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

Revised by Lindy B. Walton
Barbara Taffet, advisor
National Library Service
for the Blind and
Physically Handicapped

The Library of Congress
I believe that I could not have reached my potential in mathematics without the Nemeth Code. With it, I am able to read and write mathematics, as well as other sciences, at all levels, limited only by my talent and my ambition.

—Dr. Abraham Nemeth, creator of the braille code for mathematics and science notation

DEDICATION

I credit my interest in the continued training of braille transcribers in the Nemeth Code to my friend and mentor, Helen Hay, whose fascination and enthusiasm about this braille code was contagious.

THANKS

I offer my gratitude to the original authors of this lesson manual, Helen Roberts, Bernard M. Krebs, and Barbara Taffet, for their insight into the learning process and for their eye for detail. Many of the excellent examples from the original book are preserved in this edition. I also wish to thank my supervisors and colleagues in the Madison Metropolitan School District for realizing the importance of the development of this curriculum.

—Lindy Walton
ABOUT THE PROGRAM

This course is designed for the UEB certified transcriber who is ready to take on the challenge of transcribing print mathematics and science materials into braille using the Nemeth Braille Code for Mathematics and Science Notation. The program operates under a contract with the National Library Service for the Blind and Print Disabled, Library of Congress (NLS). All transcribing and proofreading course lessons and tests are administered under the National Federation of the Blind Braille Certification Training Program (BCTP). The following information is copied from the (2022) cover letter that the enrolled student will receive when accepted into the course. Up-to-date instructions will be sent at the time of enrollment.

The course is based on The Nemeth Braille Code for Mathematics and Science Notation, 2022, a publication of the Braille Authority of North America (BANA). Course materials do not supersede the authority of the official BANA code book.

Eligibility

- United States citizenship or residency
- High school diploma or equivalent
- Knowledgeable in recommended braille formats for textbooks

Prerequisite

- Library of Congress certification in literary braille transcribing (UEB) for a minimum of six months

Equipment

Any of the following methods may be used in order to submit lesson exercises in braille: a forty-cell slate, a braillewriter, or a computer application that allows for direct input of 6-key braille. Use of back translation is allowed but 6-key entry is a necessity as well. A line length of forty cells is required, regardless of production method.

The Lesson Material

The lessons are available by following the “Mathematics Braille Transcribing” link at www.nfb.org/transcribers. If you are unable to utilize the material from the website, please contact us at transcribers@nfb.org or (410) 659-9314, extension 2510, and we will work with you to ensure you receive the material in a format that is usable for you.

Most lessons conclude with an exercise, which will be given to you as you complete each lesson and which is to be submitted to your grader for evaluation. You are encouraged to submit your work on a regular basis (at least monthly). You may submit only one lesson at a time.

Revisions to the online course lessons are occasionally necessary. The student should check the website to ensure that any lesson being completed is the current version. To report errors in this instruction manual, please send your message to transcribers@nfb.org.
Your Grader

A student must take the course by correspondence with the NFB. After receiving your transcription of the first exercise, a grader will be assigned. Your grader will evaluate your first submission and will be your point of contact for the rest of the course.

The Certification Test

Upon completion of the course, the student may apply for the certification test. When requesting the test, students who have taken the course locally must include a letter from their Library of Congress certified mathematics braille instructor attesting that the student has successfully completed the course. Certification tests are distributed and evaluated by the National Federation of the Blind. Instructions for preparation and submission will accompany the exam. The Library of Congress remains the certifying authority. Candidates scoring a passing grade will receive a Library of Congress certificate.

How to Enroll

Whether intending to take the course with a local teacher or through correspondence, prospective students must submit the application form before beginning the course. Applicants can enroll in the course in one of two ways.

- Complete the application online at https://nfb.org/programs-services/braille-certification/mathematics-braille-transcribing
- Or mail a print application to the address shown below.

National Federation of the Blind
Braille Certification Training Program
200 East Wells Street at Jernigan Place
Baltimore, MD 21230

Further Information

For more information about the braille certification training program, you may email, call, or write:

- email: transcribers@nfb.org
- call: 410-659-9314, extension 2510
- write to the address shown above.
FOREWORD TO THE 2022 EDITION

The first edition of the *Introduction to Braille Mathematics* was published in 1978 and was written by the late Helen Roberts and Bernard M. Krebs. It was my privilege to complete the text with Mr. Krebs after Helen passed away. Since that time, numerous corrections and updates have been made both to the Nemeth Code itself and to this manual. Now, however, a major change has necessitated a complete rewriting of the lessons. 2016 was the implementation year in the United States for new transcriptions to be produced using the Unified English Braille Code. Because Nemeth Code works within UEB, many of the rules of Nemeth Code must be modified.

After the first lesson most examples, practices, and exercises are shown in a text-like context. In this way, the student can see how the Nemeth Code works in a real setting such as found in texts of many grade levels and complexities.

The practices within each lesson are available for self checking by the student. Answers to the practices are given at the end of each lesson. Braille reading practice is offered in Appendix A. Most lessons conclude with an exercise which will be sent to you and evaluated by your teacher or by your NFB-assigned grader.

The student should understand that the Nemeth Code itself is the authoritative source for all mathematics transcriptions. The student should also be thoroughly familiar with the sourcebooks listed in the PREREQUISITES which follow this Foreword.

It has long been my hope that this manual could be brought into the present era. Lindy Walton, an experienced transcriber who works with the NLS Nemeth certification program, led the writing of this Second Edition. Once again, it is my honor to work with an exceptional member of the braille transcriber community.

Both Lindy and I thank the following for their support and help: Mary Denault, Peggy Jackson, Bill Jackson, Kyle DeJute, Julie Sumwalt, Lynnette Taylor, the members of the BANA Nemeth Code Technical Committee, the Grafton Braille Service Center, and the students who participated in the beta testing of this course. Lastly, we direct our sincerest gratitude to the National Federation of the Blind which has lent support to the development and publication of this comprehensive manual.

—Barbara Taffet
PREREQUISITES

A prerequisite to the study of the Nemeth Code within UEB context is certification in Unified English Braille, adequate experience in literary braille transcription, and confidence in your production method. Before beginning this course of study the student should also be thoroughly familiar with current methods for transcribing a textbook. Rules and guidelines are found in the following sourcebooks, all of which are available from the Braille Authority of North America (BANA) at www.brailleauthority.org. Dates shown below are the editions used as a resource in this lesson manual.

*Braille Formats: Principles of Print-to-Braille Transcription, 2016*
*The Nemeth Braille Code for Mathematics and Science Notation, 2022*
*Guidelines and Standards for Tactile Graphics, 2022*
*Chemical Notation Using Nemeth Braille Code, 2022*
CONTENTS

About the Program ................................................................. iv
Foreword to the 2022 Edition .................................................... vi
Prerequisites .............................................................................. vii

Preliminary Lesson

P1 Philosophy ................................................................. P–1
P2 Literary vs. Technical Texts ...................................................... P–1
P2.1 Literary Texts ............................................................. P–1
P2.2 Technical Texts ............................................................. P–1

INTRODUCTION TO NUMERALS AND THE NUMERIC INDICATOR

P3 Representation of Arabic Numerals ........................................ P–2
P3.1 English Braille Numerals ................................................. P–2
P3.2 Nemeth Digits ............................................................... P–3
P4 Numeric Indicator ............................................................. P–3
P4.1 Special Case—Partitioned Numbers ................................... P–3

THE PRACTICE MATERIAL

Practice A ................................................................. P–4

THE MATHEMATICAL COMMA AND DECIMAL POINT

P5 Mathematical Comma ....................................................... P–5
P6 Mathematical Decimal Point .............................................. P–5
P6.1 Spacing of the Decimal Point .......................................... P–5
P6.2 The Decimal Point and the Numeric Indicator ...................... P–5
P7 Format: General Principles ................................................ P–6
Practice B ................................................................. P–6

INTRODUCTION TO SIGNS OF OPERATION

P8 Signs of Operation ......................................................... P–7
P8.1 Spacing with Signs of Operation ..................................... P–7
P8.2 Positive and Negative Numbers ..................................... P–7
Practice C ................................................................. P–8

INTRODUCTION TO SIGNS OF COMPARISON

P9 Signs of Comparison ....................................................... P–8
P9.1 Spacing with Signs of Comparison ................................... P–8
Practice D ................................................................. P–9

MONETARY, PERCENT, AND PRIME SIGNS

P10 Monetary Signs ............................................................ P–10
P10.1 Spacing with Monetary Signs ........................................ P–10
P11 Percent and Per Mille Signs ............................................. P–10
P11.1 Spacing with Percent and Per Mille Signs ......................... P–10
P12 Prime Sign ................................................................. P–11
Practice E ................................................................. P–11

EUROPEAN SYMBOLS

P13 The European Mathematical Comma ............................... P–12
P14 The European Decimal .................................................... P–12
Lesson 1

INTRODUCTION TO CODE SWITCHING

1.1 A Complete Transcription ................................................................. 1–2
1.2 Use of the Code Switch Indicators .................................................... 1–2
  Practice 1A ......................................................................................... 1–3
1.3 Which Code? ...................................................................................... 1–3
  1.3.1 UEB Required ............................................................................. 1–3
  1.3.2 UEB Allowed ............................................................................ 1–3
  1.3.3 Nemeth Required ....................................................................... 1–5
1.4 Placement of Literary Punctuation ..................................................... 1–6
  Practice 1B ......................................................................................... 1–7
1.5 Format:
  Keep Together—General Principle Regarding Mathematical Expressions .... 1–7
  Placement of the Switch Indicators
  1.5.1 Keep Together If Possible ............................................................... 1–7
  1.5.2 A Switch Indicator May Stand Alone on a Line ............................. 1–8
  1.5.3 Switch Indicators at Braille Page Turns ....................................... 1–10
  Practice 1C ......................................................................................... 1–11
1.6 Consistency with Mathematical Symbols ............................................ 1–11
  Practice 1D ......................................................................................... 1–12

THE HYPHEN AND THE DASH

1.7 The Hyphen and the Dash As Punctuation ......................................... 1–12
  1.7.1 A Hyphen May Divide a Long Numeral ....................................... 1–12
  1.7.2 A Hyphen May Connect Numerals ................................................. 1–13
  1.7.3 The Short Dash ............................................................................ 1–14
  1.7.4 Hyphen, Dash, or Minus Sign? ...................................................... 1–15
  Practice 1E ......................................................................................... 1–16

SIGNS OF OMISSION

1.8 General Use of Signs of Omission ..................................................... 1–16
1.9 Ellipsis ............................................................................................... 1–16
1.10 Long Dash ......................................................................................... 1–17
1.11 General Omission Symbol ................................................................. 1–17
1.12 Spacing of the Ellipsis and Long Dash ............................................. 1–19
1.13 Other Omission Symbols ................................................................ 1–20
1.14 Format: Paragraph Margins for Narrative Portions of Text (3-1) ........ 1–20
  Practice 1F ......................................................................................... 1–21

INTRODUCTION TO IDENTIFIERS

1.15 Terminology ..................................................................................... 1–22
1.16 Format: Margins for Itemized Material with No Subdivisions (1-3) ... 1–22
  Practice 1G ......................................................................................... 1–23

FORMAT SUMMARY #1 ................................................................. 1–24
Answers to Practice Material .............................................................. 1–25
Lesson 2

MORE ABOUT PUNCTUATION

2.1 Punctuation Mode ................................. 2–2
2.2 Spacing of UEB Punctuation and Code Switch Indicators .............. 2–2
2.3 Nemeth Punctuation ............................... 2–3

Practice 2A ........................................... 2–4

PUNCTUATION IN NEMETH CODE

2.4 Background ......................................... 2–4

The Punctuation Indicator

2.5 Role of the Punctuation Indicator ........................................ 2–5
2.5.1 Two or More Punctuation Marks in a Row ........................... 2–5
2.5.2 A Comparison Sign in Quotes ....................................... 2–6
2.5.3 A Number in Quotes ............................................. 2–6
2.5.4 Digital Clock Time ............................................. 2–7

2.6 Punctuation with Omission Signs ........................................ 2–7
2.6.1 Spacing Exception—The Hyphen .................................. 2–8

2.7 Punctuation and Spacing of Plural or Possessive Endings .............. 2–9

Practice 2B .............................................. 2–10

2.8 Summary of the Use and Nonuse of the Punctuation Indicator .. 2–10
2.8.1 Situations That Do Not Require a Punctuation Indicator .... 2–10
2.8.2 Situations That Require a Punctuation Indicator ............ 2–11

INTRODUCTION TO SIGNS OF GROUPING

2.9 Definition ........................................... 2–12
2.10 Signs of Grouping with Numerals ...................................... 2–12
2.10.1 Identifiers .......................................... 2–12
2.11 Punctuation with Grouping Symbols .................................. 2–13
2.12 Nested Grouping Symbols ........................................... 2–14

Code-Switching Considerations

2.13 Enclosed Technical Material .......................................... 2–14
2.13.1 Punctuation Following a Sign of Grouping ......................... 2–15
2.14 Paired Punctuation ........................................ 2–15

Spacing with Signs of Grouping

2.15 Spacing Inside of the Grouping Signs ................................ 2–16
2.15.1 Special Case ......................................... 2–16
2.16 Spacing Outside of the Grouping Signs ................................ 2–17

Practice 2C .............................................. 2–18

IDENTIFIERS, cont.

2.17 Identifiers and Braille Page Turns .................................... 2–19
2.17.1 Print Page Number Interference ................................. 2–19
2.18 Code Switching and Identifiers ....................................... 2–19
2.18.1 A Numbered List of Nemeth Items .............................. 2–19
2.18.2 An Itemized List of Mixed Items ............................... 2–20

Practice 2D .............................................. 2–23
2.19 Format: Keep Together—Hyphenated Expressions ......... 2–24
2.20 Side-by-Side Layout of Itemized Material ........................................ 2–24
2.21 Code Switching with Listed Items .................................................. 2–25
   2.21.1 Unitemized List ................................................................. 2–25
   2.21.2 Bulleted List .................................................................. 2–25
   2.21.3 Itemized List .................................................................. 2–25
   2.21.4 A List with a Heading ......................................................... 2–25
Answers to Practice Material ................................................................. 2–27

Lesson 3

WORDS
   3.1 Words in Mathematical Context .................................................. 3–2
      3.1.1 Capitalization ................................................................. 3–3
   3.2 Words in Narrative ................................................................. 3–3
   3.3 Punctuation With Words .......................................................... 3–4
      Practice 3A ........................................................................ 3–5

Introduction to Abbreviations
   3.4 Abbreviations ........................................................................ 3–6
      3.4.1 Format—Keep Together .................................................. 3–7
      3.4.2 Punctuation with Abbreviations ..................................... 3–7
      3.4.3 Spacing with Abbreviations .......................................... 3–9
   3.5 Numbers with Ordinal Endings .................................................. 3–10
      Practice 3B ........................................................................ 3–10

Single-Word Switch Indicator
   3.6 The Single-Word Switch Indicator ............................................. 3–11
      3.6.1 Spacing and Contractions ................................................ 3–11
      3.6.2 With a Hyphenated Compound Word ............................. 3–11
      3.6.3 With Typeform ................................................................ 3–12
      3.6.4 With Lower Wordsigns .................................................. 3–12
      3.6.5 With a Heading ............................................................. 3–12
      3.6.6 With Abbreviations ...................................................... 3–12
      3.6.7 Switch Considerations ................................................... 3–13
      3.6.8 With Punctuation ........................................................... 3–13
      3.6.9 The Word "of" ............................................................... 3–14
      3.6.10 Two or More Words ...................................................... 3–15
   3.7 More About Switch Indicators at Braille Page Turns .................. 3–16
      3.7.1 Layout #1 ................................................................. 3–16
      3.7.2 Layout #2 ................................................................. 3–17
      3.7.3 Layout #3 ................................................................. 3–18
      3.7.4 Layout #4 ................................................................. 3–19
      Practice 3C ........................................................................ 3–19
   3.8 New Print Page ........................................................................ 3–20

LETTERS
   3.9 Single English Letters in Narrative ............................................. 3–20
   3.10 Single English Letters in Nemeth Code ..................................... 3–21
      3.10.1 Nemeth Definition of "Single Letter" ............................ 3–21

Introduction to the English Letter Indicator
   3.11 Use of the English Letter Indicator with a "Single Letter" .......... 3–23
Lesson 4

MORE ABOUT LETTERS

Variables

4.1 Mathematical Variables ........................................ 4–2
  4.1.1 A Variable with an Associated Abbreviation—Keep Together 4–2
  4.1.2 Abbreviation or Variable? ................................... 4–2
  4.1.3 Code Switching Considerations .............................. 4–3
  Practice 4A .......................................................... 4–3

Roman Numerals

4.2 Code Switching with Roman Numerals ......................... 4–4
4.3 Capital Roman Numerals ......................................... 4–4
  4.3.1 Roman Numerals Consisting of One Capital Letter .... 4–4
  4.3.2 Roman Numerals Consisting of Two or More Capital Letters 4–5
4.4 Lowercase Roman Numerals .................................... 4–5
4.5 Punctuation with Roman Numerals ............................ 4–6
4.6 Roman Numerals Used as Identifiers .......................... 4–6
4.7 Mathematical Letter Combinations Similar to Roman Numerals 4–7

Review: Nonuse of the English-letter Indicator .................. 4–8
  Practice 4B .......................................................... 4–8

Nondecimal Bases

4.8 Letters Used to Represent Numerals in Nondecimal Bases .... 4–9
4.9 Nonalphabetic Symbols Used to Represent Numerals .......... 4–9
  Practice 4C .......................................................... 4–10

OTHER ALPHABETS

4.10 Alphabetic Indicators ............................................ 4–11
  4.10.1 Code Switching and Use of Letter Indicators ......... 4–11
  4.10.2 Capitalization and Punctuation ............................ 4–11
4.11 The Greek Alphabet ............................................. 4–11
Greek Alphabet Table .......................... 4–12
4.11.1 Code Switching with Greek Letters .............. 4–12
4.11.2 Capital Greek Letters .......................... 4–13
4.11.3 Alternate Form of Greek Letters ................. 4–14
  Practice 4D ........................................ 4–14
4.12 The German Alphabet .............................. 4–15
4.13 The Hebrew Alphabet .............................. 4–16
4.14 The Russian Alphabet .............................. 4–16
  Practice 4E ........................................ 4–17
4.15 A Sequence of Unspaced Letters ................. 4–17
  4.15.1 Derivatives .................................. 4–18
4.16 Mathematical Constant ............................ 4–18
  Practice 4F ........................................ 4–19
ENCLOSED LISTS
  4.17 Special Case—Definition of "Enclosed List" ........ 4–19
    4.17.1 Nonuse of the Numeric Indicator in an Enclosed List 4–20
    4.17.2 Nonuse of the English-letter Indicator in an Enclosed List 4–21
    4.17.3 Format—Keep Together ........................ 4–22
  Practice 4G ........................................ 4–24
MORE ABOUT ENGLISH LETTERS
  4.18 An English Letters Touching Only One Grouping Symbol 4–25
  4.19 English Letters with Plural, Possessive, or Ordinal Endings 4–26
  Practice 4H ........................................ 4–27
MORE ABOUT ABBREVIATIONS
  4.20 More Spacing Rules ................................ 4–28
    4.20.1 Spacing of Abbreviated Units of Measure and Operation Signs 4–28
    4.20.2 Spacing of Omission Symbols with Abbreviations ............... 4–29
  4.21 Single-Letter Abbreviations ....................... 4–29
  4.22 Abbreviations Whose Letters Correspon d to a Shortform ........... 4–30
  4.23 Context Clues .................................. 4–31
  4.24 Fully Capitalized Abbreviations – Acronyms and Initialisms ....... 4–32
CODE SWITCHING, cont.
  4.25 General Rule Regarding Blank Lines ................ 4–33
    4.25.1 Initiating Nemeth Code Before Itemized Material, Following a Heading 4–33
  4.26 Transcriber's Notes ................................ 4–34
  4.27 Embedded Identifiers ............................. 4–34
  Practice 4I ........................................ 4–35
Answers to Practice Material ......................... 4–37

Lesson 5

SIGNS OF OPERATION, cont.
  5.1 Review of Signs of Operation ......................... 5–2
  5.2 Signs of Operation Using Plus and Minus .............. 5–2
  5.3 Signs of Operation That Look Like Literary Symbols .... 5–3
    5.3.1 Ampersand .................................... 5–4
    5.3.2 Asterisk ....................................... 5–5

xiii 6-10-2023
5.3.3 Crosshatch  .............................................. 5–5
5.3.4 Dagger and Double Dagger ................................... 5–6
5.3.5 Paragraph Mark ........................................... 5–6
5.3.6 Section Mark ............................................. 5–6

Practice 5A ....................................................... 5–7

5.4 Signs of Operation Unique to Mathematics .................. 5–8
5.4.1 Backslash .................................................. 5–8
5.4.2 Dot .......................................................... 5–9
5.4.3 Hollow Dot ............................................... 5–9
5.4.4 Intersection ............................................. 5–9
5.4.5 Logical Product ........................................... 5–10
5.4.6 Logical Sum ............................................... 5–10
5.4.7 Minus with Dot Over ..................................... 5–10
5.4.8 Slash ...................................................... 5–10
5.4.9 Tilde and Extended Tilde ................................. 5–12
5.4.10 Union ..................................................... 5–12
5.4.11 Vertical Bar ............................................. 5–13
5.4.12 Vertical Bar, Negated ................................... 5–13

Format: Simple Tables

5.5 Introduction to Table Format ................................ 5–13
5.5.1 Omissions in a Simple Table .............................. 5–14

Practice 5B ....................................................... 5–15

SIGNS OF COMPARISON, cont.

5.6 More Comparison Signs ........................................ 5–16
5.6.1 Equivalence ("is equivalent to") ......................... 5–17
5.6.2 Greater Than with Curved Sides ("is greater than") ....... 5–17
5.6.3 Identity (Triple Bar) ..................................... 5–17
5.6.4 Inclusion .................................................. 5–17
5.6.5 Less Than with Curved Sides ("is less than") ............ 5–17
5.6.6 Membership .............................................. 5–18
5.6.7 Parallel To ("is parallel to") ............................. 5–18
5.6.8 Perpendicular To ("is perpendicular to") .................. 5–18
5.6.9 Relation .................................................. 5–18
5.6.10 Reverse Inclusion ...................................... 5–19
5.6.11 Reverse Membership .................................... 5–19
5.6.12 Tilde and Extended Tilde ................................. 5–19
5.6.13 Variation ("varies as") ................................ 5–20
5.6.14 Vertical Bar ............................................. 5–20

Practice 5C ....................................................... 5–21

5.7 Special Case: A Colon Meaning "Such That" .................. 5–21

5.8 Signs of Comparison Compounded Vertically ................. 5–23
5.8.1 Greater Than or Equal To .................................. 5–24
5.8.2 Inclusion ("is a subset of") ............................... 5–24
5.8.3 Intersection ............................................. 5–24
5.8.4 Less Than or Equal To ................................... 5–25
5.8.5 Logical Product ........................................... 5–26
5.8.6 Logical Sum ............................................... 5–27
5.8.7 Reverse Inclusion ........................................ 5–27
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.8.8 Tilde</td>
<td>5–28</td>
</tr>
<tr>
<td>5.8.9 Union</td>
<td>5–28</td>
</tr>
<tr>
<td>Practice 5D</td>
<td>5–29</td>
</tr>
<tr>
<td>5.9 Signs of Comparison Compounded Horizontally</td>
<td>5–30</td>
</tr>
<tr>
<td>5.9.1 Greater Than</td>
<td>5–30</td>
</tr>
<tr>
<td>5.9.2 Less Than</td>
<td>5–30</td>
</tr>
<tr>
<td>5.10 Negated Signs of Comparison</td>
<td>5–30</td>
</tr>
<tr>
<td>Practice 5E</td>
<td>5–31</td>
</tr>
<tr>
<td>Format: Instructions</td>
<td></td>
</tr>
<tr>
<td>5.11 Margins for Instructions Preceding Itemized Material (5-3)</td>
<td>5–32</td>
</tr>
<tr>
<td>5.11.1 Keep Together</td>
<td>5–33</td>
</tr>
<tr>
<td>5.11.2 Code Switching and Instructions</td>
<td>5–33</td>
</tr>
<tr>
<td>5.12 Narrative Directions</td>
<td>5–35</td>
</tr>
<tr>
<td>5.12.1 Margins for Directions Preceding Unitemized Material (3-1)</td>
<td>5–35</td>
</tr>
<tr>
<td>5.12.2 Itemized Directions</td>
<td>5–35</td>
</tr>
<tr>
<td>5.12.3 Margins for Narrative Preceding Itemized Material (3-1)</td>
<td>5–36</td>
</tr>
<tr>
<td>Practice 5F</td>
<td>5–37</td>
</tr>
<tr>
<td>Answers to Practice Material</td>
<td>5–39</td>
</tr>
<tr>
<td><strong>Lesson 6</strong></td>
<td></td>
</tr>
<tr>
<td>Format:</td>
<td></td>
</tr>
<tr>
<td>6.1 Margins for Itemized Material with Subdivisions (1-5; 3-5)</td>
<td>6–2</td>
</tr>
<tr>
<td>6.1.1 Paragraphs Within Itemized Material with Subdivisions (7-5)</td>
<td>6–3</td>
</tr>
<tr>
<td>6.1.2 Side-by-Side Layout in Print</td>
<td>6–5</td>
</tr>
<tr>
<td>Practice 6A</td>
<td>6–6</td>
</tr>
<tr>
<td>6.1.3 Tabular Format</td>
<td>6–6</td>
</tr>
<tr>
<td>6.1.4 Varied Margins</td>
<td>6–8</td>
</tr>
<tr>
<td><strong>LEVEL INDICATORS</strong></td>
<td></td>
</tr>
<tr>
<td>6.2 Definition</td>
<td>6–9</td>
</tr>
<tr>
<td><strong>Superscripts</strong></td>
<td></td>
</tr>
<tr>
<td>6.3 Superscript Level Indicator</td>
<td>6–9</td>
</tr>
<tr>
<td>6.3.1 Abbreviations with Superscripts</td>
<td>6–10</td>
</tr>
<tr>
<td>Practice 6B</td>
<td>6–10</td>
</tr>
<tr>
<td>6.4 Returning to the Baseline Level</td>
<td>6–11</td>
</tr>
<tr>
<td>6.5 Raised Hollow Dot</td>
<td>6–13</td>
</tr>
<tr>
<td>Practice 6C</td>
<td>6–13</td>
</tr>
<tr>
<td><strong>Introduction to the Baseline Indicator</strong></td>
<td></td>
</tr>
<tr>
<td>6.6 Function of the Baseline Indicator</td>
<td>6–14</td>
</tr>
<tr>
<td>6.6.1 Degrees Fahrenheit and Degrees Celsius</td>
<td>6–14</td>
</tr>
<tr>
<td>Practice 6D</td>
<td>6–15</td>
</tr>
<tr>
<td>6.7 Higher Levels of Writing</td>
<td>6–16</td>
</tr>
<tr>
<td>6.7.1 Combinations</td>
<td>6–16</td>
</tr>
<tr>
<td>6.8 Certain Raised Signs</td>
<td>6–17</td>
</tr>
<tr>
<td>6.8.1 Raised Ordinal</td>
<td>6–17</td>
</tr>
<tr>
<td>6.8.2 Prime Sign</td>
<td>6–17</td>
</tr>
<tr>
<td>6.8.3 Apostrophe-s</td>
<td>6–18</td>
</tr>
<tr>
<td>Practice 6E</td>
<td>6–18</td>
</tr>
</tbody>
</table>
Subscripts

6.9 Subscript Level Indicators ........................................... 6–19
  Practice 6F ......................................................... 6–19

6.10 Returning to the Baseline Level ........................................... 6–20
  Practice 6G ......................................................... 6–21

6.11 Special Case—Nonuse of the Subscript Level Indicator ........................................... 6–21
  6.11.1 Further Conditions ........................................... 6–22
  6.11.2 Restrictions .................................................. 6–23
  6.11.3 Summary ..................................................... 6–23
  Practice 6H ......................................................... 6–24

6.12 Spaces Within Superscripts and Subscripts ........................................... 6–24
  6.12.1 Commas ....................................................... 6–24
  6.12.2 Words, Abbreviations, and Letters ........................................... 6–26
  6.12.3 Comparison Signs ............................................ 6–26
  6.12.4 Ellipsis or Long Dash Within Superscripts and Subscripts ........................................... 6–26
  6.12.5 Ellipsis or Long Dash on the Baseline of Writing ........................................... 6–28
  6.12.6 Segmented Numbers ........................................... 6–28
  Practice 6I ......................................................... 6–29

More about Superscripts and Subscripts

6.13 Superscript and Subscript Combinations ........................................... 6–30
  6.13.1 Superscripts with Subscripts ........................................... 6–30
  6.13.2 Subscripts with Superscripts ........................................... 6–30
  Practice 6J ......................................................... 6–31

6.14 Left Subscripts and Superscripts ........................................... 6–31
  6.14.1 Raised Negative Sign ........................................... 6–31

6.15 Further Combinations ........................................... 6–32

6.16 Consecutive Superscripts and Subscripts ........................................... 6–33

6.17 Simultaneous Superscripts and Subscripts ........................................... 6–33

6.18 Nonsimultaneous Superscripts and Subscripts ........................................... 6–34

6.19 Detached Superscripts and Subscripts ........................................... 6–34

6.20 Literary Symbols and Level Indicators ........................................... 6–35

Summary ........................................... 6–35
  Practice 6K ......................................................... 6–36

6.21 More About Grouping Symbols and Level Indicators ........................................... 6–37
  Practice 6L ......................................................... 6–38

Answers to Practice Material ........................................... 6–39

Lesson 7

DISPLAYED FORMATS

7.1 Displayed Mathematical Material ........................................... 7–2
  7.1.1 Placement of Code Switch Indicators ........................................... 7–2

Displayed Math Using 3-5 Margins
  7.1.2 Math Displayed to Unitemized Text ........................................... 7–3
  7.1.3 More Than One Displayed Math Item ........................................... 7–4
  Practice 7A ......................................................... 7–6

Displayed Math Using 5-7 Margins
  7.1.4 Math Displayed to Itemized Text ........................................... 7–7
7.1.5 Displayed Material Associated with Instructions 7–7

Displayed Math Using 7-9 Margins
7.1.6 Math Displayed to Itemized Text with Subdivisions 7–9

Practice 7C 7–10

7.1.7 An Alternate Layout 7–11

7.2 Displayed Material with Labels 7–11

7.2.1 Braille Layout 7–11

7.2.2 Transcriber’s Notes Page Required 7–12

7.2.3 Page Number Citation 7–13

7.3 Displayed Narrative Material 7–13

Practice 7D 7–14

7.4 General Guidelines Regarding Typeform 7–15

7.4.1 Determining Significance of a Variant Typeform 7–15

7.5 The Five Mathematical Typeform Indicators 7–16

7.6 Typeform of Letters 7–16

Practice 7E 7–18

Practice 7F 7–19

7.6.1 Barred Letters 7–20

7.6.2 Boldface Letters 7–20

7.6.3 Italic Letters 7–22

7.6.4 Sans Serif Letters 7–23

7.6.5 Script Letters 7–23

Practice 7G 7–24

7.7 Typeform of Numerals 7–24

7.7.1 Typeform Indicators with One Numeral 7–24

7.7.2 Typeform Indicators with More Than One Numeral 7–25

7.7.3 Barred Numerals 7–25

7.7.4 Boldface Numerals 7–25

7.7.5 Typeform Indicators with Numeral/Symbol Combinations 7–26

Practice 7H 7–26

7.8 Nonregular Typeform in Contact with a Grouping Symbol 7–27

7.8.1 Nonregular Typeform in an Enclosed List 7–27

Practice 7I 7–28

7.9 Boldface Mathematical Symbols 7–29

7.9.1 Signs of Operation in Boldface Type 7–29

7.9.2 Equals Sign in Boldface Type 7–29

7.9.3 Grouping Signs in Boldface Type 7–30

Practice 7J 7–31

7.10 Barred Grouping Symbols and Other Signs of Grouping 7–31

7.10.1 Barred Brackets and Barred Braces 7–31

7.10.2 Half Brackets 7–32

7.10.3 Transcriber-Devised Grouping Symbols 7–33

Practice 7K 7–33

7.11 Further Details Regarding Typeform of Letters and Numerals 7–34

7.11.1 Typeform with Subscripts 7–34

7.11.2 Typeform with Unspaced Mathematical Expressions 7–34

TYPEFORM
Lesson 8

INTRODUCTION TO FRACTIONS

Simple Fractions

8.1 Definition .................................................. 8–2
8.2 Simple Fraction Indicators ................................. 8–3
8.3 The Horizontal Simple Fraction Line ................. 8–3
   Practice 8A .................................................. 8–5
8.4 The Diagonal Simple Fraction Line ................. 8–6
   8.4.1 Use of Simple Fraction Indicators with the Diagonal Simple Fraction Line 8–6
   8.4.2 Type Size on the Baseline of Writing ............... 8–6
   8.4.3 A Reminder About the UEB Slash .................. 8–8
   8.4.4 Spacing .................................................. 8–8
   8.4.5 Code Switch Reminders ............................. 8–9
   Practice 8B .................................................. 8–11

Mixed Numbers

8.5 Definition of Mixed Number ............................ 8–12
   8.5.1 Use of Mixed Number Fraction Indicators .......... 8–12
   8.5.2 Mixed Numbers and Omissions ...................... 8–13
   8.5.3 Nonuse of Mixed Number Fraction Indicators ......... 8–13
   Practice 8C .................................................. 8–13

Complex Fractions

8.6 Definition of Complex Fraction .......................... 8–14
   8.6.1 Use of Complex Fraction Indicators and Complex Fraction Lines 8–14
   Practice 8D .................................................. 8–15

More Fraction Rules

8.7 Fractions and the Baseline Indicator ................. 8–16
8.8 Further Observations Regarding Spacing ................ 8–16
8.9 Fractions and the Ellipsis and Long Dash ......... 8–17
8.10 Fractions in an Enclosed List .......................... 8–18
   Practice 8E .................................................. 8–19

RADICAL EXPRESSIONS

8.11 Terminology .................................................. 8–20
8.12 The Termination Indicator .............................. 8–20
8.13 Spacing ...................................................... 8–21
8.14 Index of Radical ........................................ 8–21
   Practice 8F .................................................. 8–22
8.15 Nested Radical Expressions ............................ 8–23
   8.15.1 Nested Radical Expression with an Index .......... 8–23
8.16 Radical Expressions and the Baseline Indicator .... 8–23
8.17 Radical Expressions and the Ellipsis and Long Dash 8–24
8.18 Radical Expressions and Abbreviations ............... 8–24
8.19 Enclosed Lists with Radical Expressions ............. 8–24
Lesson 9

ARROWS

9.1 Arrows Used in Mathematics .................................................. 9–2
9.2 Construction of Braille Arrows .................................................. 9–2
9.3 Spacing and Punctuation with Arrows ........................................... 9–2
9.4 Horizontal Arrow Shafts ............................................................ 9–2
9.5 Barbed and Solid Arrowheads ...................................................... 9–3
9.6 Special Case: The Contracted Form of the Right-Pointing Arrow ........ 9–5
  9.6.1 Nonuse of the Contracted Form of the Right-Pointing Arrow ........ 9–6
  Practice 9A ................................................................................. 9–6
9.7 Blunted, Straight, and Curved Arrowheads ..................................... 9–7
9.8 Arrows With Dotted Ends ............................................................ 9–8
  Practice 9B .................................................................................. 9–9

Vertical, Slanted, and Curved Arrow Shafts

9.9 Arrow Direction Indicators .......................................................... 9–10
  9.9.1 Vertical Arrow Shaft ............................................................... 9–10
  9.9.2 Slanted Arrow Shaft ............................................................... 9–10
  9.9.3 Curved Arrow Shaft ............................................................... 9–12
  Practice 9C .................................................................................. 9–12

Boldface and Compounded Arrows

9.10 Boldface Arrow ........................................................................... 9–13
9.11 Arrows Used as Signs of Comparison Compounded Vertically ........ 9–13
9.12 Arrows Used as Signs of Comparison Compounded Horizontally .... 9–14
9.13 Nonmathematical Arrows ............................................................ 9–15

INTRODUCTION TO SPATIAL ARRANGEMENTS

9.14 Background .................................................................................. 9–16
  9.14.1 Numeric Indicator ................................................................... 9–16
  9.14.2 Format .................................................................................... 9–16

Spatial Arrangements with Addition and Subtraction

9.15 Separation Line ............................................................................ 9–17
9.16 Alignment with Addition and Subtraction ........................................ 9–17
Lesson 10

Review of Format for Spatial Arrangements .............................................. 10–2

SPATIAL ARRANGEMENT WITH MULTIPLICATION

10.1 Alignment ............................................ 10–2
10.2 Placement of Multiplication Symbol ............................................. 10–2
10.3 Separation Line ......................................... 10–3

Alignment of Partial Products

10.4 Partial Products ........................................ 10–4
  10.4.1 Spacing ........................................... 10–5
  Practice 10A .............................................. 10–5

10.5 Omissions in Spatial Multiplication Problems ............................. 10–6
10.6 Fractions and Mixed Numbers .................................................. 10–6
10.7 Polynomials ............................................. 10–7
10.8 Subscripts Denoting Nondecimal Bases ..................................... 10–8
10.9 Regrouping Numbers with Multiplication ................................. 10–8
10.10 Placement of Identifiers with Spatial Multiplication .................. 10–10
  Practice 10B .............................................. 10–11

DIVISION PROBLEMS

10.11 Notation Devices ......................................... 10–12
10.12 Linear (Nonspatial) Representation of Division Problems .......... 10–12
  Practice 10C .............................................. 10–14

10.13 Spatial Representation of Division Problems ............................. 10–15
  10.13.1 Width of the Separation Line ....................................... 10–15
  10.13.2 A Quotient with a Remainder ....................................... 10–17
  10.13.3 Abbreviations ........................................ 10–17
  10.13.4 Embedded Division Problem ....................................... 10–18
  10.13.5 Review of Format for Spatial Arrangements ..................... 10–18
  10.13.6 Long Division ......................................... 10–19
  Practice 10D .............................................. 10–24

10.14 Omissions in Spatial Division Problems .................................... 10–25
10.15 Regrouping in Division ........................................... 10–25
10.16 Cancellation in Long Division ............................................. 10–27
10.17 Placement of Identifiers with Spatial Division .......................... 10–29
10.18 Other Layouts ........................................... 10–29
  Practice 10E .............................................. 10–29

REVISITING SOME RULES

10.19 Summary of the Use and Nonuse of the Numeric Indicator ......... 10–30
  10.19.1 Use of the Numeric Indicator ....................................... 10–30
  10.19.2 Nonuse of the Numeric Indicator ................................... 10–31

10.20 Review of Rules for Signs of Grouping .................................. 10–32

Answers to Practice Material .......................................................... 10–33

Lesson 11

SIGNS OF SHAPE

11.1 Definition .............................................. 11–2
Lesson 12

MODIFIERS AND MODIFIED EXPRESSIONS

12.1 Definition .................................................. 12–2
12.2 Construction of Simple Modified Expressions – The Five-Step Rule ............... 12–2

Common Modifiers

12.3 Arrows as Modifiers ........................................... 12–3
  12.3.1 Right-Pointing Arrow .................................. 12–3
  12.3.2 Other Arrows ............................................. 12–4
  12.3.3 Arrows Used in Vector Notation ....................... 12–5
  12.3.4 When the Arrow Itself is Being Modified .............. 12–6
  12.3.5 When Other Rules Apply ............................... 12–6

Practice 12A .......................................................... 12–7

12.4 Carets as Modifiers ............................................ 12–8
12.5 Horizontal Bar as a Modifier ................................ 12–8
  12.5.1 Bar Over or Under More than One Digit or Letter .... 12–8
  12.5.2 Bar Over or Bar Under Only One Digit or Letter .... 12–9

Practice 12B .......................................................... 12–12

12.6 Other Symbols Used as Modifiers ................................ 12–13
  12.6.1 Arc ......................................................... 12–13
  12.6.2 Dot ......................................................... 12–13
  12.6.3 Horizontal Grouping Sign ............................... 12–14
  12.6.4 Question Mark ........................................... 12–15
  12.6.5 Tilde ....................................................... 12–16

12.7 Expressions as Modifiers ....................................... 12–16

Answers to Practice Material ........................................ 12–18

11.30 Omissions in Spatially Arranged Problems .................................................. 11–25

Practice 11E .......................................................... 11–26

Identified Signs of Shape

11.31 Spacing .......................................................... 11–27
  11.31.1 Keep Together ........................................... 11–27
  11.31.2 Surrounding Symbols ................................... 11–27

11.32 A Shape Within a Superscript or a Subscript ............................................. 11–28

11.33 A Shape Which Carries a Superscript or a Subscript .................................... 11–28

11.34 The English-letter Indicator ...................................... 11–29
  11.34.1 The Letter "m" Meaning "measure" ....................... 11–30

11.35 Use of the Numeric Indicator in an Enclosed List ...................................... 11–30

Practice 11F .......................................................... 11–31

Typeform Indicators for Mathematical Words and Phrases

11.36 Italic and Boldface Typeform Indicators .................................................. 11–32
  11.36.1 One Word in Italics or Boldface ......................... 11–32
  11.36.2 A Phrase in Italics or Boldface .......................... 11–35
  11.36.3 Significant Typeform Applied to a Fraction or a Mathematical Symbol .... 11–36

11.37 Code Switching Within an Emphasized UEB Passage ................................. 11–36

Mathematical Statements

11.38 Axioms, Corollaries, Definitions, Laws, Lemmas, Propositions, Theorems ........ 11–38

Practice 11G .......................................................... 11–41

Answers to Practice Material ........................................ 11–43
12.7.1 Binomial Coefficient ........................................... 12–17

Practice 12C .............................................................. 12–18

12.8 Spacing with Modified Expressions ................................ 12–19

Practice 12D .............................................................. 12–19

Modified Expressions and Superscripts/Subscripts

12.9 Modified Expression on the Baseline of Writing ............... 12–20

12.9.1 Superscript/Subscript After the Modification ............... 12–20

12.9.2 Superscript/Subscript Within the Modification ............... 12–20

Practice 12E .............................................................. 12–21

12.9.3 Modified Expression on the Baseline That
Follows a Superscript or a Subscript ............................... 12–22

12.10 Modified Expression Within a Superscript or Subscript .... 12–24

Practice 12F .............................................................. 12–24

Modified Signs of Comparison

12.11 Definition ................................................................... 12–25

12.12 Transcription ............................................................ 12–25

Practice 12G .............................................................. 12–27

Expressions with More Than One Modifier

12.13 Modifiers of Higher Order ........................................... 12–28

12.13.1 Parallel Horizontal Bars ........................................... 12–29

12.14 Individual Modifiers .................................................. 12–29

12.15 Simultaneous Modifiers ............................................. 12–30

Practice 12H .............................................................. 12–32

Format

12.16 Formal Proof ............................................................ 12–33

12.16.1 Two-Column Proof ............................................... 12–33

12.16.2 End of Proof Icon ................................................ 12–34

Practice 12I .............................................................. 12–36

Practice 12J .............................................................. 12–36

Postscript: Vector Notation Notes ...................................... 12–37

Answers to Practice Material ............................................... 12–39

Lesson 13

MISCELLANEOUS SYMBOLS

Unspaced Symbols

13.1 Spacing Rules for Unspaced Symbols ................................. 13–2

13.1.1 Caret .................................................................... 13–2

13.1.2 Crossed Letters ...................................................... 13–3

13.1.3 Del ...................................................................... 13–3

13.1.4 Differentials and the Partial Derivative Symbol (Round d) . 13–3

13.1.5 Empty Set (null set, void set) .................................... 13–4

13.1.6 Factorial Sign ........................................................ 13–5

13.1.7 Infinity .................................................................. 13–6

13.1.8 Integrals ............................................................... 13–7

13.1.9 Quantifiers ............................................................ 13–8

13.1.10 Transcriber-Devised Symbols .................................. 13–9
Practice 13A .......................................................... 13–10

Spaced Symbols
13.2 Spacing Rules for Spaced Symbols .................................................. 13–11
  13.2.1 "At" Sign in Mathematical Context ........................................... 13–11
  13.2.2 Check Mark ..................................................................... 13–11
  13.2.3 Ditto Mark ..................................................................... 13–11
  13.2.4 Since (because) .................................................................. 13–12
  13.2.5 Therefore ........................................................................... 13–13

Practice 13B .......................................................... 13–13

Spacing with the Angstrom Unit and Tally Marks
13.3 Angstrom Unit ........................................................................ 13–14
13.4 Tally Mark ........................................................................... 13–15

Practice 13C ..................................................................... 13–16

SUPERPOSED SIGNS
13.5 Definition and Analysis. ............................................................. 13–17
13.6 Transcription of Superposed Signs .................................................. 13–18
  13.6.1 Integral Modified by Superposition ........................................ 13–18
  13.6.2 Signs of Operation Modified by Superposition ....................... 13–18
  13.6.3 Horizontal and Vertical Bars Modified by Superposition ........ 13–19
  13.6.4 Signs of Shape Modified by Superposition ......................... 13–19
  13.6.5 Two Signs of Comparison Modified by Superposition ............ 13–20
  13.6.6 Negated Symbols and Tally Marks ........................................... 13–20

Practice 13D ..................................................................... 13–21

AMBIGUOUS SIGNS
13.7 Context ................................................................................. 13–22
  13.7.1 Vertical Bar and Colon ................................................................. 13–23
  13.7.2 Spacing ........................................................................... 13–23
  13.7.3 Capital Greek Letters ............................................................... 13–23
  13.7.4 Chemical Notation ................................................................. 13–23

MULTIPURPOSE INDICATOR
13.8 Review ................................................................................. 13–24
13.9 Additional Uses of the Multipurpose Indicator .................................. 13–24
  13.9.1 Letter Followed by a Decimal Point and a Numeral ............. 13–24
  13.9.2 Numeric Subscript Followed by a Numeral ......................... 13–24
  13.9.3 Decimal Point Followed by a Nonnumeric Character .......... 13–25
  13.9.4 Side-by-Side Vertical Bars .................................................... 13–25

REFERENCE SIGNS AND SYMBOLS
13.10 Reference Signs and Symbols ......................................................... 13–26
  13.10.1 Asterisk, Daggers, Star, and Other Symbols ....................... 13–26
  13.10.2 Numerals or Letters .............................................................. 13–26
  13.10.3 Layout and Spacing .............................................................. 13–26
  13.10.4 The Note ........................................................................... 13–27

Practice 13E ..................................................................... 13–29

Answers to Practice Material .............................................................. 13–31

xxv 6-10-2023
Lesson 14

FUNCTION NAMES AND THEIR ABBREVIATED FORMS

14.1 List of Common Function Names and Their Abbreviated Forms .................................. 14–2
14.2 Code Switching and Punctuation ...................................................................................... 14–3
  14.2.1 Function Names in UEB .............................................................................................. 14–3
  14.2.2 Function Names in Nemeth ......................................................................................... 14–3
  14.2.3 Abbreviated Function Names ...................................................................................... 14–4
  14.2.4 "Arc" in Context ........................................................................................................... 14–4
  Practice 14A ........................................................................................................................... 14–5
14.3 Spacing of Function Names ................................................................................................ 14–6
  14.3.1 Spacing with Operation Symbols .................................................................................. 14–7
  14.3.2 Spacing with Indicators ............................................................................................... 14–7
  14.3.3 Examples ..................................................................................................................... 14–7
  Practice 14B ........................................................................................................................... 14–9
  14.3.4 Spacing with Consecutive Function Names ................................................................. 14–10
  14.3.5 Examples ..................................................................................................................... 14–10
14.4 Nonuse of the English-letter Indicator .............................................................................. 14–10
  14.4.1 Examples ..................................................................................................................... 14–11
14.5 Keep Together ................................................................................................................... 14–11
14.6 Clarification—Function Names in an Enclosed List .......................................................... 14–12
  Practice 14C ........................................................................................................................... 14–12
14.7 Superscripts and Subscripts ............................................................................................... 14–13
  14.7.1 Examples ..................................................................................................................... 14–13
  14.7.2 Use/Nonuse of the Subscript Indicator ....................................................................... 14–14
  14.7.3 Function Names Within a Superscript or a Subscript .................................................. 14–14
  14.7.4 Examples ..................................................................................................................... 14–15
  Practice 14D ........................................................................................................................... 14–16
14.8 Modifiers ............................................................................................................................ 14–17
  14.8.1 Examples ..................................................................................................................... 14–17
  14.8.2 Special Case—Upper Limit and Lower Limit .............................................................. 14–17
  Practice 14E ........................................................................................................................... 14–18

Spatial Arrangements, cont.

SQUARE ROOT DIVISION

14.9 Review of Terminology ........................................................................................................ 14–19
14.10 Spatial Arrangement for Square Root Problems ............................................................... 14–19
14.11 Placement of Identifiers with Spatial Radical Expressions ................................................ 14–21
  Practice 14F ........................................................................................................................... 14–22

OTHER PRINT LAYOUTS SHOWING DIVISION

14.12 Partial Quotients ............................................................................................................... 14–23
  Practice 14G ........................................................................................................................... 14–24
14.13 Synthetic Division ............................................................................................................. 14–25
  14.13.1 Alignment and Spacing ............................................................................................... 14–25
  14.13.2 Vertical Line ............................................................................................................... 14–25
  14.13.3 Another Print Style—Divisor on the Right ................................................................. 14–26
  14.13.4 Another Print Style—Boxed Divisor .......................................................................... 14–26
  14.13.5 Placement of Identifiers with Synthetic Division ....................................................... 14–27
  Practice 14H ........................................................................................................................... 14–28
Lesson 15

MATHEMATICAL EXPRESSIONS REQUIRING RUNOVERS

15.1 Review .......................................................... 15–2
   15.1.1 Symbols to Keep Together .......................... 15–2
   15.1.2 Expressions to Keep Together ..................... 15–2
   15.1.3 Runover Rules Already Studied ................... 15–2
   15.1.4 Nemeth Code Switch Indicators ................... 15–3

15.2 Mathematical Units ........................................ 15–3
   15.2.1 A Systematic Approach .............................. 15–4

15.3 Step i: Divide Before a Comparison Sign on the Baseline ................................. 15–4
   Practice 15A ..................................................... 15–8

15.4 Step ii: Divide Before an Operation Sign on the Baseline ................................. 15–9
   15.4.1 A Sign of Operation within a Mathematical Unit ................................. 15–10
   15.4.2 Linked Expressions .................................... 15–11
   Practice 15B ..................................................... 15–13

15.5 Step iii: Divide Before a Mathematical Unit ........................................ 15–14
   15.5.1 A Fraction is a Unit .................................. 15–14
   15.5.2 A Mixed Number is a Unit .......................... 15–16
   15.5.3 A Base and its Exponent are a Unit .............. 15–16
   Practice 15C ..................................................... 15–18
   15.5.4 A Grouped Expression is a Unit .................... 15–19
   Practice 15D ..................................................... 15–20

15.6 Step iv: Divide After a Termination Indicator ........................................ 15–21
   15.6.1 A Radical Expression is a Unit ...................... 15–21
   15.6.2 A Modified Expression is a Unit ................... 15–21
   Practice 15E ..................................................... 15–22

15.7 Function Notation, Integral Notation, Sigma Notation, and Pi Notation ............. 15–23
   15.7.1 A Function and its Argument are a Unit .......... 15–23
   Practice 15F ..................................................... 15–23
   15.7.2 Integral Notation ....................................... 15–24
   Practice 15G ..................................................... 15–26
   15.7.3 Sigma and Pi Notation ............................... 15–27
   Practice 15H ..................................................... 15–29
   15.7.4 Notation Combinations ............................... 15–30
   Practice 15I ..................................................... 15–30

Summary .......................................................... 15–31
Answers to Practice Material ................................ 15–33

Lesson 16

SPATIAL ARRANGEMENTS OF FRACTIONS

16.1 Spatial Fraction Line ........................................ 16–2
   16.2 Numerator and Denominator ............................ 16–2
   16.3 Placement of Identifiers with Spatially Arranged Fractions ...................... 16–3
Situations Requiring Spatial Presentation of Simple Fractions

16.4 Fractions Arranged Spatially for Illustration ........................................ 16–4
    Practice 16A ....................................................................................... 16–5
16.5 Cancellation With Replacement Values .................................................. 16–5
    16.5.1 Alignment Considerations with Cancellation .................................. 16–6
    16.5.2 Stacked Cancellation ...................................................................... 16–7
    Practice 16B ....................................................................................... 16–8
    16.5.3 Cancellation and Level Indicators .................................................. 16–8
    Practice 16C ....................................................................................... 16–9
16.6 Cancellation Without Replacement Values .............................................. 16–9
    16.6.1 Linear Presentation of Simple Fractions with Canceled Items .......... 16–9
    16.6.2 Canceled Abbreviations .................................................................. 16–10
    Practice 16D ....................................................................................... 16–11

HYPERCOMPLEX FRACTIONS
16.7 Definition and Recognition ...................................................................... 16–12
16.8 Transcription of Hypercomplex Fractions ............................................... 16–13
    16.8.1 Hypercomplex Fraction Indicators ............................................... 16–13
    16.8.2 Other Layouts ............................................................................... 16–14
16.9 Higher Orders of Complexity .................................................................. 16–15
    Practice 16E ....................................................................................... 16–15

CONTINUED FRACTIONS
16.10 Definition and Recognition .................................................................... 16–16
    16.10.1 Transcription Rules ...................................................................... 16–16
    Practice 16F ....................................................................................... 16–18

INSTRUCTIONAL COMMENTARY
16.11 Format for Instructional Commentary .................................................... 16–19
    16.11.1 Alignment of Equals Signs ......................................................... 16–20
    Practice 16G ....................................................................................... 16–23

STEM-AND-LEAF PLOTS
16.12 Recognition ........................................................................................... 16–24
16.13 The Table ............................................................................................... 16–24
16.14 The Key .................................................................................................. 16–25
    16.14.1 Runovers in the Key ..................................................................... 16–26
16.15 Data Consisting of More Than One Character; Punctuation Between Entries .............................................................................. 16–27
16.16 Alphabetic Data ...................................................................................... 16–28
    16.16.1 Alphabetic Key ............................................................................. 16–28
16.17 Blank Entries .......................................................................................... 16–28
16.18 Runovers Within the Table ..................................................................... 16–30
    16.18.1 Print Runovers ............................................................................ 16–30
    16.18.2 Braille Runovers ......................................................................... 16–31
16.19 Back-To-Back Plot .................................................................................. 16–31
    Practice 16H ....................................................................................... 16–33

Answers to Practice Material ........................................................................... 16–35

Lesson 17

SYSTEM OF EQUATIONS
17.1 Definition and Recognition ...................................................................... 17–2
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.2</td>
<td>Transcription Rules for Systems of Equations</td>
<td>17–2</td>
</tr>
<tr>
<td>Practice 17A</td>
<td></td>
<td>17–5</td>
</tr>
<tr>
<td><strong>Enlarged Signs of Grouping</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.3</td>
<td>A Unified Expression</td>
<td>17–5</td>
</tr>
<tr>
<td>17.4</td>
<td>Transcription Rules for Enlarged Signs of Grouping</td>
<td>17–5</td>
</tr>
<tr>
<td>17.4.1</td>
<td>Left Enlarged Brace</td>
<td>17–6</td>
</tr>
<tr>
<td>17.4.2</td>
<td>Right Enlarged Brace</td>
<td>17–6</td>
</tr>
<tr>
<td>17.5</td>
<td>Embedded Vertical Groupings</td>
<td>17–7</td>
</tr>
<tr>
<td>Practice 17B</td>
<td></td>
<td>17–8</td>
</tr>
<tr>
<td>17.6</td>
<td>Enlarged Parentheses</td>
<td>17–8</td>
</tr>
<tr>
<td>17.7</td>
<td>Placement of Symbols</td>
<td>17–8</td>
</tr>
<tr>
<td>17.8</td>
<td>Placement of Identifiers and Punctuation</td>
<td>17–9</td>
</tr>
<tr>
<td>17.9</td>
<td>Nested Grouping Symbols</td>
<td>17–11</td>
</tr>
<tr>
<td>Practice 17C</td>
<td></td>
<td>17–11</td>
</tr>
<tr>
<td>17.10</td>
<td>Conditions or Commentary Printed Next to Spatial Arrangements</td>
<td>17–12</td>
</tr>
<tr>
<td>17.10.1</td>
<td>Alignment and Runovers</td>
<td>17–12</td>
</tr>
<tr>
<td>17.10.2</td>
<td>When Comments are Words</td>
<td>17–12</td>
</tr>
<tr>
<td>17.10.3</td>
<td>A Long Comment</td>
<td>17–14</td>
</tr>
<tr>
<td>17.10.4</td>
<td>Transcriber-Inserted Grouping Symbol</td>
<td>17–14</td>
</tr>
<tr>
<td>17.10.5</td>
<td>Line-by-Line Commentary</td>
<td>17–16</td>
</tr>
<tr>
<td>Practice 17D</td>
<td></td>
<td>17–17</td>
</tr>
<tr>
<td>17.11</td>
<td>More Enlarged Signs of Grouping</td>
<td>17–18</td>
</tr>
<tr>
<td>Practice 17E</td>
<td></td>
<td>17–20</td>
</tr>
<tr>
<td><strong>DETERMINANTS AND MATRICES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.12</td>
<td>Definition and Recognition</td>
<td>17–21</td>
</tr>
<tr>
<td>17.13</td>
<td>Transcription Rules for Determinants and Matrices</td>
<td>17–21</td>
</tr>
<tr>
<td>17.13.1</td>
<td>Blank Lines</td>
<td>17–21</td>
</tr>
<tr>
<td>17.13.2</td>
<td>Grouping Symbols</td>
<td>17–21</td>
</tr>
<tr>
<td>17.13.3</td>
<td>Alignment and Spacing of Items</td>
<td>17–21</td>
</tr>
<tr>
<td>17.13.4</td>
<td>Numeric and Letter Indicators</td>
<td>17–22</td>
</tr>
<tr>
<td>17.13.5</td>
<td>Placement of Identifiers, Symbols, and Punctuation</td>
<td>17–23</td>
</tr>
<tr>
<td>Practice 17F</td>
<td></td>
<td>17–25</td>
</tr>
<tr>
<td><strong>Further Considerations with Determinants and Matrices</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.14</td>
<td>Multiplying Arrays</td>
<td>17–25</td>
</tr>
<tr>
<td>17.15</td>
<td>Ellipses and Blank Fields</td>
<td>17–26</td>
</tr>
<tr>
<td>17.15.1</td>
<td>A Row of Dots Printed Without Spaces Between Columns</td>
<td>17–29</td>
</tr>
<tr>
<td>Practice 17G</td>
<td></td>
<td>17–30</td>
</tr>
<tr>
<td>17.16</td>
<td>Augmented Matrix</td>
<td>17–31</td>
</tr>
<tr>
<td>17.17</td>
<td>Runovers in Arrays</td>
<td>17–31</td>
</tr>
<tr>
<td>17.17.1</td>
<td>Runovers With Indentation</td>
<td>17–31</td>
</tr>
<tr>
<td>17.17.2</td>
<td>Runovers Without Indentation</td>
<td>17–32</td>
</tr>
<tr>
<td>17.17.3</td>
<td>Runovers and Level Indicators</td>
<td>17–33</td>
</tr>
<tr>
<td>17.17.4</td>
<td>Fractions in Arrays</td>
<td>17–34</td>
</tr>
<tr>
<td>17.17.5</td>
<td>Keying</td>
<td>17–35</td>
</tr>
<tr>
<td>Practice 17H</td>
<td></td>
<td>17–36</td>
</tr>
<tr>
<td>17.18</td>
<td>Row Matrix</td>
<td>17–37</td>
</tr>
<tr>
<td>17.19</td>
<td>Embedded Arrays</td>
<td>17–37</td>
</tr>
<tr>
<td>Practice 17I</td>
<td></td>
<td>17–39</td>
</tr>
</tbody>
</table>
Lesson 18

TABLES
18.1 Structure of Tables ............................ 18–2
18.2 Table Label and Title ......................... 18–2
18.3 Column Headings ............................... 18–3
18.4 Table Entries ................................ 18–3
18.4.1 Tables in UEB ............................. 18–3
18.4.2 Tables in Nemeth Code .................. 18–3
18.4.3 Code Switching Considerations ......... 18–4
18.4.4 A Table of Values ........................ 18–7
Practice 18A ..................................... 18–9
18.5 When Row Headings are Words .......... 18–9
Practice 18B ..................................... 18–10

Boxed Tables
18.6 Code Switching and Box Lines ............ 18–11
18.6.1 Switching Within the Table .............. 18–11
18.6.2 Switching Within the Box Lines ....... 18–11
18.6.3 Technical Material Before or After a Box 18–14
18.6.4 Placement of Transcriber's Note ....... 18–16
Practice 18C ..................................... 18–19

More Table Rules Specific to the Nemeth Code
18.7 A Table of Numbers .......................... 18–20
18.7.1 Numeric Indicator May Be Omitted ...... 18–20
18.7.2 Numeric Indicator Required ............. 18–21
Practice 18D ..................................... 18–22

FIGURES AND DIAGRAMS
18.8 Which Code? .................................. 18–23
18.8.1 Letters Used as Diagram Labels ......... 18–23
18.9 Switch Indicators and Tactile Graphics ... 18–24
18.10 Number Lines ................................ 18–26
18.11 Diagrams in Exercise Material .......... 18–26
18.12 Molecular Diagrams ......................... 18–26
Practice 18E ..................................... 18–27

KEYING TECHNIQUE
18.13 Keying ....................................... 18–28
18.13.1 Alphabetic Key ........................... 18–28
18.13.2 Numeric Key .............................. 18–28
18.13.3 Combination Key ......................... 18–28
18.13.4 The Key List .............................. 18–28
Practice 18F ..................................... 18–33

Answers to Practice Material .................... 18–35
Final Lesson

F1 Preparing for the Certification Exam ........................................ F–1
F2 The Nemeth Code Book ......................................................... F–1
F3 Beyond the Nemeth Code ...................................................... F–3

Structuring a Textbook

F4 Transcriber-Generated Pages and Front Matter .......................... F–4
F4.1 Title Page ........................................................................ F–4
F4.2 Special Symbols Page ........................................................ F–4
F4.3 Transcriber’s Notes Page ..................................................... F–5

Practice A .................................................................................. F–5

F5 Body of Text .......................................................................... F–7
F5.1 Follow Nemeth Formatting Rules ......................................... F–7
F5.2 Follow Braille Formats Guidelines ....................................... F–7
F5.3 Context-Dependent Formats ................................................ F–8

Four Practices

Practice B .................................................................................. F–10
Practice C .................................................................................. F–11
Practice D .................................................................................. F–12
Practice E .................................................................................. F–14

Answers to Practice Material ..................................................... F–15

Appendices

Appendix A—Reading Practice

Appendix B—Glossary Of Terms

The Four Basic Operations .......................................................... B–1
Many Ways to Denote Multiplication ......................................... B–2
Fractions .................................................................................. B–3
Geometry .................................................................................. B–3
Radical Expressions ................................................................. B–4
Statements and Functions ......................................................... B–4
Algebra ...................................................................................... B–4
Other Terminology Used with Algebraic Expressions ................. B–4

Appendix C—Nemeth Code Format Summaries

General Principles ...................................................................... C–2
“Keep Together” ...................................................................... C–2
Margins ..................................................................................... C–3
Itemized Material ..................................................................... C–3
Displayed Mathematical Material ........................................... C–6
Mathematical Statements and Proofs ....................................... C–8
Division of Mathematical Expressions Between Braille Lines .... C–8
Placement of Code Switch Indicators ....................................... C–9
Spatial Arrangements ............................................................... C–13
To report errors in this instruction manual, please send your message to transcribers@nfb.org.