Chapter 3: An Introduction to Nemeth Code Symbols Used in Grades 2-6

New Symbols Introduced

⠨ [dots 4-6] Decimal point (.)

⠄⠎ [dot 4, dots 2-3-4] Dollar sign ($)

⠄⠉ [dot 4, dots 1-4] Cent sign (¢)

⠄⠩ [dot 4, dots 3-5-6] Percent sign (%)

⠸⠸⠱ [dots 4-5, dots 4-6, dots 1-6] Degree sign (°)

⠒ [dots 1-4-6] Directly-under indicator (no print equivalent)

⠤ [dots 1-5-6] Horizontal bar symbol (_)

⠄⠡ [dot 4, dots 1-6] Multiplication cross (×)

⠐ [dots 1-6] Multiplication dot (·)

⠄⠔ [dot 4, dots 3-4-5-6] Multiplication asterisk (*)

⠲⠌ [dots 4-6, dots 3-4] Division sign or divided by sign (÷)

Key Points

- A **decimal point** and **comma** are used in numbers in Nemeth Code the same way they are used in print.
- If a **multi-digit number** is divided across lines, place a hyphen at the end of the first part of the number, after a comma if present, and repeat the numeric indicator at the beginning of the next line.
- A **dollar sign** is used with monetary amounts the same way as in print. A numeric indicator is not used with a dollar sign.
- A **cent sign** is used the same way one is used in print. A numeric indicator is used before the monetary amount when the amount is followed by a cent sign.
- A **percent sign** is used in Nemeth Code the same way it is used in print.

- A **degree sign** is used the same way it is used in print. The abbreviation "F" or "C" is considered Nemeth Code and must be placed within the switch indicators when writing degrees.
- If Fahrenheit or Celsius is abbreviated with a capital letter with no period, place the English letter indicator before the capital letter. If Fahrenheit or Celsius is abbreviated with a capital letter followed by a period, you do not need an English letter indicator.
- If the abbreviation "F." or "C." ends a sentence, treat the period as a mark of punctuation.
- The **directly-under indicator** symbol does not have a print equivalent. It is used with **the horizontal bar symbol** to show the braille reader what digit has a line drawn under it.
- In a linear (horizontal) problem, signs of computation including the **multiplication cross**, **multiplication dot**, and **division sign** do not have a space on either side of them unless they are next to a long dash.
- The **multiplication asterisk** is used to show which key to press on a calculator. A numeric indicator must be used in front of a number following the multiplication asterisk.

Introduction

Students continue to learn about numbers in grades 2-6. During second grade, they usually learn to read and write numbers to 1000, and by the time they complete fourth grade, they are expected to read, write, and round multi-digit whole numbers to any place (Common Core State Standards Initiative, 2010; Maryland State Department of Education, 2015.)

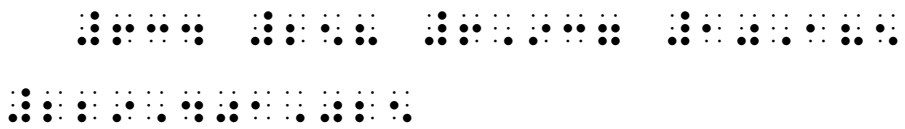
Multi-Digit Numbers

Multi-digit numbers are written similarly to the numbers 1-10. The mathematical comma is used in Nemeth Code when multi-digit numbers are partitioned by a comma (Rule II, §8b).

Example 3.1 contains several examples of multi-digit numbers, including three numbers that contain a comma. Notice that in the braille there is one space between the numbers.

Example 3.1

634 258 6,937 10,185 229,401,025

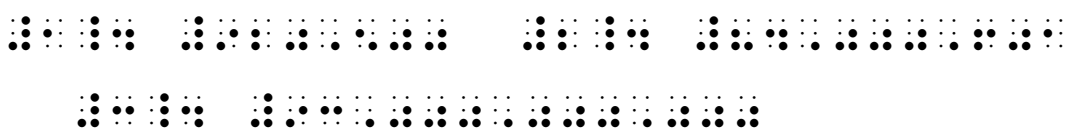


Long numbers are not divided between braille lines if the number will fit onto a single line in braille (Rule II, §12).

Example 3.2 contains 3 long numbers. Notice that the third number (93,000,000,000) is not divided across two lines. Instead, it has been moved to the following line of braille since it will fit onto a single line.

Example 3.2

1. 920,500 2. 84,000,601 3. 93,000,000,000

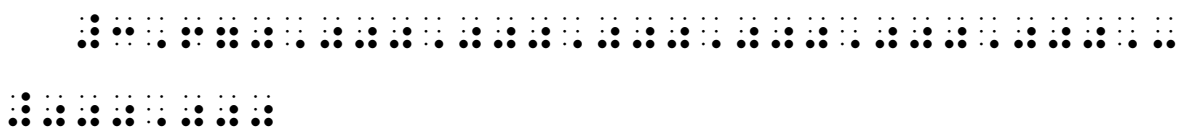


However, if the number is too long to fit onto a single braille line, then divide it across two lines (Rule II, §12). The division is made after a comma, if present, with a hyphen (Rule II, §12). A numeric indicator is required both at the beginning of the long number as well as at the beginning of the second line (Rule II, §12).

Example 3.3 contains a long number divided across two lines since it will not fit onto a single line in braille. Dots 3-6 represent the hyphen. Notice in this example that the long number does not have a problem identifier, therefore, it begins in cell 3 with runover in cell 1.

Example 3.3

3,670,000,000,000,000,000,000,000,000



Numbers with a Decimal Point

During fifth grade, students learn to read, write, and compare decimals to thousandths (Common Core State Standards Initiative, 2010; Maryland State Department of Education, 2015).

The decimal point is written with dots 4-6 in Nemeth Code.

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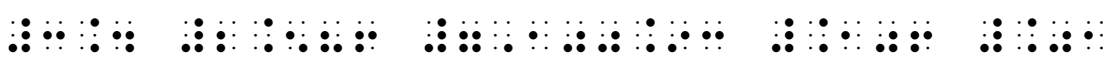
The decimal point is considered a numeric symbol (Rule II, §8c). Thus, the same rules used for writing numbers in Nemeth Code are used when writing decimals.

Example 3.4 contains examples of numbers that include a decimal point.

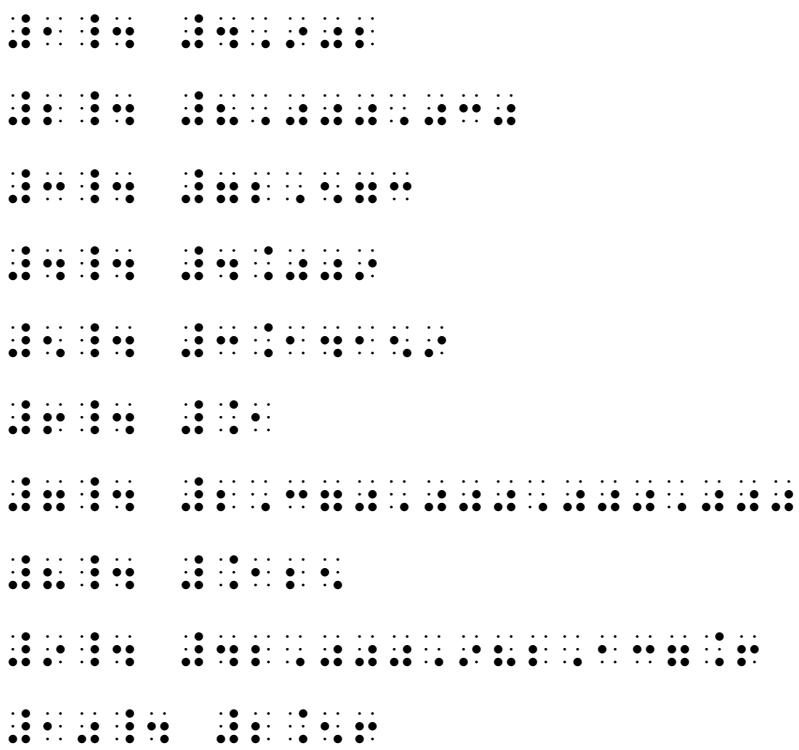
Example 3.4

3.4 2.586 7,100.93 .106 .01



Practice 3.1

Interline the following exercise.



Now write the following exercise in braille.

1. 1,743
2. 80,040.53
3. 94,602
4. 1.17
5. 3,492.91
6. 5.78
7. 6.384
8. 68,712,000,000,005
9. 1,563
10. 582.67

Symbols for Dollars and Cents

Students are introduced to the monetary signs for dollars and cents in second grade (Common Core State Standards Initiative, 2010; Maryland State Department of Education, 2015).

It takes two cells to write the **dollar sign** in Nemeth Code. It is written with dot 4 in the first cell, followed by dots 2-3-4 in the second cell.

$

> **Teaching Tip:** Point out that many of the print symbols (such as dollar, cent, and percent signs) begin with the dot 4 in Nemeth Code.
>
> **Teaching Tip:** It may be easier for students to learn the symbol for the dollar sign as dot 4, followed by the letter s. Students may also be interested to know that the letter s is used because the print symbol for the dollar includes an "s" with a line drawn through it.

When a dollar sign is used in Nemeth Code, do not include a numeric indicator (Rule XXII, §162). In addition, there is no space between the dollar sign and the first number.

Example 3.5 contains three amounts using dollar signs and decimal points. Notice that the dollar sign is placed before the number in braille just like it is placed in print.

Example 3.5

$5.99 $97.01 $28,500

It takes two cells to write the **cent sign** in braille. It is written with dot 4 in the first cell, followed by dots 1-4 in the second cell.

¢

> **Teaching Tip:** It may also be easier for students to learn the symbol for cent as dot 4, followed by the letter c. Students may also be interested to know that the letter c is used because the print symbol for a cent includes a "c" with a line drawn through it.

Since the print symbol for cent is usually placed after the number, it is placed after the number in Nemeth Code (Rule XXII, §162).

Example 3.6 contains 4 monetary amounts that use the cent sign. Notice that a numeric indicator is used with numbers followed by a cent sign.

Example 3.6

99¢ 25¢ 10¢ 38¢

Monetary amounts are sometimes used in linear addition and subtraction problems. The same rules for writing linear addition and subtraction problems you learned in Chapters 1 and 2 are used with monetary amounts in linear problems. Placement of the dollar and cent symbols follows print. There is no space between the dollar sign or the cent symbol and the number (Rule XXII, §162).

Example 3.7 contains 5 addition and subtraction problems that use monetary amounts.

Example 3.7

10¢ + 25¢ =

$3.50 − $.75 = _____

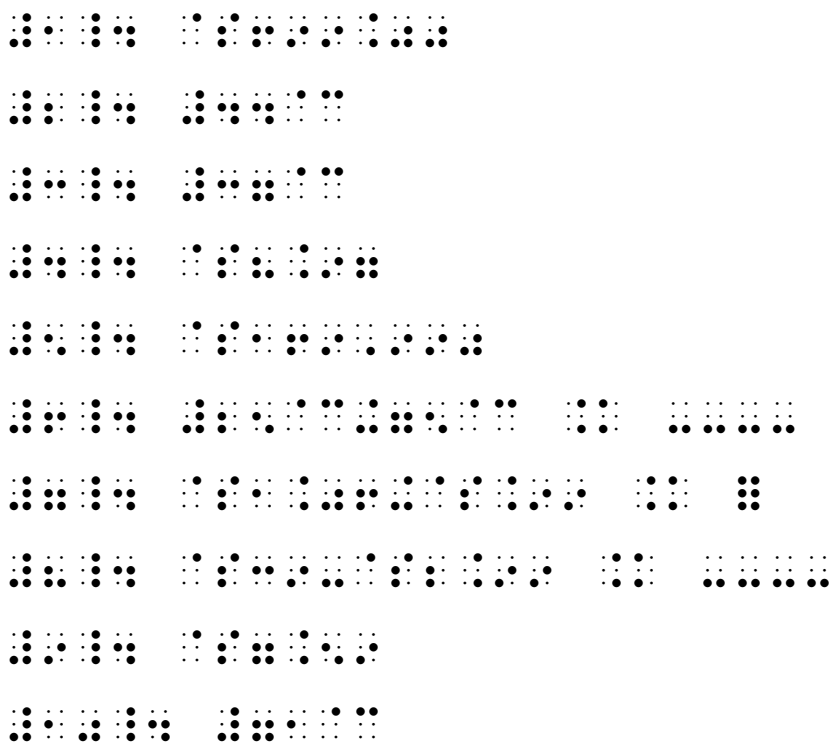
$26.00 + $3.99 = __

45¢ − 3¢ = _____

50¢ + _____ = $1.00

Practice 3.2

Interline the following exercise.



Now write the following exercise in braille. Each number should be placed on a line by itself.

$3.10

42¢

$18.99

$235,600

19¢

70¢

$1.69 + $2.49 =

10¢ + 99¢ =

$7.88 − $5.00

$25.00 + ? = $75.00

60¢ − 35¢

$23.98

Percent Sign

Students are introduced to the percent sign in sixth grade (Common Core State Standards Initiative, 2010; Maryland State Department of Education, 2015). It takes two cells to write the **percent sign** in Nemeth Code. It is written with dot 4 in the first cell, followed by dots 3-5-6 in the second cell.

%

> **Teaching Tip:** Point out that many of the print symbols (such as dollar, cent, and percent signs) begin with the dot 4 in Nemeth Code.
>
> **Teaching Tip:** Point out that the second cell of the percent sign is a Nemeth 0 (zero), and the print percent sign visually looks like two zeros separated by a slash.

Example 3.8 contains four percentages.

Example 3.8

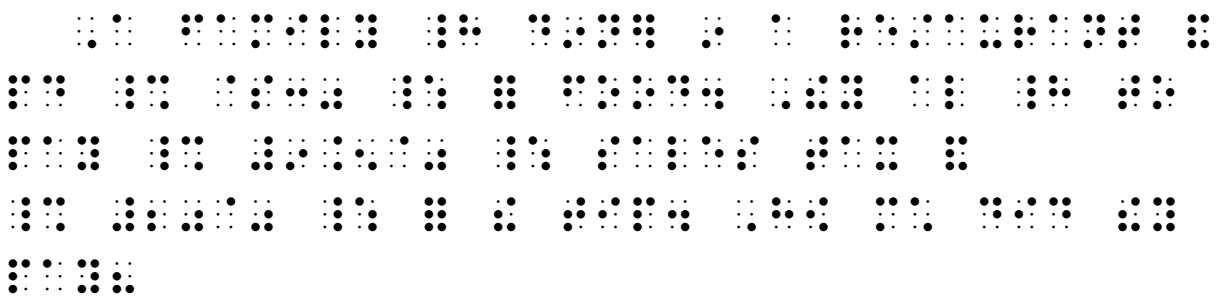
15% 45% 99% 24%

Percentages are written in Nemeth Code. Review the two word problems in Example 3.9 and Example 3.10. Pay special attention to the use of the Nemeth Code switch indicators.

The opening Nemeth Code indicator, the math material, and the Nemeth Code terminator are kept on the same braille line when possible. In Example 3.10, the whole number 2 is written in UEB both times.

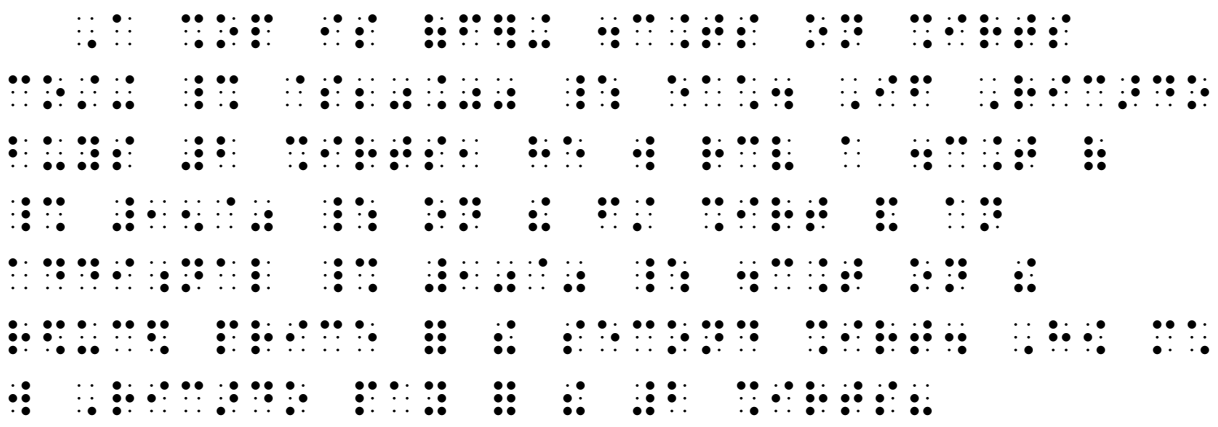
Example 3.9

A family had dinner in a restaurant and paid $30 for food. They also had to pay 9.5% sales tax and 20% for the tip. How much did they pay?



Example 3.10

A shop is offering discounts on shirts costing $20.00 each. If Ricardo buys 2 shirts, he will receive a discount of 15% on the first shirt and an additional 10% discount on the reduced price for the second shirt. How much will Ricardo pay for the 2 shirts?



Degree Sign

Students are introduced to the degree sign in second grade in science (NGSS Lead States, 2013). The degree sign is an elevated hollow dot. It takes three cells to write the **degree sign** in Nemeth Code. It is written with dots 4-5 in the first cell, dots 4-6 in the second cell, and dots 1-6 in the third cell.

°

70°

Temperatures often include either an F for Fahrenheit or a C for Celsius. In Nemeth Code, follow the spacing, capitalization, and punctuation provided in the print.

Example 3.11 provides two examples of how the degree sign is written in Nemeth Code. The abbreviation for Fahrenheit and Celsius are considered part of the math and are included within the Nemeth Code switch indicators. If a temperature with the abbreviation ends a sentence, treat the period as a mark of punctuation and place it outside of the Nemeth Code switch indicators. If the degree sign is immediately followed by a C or F, use a baseline indicator, and do not use an English letter indicator.

Example 3.11

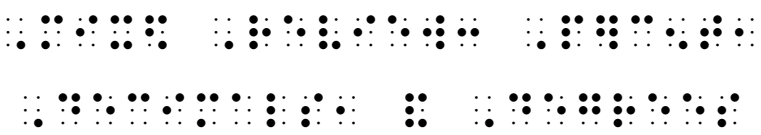
32°F

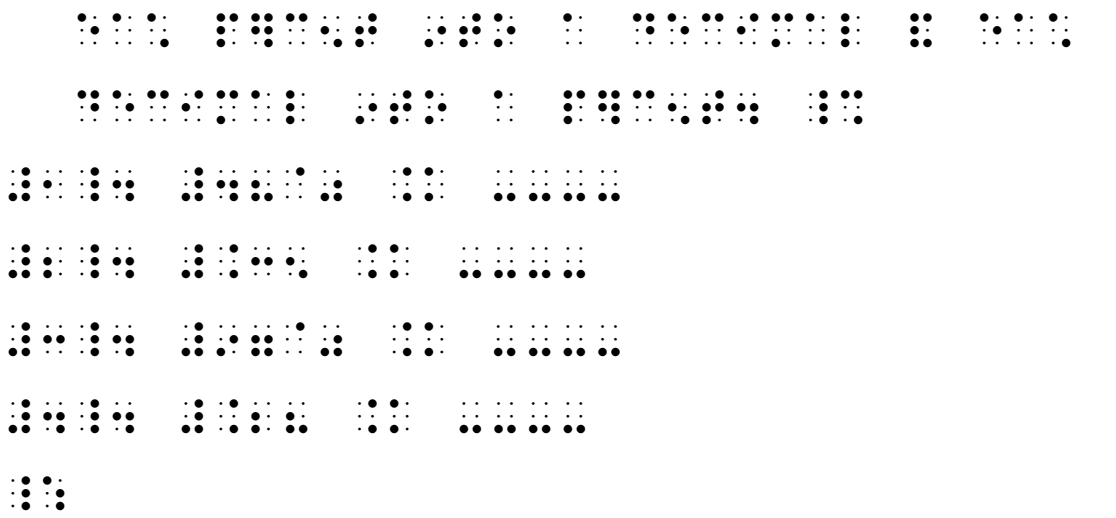
5° C

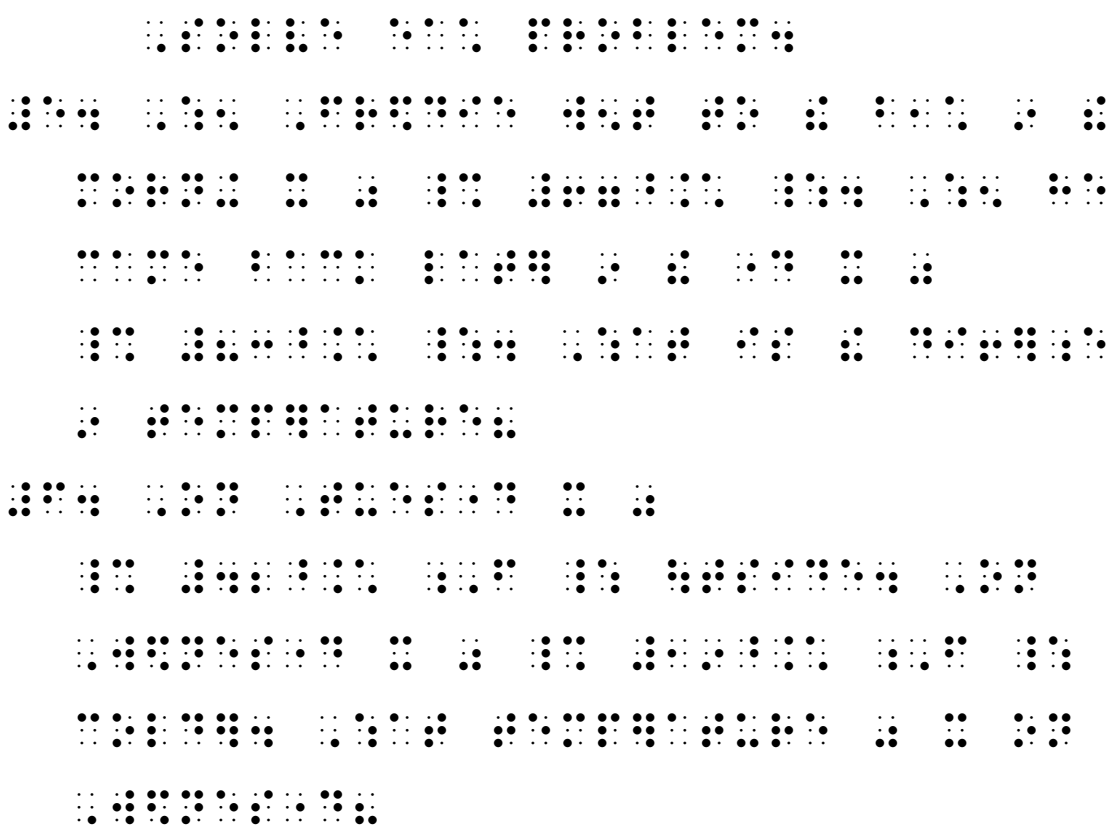
The temperature is 50°C.

Practice 3.3

Interline the following.







Write the following.

1. 114%

2. 2.37

3. 37%

4. 96%

5. 24°

6. 50%

7. 212° F is the boiling point for water. 99.98° C is also the boiling point for water.

Underlined Digit in Place Value

Sometimes a horizontal bar is placed directly under a single digit in math. For instance, a student in fourth grade might be asked to write the place value of an underlined digit in a number such as $3.6\underline{5}8$ or $4,\underline{1}00,000$. These numbers would be read as three point six five eight with a bar under the 5 and four million one hundred thousand with a bar under the 1.

It takes one braille cell to write the **directly-under indicator** in Nemeth Code. There is no print equivalent for this symbol.

It also takes one cell to write the **horizontal bar symbol** in Nemeth Code.

_

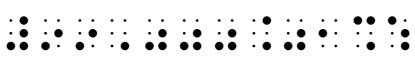
When a horizontal bar is used directly under a single digit or letter, both symbols are used. Write the directly-under indicator (dots 1-4-6) and horizontal bar symbol (dots 1-5-6) immediately after the digit or letter (BANA Nemeth Update: Rule XIV, § 86c Contracted Form of Underlining of Single Letters/Digits, 2013).

Example 3.12 contains four examples of numbers with an underlined digit. Notice that there is no space between the number and the directly-under indicator.

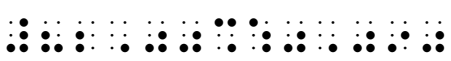
Example 3.12

$7\underline{3}.40$

$99,000.0\underline{1}$



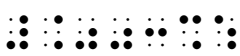
82,0̲0,090



51.3̲48

Practice 3.4

Interline the numbers with an underlined digit.



Now write the following numbers with an underlined digit in braille. Don't forget to number your problems.

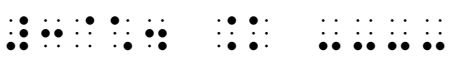
1. 6̲55,875
2. 12̲7.93
3. 456,451,814̲,221
4. 793̲.784
5. 8.929̲

Signs of Operation and Horizontal (Linear) Equations

Students begin to solve problems involving multiplication and division during third grade (Common Core State Standards Initiative, 2010; Maryland State Department of Education, 2015). As part of these processes, students are introduced to the multiplication cross, multiplication dot, multiplication asterisk, and division sign. These are considered **signs of operation** (Rule XIX).

It takes two cells to write a **multiplication cross** (×) in Nemeth Code. It is written with dot 4 in the first cell, followed by dots 1-6 in the second cell. In the following linear problem, you will find a multiplication cross.

$3 \times 4 = \_\_\_\_\_$



A **multiplication dot** ($\cdot$) is represented by dots 1-6 in Nemeth Code. In the following linear problem, you will find a multiplication dot.

$2 \cdot 5 = ?$

> **Teaching Tip:** Point out that the multiplication cross and multiplication dot are very similar in Nemeth Code.
>
> Dr. Nemeth was very clever. As students advance into algebra and the use of variables, the multiplication dot becomes much more common than the multiplication cross because in print there is confusion between the multiplication cross and the variable x.
>
> Dr. Nemeth made sure there was no such confusion in Nemeth Code, but the older braille student still gets the benefit of a one cell times sign.

Students may encounter the **multiplication asterisk** (*) if their textbook or math worksheets incorporate calculator-related problems.

It takes two cells to write a multiplication asterisk (or sometimes simply called an asterisk) in Nemeth Code. It is written with the dot 4 in the first cell, followed by dots 3-4-5-6 in the second cell. Notice in the following problem that the numeric indicator must be used after an asterisk (Rule II, §9d), which is very unusual compared to what we have learned so far. However, if the 7 is replaced with a variable such as x, then do not use the numeric indicator (Rule XIX §130).

$6 * 7 = 42$

It takes two cells to write a **divided by sign** ($\div$) in Nemeth Code. This symbol is also sometimes called an obelus or division sign. The Nemeth Code divided by sign is written with dots 4-6 in the first cell, followed by dots 3-4 in the second cell. In the following linear problem, you will find a divided by sign.

$24 \div 8 = 3$

Example 3.13 contains 10 multiplication and division problems in linear format. Notice that:

- A space is not used before or after the multiplication and division signs in a linear problem (Rule XIX, §138).
- The braille follows the print. If a multiplication dot is used in print, then a multiplication dot is used in braille.
- A numeric indicator is used at the beginning of the linear problem when it begins with a numeric symbol such as a whole number or decimal.
- A numeric indicator is also used after a space when a numeric symbol follows (Rule II, §9a).

Teaching Tip: It is very important that print be followed when transcribing multiplication and division problems. If the math or science teacher uses a particular operation sign, it is intentional. In addition, students will have the different symbols on standardized assessments, so it is essential that they become familiar with all of the symbols used within multiplication and division problems.

Example 3.13

1. $10 \times 10 = ?$

2. $48 \div 6 = 8$

3. $12 \cdot ? = 144$

4. $9 \div 3 =$ _____

5. $128 * 5 =$ _____

6. $9 \cdot 9 < 100$

⠼⠊⠄⠀⠼⠊⠄⠀⠠⠀⠼⠁⠚⠚

7. $6 \cdot 3 =$ _____

⠼⠋⠄⠀⠼⠉⠄⠀⠶⠀⠐⠐⠐⠐⠐

8. $4.1 \times 7 = ?$

⠼⠙⠄⠂⠀⠼⠛⠄⠀⠶⠀⠦

9. $3 \times 100 + 4 \times 10 + 6 \times 1 =$ _____

⠼⠉⠄⠀⠼⠁⠚⠚⠄⠀⠼⠙⠄⠀⠼⠁⠚⠄⠀⠼⠋⠄⠀⠼⠁⠄⠀⠶⠀⠐⠐⠐⠐⠐

10. $10{,}000 \div 100 = ?$

⠼⠁⠚⠄⠚⠚⠚⠀⠌⠀⠼⠁⠚⠚⠀⠶⠀⠦

Practice 3.5

Interline the following problems in linear format. Don't forget to number your problems!

⠼⠁⠄⠀⠼⠑⠄⠀⠶⠀⠐⠐⠐⠐⠐

⠼⠃⠄⠀⠼⠑⠚⠄⠀⠶⠀⠐⠐⠐⠐⠐

⠼⠉⠄⠀⠼⠊⠄⠀⠶⠀⠼⠊⠚⠚

⠼⠙⠄⠀⠼⠁⠚⠚⠚⠄⠀⠶⠀⠦

⠼⠑⠄⠀⠼⠋⠋⠄⠀⠶⠀⠐⠐⠐⠐

⠼⠉⠄⠀⠼⠁⠚⠚⠄⠀⠼⠙⠄⠀⠼⠁⠚⠄⠀⠼⠋⠄⠀⠼⠁⠄⠀⠶⠀⠐⠐⠐⠐⠐

⠼⠙⠄⠀⠼⠁⠚⠚⠚⠄⠀⠶⠀⠦

⠼⠃⠄⠀⠼⠓⠄⠀⠶⠀⠼⠃⠚

⠼⠁⠄⠀⠼⠁⠚⠄⠀⠼⠁⠚⠚⠄⠀⠼⠁⠚⠚⠚⠄⠀⠶⠀⠐⠐⠐⠐⠐

Now write the following problems in linear format in braille.

1. $9 \cdot 7 = 63$
2. $13 \times 4 =$ _____
3. $900 \div 9 = 100$
4. $9 \times 100 + 8 \times 10 + 6 \times 1 = ?$
5. $20 \times 6 =$ _____
6. $138 \div 3 = ?$
7. $9 \times 5 \times 1 =$ _____
8. $11 \cdot 10 = ?$
9. $72 \div 8 =$ _____
10. $3 \cdot 9 = ?$
11. $7 * 8 = 56$
12. $14 * 5 =$ _____

Collaboration with General Education Teachers

An important role of a teacher of students with visual impairment is supporting general education teachers who have a student in their classroom who reads and writes braille. General education teachers are responsible for:

- Teaching math content
- Assessing student progress in learning math and other academic subjects
- Implementing the accommodations listed in each student's Individualized Education Plan
- Providing instructional materials to the teacher of students with visual impairments to be adapted in a timely manner
- Communicating with the teacher of students with visual impairments and other team members to ensure the student's success

Teachers of students with visual impairment support general education teachers by:

- Making suggestions and offering strategies for teaching math to students who are visually impaired

- Showing them various tools and manipulatives from the American Printing House for the Blind's catalog
- Providing braille materials so that students have these at the same time their sighted peers have print materials
- Teaching students Nemeth symbols before they are introduced in math class
- Previewing braille materials, as needed, with students before they are used in the classroom
- Teaching students to use disability-specific technology such as the braillewriter and talking calculator
- Being available to answer questions that the general education teacher or other team members have about the student's educational needs

Chapter Summary

Multi-digit Numbers, Including Numbers with a Decimal

- The digits of multi-digit numbers in Nemeth Code are placed in the lower part of the braille cell (dots 2-3-5-6).
- The mathematical comma is used in Nemeth Code when multi-digit numbers are partitioned by a comma (Rule II, §8b).
- Long numbers are not divided between braille lines if the number will fit onto a single line in braille (Rule II, §12).
- If the number is too long to fit onto a single braille line, then divide it across two or more lines. The division is made after a comma, if present, with a hyphen (Rule II, §12).
- A numeric indicator is required both at the beginning of the long number as well as at the beginning of each continuation line (Rule II, §12).
- The same rules used for writing numbers in Nemeth Code are used when writing decimals.

Symbols for Dollars and Cents

- When a dollar sign is used, do not include a numeric indicator (Rule XXII, §162).
- Placement of these symbols follows print, and there is no space between the symbol and the number (Rule XXII, §162).

Percent and Degrees

- Placement of these symbols follows print, and there is no space between the symbol and the number (Rule XXII, §162).

Underlined Digit in Place Value

- Write the directly-under indicator (dots 1-4-6) and horizontal bar symbol (dots 1-5-6) immediately after the digit or letter.

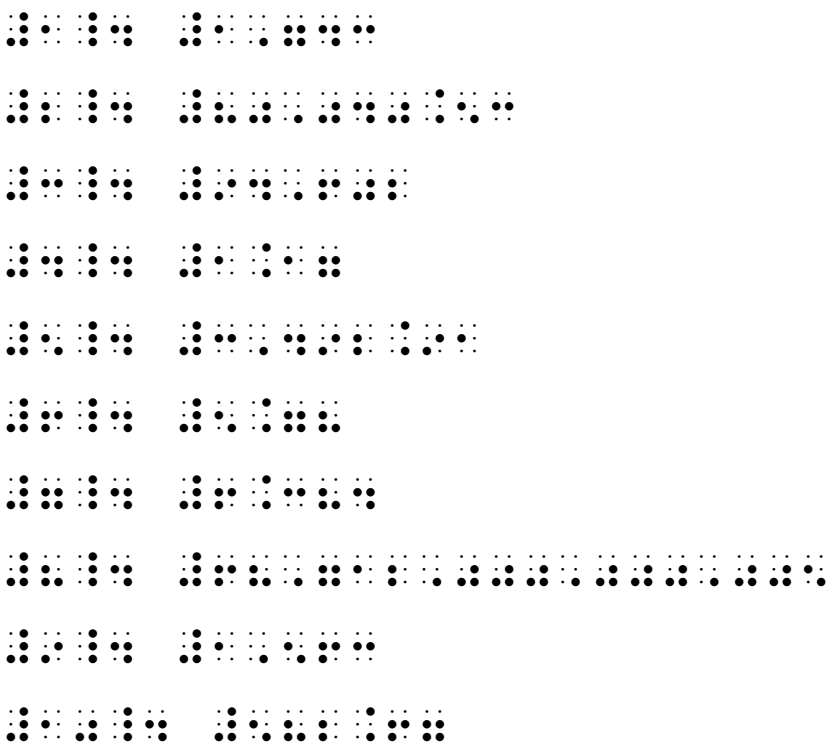
Horizontal (Linear) Problems Involving Multiplication and Division

- Equations written in horizontal format in print are written horizontally in braille.
- With few exceptions, a space is not used before or after a sign of operation, including the multiplication and division signs (Rule XIX, §138).

Chapter 3: Answer Key

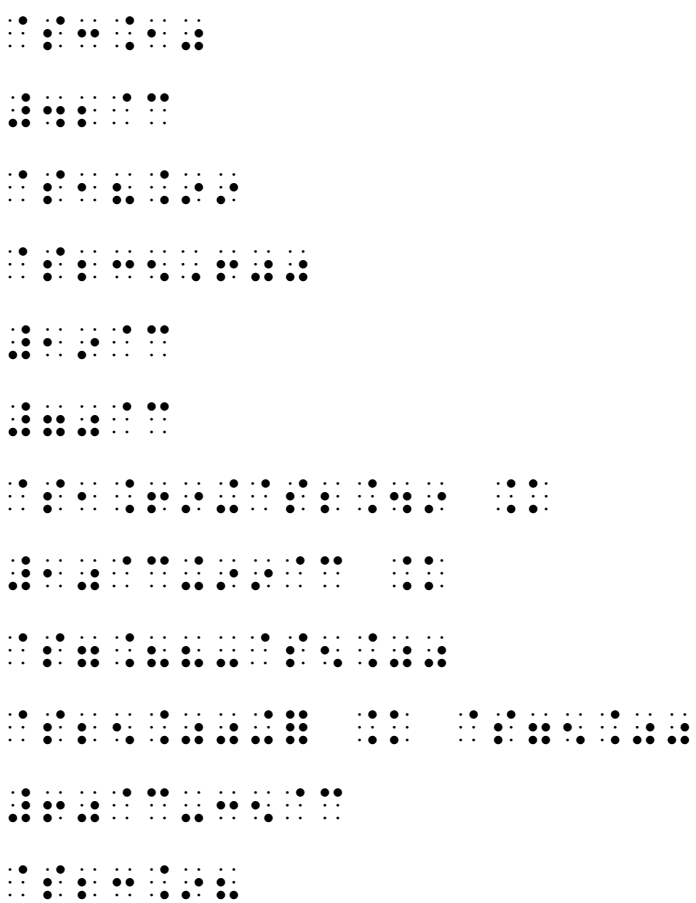
Answer 3.1

1. 4,902
2. 8,000,030
3. 72,573
4. 4.009
5. 3.14159
6. .1
7. 2,370,000,000,000
8. .125
9. 42,000,982,137.6
10. 2.56



Answer 3.2

1. $699.00
2. 44¢
3. 37¢
4. $8.97
5. $169,990
6. 25¢ + 75¢ = _____
7. $1.06 + $.99 = ?
8. $39 - $2.99 = _____
9. $7.59
10. 71¢



Answer 3.3

Mixed Review: Percent,
Decimals, and Degrees

In the following problems convert each percent into a decimal and each decimal to a percent.

1. 48% = _____

2. .35 = _____

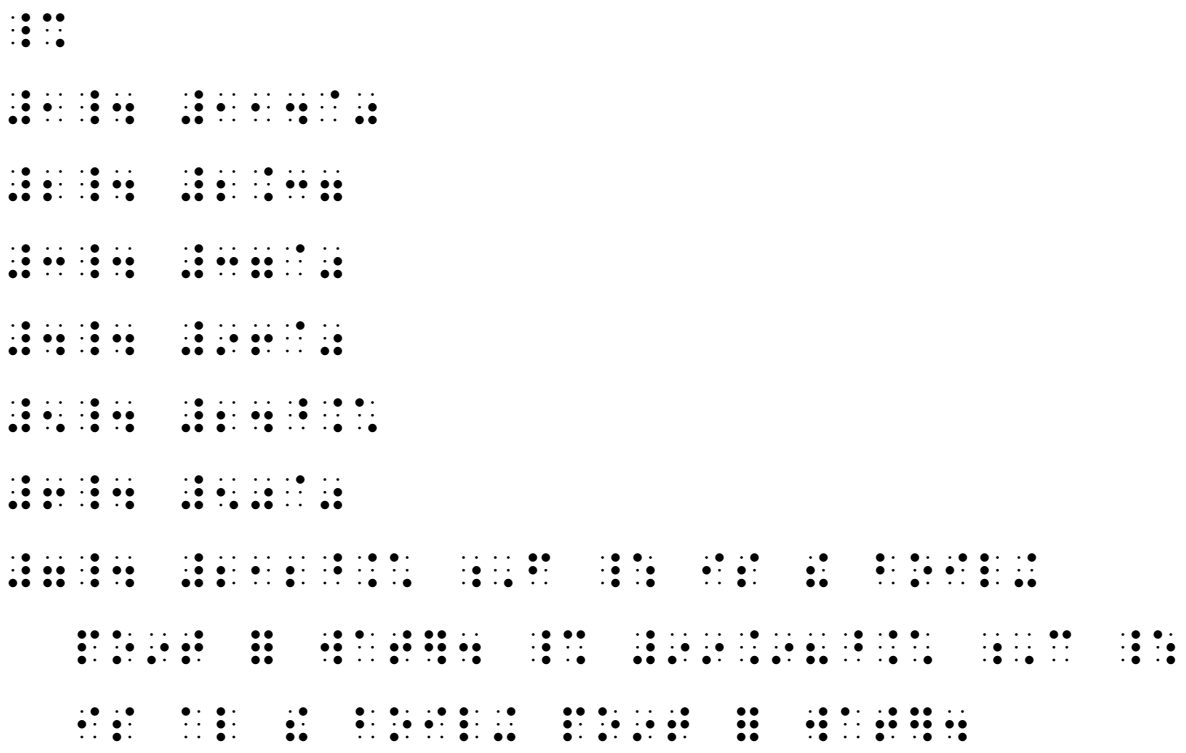
3. 97% = _____

4. .28 = _____

Solve each problem.

5. When Freddie went to the beach in the morning it was 67°. When he came back later in the day it was 83°. What is the difference in temperature?

6. On Tuesday it was 42° F outside. On Wednesday it was 19° F colder. What temperature was it on Wednesday?



Answer 3.4

$.00\underline{3}$

$55.\underline{1}9$

$1,\underline{3}29.4$

$40,\underline{0}00,000$

$38.\underline{7}$

$90,025.6\underline{1}3$

⠼⠂⠸⠲ ⠼⠖⠩⠱⠢⠢⠠⠦⠶⠢

⠼⠆⠸⠲ ⠼⠂⠆⠩⠱⠶⠨⠔⠒

⠼⠒⠸⠲ ⠼⠲⠢⠖⠠⠲⠢⠂⠠⠦⠂⠲⠩⠱⠠⠆⠆⠂

⠼⠲⠸⠲ ⠼⠶⠔⠒⠩⠱⠨⠶⠦⠲

⠼⠢⠸⠲ ⠼⠦⠨⠔⠆⠔⠩⠱

Answer 3.5

1. $5 \times 2 =$ _____
2. $6 \cdot 7 =$ _____
3. $11 \cdot 11 = 121$
4. $12 \div 6 = ?$
5. $144 \div 12 =$ _____
6. $7 \times 100 + 3 \times 10 + 5 \times 1 =$ _____
7. $10 * 12 = ?$
8. $7 \cdot ? = 49$
9. $9 \times 100 + 4 \times 10 + 5 \times 1 = ?$
10. $180 \div 6 =$ _____

⠼⠂⠸⠲ ⠼⠔⠡⠶ ⠨⠅ ⠼⠖⠒

⠼⠆⠸⠲ ⠼⠂⠒⠈⠡⠲ ⠨⠅ ⠤⠤⠤⠤

⠼⠒⠸⠲ ⠼⠔⠴⠴⠨⠌⠔ ⠨⠅ ⠼⠂⠴⠴

Answer 3.5 (continued)