AN INTRODUCTION TO BRAILLE MATHEMATICS USING UEB WITH NEMETH
A Course for Transcribers

LESSON 11

- SIGNS OF SHAPE
    - Basic Shapes
    - Shapes with Structural Modification
    - Shapes with Interior Modification
    - Other Details
    - Identified Signs of Shape
    - Shapes Used as Signs of Omission
    - Calculators and Keyboards
    - Icons
- TYPEFORM INDICATORS FOR MATHEMATICAL WORDS AND PHRASES
    - One Word in Italics or Boldface
    - A Phrase in Italics or Boldface

Format

- Mathematical Statements

Answers to Practice Material

LESSON PREVIEW

Signs of shape are studied in depth, including icons and calculator keys. The study of typeform in Nemeth continues with the study of emphasized words in mathematical context. Format guidelines are given for consistent transcription of mathematical statements.

SIGNS OF SHAPE

[NC Rule 17]

11.1 Definition

A sign of shape is a miniature picture of a geometric figure or an object.

△ (triangle) ∠ (angle) ○ (circle)

Basic Shapes

[NC 17.1]

A basic shape is represented by the shape indicator followed by a numeral, one or more letters, or a dot combination suggestive of the shape.

⠫	Shape Indicator

11.2 Basic Signs of Shape Represented by Numbers—Regular Polygons

A closed figure that has equal sides and equal angles is called a regular polygon and is represented by the shape indicator followed by a numeral specifying the number of sides in the figure.

⠫⠲	Square (4-sided)	□
⠫⠢	Regular Pentagon (5-sided)	⬠
⠫⠖	Regular Hexagon (6-sided)	⬡

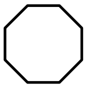
Note that the equilateral triangle, which is a regular polygon, is not represented by the number three. See Section 11.4.

11.2.1 **Unlisted Regular Polygons.** Symbols which represent regular polygons with seven or more sides are not provided for in the Nemeth Code. If the unlisted shape is a *regular polygon*—that is, it is a closed figure with equal sides and equal angles—the transcriber is instructed to devise a symbol in accordance with the principles stated in this section, based on the number of sides the shape has. It may be helpful to include a tactile drawing of the shape. Unlisted regular polygon constructions do not require a transcriber's note.

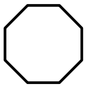
Refer to *Guidelines and Standards for Tactile Graphics* regarding shapes used in kindergarten through third grade materials such as counting symbols, pictographs, etc.

Example 11-1

An octopus has eight tentacles. What do you expect this figure is called?



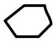
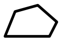
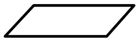
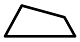
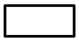
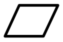
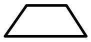
⠠⠁⠝ ⠕⠉⠞⠕⠏⠥⠎ ⠓⠁⠎ ⠑⠊⠣⠞ ⠞⠢⠞⠁⠉⠇⠑⠎⠲ ⠠⠱⠁⠞ ⠙
⠽ ⠑⠭⠏⠑⠉⠞ ⠹ ⠋⠊⠛⠥⠗⠑ ⠊⠎ ⠉⠁⠇⠇⠫⠦ ⠸⠩ ⠫⠦ ⠸⠱



In addition to the transcriber-devised symbol, the shape is presented as a tactile graphic at the first mention of the figure. The graphic's left margin is cell 1, according to Guidelines and Standards for Tactile Graphics. *Follow that BANA document for drawing techniques.*

11.3 Basic Signs of Shape Represented by Letters—Irregular Polygons

A closed figure which has at least two unequal sides and/or two unequal angles is called an *irregular polygon* and is represented by the shape indicator followed by a letter or a combination of letters suggestive of the name of the shape. (The derivation of the letter following the shape indicator is underlined in this list.)

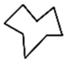
⠫⠙	Diamond	
⠫⠓⠭	Irregular Hexagon	
⠫⠏⠛	Irregular Pentagon	
⠫⠛	Parallelogram	
⠫⠟	Quadrilateral	
⠫⠗	Rectangle	
⠫⠓	Rhombus	
⠫⠵	Trapezoid	

11.3.1 **Unlisted Irregular Polygons.** You may come across a shape which is not provided for in the Nemeth Code. If the unlisted shape is an irregular polygon—that is, it is a closed figure with at least two unequal sides and/or two unequal angles—the transcriber is instructed to devise a symbol if it appears frequently in the transcription. Construct the symbol in accordance with the principles stated in this section. Be careful not to choose a letter or letter combination which already has an assigned meaning in the Nemeth Code. Refer to Appendix D of *The Nemeth Braille Code for Mathematics and Science Notation* for a list of symbols already in use. (Find the section for symbols beginning with dots 1246.)

A transcriber's note is required to define the figure unless it is described in the narrative. In your note, give the name or description of the symbol used. Include a drawing of the shape when appropriate. Sample transcriber's note:

The irregular 8-sided figure is drawn below.

Example 11-2

The irregular 8-sided figure  appears frequently in this chapter.

```
  ⠠⠮ ⠊⠗⠗⠑⠛⠥⠇⠜ ⠼⠓⠤⠎⠊⠙⠫ ⠋⠊⠛⠥⠗⠑ ⠸⠩ ⠫⠕⠉ ⠸⠱
⠁⠏⠏⠑⠜⠎ ⠋⠗⠑⠟⠥⠢⠞⠇⠽ ⠔ ⠹ ⠡⠁⠏⠞⠻⠲
      ⠈⠨⠣⠠⠮ ⠊⠗⠗⠑⠛⠥⠇⠜ ⠼⠓⠤⠎⠊⠙⠫ ⠋⠊⠛⠥⠗⠑ ⠊⠎
    ⠙⠗⠁⠺⠝ ⠆⠇⠲⠈⠨⠜
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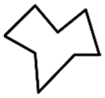


A raised outline of the shape is included as a tactile graphic at the first mention of the figure. Follow directives in Guidelines and Standards for Tactile Graphics.

11.4 Other Basic Signs of Shape Represented by Letters

The following shapes are also represented by the shape indicator followed by a letter suggestive of the name. (The derivation of the letter following the shape indicator is underlined.)

⠫⠉	Circle	○
⠫⠑	Ellipse	⬭
⠫⠊	Intersecting Lines	╳
⠫⠎	Star	☆
⠫⠞	Triangle	△

Clarification: The triangle shape shown here is an equilateral or equiangular triangle – sides are equal in length; angles are equal in measurement. The symbol ⠫⠞ is used to represent a triangle shape when the print copy uses the drawing to replace the word "triangle" or when it is used to specifically represent an equilateral/equiangular triangle. See Section 11.8 for other types of triangles.

Note: Do not mistake an uppercase Greek delta for a triangle shape. (See Lesson 4.)

The following shapes were introduced in Lesson 5 as signs of comparison. They may also be used in print to simply replace the word they represent. Notice that two signs in this category begin with the negation symbol (dots 34) immediately followed by the shape indicator.

⠫⠁	Arc, Concave Upward	$\frown$
⠫⠇	Is Parallel To	$\parallel$
⠌⠫⠇	Is Not Parallel To	$\nparallel$
⠫⠏	Is Perpendicular To	$\perp$
⠌⠫⠏	Is Not Perpendicular To	$\not\perp$

Example 11-3

Line AD $\nparallel$ Line BC.

⠸⠩ ⠠⠇⠊⠝⠑ ⠠⠁⠠⠙ ⠌⠫⠇ ⠠⠇⠊⠝⠑ ⠠⠃⠠⠉ ⠸⠱⠲

The word "Line" is a part of the math statement and so is transcribed inside of the switches, without contractions.

11.4.1 **Other Unlisted Basic Shapes.** Basic shapes not provided for in the Nemeth Code are formed in accordance with the principles stated in this section. One must be careful not to choose a symbol which already has an assigned meaning in the Nemeth Code. Refer to Appendix D of *The Nemeth Braille Code for Mathematics and Science Notation* for a list of symbols already in use. (Find the section for symbols beginning with dots 1246 and for symbols beginning with dots 34.)

A transcriber's note is required to define the figure. Include a drawing of the shape if it is vital to the mathematical topic at hand. Sample transcriber's note:

> In the following problem, ⠫⠓⠗ represents the shape of a heart.

Example 11-4

VALENTINE MATH Replace the heart with the correct math symbol: 14 ♡ 2 = 7.

⠈⠨⠣⠠⠔ ⠮ ⠋⠕⠇⠇⠪⠬ ⠏⠗⠕⠃⠇⠑⠍⠂ ⠸⠩ ⠫⠓⠗ ⠸⠱
⠗⠑⠏⠗⠑⠎⠢⠞⠎ ⠮ ⠩⠁⠏⠑ ⠷ ⠁ ⠓⠑⠜⠞⠲⠈⠨⠜
⠠⠠⠧⠁⠇⠢⠞⠔⠑ ⠠⠠⠍⠁⠹ ⠠⠗⠑⠏⠇⠁⠉⠑ ⠮ ⠓⠑⠜⠞ ⠾ ⠮
⠉⠕⠗⠗⠑⠉⠞ ⠍⠁⠹ ⠎⠽⠍⠃⠕⠇⠒ ⠸⠩ ⠼⠂⠲⠫⠓⠗⠆ ⠨⠅ ⠼⠶ ⠸⠱⠲

The transcriber represents the heart shape with ⠫⠓⠗ since ⠫⠓ means "rhombus".

11.5 Basic Signs of Shape Represented by Other Dot Combinations

Three additional shapes are identified in the Nemeth Code.

⠫⠪	Angle	∠
⠫⠄	Arc, Concave Downward	⌣
⠨⠫	Inverted Triangle	▽

Note: Do not mistake a nabla symbol for an inverted triangle shape. (See Lesson 13.)

11.6 Filled-In and Shaded Shapes

A filled-in or shaded closed shape (circle, diamond, square, etc.) is represented as such by the filled-in shape indicator or the shaded shape indicator. The indicator is placed between the shape indicator and the shape symbol.

⠸	Filled-in shape indicator
⠨	Shaded shape indicator

⫸ ★ ⠫⠸⠎ (filled-in star)

⫸ ◍ ⠫⠨⠉ (shaded circle)

⫸ ■ ⠫⠸⠲ (filled-in square)

Similar to decisions regarding significant and insignificant typeform, shaded or filled-in shapes need only be indicated when there is significance to the different color, texture, etc. The black square which is often used to indicate the end of a long example or exercise is transcribed as a filled-in square, for distinction.

Example 11-5

Complete the pattern. ◍ ● ○ ◬ ▲ ____

⠠⠉⠕⠍⠏⠇⠑⠞⠑ ⠮ ⠏⠁⠞⠞⠻⠝⠲

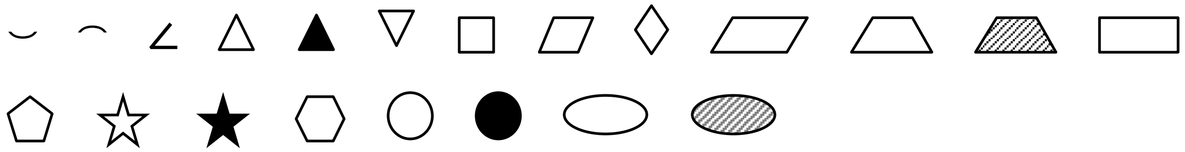
⠸⠩ ⠫⠨⠉ ⠫⠸⠉ ⠫⠉ ⠫⠨⠞ ⠫⠸⠞ ⠤⠤⠤⠤ ⠸⠱

a. *Exceptions*: A filled-in square or rectangle used to indicate the end of a mathematical proof has its own special symbol. Proofs will be discussed in Lesson 12. Shapes used as icons are discussed later in this lesson. See Section 11.35.

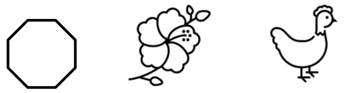
Instructions: Format the topic headings as cell-5 headings. Format each series of shapes as one paragraph, placing each opening Nemeth Code indicator at the beginning of each paragraph. Leave one space between each shape. Place as many shapes on one braille line that will fit before beginning a new line. Following the second topic heading, write a transcriber's note defining the flower and chicken shapes. Use "fl" to represent the flower and "ch" to represent the chicken.

PRACTICE 11A

Listed Shapes



Unlisted Shapes



Shapes with Structural Modification

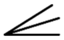
[NC 17.5]

11.7 Definition and Construction

A shape with structural modification is one in which the general print form of a basic shape (such as *triangle*) is changed to show a more specific form (such as *right triangle*).

Basic shape: △ Triangle
More specific form: ◺ Right Triangle

Composite signs in which two or more signs of shape are combined are also structurally modified shapes, for example, two *angle* shapes in print combine to form the symbol for *adjacent angles*.

Basic shape: ∠ Angle
More specific form:  Adjacent Angles

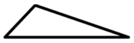
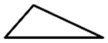
A shape with structural modification is represented by

- the basic shape symbol,
- followed by the structural shape-modification indicator,
- followed by a letter or an uncontracted combination of letters suggestive of the change in the shape,
- ending with the termination indicator which signals the end of the modification.

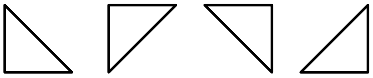
⠫	`Shape indicator`
⠨	`Structural shape-modification indicator`
⠻	`Termination indicator`

11.8 Structurally Modified Triangles

The following five structurally modified triangles are identified in the Nemeth Code. Each symbol starts with the basic shape symbol for "triangle" ⠫⠞. The derivation of the letter following the structural shape-modification indicator is underlined in the list of modified triangles in the box below.

⠫⠞⠨⠁⠻	Acute Triangle	
⠫⠞⠨⠊⠻	Isosceles Triangle	
⠫⠞⠨⠕⠻	Obtuse Triangle	
⠫⠞⠨⠗⠻	Right Triangle	
⠫⠞⠨⠎⠻	Scalene Triangle	

Know Your Triangles: Triangles are defined by the measure of angles and sides, not by orientation. For example, each of these is a "right triangle" because each contains a 90° angle.

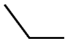
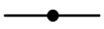


Definitions can be found in Addendum 2 of this course ("Glossary of Terms").

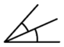
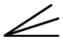
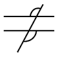
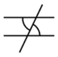
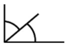
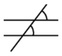
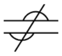
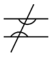
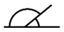
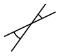
11.9 Structurally Modified Angles

The following twelve structurally modified angles are identified in the Nemeth Code. Each symbol starts with the basic shape symbol for "angle" ⠫⠪. The derivation of the letter or letters following the structural shape-modification indicator is underlined in this list.

Specific Angles

⠫⠪⠨⠕⠻	Obtuse Angle	
⠫⠪⠨⠗⠻	Right Angle	
⠫⠪⠨⠎⠻	Straight Angle	

Combined Angles

⠫⠪⠨⠚⠻	Adjacent Angles	 or 
⠫⠪⠨⠁⠑⠻	Alternate Exterior Angles	
⠫⠪⠨⠁⠊⠻	Alternate Interior Angles	
⠫⠪⠨⠉⠏⠻	Complementary Angles	
⠫⠪⠨⠉⠻	Corresponding Angles	
⠫⠪⠨⠑⠻	Exterior Angles	
⠫⠪⠨⠊⠻	Interior Angles	
⠫⠪⠨⠎⠏⠻	Supplementary Angles	
⠫⠪⠨⠧⠻	Vertical Angles	

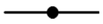
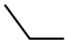
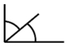
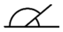
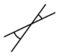
11.10 Unlisted Shapes with Structural Modification

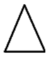
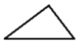
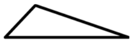
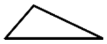
Structurally modified shapes which are not provided for in the Nemeth Code are formed in accordance with the principles stated in Section 11.7. Review the definition of *structural modification* to properly identify the unlisted shape. Be careful not to choose a symbol which already has an assigned meaning in the Nemeth Code. Refer to Appendix D of *The Nemeth Braille Code for Mathematics and Science Notation* for a list of symbols already in use. (Find the section for symbols beginning with dots 1246.) Explain the unlisted shape in a transcriber's note, giving the name or description of the symbol used. Include a drawing of the shape when appropriate.

Instructions: After completing the "Angle/Symbol" table, leave one blank line and then begin the "Triangle/Symbol" table. Do not use box lines. Review simple table format in Lesson 5.

PRACTICE 11B

Structurally Modified Shapes

Angle	Symbol
right	
straight	
obtuse	
complementary	
supplementary	
vertical	

Triangle	Symbol
isosceles	
right	
acute	
obtuse	
scalene	

Shapes with Interior Modification

[NC 17.6]

11.11 Definition and Construction

A shape with interior modification is a basic shape (for example, a *circle*) within which a letter, a numeral, a sign of operation, or other sign appears.

Basic shape:	○	Circle
More specific form:	⑧	Circle with number 8 inside
More specific form:	⊛	Circle with asterisk inside

A shape with interior modification is represented by

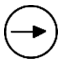
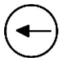
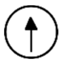
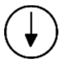
- the basic shape symbol,
- followed by the interior shape-modification indicator,
- followed by the symbol corresponding to the interior sign,
- ending with the termination indicator which signals the end of the modification.

⠫	`Shape indicator`
⠸⠫	`Interior shape-modification indicator`
⠻	`Termination indicator`

Note: Symbols, numbers, words, etc. that represent keys on a calculator or a keyboard follow different rules. See Sections 11.32-11.34.

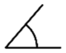
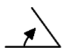
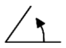
11.12 Circles with Interior Modification

Eleven circles with interior modification are identified in the Nemeth Code. Each symbol starts with the basic shape symbol for "circle" ⠫⠉ followed by the interior shape-modification indicator. ⠸⠫ Notice that an interior numeral includes a numeric indicator and that the contracted form of the right-pointing arrow is not used.

⠫⠉⠸⠫⠫⠒⠒⠕⠻	Circle with Interior Arrow Pointing Right	
⠫⠉⠸⠫⠫⠪⠒⠒⠻	Circle with Interior Arrow Pointing Left	
⠫⠉⠸⠫⠫⠣⠒⠒⠕⠻	Circle with Interior Arrow Pointing Up	
⠫⠉⠸⠫⠫⠩⠒⠒⠕⠻	Circle with Interior Arrow Pointing Down	
⠫⠉⠸⠫⠠⠺⠻	Circle with Interior Capitalized Letter	Ⓦ
⠫⠉⠸⠫⠼⠢⠻	Circle with Interior Numeral	⑤
⠫⠉⠸⠫⠈⠡⠻	Circle with Interior Cross	⊗
⠫⠉⠸⠫⠡⠻	Circle with Interior Dot	⊙
⠫⠉⠸⠫⠤⠻	Circle with Interior Minus Sign	⊖
⠫⠉⠸⠫⠬⠻	Circle with Interior Plus Sign	⊕
⠫⠉⠸⠫⠳⠻	Circle with Interior Vertical Bar	⦶

11.13 Angles with Interior Modification

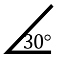
Three angles with interior modification are identified in the Nemeth Code. Each symbol starts with the basic shape symbol for "angle" ⠫⠪ followed by the interior shape-modification indicator ⠸⠫

⠫⠪⠸⠫⠫⠁⠻	Angle with Interior Arc	
⠫⠪⠸⠫⠫⠪⠢⠔⠻	Angle with Interior Clockwise Arrow	
⠫⠪⠸⠫⠫⠢⠔⠕⠻	Angle with Interior Counterclockwise Arrow	

When the print copy uses the "angle with interior arc" symbol throughout the text to simply mean "angle", the two-cell angle symbol may be used: ⠫⠪. A transcriber's note is required to inform the reader of the substitution. Sample transcriber's note:

In print, the angle shape image includes an interior arc.

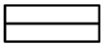
When a number with internal measurement is encountered within the text, it is constructed as shown below. (See also Section 11.18.)

⫸ 

⠫⠪⠸⠫⠼⠒⠴⠘⠨⠡⠐⠻

11.14 Rectangles and Squares with Interior Modification

One rectangle and seven squares with interior modification are identified in the Nemeth Code. Each symbol starts with the basic shape symbol for "rectangle" ⠫⠗ or for "square" ⠫⠲ followed by the interior shape-modification indicator ⠸⠫

⠫⠗⠸⠫⠱⠻	Rectangle with Interior Horizontal Bar	
⠫⠲⠸⠫⠱⠻	Square with Interior Horizontal Bar	
⠫⠲⠸⠫⠳⠻	Square with Interior Vertical Bar	
⠫⠲⠸⠫⠔⠻	Square with Interior Diagonal from Lower Left to Upper Right	
⠫⠲⠸⠫⠢⠻	Square with Interior Diagonal from Upper Left to Lower Right	
⠫⠲⠸⠫⠢⠈⠔⠻	Square with Interior Diagonals	
⠫⠲⠸⠫⠡⠻	Square with Interior Dot	
⠫⠲⠸⠫⠼⠢⠻	Square with Interior Numeral	

Note: Symbols and numbers that represent keys on a calculator or a keyboard follow different rules. See Sections 11.32-11.34.

11.15 Words Enclosed in Shapes

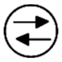
Words enclosed in shapes are transcribed according to the methods for shapes with internal modification and must be enclosed within Nemeth switches. *Note*: Words that represent keys on a calculator or a keyboard follow different rules. See Sections 11.32-11.34.

11.16 Two or More Vertically Arranged Modifiers

When two or more vertically arranged symbols occur within a basic sign of shape, the basic shape symbol and the interior shape-modification indicator are followed first by the symbol for the upper and then by the symbol for the lower interior sign. The termination indicator is used only after the last symbol.

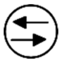
⠫⠉⠸⠫⠫⠒⠒⠕⠫⠪⠒⠒⠻

Circle with Interior Arrow Pointing Right
Over Interior Arrow Pointing Left



⠫⠉⠸⠫⠫⠪⠒⠒⠫⠒⠒⠕⠻

Circle with Interior Arrow Pointing Left
Over Interior Arrow Pointing Right

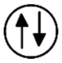


11.17 Two or More Horizontally Arranged Modifiers

When two or more horizontally arranged symbols occur within a basic sign of shape, a multipurpose indicator (dot 5) is inserted between the interior modifiers to show that they are printed horizontally, not vertically. The termination indicator is used only after the last symbol.

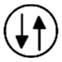
⠫⠉⠸⠫⠫⠣⠒⠒⠕⠐⠫⠩⠒⠒⠕⠻

Circle with Interior Arrow Pointing Up
Followed by Interior Arrow Pointing Down



⠫⠉⠸⠫⠫⠩⠒⠒⠕⠐⠫⠣⠒⠒⠕⠻

Circle with Interior Arrow Pointing Down
Followed by Interior Arrow Pointing Up



11.18 Unlisted Shapes with Interior Modification

Shapes with interior modification not provided for in the Nemeth Code are formed in accordance with the principles for the construction of such shapes. Review the definition of interior modification in Section 11.11 to properly identify the unlisted shape.

⋙ $\boxed{\text{W}}$ ⠫⠲⠸⠫⠠⠺⠻

⋙ $\circledast$ ⠫⠉⠸⠫⠈⠼⠻

⋙ $\angle x^\circ$ ⠫⠪⠸⠫⠭⠘⠨⠡⠐⠻

⋙ ⠫⠲⠸⠫⠳⠐⠳⠻

A symbol which already has an assigned meaning in the Nemeth Code must not be used for the unlisted sign of shape. If necessary, explain the shape in a transcriber's note giving the name or description of the symbol used. Include a drawing of the shape when appropriate.

Instructions: Transcribe this as a simple list, not as columns.

PRACTICE 11C

Squares with Interior Modification

Square with interior numeral 2	$\boxed{2}$
Square with interior dot	⊡
Square with interior horizontal bar	⊟
Square with interior vertical bar	◫
Square with interior diagonals	⊠

Other Details

11.19 Spacing with Signs of Shape

A sign of shape is spaced in accordance with its assigned meaning. For example, operation signs are unspaced.

⫸ $x \oplus y$ ⠭⠫⠉⠸⠫⠬⠻⠽

Comparison signs are spaced.

⫸ $x \boxed{>} y$ ⠭ ⠫⠲⠸⠫⠨⠂⠻ ⠽

Exception: Keystroke constructions follow different spacing rules. See Section 11.33.2.

Example 11-6

Operation signs appear within circles. The comparison sign appears inside a square.

$2 \oplus 3 \boxed{=} 3 \oplus 2$

⠠⠕⠏⠻⠁⠰⠝ ⠎⠊⠛⠝⠎ ⠁⠏⠏⠑⠜ ⠾⠔ ⠉⠊⠗⠉⠇⠑⠎⠲ ⠠⠮
⠉⠕⠍⠏⠜⠊⠎⠕⠝ ⠎⠊⠛⠝ ⠁⠏⠏⠑⠜⠎ ⠔⠎⠊⠙⠑ ⠁ ⠎⠟⠥⠜⠑⠲
⠸⠩ ⠼⠆⠫⠉⠸⠫⠬⠻⠒ ⠫⠲⠸⠫⠨⠅⠻ ⠼⠒⠫⠉⠸⠫⠬⠻⠆ ⠸⠱

11.20 Punctuation with Signs of Shape

Signs of shape are punctuated mathematically when the punctuation is situated within the code switches.

⫸ (△, ○, □) ⠷⠫⠞⠠ ⠫⠉⠠ ⠫⠲⠾

11.21 Plurals/Possessives

The uncapitalized letter "s" or the apostrophe-s combination occurring inside or after a sign of shape to show its plural or possessive are placed after the shape symbol. Apply the general rules for the English-letter indicator to the plural or possessive ending.

Example 11-7

∠s and △s.

⠸⠩ ⠫⠪⠎ ⠠⠄⠯ ⠫⠞⠎ ⠸⠱⠲

Each "s" is printed inside the shape.

Example 11-8

∠ s and △s.

⠸⠩ ⠫⠪⠎ ⠠⠄⠯ ⠫⠞⠎ ⠸⠱⠲

Each "s" follows the printed shape.

Example 11-9

∠'s and △'s.

⠸⠩ ⠫⠪⠸⠄⠎ ⠠⠄⠯ ⠫⠞⠸⠄⠎ ⠸⠱⠲

A punctuation indicator precedes each apostrophe.

Example 11-10

(∠'s, △'s, and ○'s.)

⠸⠩ ⠷⠫⠪⠸⠄⠎⠠ ⠫⠞⠸⠄⠎⠠ ⠠⠄⠯ ⠫⠉⠸⠄⠎⠸⠲⠾ ⠸⠱

Each "apostrophe-s" is punctuated mathematically because each is associated with a mathematical item.

11.22 Further Considerations Regarding Transcriber-Devised Shapes

As previously noted, when encountering a shape not provided for in the Nemeth Code the transcriber may devise a symbol if that shape appears more than occasionally. The print shape should also be drawn as a raised-line diagram the first time the new symbol is introduced. In addition to the guidelines regarding unlisted shapes throughout this lesson, observe the following.

11.22.1 **Usage Rules Regarding Interior Numerals and Arrows.** Transcriber-devised forms should heed the following principles regarding interior numerals and arrows.

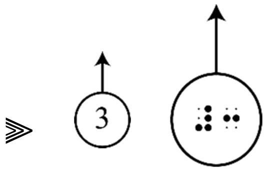
a. The numeric indicator is used before a numeral or before a decimal point and a numeral following the interior shape-modification indicator.

⫸ ⑧ ⠫⠉⠸⠫⠼⠦⠻

b. When a right-pointing arrow is part of a shape symbol, the shaft is transcribed. The contracted form of the right-pointing arrow is not used.

⫸ $\boxed{\rightarrow}$ ⠫⠗⠸⠫⠫⠒⠒⠕⠻

11.22.2 **Shapes Represented by Drawing.** Drawn-in shapes are often more readable than elaborate braille constructions. Since it is not possible to formulate specific rules for the selection of an appropriate form, the decision is left to the experience and judgment of the transcriber. Shapes may also be represented by a combination of drawing and braille symbols. For example, if a modified shape cannot be represented clearly by braille symbols alone, the shape can be drawn, and the modification shown in braille.



PRACTICE 11D

1. ▯ , ○ , △ , ∡ , ⊙ , ∠ .
2. (○'s, ∠'s, and △'s.)
3. a ⊕ (b ⊕ c)
4. r ⊗ s ⊗ ____ = rst
5. How many △s can you find in the giant □ ?

Identified Signs of Shape

[NC 17.10.1]

A sign of shape which is followed by a letter, a sequence of letters, or a numeral, is an *identified sign of shape*. The entire unit is mathematical and therefore transcribed in Nemeth.

11.23 Spacing

There must be a space between the shape symbol and its identification. A space often does not appear in the print copy, but it must be present in braille.

⫸	△ABC	⠫⠞ ⠠⠁⠠⠃⠠⠉	("triangle ABC")
⫸	∠θ	⠫⠪ ⠨⠹	("angle theta")

Example 11-11

⏢5 denotes "trapezoid 5."

⠸⠩ ⠫⠵ ⠼⠢ ⠸⠱ ⠙⠢⠕⠞⠑⠎ ⠦⠞⠗⠁⠏⠑⠵⠕⠊⠙ ⠼⠑⠲⠴

The first 5 is associated with the mathematical shape and is included inside the switches. A switch to Nemeth is not necessary for the second 5 – it is a freestanding numeral in UEB context.

11.23.1 **Keep Together.** A sign of shape and the letter, sequence of letters, or numeral which follows it is regarded as a single mathematical item and therefore should not be divided between braille lines.

Example 11-12

How many different triangles can you draw within the boundaries of these shapes: ⏢ ABCD? △ EFG? ⬡ HIJKLM?

⠀⠀⠠⠓⠪ ⠸⠍ ⠙⠊⠖⠻⠢⠞ ⠞⠗⠊⠁⠝⠛⠇⠑⠎ ⠉ ⠽ ⠙⠗⠁⠺ ⠾⠔ ⠮
⠨⠙⠜⠊⠑⠎ ⠷ ⠘⠮ ⠩⠁⠏⠑⠎⠒ ⠸⠩ ⠫⠵ ⠠⠁⠠⠃⠠⠉⠠⠙⠸⠦⠀⠀⠀⠀
⠫⠞ ⠠⠑⠠⠋⠠⠛⠸⠦ ⠫⠖ ⠠⠓⠠⠊⠠⠚⠠⠅⠠⠇⠠⠍ ⠸⠱⠦

11.23.2 **Surrounding Symbols.** The spacing before and after a sign of shape and its identification is subject to the spacing rules for the symbols preceding or following it.

⫸ △PQR ~ △P'Q'R'

⠫⠞ ⠠⠏⠠⠟⠠⠗ ⠈⠱ ⠫⠞ ⠠⠏⠄⠠⠟⠄⠠⠗⠄

A space precedes and follows the tilde, which, in this case, is a sign of comparison meaning "is similar to".

⫸ $\angle 2 + \angle 3 = \angle 4$

⠫⠪ ⠼⠆⠬⠫⠪ ⠼⠒ ⠨⠅ ⠫⠪ ⠼⠲

There is no space before or after the operation sign (plus sign).

11.24 A Shape Within a Superscript or a Subscript

An identified sign of shape is read as a unit, therefore when one appears in a superscript or a subscript the effect of the level indicator extends through the space following the sign of shape. That is, the space preserves the superscript or subscript level where the sign of shape appears.

⫸ $A_{\triangle ABC}$ ⠠⠁⠰⠫⠞ ⠠⠁⠠⠃⠠⠉

Only one subscript indicator is required.

This seems to be rare notation as an example in context cannot be found.

11.25 A Shape Which Carries a Superscript or a Subscript

When a sign of shape carries a superscript or subscript, the level indicator is unspaced from the shape.

⫸ $\bigcirc^2$ ⠫⠉⠘⠆

⫸ $\square_2$ ⠫⠲⠰⠆

The rule for nonuse of the subscript indicator following a letter (Section 6.11 in Lesson 6) does not apply to a letter that is preceded by the shape indicator. Compare:

⫸ C_2 ⠠⠉⠆ *A subscript indicator is not required.*

⫸ $\bigcirc_2$ ⠫⠉⠰⠆ *A subscript indicator is required.*

When a sign of shape is followed by its identification, the space required between the sign of shape and its identifier follows the superscript or subscript. When the identified shape is on the baseline of writing, the space following the superscript or subscript terminates the effect of the level indicator and reinstates the baseline level.

⫸ $\square^2$ DEF ⠫⠲⠘⠆ ⠠⠙⠠⠑⠠⠋

Only the numeral "2" is in the superscript position. The shape and letters "DEF" are on the baseline of writing.

11.26 The English-letter Indicator

When an English letter or a Roman numeral identifies a shape, the English-letter indicator is not used. *Exception:* If such letters are in nonregular type, rules regarding typeform are followed and an English-letter indicator is required if the variant typeform is retained. Also, if the sign of shape has a plural or a possessive ending, an English-letter indicator may be required. See Section 11.21.

⫸ $\angle p$ ⠫⠪ ⠏ (*Spoken:* angle p)

⫸ □ ii ⠫⠲ ⠊⠊ (*Spoken:* square ii)

Example 11-13

⊙ Q denotes "circle Q."

⠸⠩ ⠫⠉⠸⠫⠡⠻ ⠠⠟ ⠸⠱ ⠙⠢⠕⠞⠑⠎ ⠦⠉⠊⠗⠉⠇⠑ ⠰⠠⠟⠲⠴

Example 11-14

Compare ⬭ Z to ⬭ **Z**.

⠠⠉⠕⠍⠏⠜⠑ ⠸⠩ ⠫⠑ ⠠⠵ ⠠⠄⠞⠕ ⠫⠑ ⠸⠰⠠⠵ ⠸⠱⠲

Example 11-15

Find the sum of $\angle$s a and b. Find the difference of $\angle$s acr and adr.

⠠⠋⠔⠙ ⠮ ⠎⠥⠍ ⠷ ⠸⠩ ⠫⠪⠎ ⠰⠁ ⠠⠄⠯ ⠰⠃ ⠸⠱⠲ ⠠⠋⠔⠙
⠮ ⠙⠊⠖⠻⠰⠑ ⠷ ⠸⠩ ⠫⠪⠎ ⠁⠉⠗ ⠠⠄⠯ ⠁⠙⠗ ⠸⠱⠲

Single letters "a" and "b" require an English-letter indicator in Nemeth.
(Review the definition of "single letter" in Lesson 3.)

11.26.1 **The Letter "m" Meaning "measure".** Notation regarding angle measurement often uses the letter "m" for "measure". The letter "m" is unspaced from the following symbol regardless of spacing used in the print copy.

⫸ $m\angle\theta$ ⠍⠫⠪ ⠨⠹

(*Spoken:* the measure of angle theta)

⫸ $m^\circ\ \angle\alpha$ ⠍⠘⠨⠡⠐⠫⠪ ⠨⠁

(*Spoken:* the measure in degrees of angle alpha)

11.27 Use of the Numeric Indicator in an Enclosed List

The "enclosed list" was introduced in Lesson 4 where it states that a numeric indicator is not used before a numeral in an enclosed list. More specifically, this rule applies to a numeral that occurs at the beginning of the item. A sign of shape and an identifying numeral which follows it are a single item even though a space occurs between them. In an enclosed list, the numeric indicator is required for the identifying numeral because the numeral is not at the beginning of the item. Look carefully at the use and nonuse of the numeric indicator in each sample below, as described in the comments.

⫸ $(\angle 1,\ \angle 2,\ \angle 3)$

⠷⠫⠪ ⠼⠂⠠ ⠫⠪ ⠼⠆⠠ ⠫⠪ ⠼⠒⠾

In this enclosed list, each numeral needs a numeric indicator because it identifies the angle symbol—the numeral does not begin the item.

⫸ $(\angle 1,\ 2\angle 1,\ 3\angle 1)$

⠷⠫⠪ ⠼⠂⠠ ⠆⠫⠪ ⠼⠂⠠ ⠒⠫⠪ ⠼⠂⠾

Only the numerals which begin an item ("2" and "3") are transcribed without a numeric indicator in this enclosed list.

⫸ $(1\angle a,\ 2\angle b)$ ⠷⠂⠫⠪ ⠁⠠ ⠆⠫⠪ ⠃⠾

The numerals ("1" and "2") begin each item in this enclosed list—a numeric indicator is not transcribed. The letters ("a" and "b") are transcribed without a letter indicator according to the rules governing identified signs of shape.

PRACTICE 11E

1. □ABCD is a square. ▱ EFGH is a parallelogram. ▱ JKLM is a rhombus.
2. Compare triangles: △ADM ≅ △A'D'M'. ⊿BEP ≇ ⊿CFP.
3. Should △ABV be included in the set {△3, ∠ GHA, ◊2}?
4. $\angle 3 + \angle 4 = 90°$
5. $m\angle p + m\angle q = 180°$
6. $m°\angle\theta = -45$
7. $A_{\Delta DEF} = \frac{1}{2}bh$
8. $5_8 + \bigcirc_8 = 22_8$
9. $\angle ECB = \frac{1}{2}\angle ABC$

Shapes Used as Signs of Omission

11.28 Usage and Spacing

When a sign of shape is used as a sign of omission or placeholder to represent a numeral, letter, sign of comparison, sign of operation, abbreviation, or any other item, the appropriate Nemeth shape symbol is transcribed. The general omission symbol is not used.

The shape symbol is spaced in accordance with the rules for the omitted material it represents. A shape symbol is unspaced from any braille indicator which applies to it.

⋙ $12 \div 4 = \square$ ⠼⠂⠆⠨⠌⠲ ⠨⠅ ⠫⠲

(The omitted numeral is printed as a square. The symbol is spaced from the comparison sign.)

⋙ $40 \text{ dimes} = \$\bigcirc$ ⠼⠲⠴ ⠙⠊⠍⠑⠎ ⠨⠅ ⠈⠎⠫⠉

(The omitted numeral is printed as a circle. The symbol is unspaced from its related monetary symbol.)

⋙ $\square \text{ l} = 1000 \text{ cc}$ ⠫⠲ ⠰⠇ ⠨⠅ ⠼⠂⠴⠴⠴ ⠉⠉

(The omitted numeral is printed as a square. The symbol is spaced from "l" according to spacing rules for abbreviations.)

⋙ $15 \bigcirc 15 = 30$ ⠼⠂⠢⠫⠉⠂⠢ ⠨⠅ ⠼⠒⠴

(The omitted operation sign is printed as a circle. The symbol is unspaced according to the rules for symbols of operation.)

⋙ $24 \text{ hrs.} = 1 \triangle$ ⠼⠆⠲ ⠓⠗⠎⠲ ⠨⠅ ⠼⠂ ⠫⠞

(The triangle represents a missing abbreviation. The symbol is preceded by a space according to spacing rules for abbreviations.)

⋙ $24_{\Diamond} + 11_{\Diamond} = 40_5$

⠼⠆⠲⠰⠫⠙⠐⠬⠂⠂⠰⠫⠙ ⠨⠅ ⠼⠲⠴⠰⠢

(The omitted numeric subscripts are printed as diamond shapes. Spacing rules for subscripts are followed.)

⋙ $y^{\frac{1}{3}} = \sqrt[3]{\blacksquare}$ ⠽⠘⠹⠂⠌⠒⠼ ⠨⠅ ⠣⠒⠜⠫⠸⠲⠻

(The omitted radicand is printed as a black square. Spacing rules for radicands are followed.)

Example 11-16

Fill in the square with the proper sign: = or ≠.

15 ÷ 3 □ 3 ÷ 15

⠠⠋⠊⠇⠇ ⠔ ⠮ ⠎⠟⠥⠜⠑ ⠾ ⠮ ⠏⠗⠕⠏⠻ ⠎⠊⠛⠝⠒ ⠸⠩ ⠨⠅
⠠⠄⠕⠗ ⠌⠨⠅⠸⠲
⠼⠂⠢⠨⠌⠒ ⠫⠲ ⠼⠒⠨⠌⠂⠢ ⠸⠱

11.29 The English-letter Indicator and Comparison Signs

When a sign of shape is used in place of a comparison sign, rules regarding use of the English-letter indicator to items immediately preceding or following the shape apply just as they would for any comparison sign. In these four samples a shape is used as a sign of omission representing a comparison sign.

⫸ *x* □ *y* ⠭ ⠫⠲ ⠽

An English-letter indicator is not used for a single letter which is immediately preceded or followed by a sign of comparison.

⫸ 1 yr ○ 200 da

⠼⠂ ⠽⠗ ⠫⠉ ⠼⠆⠴⠴ ⠙⠁

An abbreviation whose letters correspond to a shortform will not be misread as a word in Nemeth because contractions are not used inside the switches. An English-letter indicator is not needed. See Section 4.22 in Lesson 4.

⫸ ray ab ⬭ ray ac

⠗⠁⠽ ⠁⠃ ⠫⠑ ⠗⠁⠽ ⠁⠉

A mathematical sequence that corresponds to a shortform will not be misread as a word in Nemeth. No English-letter indicator is needed.

⫸ iii □ iv ⠊⠊⠊ ⠫⠲ ⠊⠧

An English-letter indicator is not used for a Roman numeral which is immediately preceded or followed by a sign of comparison.

11.30 Use of the Multipurpose Indicator

Because a regular polygon with four or more sides is represented by a numeral, when an unspaced numeral follows such a shape, a multipurpose indicator is used before the numeral to prevent it from being misread. The shapes in these two samples represent a sign of operation.

⫸ $15 \ \square\ 15 = 30$ ⠼⠂⠢⠫⠲⠐⠂⠢ ⠨⠅ ⠼⠒⠴

Without the multipurpose indicator this is read as a 415-sided regular polygon.

This situation occurs only when the shape is represented by a numeral.

⫸ $15 \bigcirc 15 = 30$ ⠼⠂⠢⠫⠉⠂⠢ ⠨⠅ ⠼⠒⠴

The circle shape is represented in braille with a letter ("c"). The following numeral will not be misread.

11.31 Omissions in Spatially Arranged Problems

In a spatial arrangement, omissions are indicated with the general omission symbol regardless of the symbol used in print.

Example 11-17

$$\begin{array}{r} 9\ 4\ 6 \\ +\ \square\square \\ \hline 1\ 0\ 0\ 2 \end{array}$$

```
  ⠔⠲⠖
 ⠬ ⠿⠿
⠒⠒⠒⠒⠒⠒
 ⠂⠴⠴⠆
```

In print, the omissions are indicated as two squares.

Instructions: Review Section 6.11 in Lesson 6 carefully regarding the subscripts in subitem d.

PRACTICE 11F

1. Fill in the circle with the correct exponent.
    a. $x^2 \times x^4 = x^{\bigcirc}$
    b. $y^3 \times y^{\bigcirc} = y^9$
    c. $z^{\bigcirc} \times z^5 = z^{15}$
2. Fill in the box with the missing number.
    a. $436 - \square = 102$
    b. $5\frac{18}{12} = \square\frac{1}{2}$
    c. $\frac{15}{20} = \frac{3}{\square}$
    d. $H_2 + O_2 \rightarrow H_{\square}O$
3. Name two different operation signs that make this a true statement: $1 \square 1 = 1$.

Calculators and Keyboards

[NC 17.6.4]

11.32 The Keystroke Indicator

When a print shape with interior modification depicts a labeled calculator or computer key, a contracted form employing a keystroke indicator is used in braille. A keystroke is represented by

- the keystroke indicator,
- followed by the label printed on the calculator key or the computer key,
- ending with the termination indicator which signals the end of the modification.

⠫⠅	Keystroke indicator
⠻	Termination indicator

11.32.1 **Shape in Print.** The keystroke indicator is used regardless of the shape of the key in the print copy.

⫸ $\boxed{+}$ ⠫⠅⠬⠻

⫸ $\circledast$ ⠫⠅⠈⠼⠻

⫸ $\boxed{\rightarrow}$ ⠫⠅⠫⠒⠒⠕⠻

The actual key shape(s) used in a particular text should be specified in a transcriber's note. Sample transcriber's note:

Calculator keys are depicted in print as square shapes.

11.33 Other Details Concerning Keystrokes

11.33.1 **The Label.** Regarding the label depicted on the key, note the following.

a. Capitalization is duplicated in braille. Words are transcribed without contractions.

⫸ $\boxed{\text{ENTER}}$ ⠫⠅⠠⠠⠑⠝⠞⠑⠗⠻

⫸ $\boxed{\text{Enter}}$ ⠫⠅⠠⠑⠝⠞⠑⠗⠻

b. Follow Nemeth rules for the use of level indicators.

⫸ $\boxed{x^2}$ ⠫⠅⠭⠘⠆⠐⠻

A baseline indicator is required before this termination indicator.

Example 11-18

Press $\boxed{\text{F1}}$ for help.

⠠⠏⠗⠑⠎⠎ ⠸⠩ ⠫⠅⠠⠋⠐⠂⠻ ⠸⠱ ⠿ ⠓⠑⠇⠏⠲

A multipurpose indicator (dot 5) is needed to show that the numeral is not a subscript. See Section 6.11.1.c in Lesson 6.

c. The numeric indicator is not required within the keystroke construction.

⫸ $\boxed{8}$ ⠫⠅⠦⠻

Compare this to a shape with interior modification which does require a numeric indicator. See Section 11.22.1.

d. The contracted form of the right-pointing arrow is not used in a keystroke construction.

⫸ $\boxed{\rightarrow}$ ⠫⠅⠫⠒⠒⠕⠻

11.33.2 **Spacing.** No space is left between keystroke constructions and other similar constructions or mathematical symbols in a sequence of related calculations. Arrows contained in the labels on the keys should not be spaced from the material to which they apply.

⫸ $\boxed{A\ {}^{b}\!/\!_{c} \leftrightarrow {}^{d}\!/\!_{e}}$

⠫⠅⠠⠁⠹⠃⠸⠌⠉⠼⠫⠪⠒⠒⠕⠹⠙⠸⠌⠑⠼⠻

⫸ **ENTER ↑**

⠫⠅⠠⠠⠑⠝⠞⠑⠗⠫⠣⠒⠒⠕⠻

Example 11-19

Solve the division problem (2 × 3 + 4) ÷ 5 on your calculator as follows:

$\boxed{(}\,2\,\boxed{*}\,3\,\boxed{+}\,4\,\boxed{)}\,\boxed{\div}\,5\,\boxed{=}$

⠀⠀⠀⠀⠠⠎⠕⠇⠧⠑ ⠮ ⠙⠊⠧⠊⠨⠝ ⠏⠗⠕⠃⠇⠑⠍⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀
⠸⠩ ⠷⠆⠈⠡⠒⠬⠲⠾⠨⠌⠢ ⠸⠱ ⠕⠝ ⠽⠗ ⠉⠁⠇⠉⠥⠇⠁⠞⠕⠗ ⠵
⠋⠕⠇⠇⠪⠎⠒
⠀⠀⠀⠀⠸⠩ ⠫⠅⠷⠻⠆⠫⠅⠈⠼⠻⠒⠫⠅⠬⠻⠲⠫⠅⠾⠻⠫⠅⠨⠌⠻⠢⠫⠅⠨⠅⠻ ⠸⠱

11.34 Long Keystroke Constructions

Use the fullest extent of the current braille line, making sure that a single keystroke construction is not divided between braille lines.

Example 11-20

$n\ \boxed{\times}\ P\ \boxed{\times}\ \boxed{(}\ \boxed{(}\ 1\ \boxed{-}\ \boxed{(}\ 1\ \boxed{+}\ i\ \boxed{\%}\ \boxed{)}\ \boxed{y^x}\ n\ \boxed{+/-}\ \boxed{)}\ \boxed{\div}\ i\ \boxed{\%}\ \boxed{)}$

```
⠸⠩ ⠝⠫⠅⠈⠡⠻⠠⠏⠫⠅⠈⠡⠻⠫⠅⠷⠻⠫⠅⠷⠻⠂⠫⠅⠤⠻⠫⠅⠷⠻⠂⠫⠅⠬⠻⠊
⠫⠅⠈⠴⠻⠫⠅⠾⠻⠫⠅⠽⠘⠭⠐⠻⠝⠫⠅⠬⠸⠌⠤⠻⠫⠅⠾⠻⠫⠅⠨⠌⠻⠊⠫⠅⠈⠴⠻
⠫⠅⠾⠻ ⠸⠱
```

Icons

11.35 Consistency in Representation of Icons

Icons may be used to mark items of special interest, for example a calculator (marking problems for which use of a calculator is allowed), a pencil, a check mark, etc. When icons appear in mathematical context, the UEB transcriber-defined shape indicator may be used without the insertion of switch indicators. Identify the icon in a transcriber's note, or on the Special Symbols page when used throughout a volume. Here is a sample using the icon in Example 11-21, identifying this symbol to mean "Extra Credit".

```
⠨⠿⠈⠫⠑⠭ ⠠⠊⠉⠕⠝ ⠍⠂⠝⠬ ⠦⠠⠑⠭⠞⠗⠁ ⠠⠉⠗⠫⠊⠞⠴
```

Note: An icon used to indicate the end of a proof has its own special symbol. Proofs will be discussed in Lesson 12.

Identifiers do not need to align when certain items are preceded by an icon. The icon is placed in the appropriate cell for the itemized material.

Example 11-21

Evaluate each expression.

13. $\frac{1}{2}(5+13)-4\cdot 5$

14. $(5+11)-(24-15)\cdot(3)$

🏅 15. $6^2+3\cdot 7-9\div 3$

```
    ⠠⠑⠧⠁⠇⠥⠁⠞⠑ ⠑⠁⠡ ⠑⠭⠏⠗⠑⠎⠨⠝⠲ ⠸⠩
⠼⠂⠒⠸⠲ ⠹⠂⠌⠆⠼⠷⠢⠬⠂⠒⠾⠤⠲⠡⠢
⠼⠂⠲⠸⠲ ⠷⠢⠬⠂⠂⠾⠤⠷⠆⠲⠤⠂⠢⠾⠡⠷⠒⠾
⠈⠫⠑⠭ ⠼⠂⠢⠸⠲ ⠼⠖⠘⠆⠐⠬⠒⠡⠶⠤⠔⠨⠌⠒ ⠸⠱
```

This textbook has stated that a gold ribbon indicates an extra credit problem.
Line 1: Instructions begin in cell 5. The opening Nemeth Code indicator is placed at the end of this line of text so that all identifiers (and icons) may start in the same cell.
Line 4: An icon was created to represent the "extra credit" print symbol. There is no need to switch out of Nemeth in order to transcribe the icon.

Instructions: Use the letter p for the "pencil" icon. After completing item D, center "SPECIAL SYMBOLS USED IN THIS VOLUME" and show how the icon will be listed on the Special Symbols page.

PRACTICE 11G

Input the equation using the $\boxed{x}$ key. Press $\boxed{\text{SHIFT}}$ and $\boxed{\text{ln}}$ to access $\left(e^{\square}\right)$. Press $\boxed{=}$ for the y value. Now input these values into your calculator.

$\boxed{(}$ 2 $\boxed{*}$ 3 $\boxed{+}$ 9 $\boxed{)}$ $\boxed{\div}$ 5 $\boxed{=}$ and

2 1 2 $\boxed{\circ}$ $\boxed{\to {}^{\circ}\mathrm{C}}$ $\boxed{\text{End}}$

Use PEMDAS to solve these operations. Problems marked with ✎ indicate that you are to show your work.

A. $-1\times\left[(3-4\times7)\div5\right]-2\times24\div6$

✎ B. $(3\times5^{2}\div15)(5-2^{2})$

C. $9\div3+2(9+10)-8+4\times3$

✎ D. $\left(11-20\div\dfrac{5^{2}-13}{3}+8\right)\times2$

Typeform Indicators for Mathematical Words and Phrases

[NC 7.3 and 7.4]

As discussed in Lesson 7, when a variant typeform has mathematical significance or is illustrating a teaching point, the typeform is retained in the braille transcription. Otherwise, the variant typeform is disregarded. In this lesson, we will study how to apply this practice to words and phrases.

11.36 Italic and Boldface Typeform Indicators

The Nemeth Code recognizes two possible typeforms for words: italics and boldface. Different methods are used depending upon the extent of the variant typeform.

11.36.1 **One Word in Italics or Boldface.** When an italicized or boldfaced word is part of a mathematical expression and the typeform is determined to be significant, the following indicators are used. The indicator is unspaced from the following word.

⠨	`Single Word Italic Type`
⠸	`Single Word Boldface Type`
⠸⠨	`Single Word Bold Italic Type`

⫸ *four* ⠨⠋⠕⠥⠗

⫸ **four** ⠸⠋⠕⠥⠗

⫸ ***four*** ⠸⠨⠋⠕⠥⠗

Example 11-22

Is the unit *pieces* or *people*?

6 *pieces* of pizza ÷ 2 people = 3 *pieces* per person

```
⠀⠀⠠⠊⠎ ⠮ ⠥⠝⠊⠞ ⠨⠂⠏⠊⠑⠉⠑⠎ ⠕⠗ ⠨⠂⠏⠦ ⠸⠩
  ⠼⠖ ⠨⠏⠊⠑⠉⠑⠎ ⠕⠋ ⠏⠊⠵⠵⠁⠨⠌⠆ ⠏⠑⠕⠏⠇⠑⠀⠀⠀⠀⠀⠀⠀⠀⠀
    ⠨⠅ ⠼⠒ ⠨⠏⠊⠑⠉⠑⠎ ⠏⠑⠗ ⠏⠑⠗⠎⠕⠝ ⠸⠱
```

Typeface is retained for the italicized words in the formula in order to emphasize the teaching point.

Example 11-23

The subset of *even-number words* is shown in italics.
{one, *two*, three, *four*, five}

⠠⠮ ⠎⠥⠃⠎⠑⠞ ⠷ ⠨⠂⠑⠧⠢⠤⠝⠥⠍⠃⠻ ⠨⠂⠘⠺⠎ ⠊⠎ ⠩⠪⠝ ⠔
⠊⠞⠁⠇⠊⠉⠎⠲ ⠸⠩
⠨⠷⠕⠝⠑⠠ ⠨⠞⠺⠕⠠ ⠞⠓⠗⠑⠑⠠ ⠨⠋⠕⠥⠗⠠ ⠋⠊⠧⠑⠨⠾ ⠸⠱

In UEB context, the UEB italic word indicator is used. In Nemeth context, the Nemeth single word italic type indicator is used.

Example 11-24

In this set, the **even-number word** is shown in boldface.
{three, **four**, five}

⠠⠔ ⠹ ⠎⠑⠞⠂ ⠮ ⠘⠂⠑⠧⠢⠤⠝⠥⠍⠃⠻ ⠘⠂⠘⠺ ⠊⠎ ⠩⠪⠝ ⠔
⠃⠕⠇⠙⠋⠁⠉⠑⠲
⠸⠩ ⠨⠷⠞⠓⠗⠑⠑⠠ ⠸⠋⠕⠥⠗⠠ ⠋⠊⠧⠑⠨⠾ ⠸⠱

In UEB context, the UEB boldface word indicator is used. In Nemeth context, the Nemeth single word boldface type indicator is used.

a. **Probability Statements and Typeform.** There is no standard for how the letters or the words in a probability statement appear in print. They could be printed in regular type, in italics, or in boldface. When all such letters and words in the publication are printed in the same typeface, the distinction is disregarded in braille. Capitalization is not a typeform. If a word is fully capitalized, the double capitalization indicator is used.

Assume these samples are from different publications and that the typeform is insignificant.

⫸ $P(A \textit{ and } B) = 0$

⠠⠏⠷⠠⠁ ⠁⠝⠙ ⠠⠃⠾ ⠨⠅ ⠼⠴

Italics are disregarded.

⫸ $P(\mathrm{A}\ \textbf{not}\ \mathrm{B}) = 0$

⠠⠏⠷⠠⠁ ⠝⠕⠞ ⠠⠃⠾ ⠨⠅ ⠼⠴

Italics and bold are disregarded.

⫸ $\mathrm{P(A\ OR\ B)}$

⠠⠏⠷⠠⠁ ⠠⠠⠕⠗ ⠰⠠⠃⠾

Capitalization is retained.

Example 11-25

When A and B are independent events, the probability of both happening at the same time is expressed as follows: $P(A \textit{ and } B) = P(A) \times P(B)$.

⠠⠱⠢ ⠠⠁ ⠯ ⠰⠠⠃ ⠜⠑ ⠔⠙⠑⠏⠢⠙⠢⠞ ⠑⠧⠢⠞⠎⠂ ⠮
⠏⠗⠕⠃⠁⠃⠊⠇⠰⠽ ⠷ ⠃⠕⠹ ⠓⠁⠏⠏⠢⠬ ⠁⠞ ⠮ ⠎⠁⠍⠑ ⠐⠞ ⠊⠎
⠑⠭⠏⠗⠑⠎⠎⠫ ⠵ ⠋⠕⠇⠇⠪⠎⠒⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀
⠸⠩ ⠠⠏⠷⠠⠁ ⠁⠝⠙ ⠠⠃⠾ ⠨⠅ ⠠⠏⠷⠠⠁⠾⠈⠡⠠⠏⠷⠠⠃⠾ ⠸⠱⠲

The italicized word "and" is part of the mathematical expression $P(A \text{ and } B)$ and so is transcribed in Nemeth, uncontracted. The italics are disregarded when all such statements are printed in italics.

Example 11-26

Multiplication Rule: $P(\mathrm{A} \cap \mathrm{B}) = P(\mathrm{A}) * P(\mathrm{B} \backslash \mathrm{A})$, or $P(\mathrm{B}) * P(\mathrm{A} \backslash \mathrm{B})$

⠘⠂⠠⠍⠥⠇⠞⠊⠏⠇⠊⠉⠁⠰⠝ ⠘⠂⠠⠗⠥⠇⠑⠒⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀
⠸⠩ ⠠⠏⠷⠠⠁⠨⠩⠠⠃⠾ ⠨⠅ ⠠⠏⠷⠠⠁⠾⠈⠼⠠⠏⠷⠠⠃⠸⠡⠠⠁⠾⠠
⠠⠄⠕⠗ ⠠⠏⠷⠠⠃⠾⠈⠼⠠⠏⠷⠠⠁⠸⠡⠠⠃⠾ ⠸⠱

The word "or" is not part of the rule and so is transcribed in UEB using the single-word switch indicator. The intersection symbol, multiplication asterisk, and backslash are operation signs and so are unspaced.

Probability Notation Notes

Review these rules in addition to those regarding typeform presented in Section 11.36.1.a.

The letter P is unspaced from the left parenthesis. The letter is not a "single letter" and so an English-letter indicator is not used. (See Section 3.13.2 in Lesson 3. See also Section 3.11.1 in Lesson 3 for the definition of "single letter".)

Words encountered in a probability statement are part of the math. The words are transcribed in Nemeth, without contractions. Single words do not use a the single-word switch indicator. Typeform is disregarded; capitalization is retained. (See Examples 4-35 and 4-48 in Lesson 4.)

An English letter touching only one grouping symbol needs an English-letter indicator if it would be required with the grouping symbol removed. (See Section 4.18 in Lesson 4.)

A vertical bar encountered in the study of conditional probability and logic is a sign of comparison and so is spaced. (See Example 5-27 in Lesson 5.)

11.36.2 **Hyphenated Mathematical Expressions and Typeform.** If one or both components of a hyphenated mathematical expression are printed in a nonregular typeform and if it is determined that the typeform must be retained, the appropriate single word typeform indicator is used. Even when only one component of the hyphenated expression requires Nemeth, the entire hyphenated expression is transcribed inside the switches.

a. When both components of the hyphenated expression are in the same nonregular typeform, the appropriate single word typeform indicator is used. The typeform continues through the hyphen.

⋙ *4.5-ohm* ⠨⠼⠲⠨⠢⠤⠕⠓⠍
(both parts are in italics)

⋙ **ζ-function** ⠸⠨⠵⠤⠋⠥⠝⠉⠞⠊⠕⠝
(both parts are bold)

b. When only the second component of the hyphenated expression is in nonregular type, the appropriate single word typeform indicator is used following the hyphen.

⋙ 4.5-*watt* ⠼⠲⠨⠢⠤⠨⠺⠁⠞⠞
(only the word is in italics)

Example 11-27

Compare: 4.5-*ohm* vs. 4.5-*watt*.

⠠⠉⠕⠍⠏⠜⠑⠒ ⠸⠩ ⠼⠲⠨⠢⠤⠨⠕⠓⠍ ⠠⠄⠧⠎⠲
⠼⠲⠨⠢⠤⠨⠺⠁⠞⠞ ⠸⠱⠲

c. Because a hyphen does not terminate typeform, when only the first component of the hyphenated expression is in nonregular type a return to regular type after the hyphen is shown by inserting a typeform terminator before the hyphen.

⠠⠄	Typeform Terminator

⋙ *4.5*-ohm ⠨⠼⠲⠨⠢⠠⠄⠤⠕⠓⠍
(4.5 is in italics, ohm is in regular type)

d. If there is a change in typeform after the hyphen to a different nonregular type, the first typeform does not need an explicit terminator. The appropriate typeform indicator used after the hyphen terminates the effect of the first indicator.

⋙ *4.5-**ohm*** ⠨⠼⠲⠨⠢⠤⠸⠨⠕⠓⠍
(4.5 is in italics, ohm is in bold italics)

e. Within narrative, a hyphenated expression may be transcribed in UEB unless the numeral or letter itself requires a switch to Nemeth.

Example 11-28

Compare the *25*-watt bulb to the *60*-watt bulb.

⠠⠉⠕⠍⠏⠜⠑ ⠮ ⠨⠂⠼⠃⠑⠨⠄⠤⠺⠁⠞⠞ ⠃⠥⠇⠃ ⠞⠕ ⠮⠀⠀⠀⠀⠀⠀
⠨⠂⠼⠋⠚⠨⠄⠤⠺⠁⠞⠞ ⠃⠥⠇⠃⠲

11.36.3 **A Phrase in Italics or Boldface.** When an italicized or boldfaced phrase is part of a mathematical expression and the typeform is retained, the following indicators are used.

⠠⠄⠨	`Opening Italic Type for two or more words`
⠨⠠⠄	`Closing Italic Type for two or more words`
⠠⠄⠸	`Opening Boldface Type for two or more words`
⠸⠠⠄	`Closing Boldface Type for two or more words`

These typeform indicators are preceded and followed by a space and must not stand alone on a line. When both indicators are required for the same word or phrase, they are unspaced from each other and are closed in the opposite order as opened.

⫸ *4.9 sq. ft.*

⠠⠄⠨ ⠼⠲⠨⠔ ⠎⠟⠲ ⠋⠞⠲ ⠨⠠⠄

⫸ *4.9 sq.* ***ft.***

⠠⠄⠨ ⠼⠲⠨⠔ ⠎⠟⠲ ⠸⠋⠞⠲ ⠨⠠⠄

⫸ *4.9* ***sq. ft.***

⠠⠄⠨ ⠼⠲⠨⠔ ⠠⠄⠸ ⠎⠟⠲ ⠋⠞⠲ ⠸⠠⠄⠨⠠⠄

11.36.4 **Significant Typeform Applied to a Fraction or a Mathematical Symbol.** When typeform is retained for a fraction, or for a numeral that is associated with a mathematical symbol such as a percent sign or monetary symbol, the appropriate three-cell typeform indicators are used.

⫸ $\boldsymbol{\frac{9}{100}}$ ⠠⠄⠸ ⠹⠔⠌⠂⠴⠴⠼ ⠸⠠⠄

⫸ **9%** ⠠⠄⠸ ⠼⠔⠈⠴ ⠸⠠⠄

⫸ *$9* ⠠⠄⠨ ⠈⠎⠔ ⠨⠠⠄

Example 11-29

ValueCo enjoyed a **9%** increase in profits last quarter.

⠀⠀⠠⠧⠁⠇⠥⠑⠠⠉⠕ ⠢⠚⠕⠽⠫ ⠁ ⠸⠩ ⠠⠄⠸ ⠼⠔⠈⠴ ⠸⠠⠄ ⠸⠱
⠔⠉⠗⠂⠎⠑ ⠔ ⠏⠗⠷⠊⠞⠎ ⠇⠁⠌ ⠟⠥⠜⠞⠻⠲

11.37 Code Switching Within an Emphasized UEB Passage

Switching from UEB to Nemeth terminates the effect of a UEB typeform. The appropriate UEB typeform indicator is restated after Nemeth is terminated when emphasis continues. Nemeth typeform indicators are not used in the math portion unless the typeform gives unique meaning to the mathematical word or symbol.

Example 11-30

The resistance values of **resistors A and B in the 4.5-volt series circuit** are 21.1 Ω and 7.0 Ω, respectively.

1 ⠀⠀⠠⠮ ⠗⠑⠎⠊⠌⠨⠑ ⠧⠁⠇⠥⠑⠎ ⠷ ⠘⠶⠗⠑⠎⠊⠌⠕⠗⠎ ⠠⠁ ⠯
2 ⠰⠠⠃ ⠔ ⠮ ⠸⠩ ⠼⠲⠨⠢⠤⠧⠕⠇⠞ ⠸⠱ ⠘⠂⠎⠻⠊⠑⠎
3 ⠘⠂⠉⠊⠗⠉⠥⠊⠞ ⠜⠑ ⠸⠩ ⠼⠆⠂⠨⠂ ⠨⠠⠺ ⠠⠄⠯⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀
4 ⠼⠶⠨⠴ ⠨⠠⠺ ⠸⠱⠂ ⠗⠑⠎⠏⠑⠉⠞⠊⠧⠑⠇⠽⠲

Line 1: The UEB boldface passage indicator applies to "resistors A and B in the".
Line 2: A switch to Nemeth is required for the decimal number. The switch to Nemeth terminates the effect of the UEB typeform indicator without the need for a UEB termination indicator. Boldface is not retained in the Nemeth portion. UEB boldface is reinstated following the Nemeth Code terminator.
Line 4: Although 7.0 Ω fits on line 3, the Nemeth Code terminator does not. All are brought down to line 4.

Example 11-31

If the cost **after applying the 15% discount** is $25.34, what is the original price?

1 ⠀⠀⠠⠊⠋ ⠮ ⠉⠕⠌ ⠘⠶⠁⠋ ⠁⠏⠏⠇⠽⠬ ⠮ ⠸⠩ ⠼⠂⠢⠈⠴ ⠸⠱
2 ⠘⠂⠲⠉⠨⠞ ⠊⠎ ⠸⠩ ⠈⠎⠆⠢⠨⠒⠲ ⠸⠱⠂ ⠱⠁⠞ ⠊⠎ ⠮
3 ⠕⠗⠊⠛⠔⠁⠇ ⠏⠗⠊⠉⠑⠦

Line 1: The UEB boldface passage indicator applies "after applying the".
Line 2: A switch to Nemeth is required for the percentage. The switch to Nemeth terminates the effect of the UEB typeform indicator without the need for a UEB termination indicator. Boldface is not retained in the Nemeth portion. UEB boldface is reinstated following the Nemeth Code terminator.

Example 11-32

Energy and mass are equivalent, *which is the message of* $E = mc^2$.

⠀⠀⠠⠢⠻⠛⠽ ⠯ ⠍⠁⠎⠎ ⠜⠑ ⠑⠟⠥⠊⠧⠁⠇⠢⠞⠂ ⠨⠶⠱ ⠊⠎ ⠮
⠍⠑⠎⠎⠁⠛⠑ ⠷ ⠸⠩ ⠠⠑ ⠨⠅ ⠍⠉⠘⠆ ⠸⠱⠲

> *Even though the formula is part of the italicized passage, italics are disregarded inside the switches because the typeform is not mathematically significant.*

a. Although switching from UEB to Nemeth terminates typeform, switching from Nemeth to UEB does not. When the three-cell Nemeth typeform indicators are used inside the switches, the closing typeform indicator is required before terminating Nemeth.

Example 11-33

Thus, 6 pieces of pizza ÷ 2 people = 3 *pieces per person,* as illustrated in the diagram.

⠀⠀⠠⠹⠥⠎⠂ ⠸⠩ ⠼⠖ ⠏⠊⠑⠉⠑⠎ ⠕⠋ ⠏⠊⠵⠵⠁ ⠨⠌⠆ ⠏⠑⠕⠏⠇⠑
⠨⠅ ⠼⠒ ⠠⠄⠨ ⠏⠊⠑⠉⠑⠎ ⠏⠑⠗ ⠏⠑⠗⠎⠕⠝ ⠨⠠⠄ ⠸⠱⠂ ⠵
⠊⠇⠇⠥⠌⠗⠁⠞⠫ ⠔ ⠮ ⠙⠊⠁⠛⠗⠁⠍⠲

> *The italic typeface is retained for the phrase "pieces per person" because it illustrates a teaching point.*

Mathematical Statements

[NC 7.4.4 and 26.7]

11.38 Axioms, Corollaries, Definitions, Laws, Lemmas, Propositions, Theorems

A mathematical statement is often printed in a distinctive style to catch the reader's attention. It also may be set off from the main text by different margins or some other means of distinction. The statement is usually introduced by a word such as Axiom, Corollary, Definition, Law, Lemma, Proposition, or Theorem. We will refer to this word as a "label" in this section.

Follow these directives in the braille transcription.

a. To draw attention to the mathematical statement in braille, leave one blank line before the label and one blank line after the statement.

b. The label can be formatted as a paragraph heading or as a cell-5 or cell-7 heading, at the transcriber's discretion. Consistent treatment is important. Follow print for the capitalization style of the label. Typeform is disregarded in a cell-5 or cell-7 heading. Typeform is retained in a paragraph heading unless it is printed as fully capitalized as well as a variant typeform, in which case capitalization is retained but typeform is disregarded.

c. Continue with the text, using normal (3-1) paragraph style. When all statements in the text are printed in the same typeform, the uniform typeform may be disregarded in the transcription.

d. If, in the body of a mathematical statement, a word or phrase is singled out for special attention by using a nonregular typeface, the change in typeface is retained in braille.

Example 11-34

Definition *A set which can be put into one-to-one correspondence with the natural numbers is called a* ***countable set****.*

```
1 ⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀
2 ⠀⠀⠘⠂⠠⠙⠑⠋⠔⠊⠰⠝⠀⠠⠁⠀⠎⠑⠞⠀⠱⠀⠉⠀⠃⠀⠏⠥⠞⠀⠔⠞⠕⠀⠀⠀⠀⠀⠀⠀
3 ⠐⠕⠤⠞⠕⠤⠐⠕⠀⠉⠕⠗⠗⠑⠎⠏⠕⠝⠙⠰⠑⠀⠾⠀⠮⠀⠝⠁⠞⠥⠗⠁⠇⠀⠝⠥⠍⠃⠻⠎
4 ⠊⠎⠀⠉⠁⠇⠇⠫⠀⠁⠀⠘⠂⠉⠨⠞⠁⠃⠇⠑⠀⠘⠂⠎⠑⠞⠲
5 ⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀
```

Lines 1 and 5: A blank line precedes and follows the mathematical statement.
Line 2: In print, "Definition" is a marginal heading and is in boldface type. In braille, the label is transcribed as a paragraph heading, but could have been formatted as a cell-5 or cell-7 heading. As a paragraph heading, typeface is retained.
Lines 2-4: The statement is printed in italics and is set off from the main body text with indented margins. We will assume that all Definition statements in this book are printed in italics, therefore the uniform typeface of the statement is disregarded.
Line 4: Boldface is retained for the bold words within the statement.

Example 11-35

THEOREM 4. *The diagonals of a rectangle are of equal length.*

```
1
2   ⠠⠠⠮⠕⠗⠑⠍ ⠼⠙⠲ ⠠⠮ ⠙⠊⠁⠛⠕⠝⠁⠇⠎ ⠷ ⠁ ⠗⠑⠉⠞⠁⠝⠛⠇⠑
3 ⠜⠑ ⠷ ⠑⠟⠥⠁⠇ ⠇⠢⠛⠹⠲
4
```

Lines 1 and 4: A blank line precedes and follows the mathematical statement.

Line 2: The label is printed in bold type. Transcribed as a paragraph heading, the typeform is disregarded because it is fully capitalized.

Lines 2-3: The statement is printed in italics. We will assume that all Theorem statements in this book are printed in italics, therefore the uniform typeface of the statement is disregarded.

Example 11-36

> **Bauer-Fike Theorem**
> Let μ be an eigenvalue of $A + \delta A$. Then there exists $\lambda \in \Lambda(A)$ such that
> $$|\lambda - \mu| \leq \kappa_p(V)\|\delta A\|_p.$$

```
1
2 ⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶
3     ⠠⠃⠁⠥⠻⠤⠠⠋⠊⠅⠑ ⠠⠮⠕⠗⠑⠍
4   ⠠⠇⠑⠞ ⠸⠩ ⠨⠍ ⠸⠱ ⠆ ⠁⠝ ⠑⠊⠛⠢⠧⠁⠇⠥⠑ ⠷
5 ⠸⠩ ⠠⠁⠬⠨⠙⠠⠁ ⠸⠱⠲ ⠠⠮⠝ ⠐⠮ ⠑⠭⠊⠌⠎
6 ⠸⠩ ⠨⠇ ⠈⠑ ⠨⠠⠇⠷⠠⠁⠾ ⠸⠱ ⠎⠡ ⠞
7   ⠸⠩ ⠳⠨⠇⠤⠨⠍⠳ ⠐⠅⠱ ⠨⠅⠰⠏⠐⠷⠠⠧⠾⠳⠳⠨⠙⠠⠁⠳⠳⠰⠏ ⠸⠱⠲
8 ⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛
9
```

Lines 1 and 9: A blank line precedes and follows the mathematical statement.

Lines 2 and 8: The mathematical statement is boxed. Box lines are retained for distinction.

Line 3: The label, printed in boldface, is formatted as a cell-5 heading. Typeform is disregarded in a cell-5 heading, (The label could just as well have been formatted as a paragraph heading, in which case the bold type would be retained.)

Lines 4-7: The definition is printed in normal typeface, with the exception of the letters in the mathematical expressions which are in italics. In braille, variables are transcribed in normal type unless the typeface has mathematical significance. You may wish to review any unfamiliar symbols in this example. Greek letters mu, delta, lambda (both capital and lowercase), and kappa, as well as the comparison sign for "membership".

Instructions: Format each statement's label as a paragraph heading. Assume all Theorem statements in this book are printed in italics. Retain the box around the Definition.

PRACTICE 11H

Write your answer in the box. Pay close attention to the italicized units.

$52\ \textit{churros} \div 26\ \textit{children} = \square\ \textit{churros per child}$

Pythagorean Theorem *In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.*

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

DEFINITION	A positive number expressed in the form $a \times 10^n$, where $1 \leq a < 10$ and n is an integer is said to be written in **scientific notation.**

For further practice, see Addendum 1—Reading Practice.

Submit Exercise 11 to your instructor.

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ANSWERS TO PRACTICE MATERIAL

PRACTICE 11A

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⠀⠀⠀⠀⠠⠇⠊⠌⠫ ⠠⠩⠁⠏⠑⠎
  ⠸⠩ ⠫⠄ ⠫⠁ ⠫⠪ ⠫⠞ ⠫⠸⠞ ⠨⠫ ⠫⠲ ⠫⠓ ⠫⠙ ⠫⠛ ⠫⠵
⠫⠨⠵ ⠫⠗ ⠫⠢ ⠫⠎ ⠫⠸⠎ ⠫⠖ ⠫⠉ ⠫⠸⠉ ⠫⠑ ⠫⠨⠑ ⠸⠱
⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀
⠀⠀⠀⠀⠠⠥⠝⠇⠊⠌⠫ ⠠⠩⠁⠏⠑⠎
      ⠈⠨⠣⠠⠔ ⠮ ⠇⠊⠌ ⠆⠇⠂ ⠸⠩ ⠫⠋⠇ ⠸⠱
    ⠗⠑⠏⠗⠑⠎⠢⠞⠎ ⠁ ⠋⠇⠪⠻ ⠩⠁⠏⠑ ⠯ ⠸⠩ ⠫⠉⠓ ⠸⠱
    ⠗⠑⠏⠗⠑⠎⠢⠞⠎ ⠁ ⠡⠊⠉⠅⠢ ⠩⠁⠏⠑⠲⠈⠨⠜
⠀⠀⠸⠩ ⠫⠦ ⠫⠋⠇ ⠫⠉⠓ ⠸⠱
```

PRACTICE 11B

⠠⠌⠗⠥⠉⠞⠥⠗⠁⠇⠇⠽ ⠠⠍⠕⠙⠊⠋⠊⠫ ⠠⠩⠁⠏⠑⠎
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⠕⠃⠞⠥⠎⠑ ⠐⠐⠐⠐⠐⠐ ⠫⠪⠨⠕⠻
⠉⠕⠍⠏⠇⠑⠍⠑⠝⠞⠁⠗⠽ ⠫⠪⠨⠉⠏⠻
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⠁⠉⠥⠞⠑ ⠐⠐⠐ ⠫⠞⠨⠁⠻
⠕⠃⠞⠥⠎⠑ ⠐⠐ ⠫⠞⠨⠕⠻
⠎⠉⠁⠇⠑⠝⠑ ⠫⠞⠨⠎⠻
⠸⠱

PRACTICE 11C

⠠⠎⠟⠥⠜⠑⠎ ⠾ ⠠⠔⠞⠻⠊⠕⠗ ⠠⠍⠕⠙⠊⠋⠊⠉⠁⠰⠝
⠀⠀
⠠⠎⠟⠥⠜⠑ ⠾ ⠔⠞⠻⠊⠕⠗ ⠝⠥⠍⠻⠁⠇ ⠼⠃ ⠸⠩ ⠫⠲⠸⠫⠼⠆⠻ ⠸⠱
⠠⠎⠟⠥⠜⠑ ⠾ ⠔⠞⠻⠊⠕⠗ ⠙⠕⠞ ⠸⠩ ⠫⠲⠸⠫⠡⠻ ⠸⠱
⠠⠎⠟⠥⠜⠑ ⠾ ⠔⠞⠻⠊⠕⠗ ⠓⠕⠗⠊⠵⠕⠝⠞⠁⠇ ⠃⠜
  ⠸⠩ ⠫⠲⠸⠫⠱⠻ ⠸⠱
⠠⠎⠟⠥⠜⠑ ⠾ ⠔⠞⠻⠊⠕⠗ ⠧⠻⠞⠊⠉⠁⠇ ⠃⠜ ⠸⠩ ⠫⠲⠸⠫⠳⠻ ⠸⠱
⠠⠎⠟⠥⠜⠑ ⠾ ⠔⠞⠻⠊⠕⠗ ⠙⠊⠁⠛⠕⠝⠁⠇⠎ ⠸⠩ ⠫⠲⠸⠫⠢⠈⠔⠻ ⠸⠱

PRACTICE 11D

⠸⠩
⠼⠂⠸⠲ ⠫⠗⠠ ⠫⠉⠠ ⠫⠞⠠ ⠫⠪⠨⠚⠻⠠ ⠫⠉⠸⠫⠨⠡⠻⠠
  ⠫⠪⠸⠫⠫⠢⠔⠕⠻⠸⠲
⠼⠆⠸⠲ ⠷⠫⠉⠸⠄⠎⠠ ⠫⠪⠸⠄⠎⠠ ⠠⠄⠯ ⠫⠞⠸⠄⠎⠸⠲⠾
⠼⠒⠸⠲ ⠁⠫⠉⠸⠫⠬⠻⠷⠃⠫⠉⠸⠫⠬⠻⠉⠾
⠼⠲⠸⠲ ⠗⠫⠉⠸⠫⠈⠡⠻⠎⠫⠉⠸⠫⠈⠡⠻ ⠤⠤⠤⠤ ⠨⠅ ⠗⠎⠞ ⠸⠱
⠼⠑⠲ ⠠⠓⠪ ⠸⠍ ⠸⠩ ⠫⠞⠎ ⠸⠱ ⠉ ⠽ ⠋⠔⠙ ⠔ ⠮ ⠛⠊⠁⠝⠞
  ⠸⠩ ⠫⠲ ⠸⠱⠦

PRACTICE 11E

⠼⠁⠲ ⠸⠩ ⠫⠲ ⠠⠁⠠⠃⠠⠉⠠⠙ ⠸⠱ ⠊⠎ ⠁ ⠎⠟⠥⠜⠑⠲
⠸⠩ ⠫⠛ ⠠⠑⠠⠋⠠⠛⠠⠓ ⠸⠱ ⠊⠎ ⠁ ⠏⠜⠁⠇⠇⠑⠇⠕⠛⠗⠁⠍⠲
⠸⠩ ⠫⠓ ⠠⠚⠠⠅⠠⠇⠠⠍ ⠸⠱ ⠊⠎ ⠁ ⠗⠓⠕⠍⠃⠥⠎⠲
⠼⠃⠲ ⠠⠉⠕⠍⠏⠜⠑ ⠞⠗⠊⠁⠝⠛⠇⠑⠎⠒
⠸⠩ ⠫⠞ ⠠⠁⠠⠙⠠⠍ ⠈⠱⠨⠅ ⠫⠞ ⠠⠁⠄⠠⠙⠄⠠⠍⠄⠸⠲
⠫⠞⠨⠗⠻ ⠠⠃⠠⠑⠠⠏ ⠌⠈⠱⠨⠅ ⠫⠞⠨⠗⠻ ⠠⠉⠠⠋⠠⠏⠸⠲
⠼⠒⠸⠲ ⠠⠄⠠⠩⠙ ⠫⠞ ⠠⠁⠠⠃⠠⠧ ⠸⠱ ⠆ ⠔⠉⠇⠥⠙⠫ ⠔ ⠮ ⠎⠑⠞
⠸⠩ ⠨⠷⠫⠞ ⠼⠒⠠ ⠫⠪ ⠠⠛⠠⠓⠠⠁⠠ ⠫⠙ ⠼⠆⠨⠾⠸⠦
⠼⠲⠸⠲ ⠫⠪ ⠼⠒⠬⠫⠪ ⠼⠲ ⠨⠅ ⠼⠔⠴⠘⠨⠡
⠼⠢⠸⠲ ⠍⠫⠪ ⠏⠬⠍⠫⠪ ⠟ ⠨⠅ ⠼⠂⠦⠴⠘⠨⠡
⠼⠖⠸⠲ ⠍⠘⠨⠡⠐⠫⠪ ⠨⠹ ⠨⠅ ⠤⠼⠲⠢
⠼⠶⠸⠲ ⠠⠁⠰⠫⠞ ⠠⠙⠠⠑⠠⠋ ⠨⠅ ⠹⠂⠌⠆⠼⠃⠓
⠼⠦⠸⠲ ⠼⠢⠰⠦⠐⠬⠫⠉⠰⠦ ⠨⠅ ⠼⠆⠆⠰⠦
⠼⠔⠸⠲ ⠫⠪ ⠠⠑⠠⠉⠠⠃ ⠸⠅ ⠹⠂⠌⠆⠼⠫⠪ ⠠⠁⠠⠃⠠⠉ ⠸⠱

PRACTICE 11F

⠼⠁⠲ ⠠⠋⠊⠇⠇ ⠔ ⠮ ⠉⠊⠗⠉⠇⠑ ⠿ ⠮ ⠉⠕⠗⠗⠑⠉⠞
⠑⠭⠏⠕⠝⠢⠞⠲ ⠸⠩
⠰⠁⠸⠲ ⠭⠘⠆⠐⠈⠡⠭⠘⠲ ⠨⠅ ⠭⠘⠫⠉
⠰⠃⠸⠲ ⠽⠘⠒⠐⠈⠡⠽⠘⠫⠉ ⠨⠅ ⠽⠘⠔
⠰⠉⠸⠲ ⠵⠘⠫⠉⠐⠈⠡⠵⠘⠢ ⠨⠅ ⠵⠘⠂⠢ ⠸⠱
⠼⠃⠲ ⠠⠋⠊⠇⠇ ⠔ ⠮ ⠃⠕⠭ ⠿ ⠮ ⠍⠊⠎⠎⠬ ⠝⠥⠍⠃⠻⠲ ⠸⠩
⠰⠁⠸⠲ ⠼⠲⠒⠖⠤⠫⠗ ⠨⠅ ⠼⠂⠴⠆
⠰⠃⠸⠲ ⠼⠢⠸⠹⠂⠦⠌⠂⠆⠸⠼ ⠨⠅ ⠫⠲⠸⠹⠂⠌⠆⠸⠼
⠰⠉⠸⠲ ⠹⠂⠢⠌⠆⠴⠼ ⠨⠅ ⠹⠒⠌⠫⠲⠼
⠰⠙⠸⠲ ⠠⠓⠆⠬⠠⠕⠆ ⠫⠕ ⠠⠓⠰⠫⠲⠐⠠⠕ ⠸⠱
⠼⠉⠲ ⠠⠐⠝ ⠞⠺⠕ ⠙⠊⠖⠻⠢⠞ ⠕⠏⠻⠁⠰⠝ ⠎⠊⠛⠝⠎ ⠞ ⠍⠁⠅⠑ ⠹
⠁ ⠞⠗⠥⠑ ⠌⠁⠞⠑⠰⠞⠒ ⠸⠩ ⠼⠂⠫⠲⠐⠂ ⠨⠅ ⠼⠂ ⠸⠱⠲

PRACTICE 11G

⠀⠀⠠⠔⠏⠥⠞ ⠮ ⠑⠟⠥⠁⠰⠝ ⠥⠎⠬ ⠮ ⠸⠩ ⠫⠅⠭⠻ ⠸⠱ ⠅⠑⠽⠲
⠠⠏⠗⠑⠎⠎ ⠸⠩ ⠫⠅⠠⠠⠎⠓⠊⠋⠞⠻ ⠠⠄⠯ ⠫⠅⠇⠝⠻ ⠸⠱ ⠞⠕
⠁⠒⠑⠎⠎ ⠸⠩ ⠷⠑⠘⠫⠲⠐⠾⠸⠲ ⠠⠄⠠⠏⠗⠑⠎⠎ ⠫⠅⠨⠅⠻ ⠸⠱ ⠿ ⠮
⠰⠽ ⠧⠁⠇⠥⠑⠲ ⠠⠝⠪ ⠔⠏⠥⠞ ⠘⠮ ⠧⠁⠇⠥⠑⠎ ⠔⠞⠕ ⠽⠗
⠉⠁⠇⠉⠥⠇⠁⠞⠕⠗⠲ ⠸⠩
⠀⠀⠫⠅⠷⠻⠆⠫⠅⠈⠼⠻⠒⠫⠅⠬⠻⠔⠫⠅⠾⠻⠫⠅⠨⠌⠻⠢⠫⠅⠨⠅⠻ ⠠⠄⠯
⠀⠀⠀⠀⠼⠆⠂⠆⠫⠅⠘⠨⠡⠐⠻⠫⠅⠫⠒⠒⠕⠘⠨⠡⠐⠠⠉⠻⠫⠅⠠⠕⠝⠙⠻ ⠸⠱
⠀⠀
⠀⠀⠀⠀⠠⠥⠎⠑ ⠠⠠⠏⠑⠍⠙⠁⠎ ⠞⠕ ⠎⠕⠇⠧⠑ ⠘⠮ ⠕⠏⠻⠁⠰⠝⠎⠲
⠀⠀⠠⠏⠗⠕⠃⠇⠑⠍⠎ ⠍⠜⠅⠫ ⠾ ⠈⠫⠏ ⠔⠙⠊⠉⠁⠞⠑ ⠞ ⠽ ⠜⠑ ⠞⠕
⠀⠀⠩⠪ ⠽⠗ ⠐⠺⠲ ⠸⠩
⠰⠠⠁⠸⠲ ⠤⠼⠂⠈⠡⠈⠷⠷⠒⠤⠲⠈⠡⠶⠾⠨⠌⠢⠈⠾⠤⠆⠈⠡⠆⠲⠨⠌⠖
⠈⠫⠏ ⠰⠠⠃⠸⠲ ⠷⠒⠈⠡⠢⠘⠆⠐⠨⠌⠂⠢⠾⠷⠢⠤⠆⠘⠆⠐⠾
⠰⠠⠉⠸⠲ ⠼⠔⠨⠌⠒⠬⠆⠷⠔⠬⠂⠴⠾⠤⠦⠬⠲⠈⠡⠒
⠈⠫⠏ ⠰⠠⠙⠸⠲ ⠷⠂⠂⠤⠆⠴⠨⠌⠹⠢⠘⠆⠐⠤⠂⠒⠌⠒⠼⠬⠦⠾⠈⠡⠆ ⠸⠱

(Special Symbols page excerpt)

⠠⠠⠠⠎⠏⠑⠉⠊⠁⠇ ⠎⠽⠍⠃⠕⠇⠎
⠥⠎⠫ ⠔ ⠹ ⠧⠕⠇⠥⠍⠑⠠⠄
⠀⠀
⠨⠿⠈⠫⠏ ⠠⠊⠉⠕⠝ ⠩⠁⠏⠫ ⠇ ⠁ ⠏⠢⠉⠊⠇

PRACTICE 11H

```
  ⠠⠺⠗⠊⠞⠑ ⠽⠗ ⠁⠝⠎⠺⠻ ⠔ ⠮ ⠃⠕⠭⠲ ⠠⠏⠁⠽ ⠉⠇⠕⠎⠑
⠁⠞⠞⠢⠰⠝ ⠞⠕ ⠮ ⠊⠞⠁⠇⠊⠉⠊⠵⠫ ⠥⠝⠊⠞⠎⠲ ⠸⠩
  ⠼⠢⠆ ⠨⠉⠓⠥⠗⠗⠕⠎⠨⠌⠆⠖ ⠨⠉⠓⠊⠇⠙⠗⠑⠝
    ⠨⠅ ⠫⠲ ⠠⠄⠨ ⠉⠓⠥⠗⠗⠕⠎ ⠏⠑⠗ ⠉⠓⠊⠇⠙ ⠨⠄⠄ ⠸⠱

  ⠘⠂⠠⠏⠽⠹⠁⠛⠕⠗⠂⠝ ⠘⠂⠠⠮⠕⠗⠑⠍ ⠠⠔ ⠁ ⠐⠗
⠞⠗⠊⠁⠝⠛⠇⠑⠂ ⠮ ⠎⠟⠥⠜⠑ ⠷ ⠮ ⠓⠽⠏⠕⠞⠢⠥⠎⠑ ⠊⠎ ⠑⠟⠥⠁⠇
⠞⠕ ⠮ ⠎⠥⠍ ⠷ ⠮ ⠎⠟⠥⠜⠑⠎ ⠷ ⠮ ⠕⠮⠗ ⠞⠺⠕ ⠎⠊⠙⠑⠎⠲
  ⠸⠩ ⠉⠘⠆ ⠨⠅ ⠁⠘⠆⠐⠬⠃⠘⠆ ⠸⠱

⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶⠶
  ⠠⠠⠙⠑⠋⠔⠊⠰⠝ ⠠⠁ ⠏⠕⠎⠊⠞⠊⠧⠑ ⠝⠥⠍⠃⠻ ⠑⠭⠏⠗⠑⠎⠎⠫ ⠔
⠮ ⠿⠍ ⠸⠩ ⠁⠈⠡⠂⠴⠘⠝⠠ ⠠⠄⠐⠱ ⠼⠂ ⠐⠅⠱ ⠁ ⠐⠅ ⠼⠂⠴ ⠸⠱
⠯ ⠰⠝ ⠊⠎ ⠁⠝ ⠔⠞⠑⠛⠻ ⠊⠎ ⠎⠙ ⠞⠕ ⠆ ⠺⠗⠊⠞⠞⠢ ⠔
⠘⠂⠎⠉⠊⠢⠞⠊⠋⠊⠉ ⠘⠂⠝⠕⠞⠁⠰⠝⠲
⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛⠛
```

Lines 3-4: The displayed expression begins in cell 3. The linked expression will not fit on one line. It is divided before the equals sign. Review the topic of linked expressions in Lesson 8.