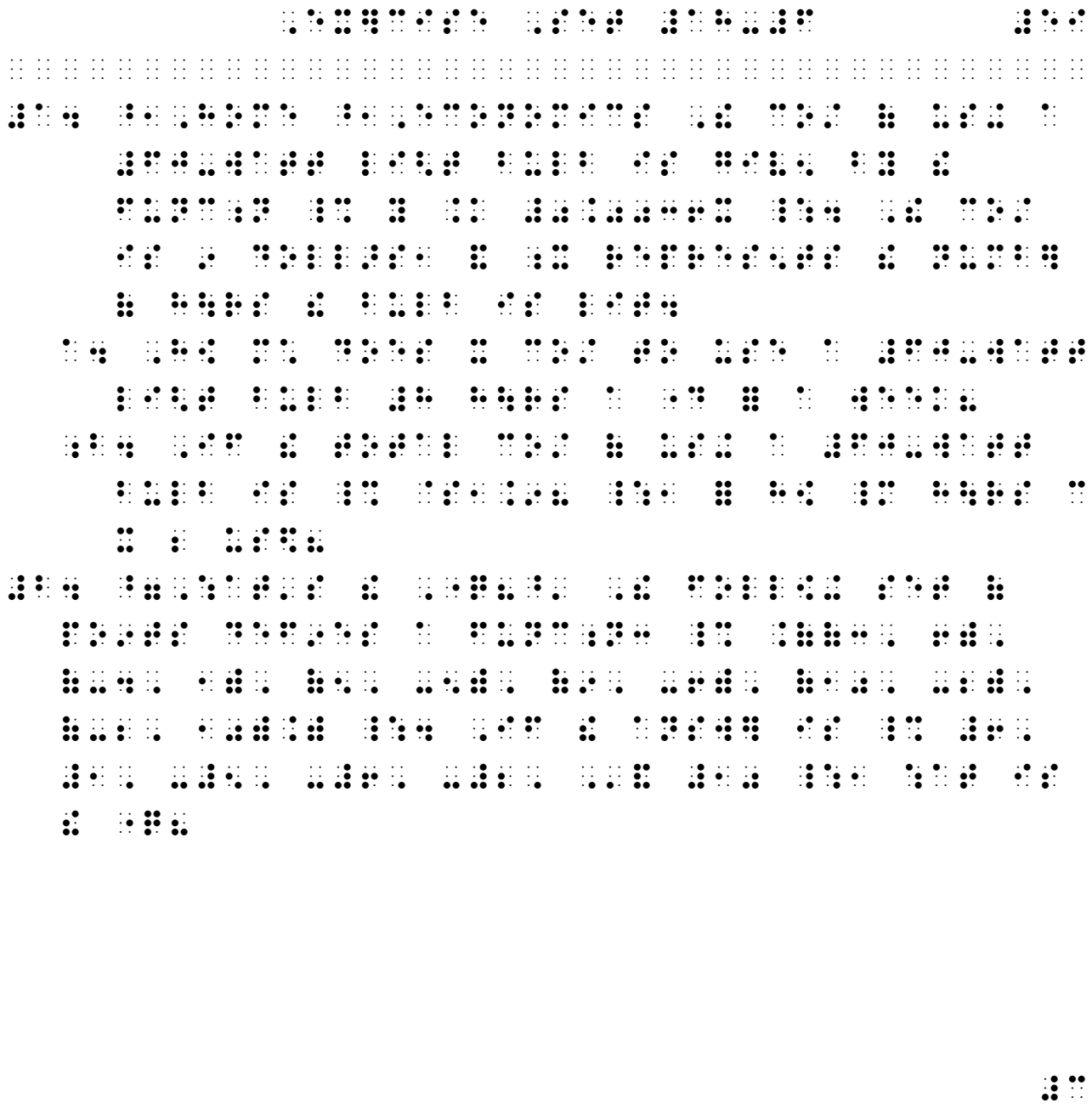
PRACTICE 19B, cont.



Lines 4-5: The embedded comparison symbols need not all be situated on the same line because this is not a mathematical "enclosed list".

Lines 6-11: Side-by-side arrangement of nonspatial itemized material is not allowed in the braille transcription. Each identifier starts in cell 1. (Nemeth format rule.)

PRACTICE 19C



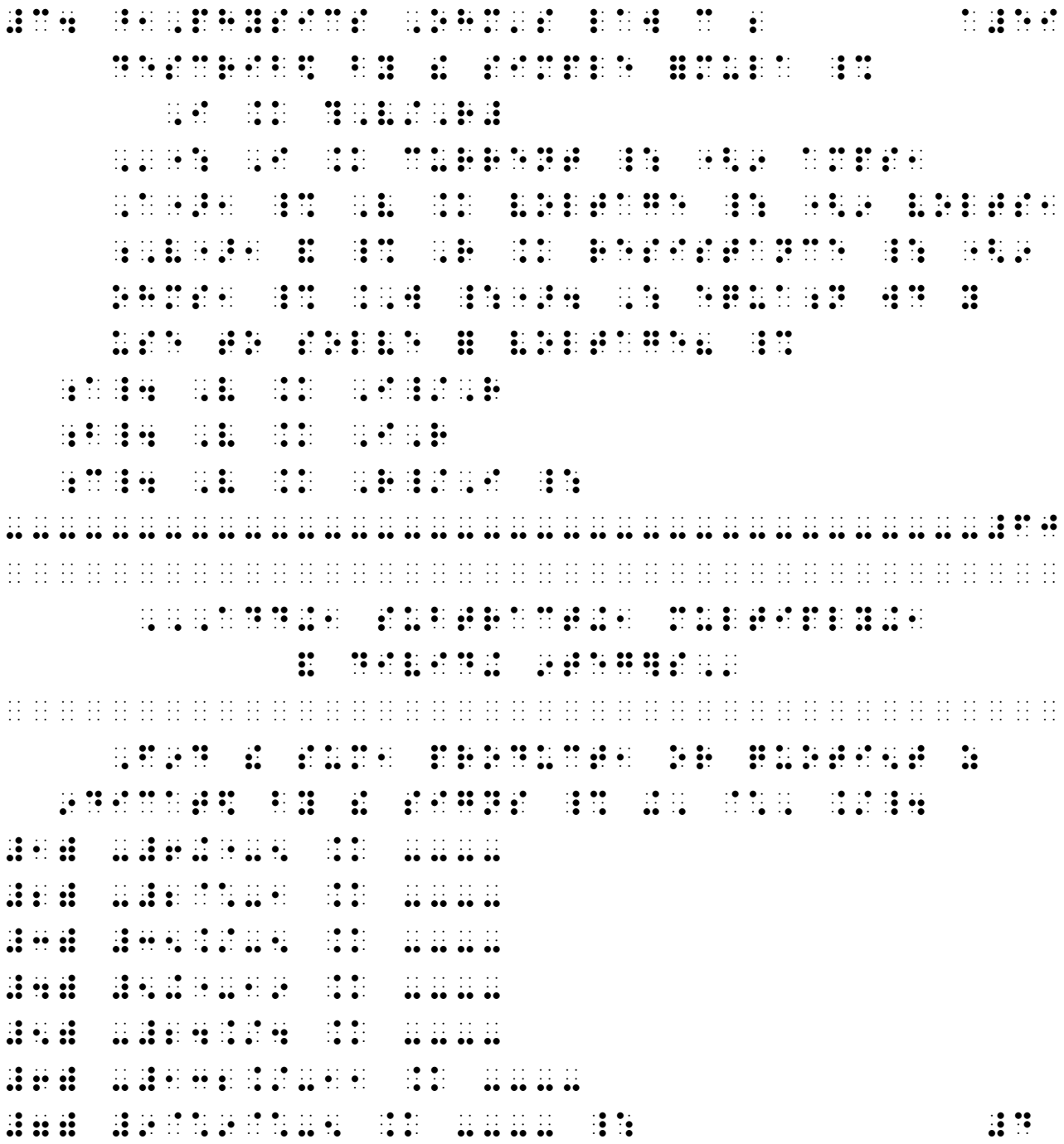
Line 1: The heading could be formatted as a cell-5 heading, in which case line 2 would not be blank. (*Braille Formats* guideline.)

Lines 14-18: Runover margins for itemized material are determined individually for each question. Problem #2 has no subdivisions, so its runovers are in cell 3. (Nemeth format rule.)

Lines 16-17: Alternate transcription: The freestanding numbers without negative signs may be transcribed in UEB, switching to Nemeth only for the three negative numbers.

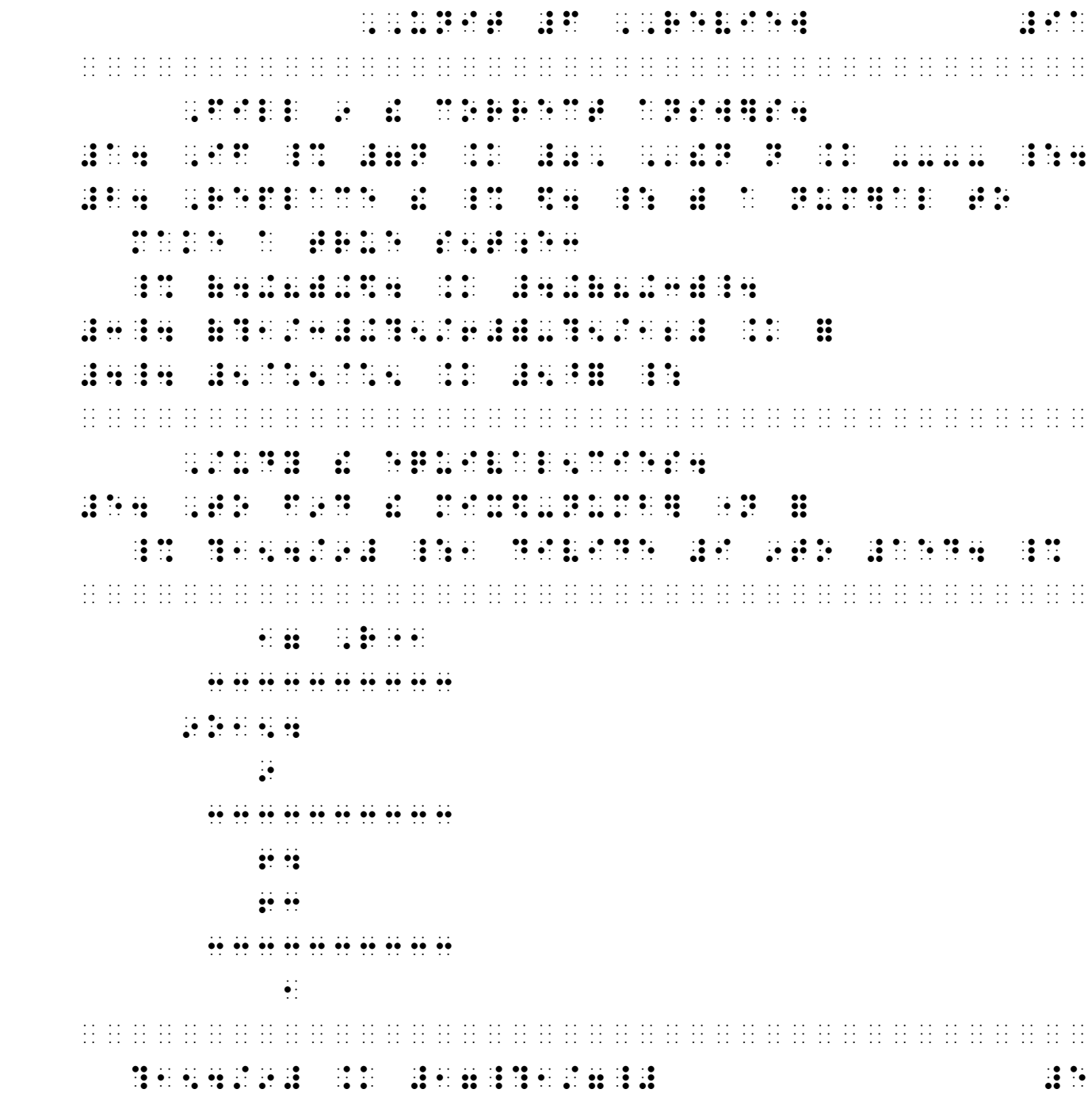
Lines 19-25: Because item 3 is a question with answer choices, it is pushed ahead to the next page in order to comply with *Braille Formats* Section 10.1.7.a which states "Question and answer choices should appear on a single page whenever space permits, regardless of the amount of blank space resulting on a page."

PRACTICE 19C, cont.



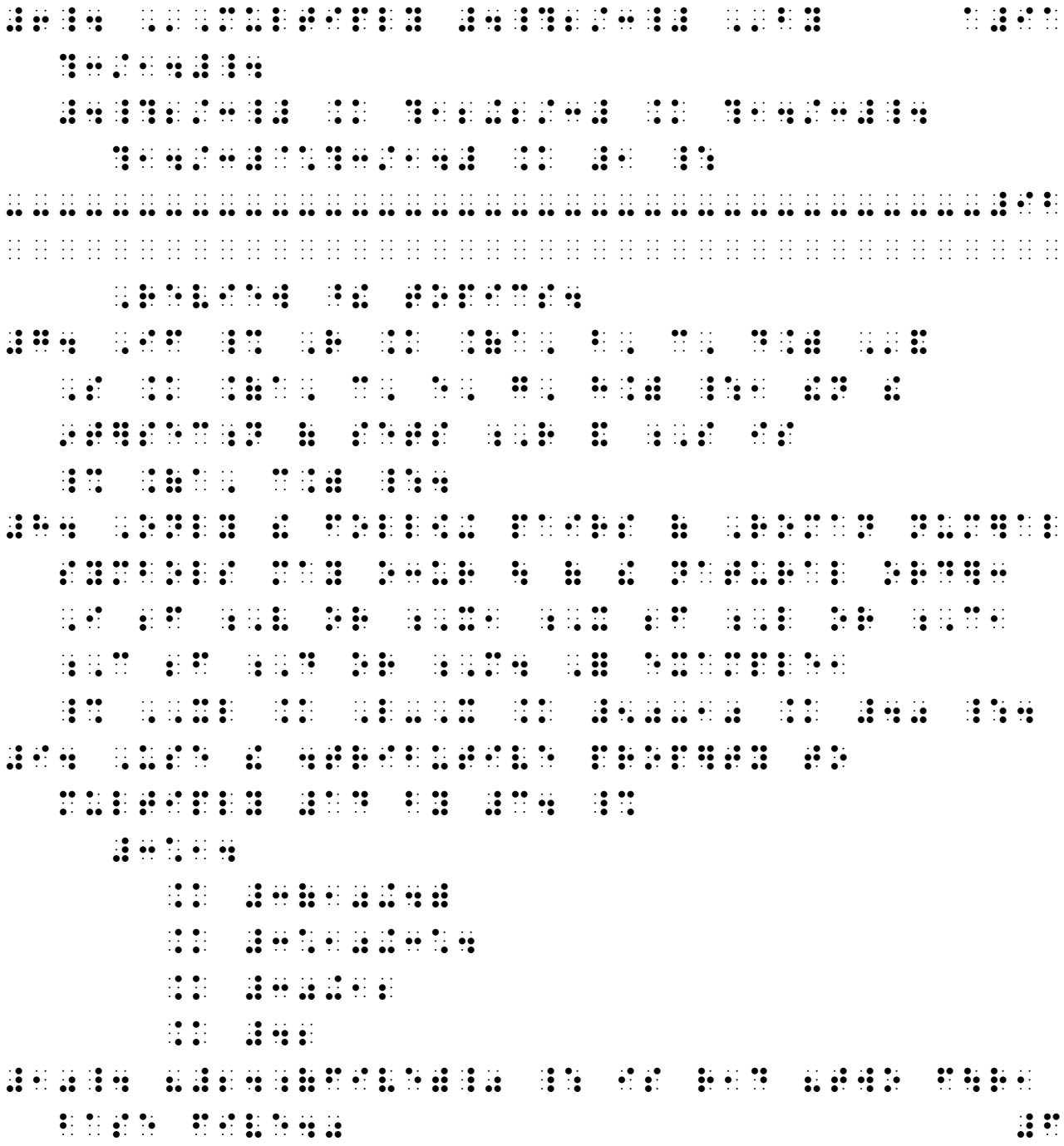
Line 2: The opening switch is placed at the end of the text on the line before the displayed expression because Nemeth continues on line 4.
Lines 19-25: Side-by-side arrangement of nonspatial itemized material is not allowed in the braille transcription. Each identifier starts in cell 1. (Nemeth format rule.)
Lines 19 and 22: A multipurpose indicator between plus and minus (negative) avoids misreading of these side-by-side operation symbols. (Section 5.2 in Lesson 5.)

PRACTICE 19D



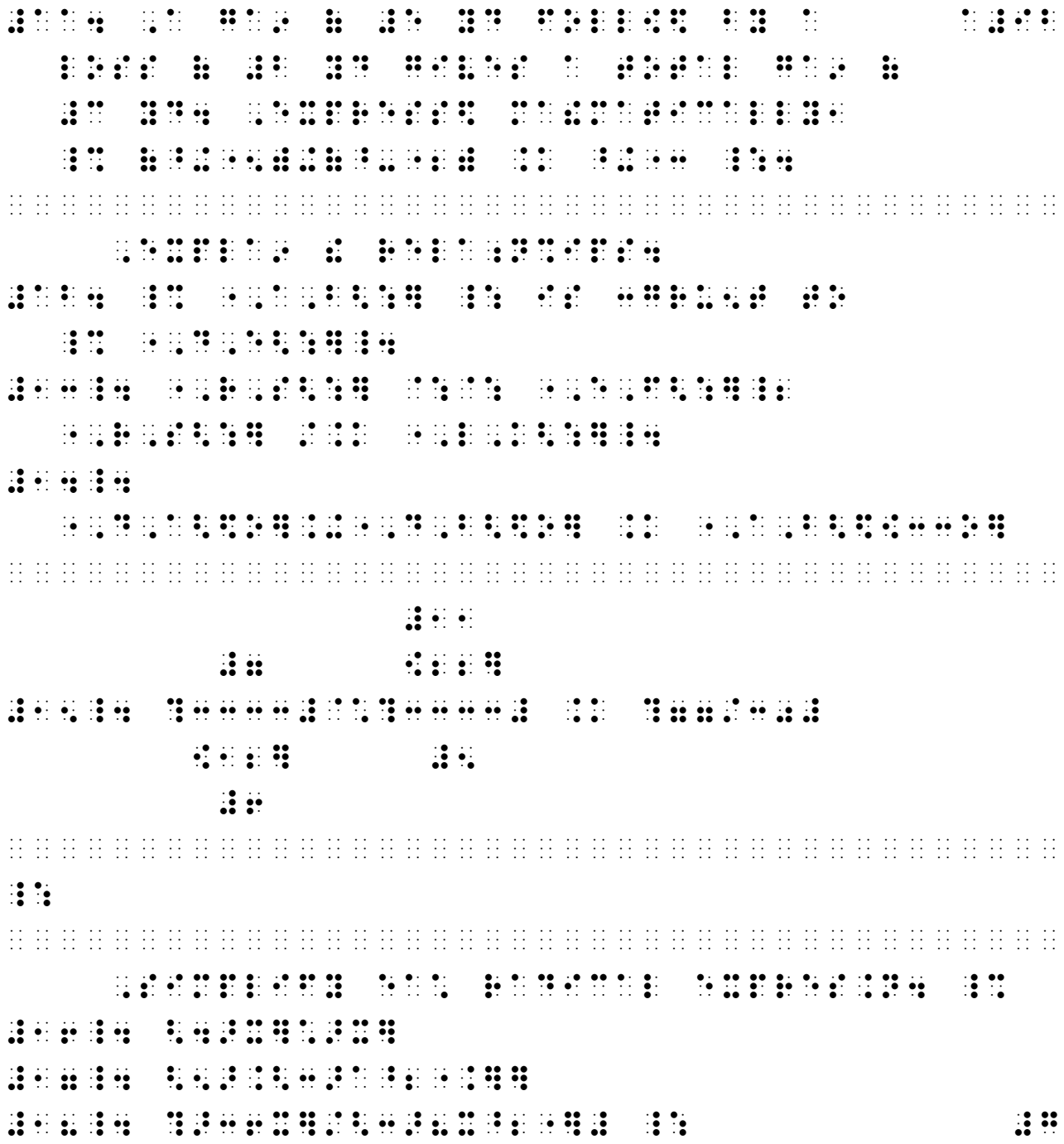
Line 7: In embedded format the opening switch is placed on the same line as the math.
Line 17: The leftmost cell of the spatial arrangement is placed in the appropriate display cell (cell 5).
Line 25: The linear portion continues in the runover cell of item 5 (cell 3).
Line 25: There is no need to switch out of Nemeth for the UEB braille page number.

PRACTICE 19D, cont.

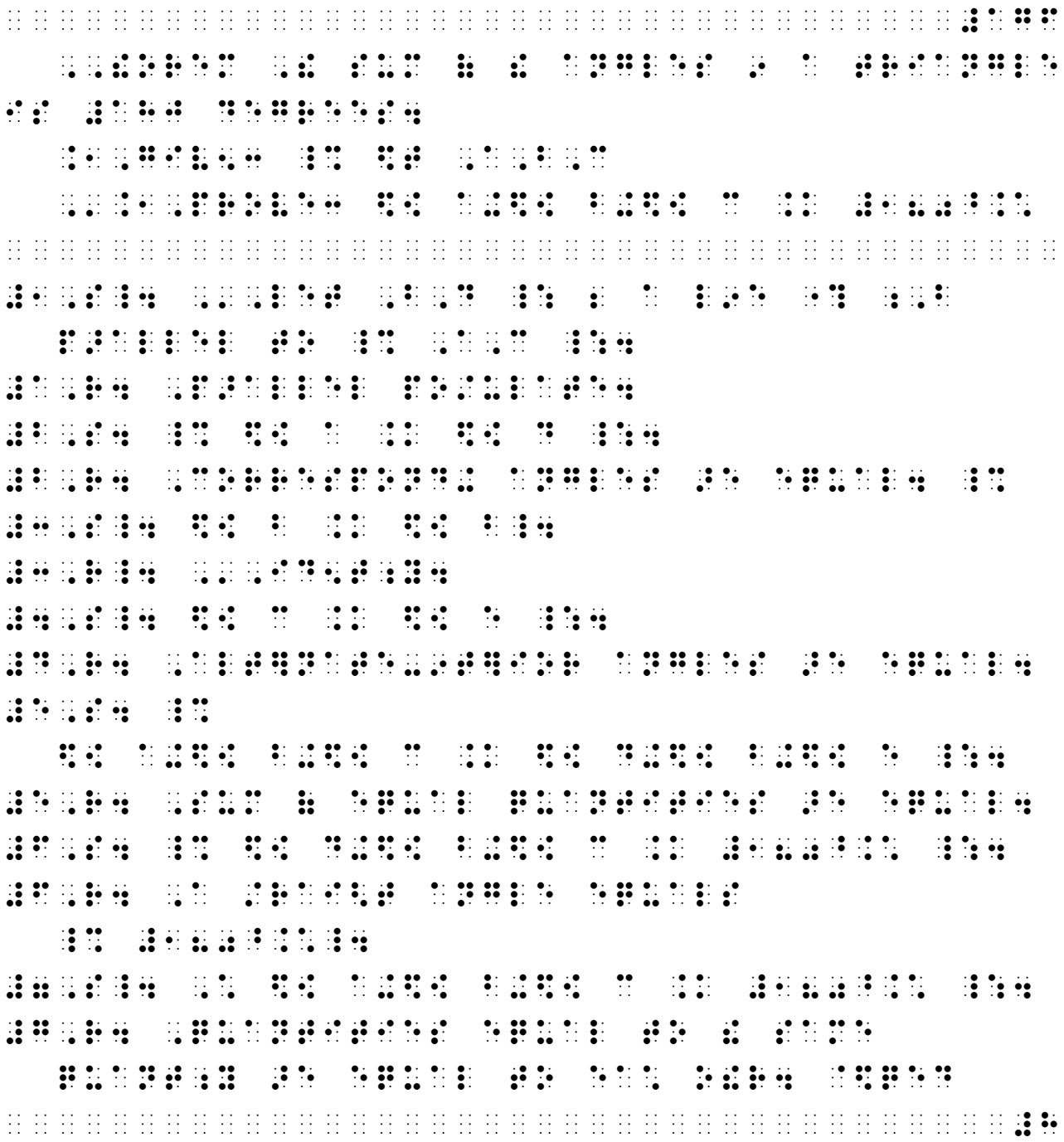


Lines 11 and 16: In embedded format the opening switch is placed on the same line as the math.
Lines 20-23: Each link begins on a new line in nested linked expression format.

PRACTICE 19D, cont.

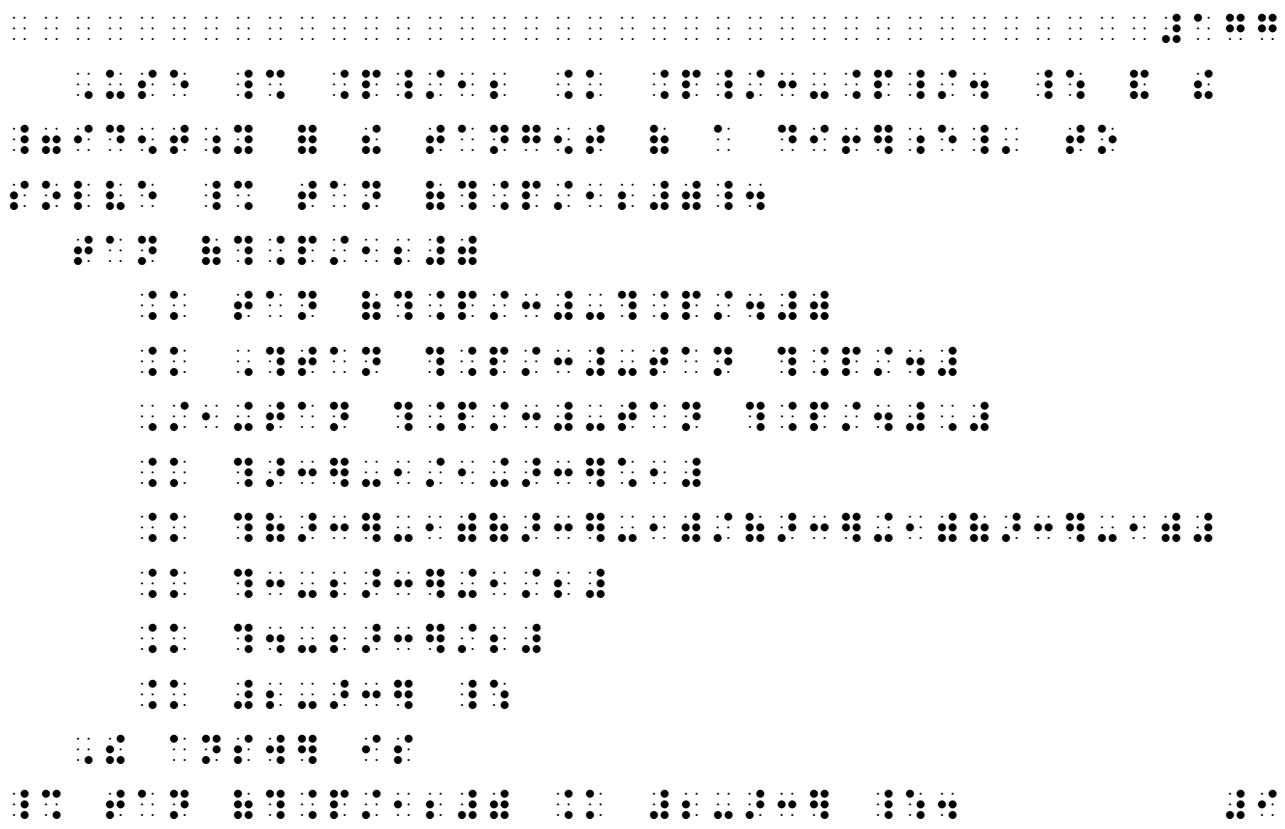


PRACTICE 19E



Line 1: In this course, we do not allow a mathematical statement to start on line 1. (See Section 11.38.a in Lesson 11.)
Line 25: The line following the end of the proof is blank.

PRACTICE 19E, cont.



Line 1 is blank because a list (itemized material) ends on line 24 of the previous page. (*Braille Formats* 1.18.)

Line 5: The displayed expression begins in cell 3.

Lines 6-13: This is not a nested linked expression, but because one of the links requires division, each link must begin on a new line. Cell 5 is the runover position.

Line 8: The divided link begins with the main fraction line. It is not indented further because, in print, the signs of comparison are not vertically aligned.