

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)	

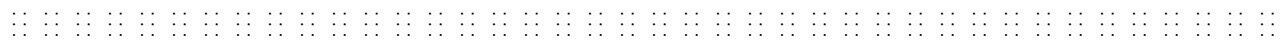
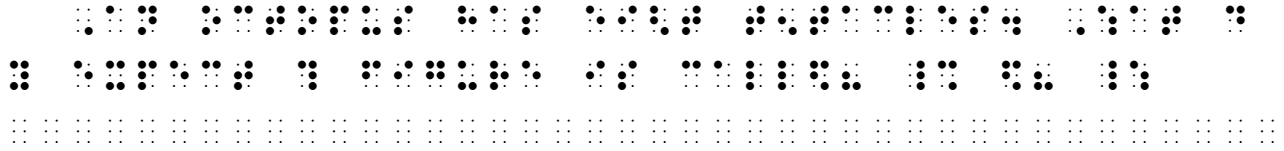
Note that the equilateral triangle, which is a regular polygon, is not represented by the number three. See 11.4.

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 above, 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—Irrregular 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 the list below.)

⠠⠠	<u>D</u> iamond	
⠠⠠⠠	Irregular <u>H</u> exagon	
⠠⠠⠠	Irregular <u>P</u> entagon	
⠠⠠	Parallelogram	
⠠⠠	<u>Q</u> uadrilateral	
⠠⠠	<u>R</u> ectangle	
⠠⠠	<u>R</u> hombus	
⠠⠠	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 above. Be careful not to choose a letter or letter combination which already has

Clarification: The triangle shape shown here is an equilateral or equiangular triangle – sides are equal in length, angles are equal in measurement. The symbol \triangle 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 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.

$\overbrace{\triangle}$	<u>A</u> rc, Concave Upward	\frown
$\triangle \parallel$	Is <u>P</u> aralle <u>l</u> To	\parallel
$\triangle \not\parallel$	Is <u>N</u> ot <u>P</u> aralle <u>l</u> To	\nparallel
$\triangle \perp$	Is <u>P</u> erpendicu <u>l</u> ar To	\perp
$\triangle \not\perp$	Is <u>N</u> ot <u>P</u> erpendicu <u>l</u> ar To	\nperp

Example 11-3

Line AD \parallel Line BC.

$\triangle \parallel$ $\triangle \not\parallel$ $\triangle \perp$ $\triangle \not\perp$ $\triangle \frown$ $\triangle \nparallel$ $\triangle \nperp$

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 above. 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.)

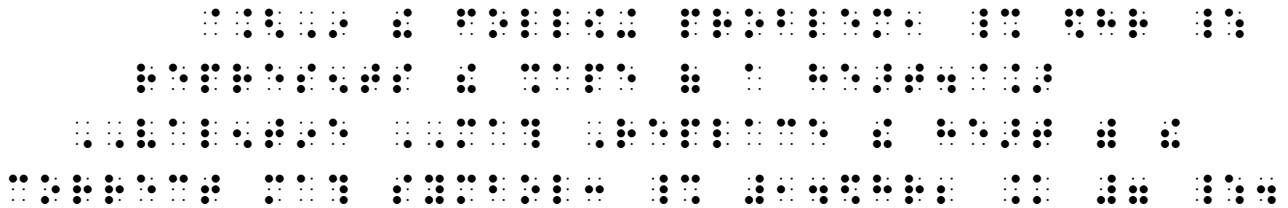
A transcriber's note is required to define the figure. Include a drawing of the shape if it is vital to the mathematical topic at hand.

Sample transcriber's note:

In the following problem, \triangle 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.

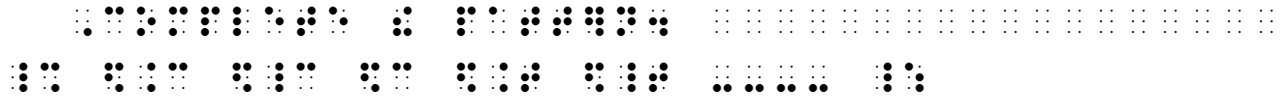
⠠	Filled-in shape indicator
⠠⠠	Shaded shape indicator

- ⠠ ⠠ ⠠ ⠠ (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. 

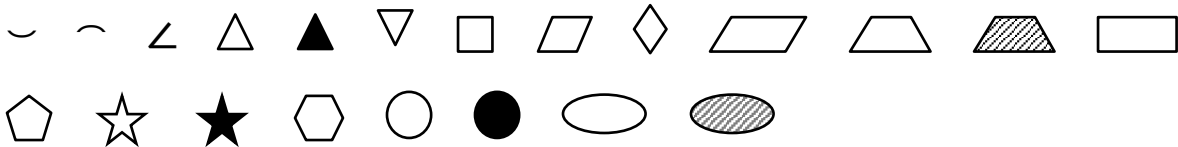


- a. *Exceptions:* A filled-in square or rectangle used to indicate the end of a mathematical proof has its own special symbol. Proofs will be discussed in Lesson 12. Shapes used as icons are discussed later in this lesson. See [11.35](#).

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



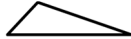

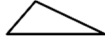
A shape with structural modification is represented by

- 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.

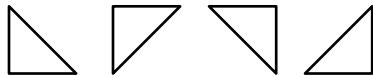
 Shape indicator
 Structural shape-modification indicator
 Termination indicator

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 below.

⠠⠠⠠⠠⠠⠠	<u>A</u> cute Triangle	
⠠⠠⠠⠠⠠⠠	<u>I</u> sosceles Triangle	
⠠⠠⠠⠠⠠⠠	<u>O</u> btuse Triangle	
⠠⠠⠠⠠⠠⠠	<u>R</u> ight Triangle	
⠠⠠⠠⠠⠠⠠	<u>S</u> calene Triangle	




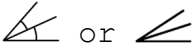









Know Your Triangles: Triangles are defined by the measure of angles and sides, not by orientation. For example, each of these is a "right triangle" because each contains a 90° angle.



Definitions can be found in Appendix B 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 the list below.

Specific Angles		
⠠⠠⠠⠠⠠	<u>O</u> btuse Angle	
⠠⠠⠠⠠⠠	<u>R</u> ight Angle	
⠠⠠⠠⠠⠠	<u>S</u> traight Angle	
Combined Angles		
⠠⠠⠠⠠⠠	<u>A</u> djacent Angles	 or 
⠠⠠⠠⠠⠠	<u>A</u> lternate <u>E</u> xterior Angles	
⠠⠠⠠⠠⠠	<u>A</u> lternate <u>I</u> nterior Angles	
⠠⠠⠠⠠⠠	<u>C</u> omplementary Angles	
⠠⠠⠠⠠⠠	<u>C</u> orresponding Angles	
⠠⠠⠠⠠⠠	<u>E</u> xterior Angles	
⠠⠠⠠⠠⠠	<u>I</u> nterior Angles	
⠠⠠⠠⠠⠠	<u>S</u> upplementary Angles	
⠠⠠⠠⠠⠠	<u>V</u> ertical Angles	








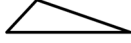

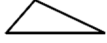

11.10 Unlisted Shapes with Structural Modification

Structurally modified shapes which are not provided for in the Nemeth Code are formed in accordance with the principles above. Review the definition of *structural modification* in 11.7 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

<u>Angle</u>	<u>Symbol</u>	<u>Triangle</u>	<u>Symbol</u>
right		isosceles	
straight		right	
obtuse		acute	
complementary		obtuse	
supplementary		scalene	
vertical			

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 [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	
⠠⠠⠠⠠⠠⠠⠠⠠	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 note on the Transcriber's Notes page: "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 follows. (See also, [11.18](#), below.)



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 [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 [11.32-11.34](#).



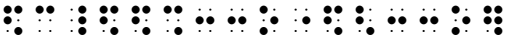

11.16 Two or More Vertically Arranged Modifiers

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	

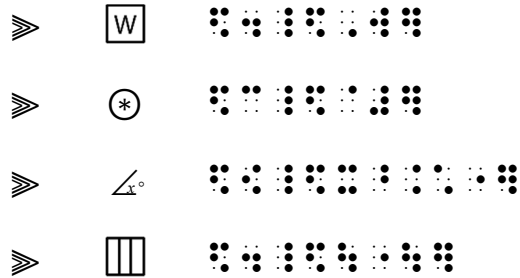
11.17 Two or More Horizontally Arranged Modifiers

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 11.11 to properly identify the unlisted shape.



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	
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.

$$\Rightarrow x \oplus y \quad \text{⠠⠭ ⠠⠎ ⠠⠕⠏ ⠠⠽}$$

Comparison signs are spaced.

$$\Rightarrow x \square y \quad \text{⠠⠭ ⠠⠠⠗⠠⠽ ⠠⠽}$$

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

Example 11-6

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

$$2 \oplus 3 \square 3 \oplus 2$$

11.20 Punctuation with Signs of Shape

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

$$\Rightarrow (\Delta, \circ, \square) \quad \text{⠠⠠⠗⠠⠽ ⠠⠠⠗⠠⠽ ⠠⠠⠗⠠⠽}$$

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.

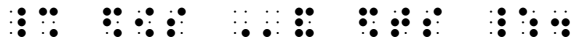
Example 11-7

\triangle_s and \triangle_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

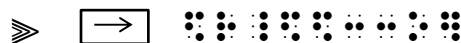
As previously noted, when encountering a shape not provided for in the Nemeth Code the transcriber may devise a symbol if that shape appears more than occasionally. The print shape should also be drawn as a raised-line diagram the first time the new symbol is introduced. In addition to the guidelines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

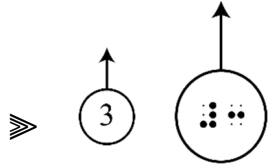
- a. The numeric indicator is used before a numeral or before a decimal point and a numeral following the interior shape-modification indicator.



- 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.



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. $\square, \bigcirc, \triangle, \sphericalangle, \odot, \sphericalangle$.
2. (\bigcirc 's, \sphericalangle 's, and \triangle 's.)
3. $a \oplus (b \oplus c)$
4. $r \otimes s \otimes \underline{\quad} = rst$
5. How many \triangle can you find in the giant \square ?

the item. Look carefully at the use and nonuse of the numeric indicator in each example below, as described in the comments.

➤ (∠1, ∠2, ∠3)

⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

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

➤ (∠1, 2∠1, 3∠1)

⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠

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

➤ (1∠a, 2∠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: $\triangle ADM \cong \triangle A'D'M'$. $\triangle BEP \not\cong \triangle CFP$.
3. Should $\triangle ABV$ be included in the set $\{\triangle 3, \angle GHA, \diamond 2\}$?
4. $\angle 3 + \angle 4 = 90^\circ$
5. $m\angle p + m\angle q = 180^\circ$
6. $m^\circ \angle \theta = -45$
7. $A_{\triangle DEF} = \frac{1}{2}bh$
8. $5_8 + \bigcirc_8 = 22_8$
9. $\angle ECB = \frac{1}{2}\angle ABC$

Shapes Used as Signs of Omission

11.28 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 sign of shape is spaced in accordance with the rules for the omitted material it represents. A sign of shape 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.)

➤ $40 \text{ dimes} = \$\circ$ ⠠⠙⠠⠒⠠⠞⠠⠎ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔

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

➤ $\square l = 1000 \text{ cc}$ ⠠⠗⠠⠞⠠⠎ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔

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

➤ $15 \circ 15 = 30$ ⠠⠑⠠⠗⠠⠞⠠⠎ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔

(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.)

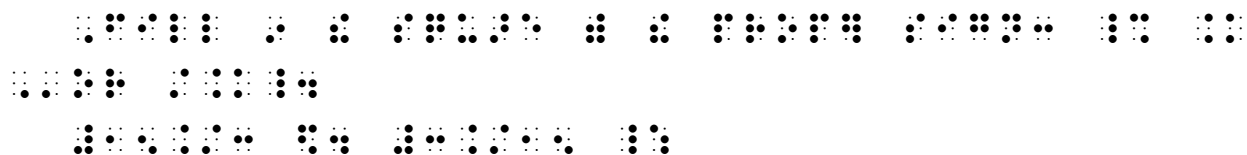
➤ $y^{\frac{1}{3}} = \sqrt[3]{\blacksquare}$ ⠠⠑ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔ ⠨⠶⠠⠗⠦⠠⠔

(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 ≠.

$$15 \div 3 \square 3 \div 15$$



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 three examples, a "square" symbol is used as a sign of omission representing a comparison sign.

➤ $x \square y$ ⠠⠭ ⠠⠽

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 shorthand 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.

➤ ray ab ○ ray ac



A mathematical sequence that corresponds to a shorthand 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 examples represent a sign of operation.

$$\gg 15 \square 15 = 30 \quad \dots \dots \dots \dots \dots \dots \dots \dots \dots$$

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

The situation stated above occurs only when the shape is represented by a numeral.

$$\gg 15 \bigcirc 15 = 30 \quad \dots \dots \dots \dots \dots \dots \dots \dots \dots$$

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

$$\begin{array}{r} 946 \\ + \square\square \\ \hline 1002 \end{array} \quad \begin{array}{r} \dots \dots \dots \\ \dots \dots \dots \\ \dots \dots \dots \dots \dots \dots \\ \dots \dots \dots \end{array}$$

In print, the omissions are indicated as two squares.

Instructions: Review 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. $y^3 \times y^{\bigcirc} = y^9$

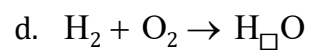
c. $z^{\bigcirc} \times z^5 = z^{15}$

2. Fill in the box with the missing number.

a. $436 - \square = 102$

b. $5\frac{18}{12} = \square\frac{1}{2}$

c. $\frac{15}{20} = \frac{3}{\square}$



3. Name two different operation signs that make this a true statement: $1 \square 1 = 1$.

Calculators and Keyboards

[NC 17.6.4]

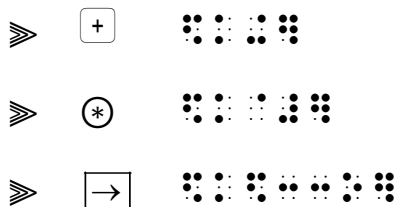
11.32 The Keystroke Indicator

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.



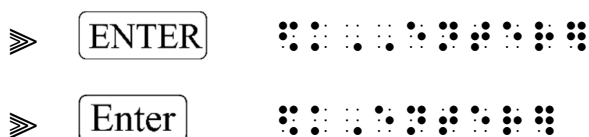
The actual key shape(s) used in a particular text should be specified in a transcriber's note.
Sample transcriber's note:

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.



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



A baseline indicator is required before this termination indicator.

Example 11-18

Press 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.

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

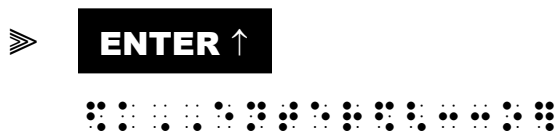
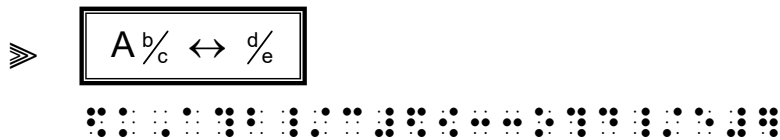


Compare to a shape with interior modification which does require a numeric indicator. See 11.22.1.

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

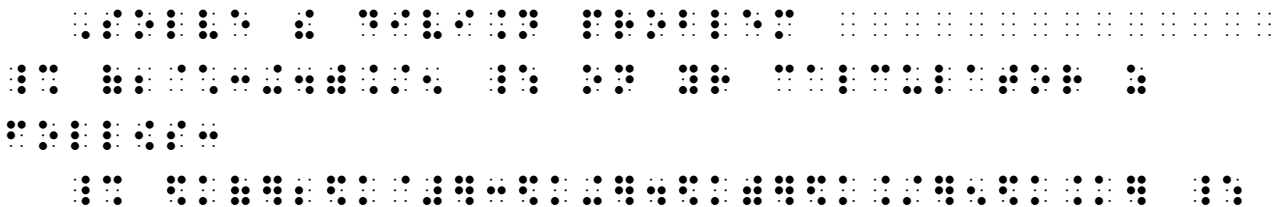
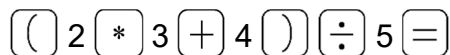


11.33.2 **Spacing.** No space is left between keystroke constructions and other similar constructions or mathematical symbols in a sequence of related calculations. Arrows contained in the labels on the keys should not be spaced from the material to which they apply.



Example 11-19

Solve the division problem $(2 \times 3 + 4) \div 5$ on your calculator as follows:

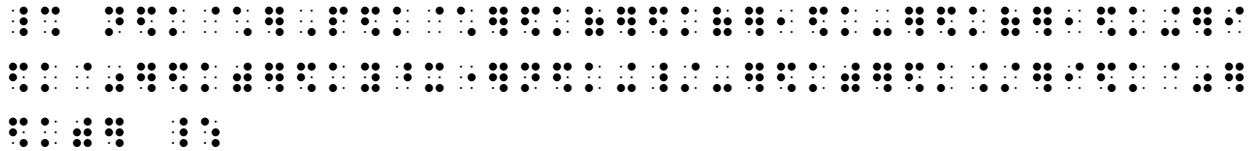


11.34 Long Keystroke Constructions

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 [x] P [x] ((1 - (1 + i [%]) [y^x] n [+/-]) ÷ i [%])



Icons

11.35 Consistency in Representation of Icons

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 the next example.



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.

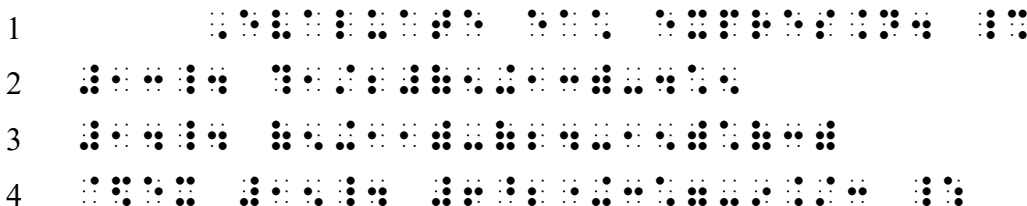
Example 11-21

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 $\boxed{\ln}$ to access (e^{\square}) . Press $\boxed{=}$ for the y value. Now input these values into your calculator.

$\boxed{(}$ $\boxed{2}$ $\boxed{*}$ $\boxed{3}$ $\boxed{+}$ $\boxed{9}$ $\boxed{)}$ $\boxed{\div}$ $\boxed{5}$ $\boxed{=}$ and
 $\boxed{2}$ $\boxed{1}$ $\boxed{2}$ $\boxed{\circ}$ $\boxed{\rightarrow}$ $\boxed{\circ\text{C}}$ $\boxed{\text{End}}$

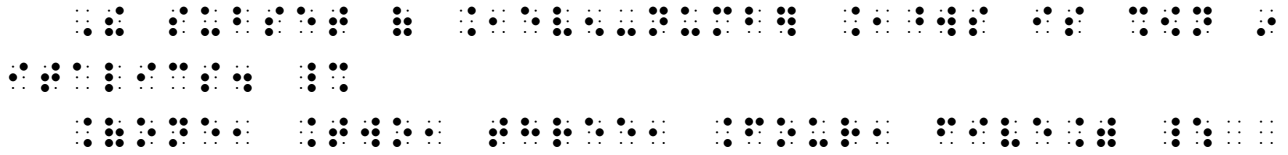
Use PEMDAS to solve these operations. Problems marked with \pencil indicate that you are to show your work.

- A. $-1 \times [(3 - 4 \times 7) \div 5] - 2 \times 24 \div 6$
- \pencil B. $(3 \times 5^2 \div 15)(5 - 2^2)$
- C. $9 \div 3 + 2(9 + 10) - 8 + 4 \times 3$
- \pencil D. $\left(11 - 20 \div \frac{5^2 - 13}{3} + 8\right) \times 2$

Example 11-23

The subset of *even-number words* is shown in italics.

{one, *two*, three, *four*, five}

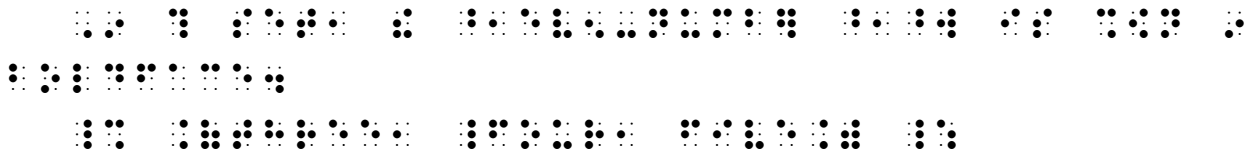


In UEB context, the UEB italic word indicator is used. In Nemeth context, the Nemeth single word italic type indicator is used.

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.

➤ $P(A \text{ and } B) = 0$



Italics are disregarded.

➤ $P(A \text{ not } B) = 0$



Italics and bold are disregarded.

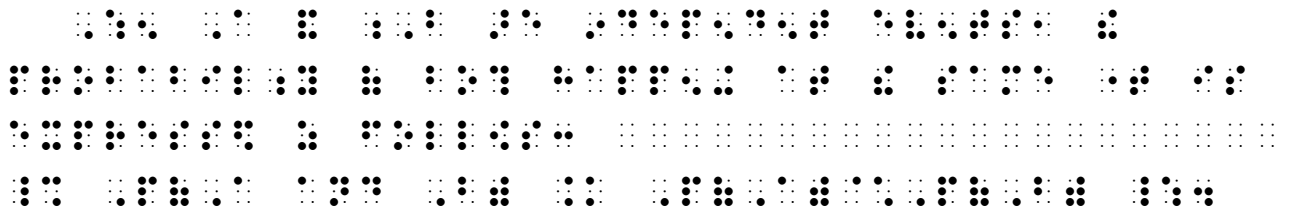
➤ $P(A \text{ OR } B)$



Capitalization is retained.

Example 11-25

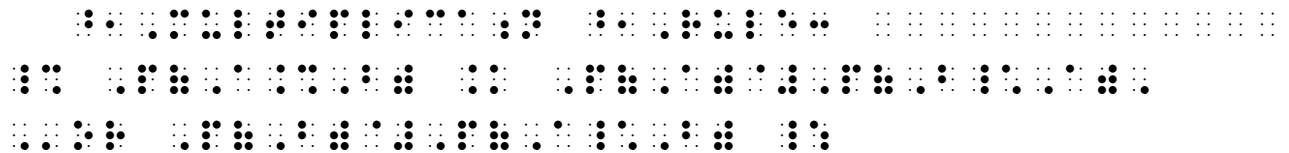
When *A* and *B* are independent events, the probability of both happening at the same time is expressed as follows: $P(A \text{ and } B) = P(A) \times P(B)$.



The italicized word "and" is part of the mathematical expression P(A 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: $P(A \cap B) = P(A) * P(B \setminus A)$, or $P(B) * P(A \setminus B)$



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 above.

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 3.12.3.a. See also Section 3.10 for the definition of “single letter”.)

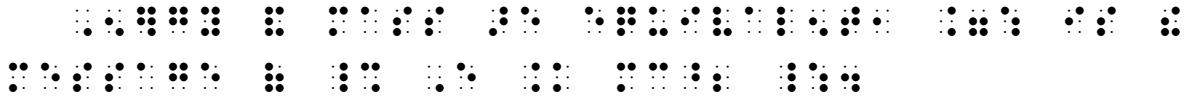
Words encountered in a probability statement are part of the math. The words are transcribed in Nemeth, without contractions. Single words do not use a the single-word switch indicator. Typeform is disregarded; capitalization is retained. (See Examples 4-36 and 4-49.)

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)

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.)

Example 11-32

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

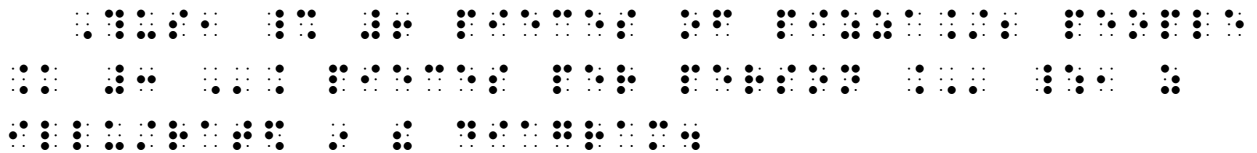


Even though the formula is part of the italicized passage, italics are disregarded inside the switches because the typeform is not mathematically significant.

- 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 \div 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

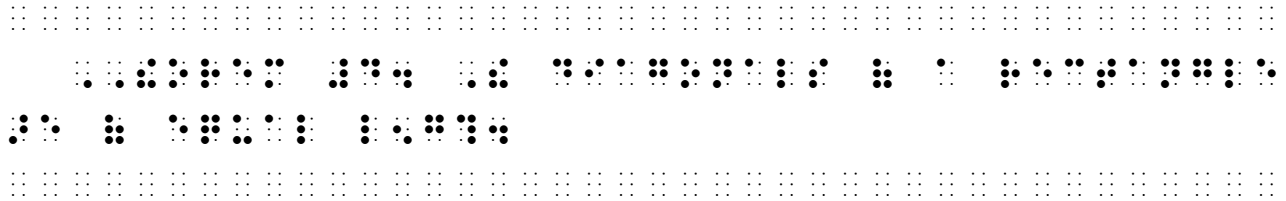
Definition *A set which can be put into one-to-one correspondence with the natural numbers is called a **countable set**.*

The image shows a Braille transcription of the definition. It consists of five lines of Braille. The first line is a blank line. The second line is the label 'Definition' in boldface, transcribed as a paragraph heading. The third line is the start of the statement, which is italicized in the original. The fourth line continues the statement. The fifth line is a blank line. The Braille uses various cell patterns to represent boldface, italics, and the bold words 'countable set' within the statement.

A blank line precedes and follows the mathematical statement. In print, "Definition" is a marginal heading and is in boldface type. The statement is printed in italics and is set off from the main body text with indented margins. 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. We will assume that all Definition statements in this book are printed in italics, therefore the uniform typeface of the statement is disregarded. Boldface is retained for the bold words within the statement.

Example 11-35

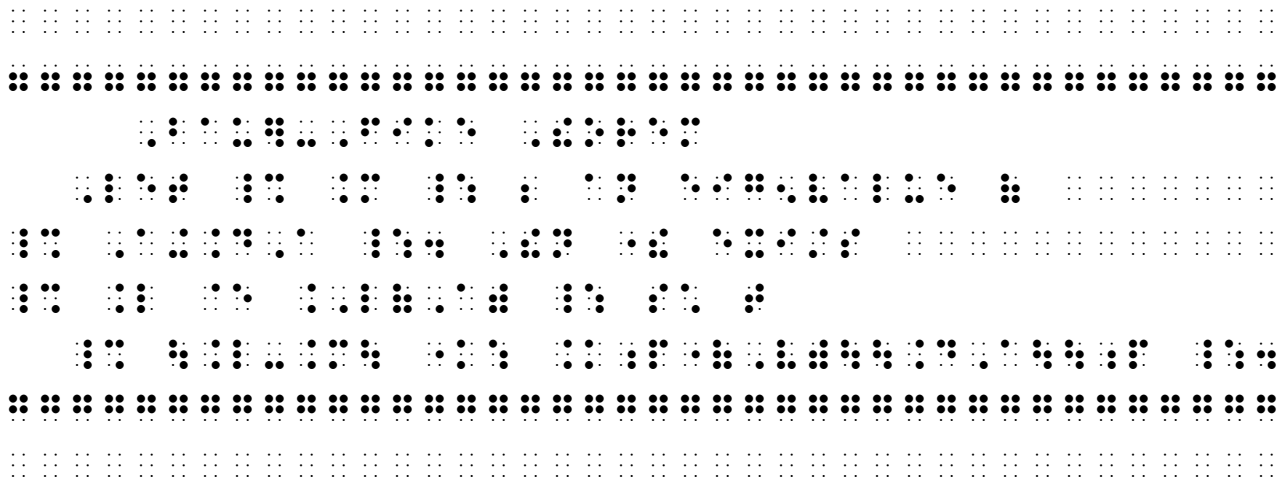
THEOREM 4. *The diagonals of a rectangle are of equal length.*



The label is printed in bold type. Typeform of the paragraph heading is disregarded because it is fully capitalized. 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

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



The mathematical statement is boxed. Box lines are retained for distinction. 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.) 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.

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

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

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

<p>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.</p>
--

<p><i>For further practice, see Appendix A—Reading Practice.</i></p>
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EXERCISE 11

Prepare Exercise 11 for your grader.

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







































































































































































































































PRACTICE 11C

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PRACTICE 11D

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PRACTICE 11H

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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.