UEB TECHNICAL

A Self-Directed Course

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This course requires the use of *Unified English Braille Guidelines for Technical Material* and *The Rules of Unified English Braille*; latest editions, including revisions. These publications can be downloaded free of charge in print or braille from iceb.org/publications/ueb/.

This course can be downloaded as electronic files in print or braille from cnib.ca/en/ueb-technical.

UEB TECHNICAL
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Introduction

UEB Technical is intended for those who are competent in Unified English Braille (UEB) for literary material.

This is a comprehensive self-directed course in UEB for technical material. It is not an instruction manual. It provides selected references to *Unified English Braille Guidelines for Technical Material* (the GTM) as the resource for examples and further explanation. Go to the ICEB website (see back of title page) for all **updates**.

Extensive practice in producing technical material in UEB is an essential element of the course. Additionally, another important purpose of *UEB Technical* is to ensure familiarity with the GTM.

There are fourteen major topics generally following the order of the material presented in the GTM. The heading for each major topic includes the main GTM reference enclosed within square brackets. Note that Section B. Line Mode refers to *The Rules of Unified English Braille* (the Rulebook). Because the GTM is not organized as a teaching manual, examples found there may use symbols that have not been covered at that point in the course.

UEB Technical is being provided by CNIB free of charge and may be done entirely without instruction. Each transcription Practice is followed on the next page by its answers.

Contact Information

Questions about the course or its content may be directed to CNIB at braillecertification@cnib.ca.

Proof of Proficiency

CNIB will issue a Letter of Proficiency for UEB Technical to a candidate

- who holds certification in UEB;
- who has a thorough knowledge of the rules and provisions of the GTM; and
- who can demonstrate accuracy in transcribing technical material in UEB by successful completion of a proficiency test.

Those who have completed all the Practices to their satisfaction and have met the first two requirements above may request the UEB Technical Pre-Test from CNIB at braille.certification@cnib.ca.

Instructions for the Practices

This course is designed for direct 6-key transcription of the Practices in order to best consolidate the information. The use of a brailler or a computer with a transcription program that allows direct entry is recommended.

UEB Technical does not address how to divide mathematical expressions between braille lines (see 1.4.2). The Practices use a 40-cell line. This is especially important for some of the material in order to understand what is intended.

When a numbered question within a Practice includes several separate questions, treat them individually rather than as part of a passage.

Check transcriptions carefully against the answers in order to discover any points which need clarification. It may be necessary to review the GTM and rebraille Practice questions to ensure complete understanding of those issues.

A.1 SIGNS OF OPERATION, COMPARISON AND OMISSION [3]

See the **update**, revised Section 3 (approved October 2018) for a list of signs of operation and comparison. See 3.6 of the GTM 2014 for omission marks.

A.2 GROUPING DEVICES (BRACKETS) [5]

UEB grouping devices in technical material include the vertical bar in addition to the grouping devices used as punctuation.

For the spacing of text separated by commas within grouping devices (e.g. ordered pairs or sets), see the first example in 5.

PRACTICE A

Transcribe question 1 as for students being introduced to the signs.

1. $4+3=7,\ 7-4=3$
2. $4\div 2<3\times 1$
3. The square root of 25 is ± 5.
4. $15:3=5:1$
5. $4+5=\_$

   $4+\ \ =9$

   $4\_5=9$

   $4+5\ ?\ 9$
6. $a(b+c)=ab+ac$
7. $10a+\left[a-(5a-4)\right]\geq 0$
8. $|a+b|\leq |a|+|b|$
9. Find the distance from $P(-3,7)$ to $Q(5,-4)$.
10. $[2,\ a,\ -4,\ 3b]$

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⠼⠁⠲ ⠼⠙ ⠐⠖ ⠼⠉ ⠐⠶ ⠼⠛ ⠐⠤ ⠼⠙ ⠐⠶ ⠼⠉

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⠼⠉⠲ ⠠⠮ ⠎⠟⠥⠜⠑ ⠗⠕⠕⠞ ⠷ ⠼⠃⠑ ⠊⠎ ⠸⠖⠼⠑⠲

⠼⠙⠲ ⠼⠁⠑⠒⠼⠉ ⠐⠶ ⠼⠑⠒⠼⠁

⠼⠑⠲ ⠼⠙⠐⠖⠼⠑ ⠐⠶ ⠨⠤

⠼⠙⠐⠖⠬ ⠐⠶ ⠼⠊

⠼⠙⠨⠤⠼⠑ ⠐⠶ ⠼⠊

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⠼⠋⠲ ⠁⠐⠣⠃⠐⠖⠉⠐⠜ ⠐⠶ ⠁⠃⠐⠖⠁⠉

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⠼⠁⠚⠲ ⠨⠣⠼⠃⠂ ⠁⠂ ⠐⠤⠼⠙⠂ ⠼⠉⠰⠃⠨⠜

B. LINE MODE [Rulebook, 16]

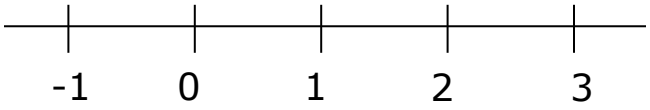
16.1 gives guidance on when line mode may be used.

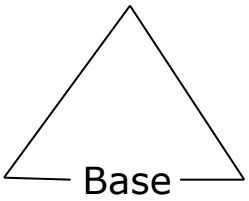
In UEB, a horizontal line always starts with the indicator, dots 5-25. Horizontal lines are used for number lines and for separation lines in spatial arrangements, tabular material and financial statements, and may be used for line drawings such as geometric figures. See 16.2 for the complete provisions.

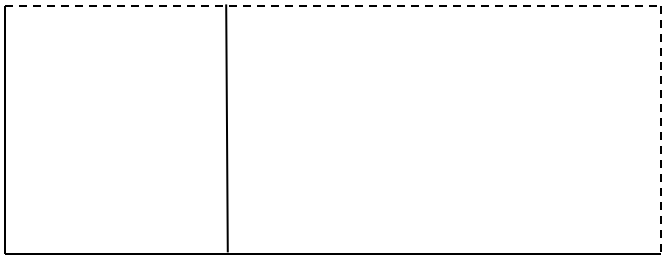
UEB provides for diagonal as well as vertical lines. See 16.3.

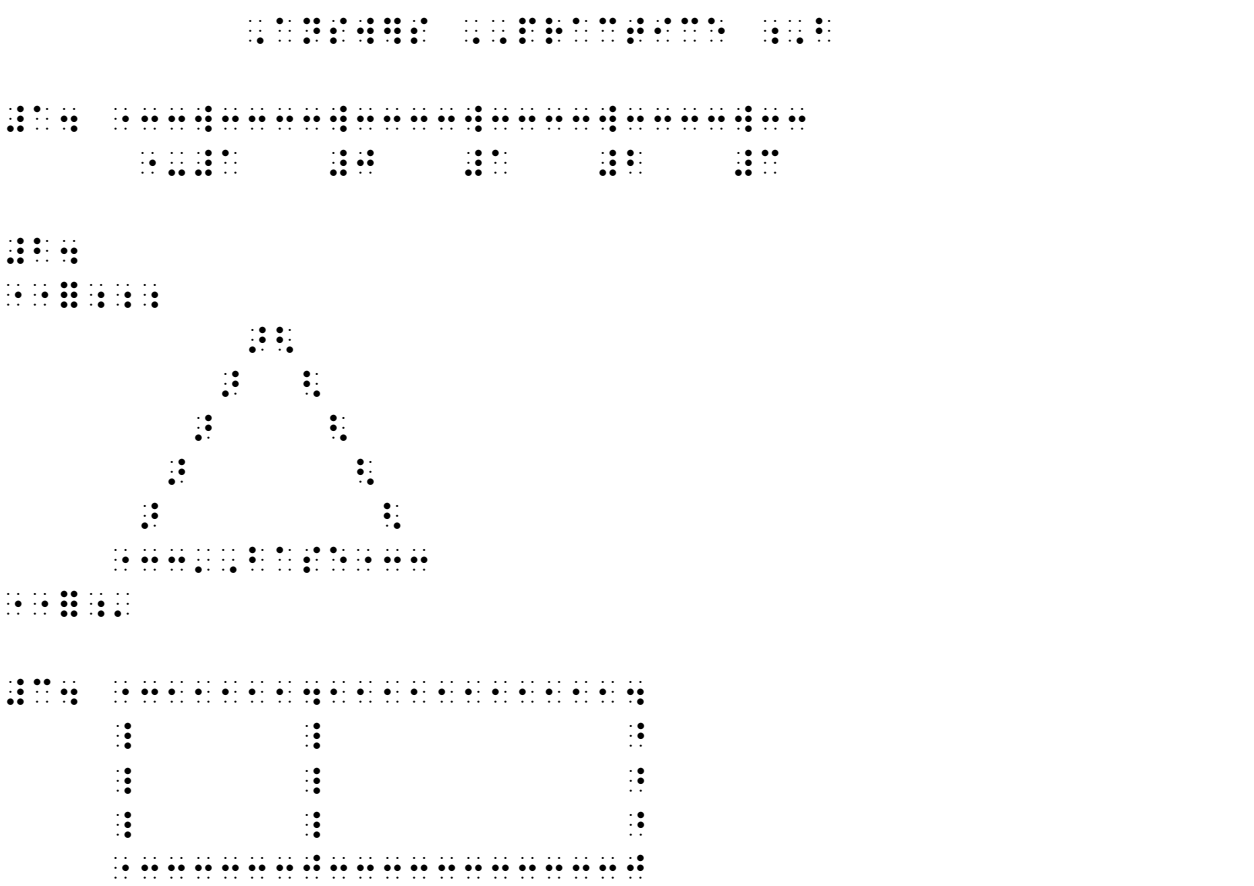
Combining various forms of lines is covered in 16.4. It is important that any form of vertical line segment be preceded and followed by a space [16.4.3].

PRACTICE B

1. 

2. 

3. 



C. SPATIAL LAYOUT AND DIAGRAMS [4]

In UEB, the numeric indicator is used in spatial diagrams [4.1]. There is the option to use a numeric passage indicator before and the terminator after the expression [4.1] or exercise [4.1.7].

Although the GTM suggests that the layout may be changed to suit local teaching practices [4.1.1 and 4.1.3], for purposes of this course, follow print. Also follow print in regards to the length and position of any horizontal lines used in the Practices.

PRACTICE C

Transcribe questions 1-2 using a numeric indicator for each number. Transcribe question 3 using a numeric passage indicator. Transcribe questions 4-7 using a numeric passage indicator and individual numeric indicators for each question number.

1.
```
 435 639
  +2 345
```

2.
```
    904
   ×21
    904
   1808
  18984
```

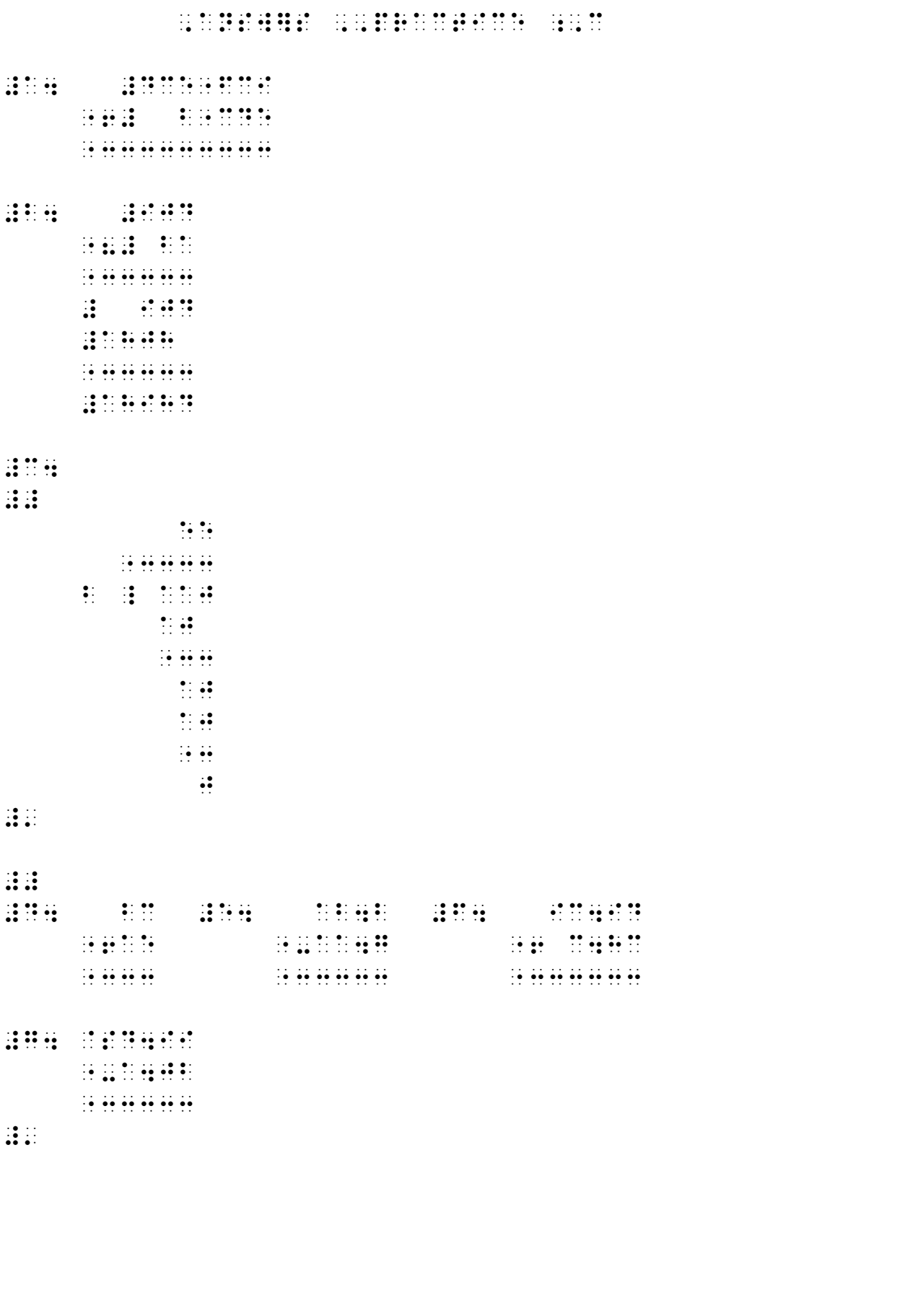
3.
```
     55
  2)110
    10
     10
     10
      0
```

4.
```
  23
 +15
```

5.
```
  12.2
 −11.7
```

6.
```
  93.94
 +3.83
```

7.
```
 $4.99
 −1.02
```



D. FRACTIONS [6]

Refer to 4.1.4 for examples of spatial fractions for teaching purposes.

Fractions in technical material are the same as in literary material. See 6.1 for simple numeric fractions and 6.4 for general fractions.

See 6.3 for fractions written linearly, i.e. with a slash, where the numerator and denominator are on the same line of print.

Use of Grade 1 Mode

General fractions usually will require the use of grade 1 indicators. See 1.2 for guidance on the use of grade 1 mode and numeric mode.

The **update**, Section 1.7 (approved July 2025) deals with choosing which grade 1 indicator to use in each situation (symbol, word or passage). (The other sections of the GTM will be revised to provide consistency in applying these principles to its examples.)

The following common technical signs and indicators could be read as contractions and may require use of grade 1 mode.

⠸⠒ ratio sign [might be read as cc]
⠸⠶ visible space [ing]
⠸⠌ simple numeric fraction line [st]
⠸⠆/⠰ general fraction open/close [of/with]
⠸⠢ subscript [en]
⠸⠔ superscript [in]
⠸⠜/⠻ braille grouping open/close [gh/ar]
⠸⠩/⠱ open/close radical [sh/ing]
⠸⠮ integral sign [the]
⠸⠶ prime [gg]
⠸⠶⠲ therefore [Child]

⠸⠿⠸ first transcriber-defined print symbol [th]
⠸⠿⠱ bar over previous item [wh]
⠸⠿⠠⠱ bar under previous item [Wh]
⠸⠿⠳ simple right-pointing arrow over previous item [whose]
⠸⠿⠠⠳ simple right-pointing arrow under previous item [Whose]
⠸⠿⠩ hat over previous item [where]
⠸⠿⠠⠩ hat under previous item [Where]
⠸⠿⠹ arrow indicator [ou]
⠸⠿⠫ shape indicator [ed]
⠸⠿⠻ shape terminator [wh]

PRACTICE D

Transcribe question 1 as spatial fractions for teaching purposes using a numeric indicator for each number.

1. $\frac{2}{16}+\frac{2}{16}=\frac{4}{16}=\frac{1}{4}$

2. $\frac{6}{12}$ $6\frac{1}{2}$ $6\frac{1}{2}$ $\frac{6.12}{2}$ 6/12 $\frac{6\ 120\ 000}{2\ 000}$ $\frac{6{,}120}{20{,}000}$

3. $\frac{2}{y}$ $\frac{x}{y}$ $4cm/8m$

4. $\frac{1/2}{3/6}$ $\frac{\frac{x}{y}}{\frac{y}{x}}$ $\frac{7/x}{8/x+4/x}$

5. $length=\frac{area}{width}$

6. $\frac{3}{5}$ $x/11$ $9/x$ 9/11 $\frac{\$3.00}{5}$

7. $\frac{}{7}$ $\frac{11}{?}$ $?\frac{?}{5}$

```
          ⠠⠁⠝⠎⠺⠻⠎ ⠠⠠⠏⠗⠁⠉⠞⠊⠉⠑ ⠰⠠⠙

⠼⠁⠲ ⠼⠃      ⠼⠃      ⠼⠙      ⠼⠁
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    ⠼⠁⠋    ⠼⠁⠋    ⠼⠁⠋    ⠼⠙

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```

E. SUPERSCRIPTS AND SUBSCRIPTS [7]

In UEB, superscripts and subscripts in technical material are done the same way as in literary material. Since the superscript and subscript indicators refer only to the next "item" (as defined in 7.1), it is not necessary to show the level change back to baseline.

If there is more than one symbol in the superscript or subscript position, use braille grouping indicators to create a UEB "item" (see number 7 in 7.1). See also 7.4 and 7.5.

Remember that in UEB the degree symbol is considered to be superscript and does not need a superscript indicator [2.10].

For simultaneous superscripts and subscripts, follow 7.7.

Transcribing modifiers directly above and below is explained in 7.9.

For the sigma notation in the following practice, see the list of Greek letters in 11.7.

PRACTICE E

1. $A = 3.14r^2 \quad b^3 \quad CO_2$
2. $p^3q \quad p^{3q} \quad a^{3b}$
3. $m^3 + n \quad m^{3+n} \quad m^{3+n} - 6$
4. $y^{3/5} \quad \frac{y^3}{5}$
5. $\frac{x^2 + y^2}{z^3}$
6. $p = q^{\frac{r}{s}}t$
7. $x^{y^3} \quad x^{(y^3)}$
8. $2^{2^{2^2}}$
9. $V_{i^2} \quad V^{i_2}$
10. c^{-3d}
11. $Fe^{III}Cl_3$
12. $m_x^y \quad m^y{}_x \quad m_{x^y}$
13. $^{-}3 + {}^{+}7 = {}^{+}4$
14. 2.7×10^7 °F
15. $\sum_{x=1}^{5} x_n{}^8$
16. $V_{cone} = \frac{1}{2}\pi r^2 h$

⠠⠁⠝⠎⠺⠻⠎ ⠠⠠⠏⠗⠁⠉⠞⠊⠉⠑ ⠰⠠⠑

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F. SQUARE ROOTS AND OTHER RADICALS [8]

8.1 explains the method of transcribing square roots. Refer to 8.2 for the transcription of a radical index. Note a nested radical is shown in the last example of 8.2.

8.3 illustrates the symbol for the square root sign without a vinculum.

PRACTICE F

1. $\sqrt{x^2+1}$
2. $3\sqrt{\frac{x}{y}}+2$
3. $\sqrt[3]{2}$
4. $\sqrt[m+n]{p+q}$
5. $\sqrt{\sqrt{x}}$
6. Use √ for square roots.

G. FUNCTIONS [9]

Follow 9.3 for the spacing of function names. Note that contractions are used unless grade 1 mode is in effect, such as following a numeric indicator (see the final example in 9.3.3).

PRACTICE G

1. $\sin 30°,\ \cos x,\ \tan\theta$
2. $a\csc x,\ 3\sin 45°,\ \cos^{-1} 0.2$
3. $2\log_4 8,\ \log_a x,\ \log_8 x$
4. $\sin A = -\frac{1}{\sqrt{2}}$
5. $y = -3\sin(2x+\pi)-1,\ -\pi \le x \le 2\pi$

⠠⠠⠠

H.1 SET THEORY, GROUP THEORY AND LOGIC [10]

Use the appropriate symbols. Symbols of comparison are spaced and symbols of operation are unspaced, as follows.

These three signs are spaced as in print:

⠸⠿⠸⠴ ∅ null set
⠸⠿⠴ ’ complement
⠸⠿⠸⠸ ¬ “not” sign

These four signs are signs of operation and are unspaced:

⠸⠿⠸⠬ ∪ union
⠸⠿⠸⠩ ∩ intersection
⠸⠿⠸⠬ ∨ or
⠸⠿⠸⠩ ∧ and

All other signs in Section 10 are signs of comparison and are spaced.

H.2 MISCELLANEOUS SYMBOLS [11]

Note which symbols can be found here e.g. integral, asterisk, infinity, angle. Some signs are now more thoroughly covered in the **update**, revised Section 3.

PRACTICE H

1. $A \cap B,\ X \subset Y$
2. $(A \wedge \neg B) \supset (\neg X \vee Y)$
3. $\int_{x=a}^{x=b} f(x)\,dx$
4. $\sum_{n=0}^{\infty} a_n$
5. $\therefore\ \angle ABC < 90°$
6. $\{(x,y) \mid x = |y|\}$
7. $\frac{n!}{r!(n-r)!}$

⠠⠁⠝⠎⠺⠻⠎ ⠠⠠⠏⠗⠁⠉⠞⠊⠉⠑ ⠰⠠⠓

⠼⠁⠲ ⠠⠁⠨⠦⠠⠃⠂ ⠰⠠⠭ ⠘⠣ ⠰⠠⠽
⠼⠃⠲ ⠐⠣⠠⠁⠈⠦⠈⠹⠠⠃⠐⠜ ⠘⠜ ⠐⠣⠈⠹⠠⠭⠈⠖⠠⠽⠐⠜
⠼⠉⠲ ⠰⠰⠮⠢⠣⠭⠐⠶⠁⠜⠔⠣⠭⠐⠶⠃⠜⠋⠐⠣⠭⠐⠜⠙⠭
⠼⠙⠲ ⠠⠨⠎⠨⠢⠰⠣⠝⠐⠶⠼⠚⠜⠨⠔⠼⠿⠁⠢⠝
⠼⠑⠲ ⠰⠠⠡ ⠸⠪⠠⠠⠁⠃⠉ ⠈⠣ ⠼⠊⠚⠘⠚
⠼⠋⠲ ⠰⠰⠰⠸⠣⠐⠣⠭⠂ ⠽⠐⠜ ⠸⠳ ⠭ ⠐⠶ ⠸⠳⠽⠸⠳⠸⠜⠰⠄
⠼⠛⠲ ⠰⠰⠷⠝⠖⠨⠌⠗⠖⠐⠣⠝⠐⠤⠗⠐⠜⠖⠾

I. BARS AND DOTS ETC. OVER AND UNDER [12]

These symbols follow the "item" which they are over or under. Note that several of these symbols have contracted meanings and will need to be in grade 1 mode. The definition of an item is repeated in 12.1.

PRACTICE I

Transcribe question 6 as a spatial arrangement.

1. $\bar{y} \neq 0$
2. $1.\overline{45}$ $1.\dot{4}\dot{5}$ $D\hat{E}F$
3. $\underset{\sim}{x}$
4. $\vec{v}$
5. $\overline{AB}^2$
6. $\frac{3}{\cancel{8}_2} \times \frac{\cancel{4}^1}{7} = \frac{3}{14}$

J. ARROWS [13]

Simple arrows are defined and their transcription is explained in 13.1. 13.2 deals with arrows with unusual shafts and 13.3 lists symbols for unusual tips. If it is necessary to determine the direction of the arrow, follow the provisions at the bottom of page 62. The order for transcribing the elements of an unusual arrow is given at the top of page 63.

PRACTICE J

1. $x \to \infty$
2. $\lim_{\theta \to 0} \cos\theta$
3. $\Uparrow \ \updownarrow$
4. $x \neq y \Leftrightarrow \neg(x = y)$
5. $x \rightharpoonup y$

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K. SHAPE SYMBOLS AND COMPOSITE SYMBOLS [14]

The shape indicators are listed in 14. Note the list of specific shapes. For a rectangle, the symbol for parallelogram may be used. Refer to 14.1 to determine when a terminator is required for a shape. Once in shape mode, grade 1 indicators are not required.

Follow 14.2 for a transcriber-defined shape. Refer to 3.26 in the Rulebook to determine when the use of a transcriber-defined *symbol* is preferred to a transcriber-defined *shape.*

The use of composite symbols is described in 14.3. Note that each is shown with a grade 1 symbol indicator preceding it.

Often calculator keys are shown enclosed within a box. The preferred method for their transcription is given in 3.5 of GTM 2014.

See 3.6 of GTM 2014 for a square used as a mark of omission.

PRACTICE K

1. $9 - 5 \square 4$
2. ○ ⬟ ▨
3. $H_2O \rightleftarrows 2H + O$
4. ☆
5. Press calculator keys $\boxed{\sqrt{}}$ $\boxed{4}$.
6. $\binom{n}{0} = \binom{n}{n} = 1$

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L. MATRICES AND VECTORS [15]

Using the enlarged grouping symbols from 5, follow the provisions in 15 for matrices [15.2], determinants [15.3] and vectors [15.6]. Note that 15.4 deals with omission dots, 15.5 gives guidance on wide matrices and 15.7 shows the use of enlarged grouping symbols for grouping of equations.

If a grade 1 passage indicator is used, it may be placed on a line by itself (replacing the blank line) preceded by the dot locator for "use" (dots 5-5-123456). See 3.14 in the Rulebook. The grade 1 terminator would also be placed on a line by itself following the arrangement and preceded by the dot locator for "use".

PRACTICE L

1. $\begin{pmatrix} 1 & -2 \\ -3 & 4 \end{pmatrix}$

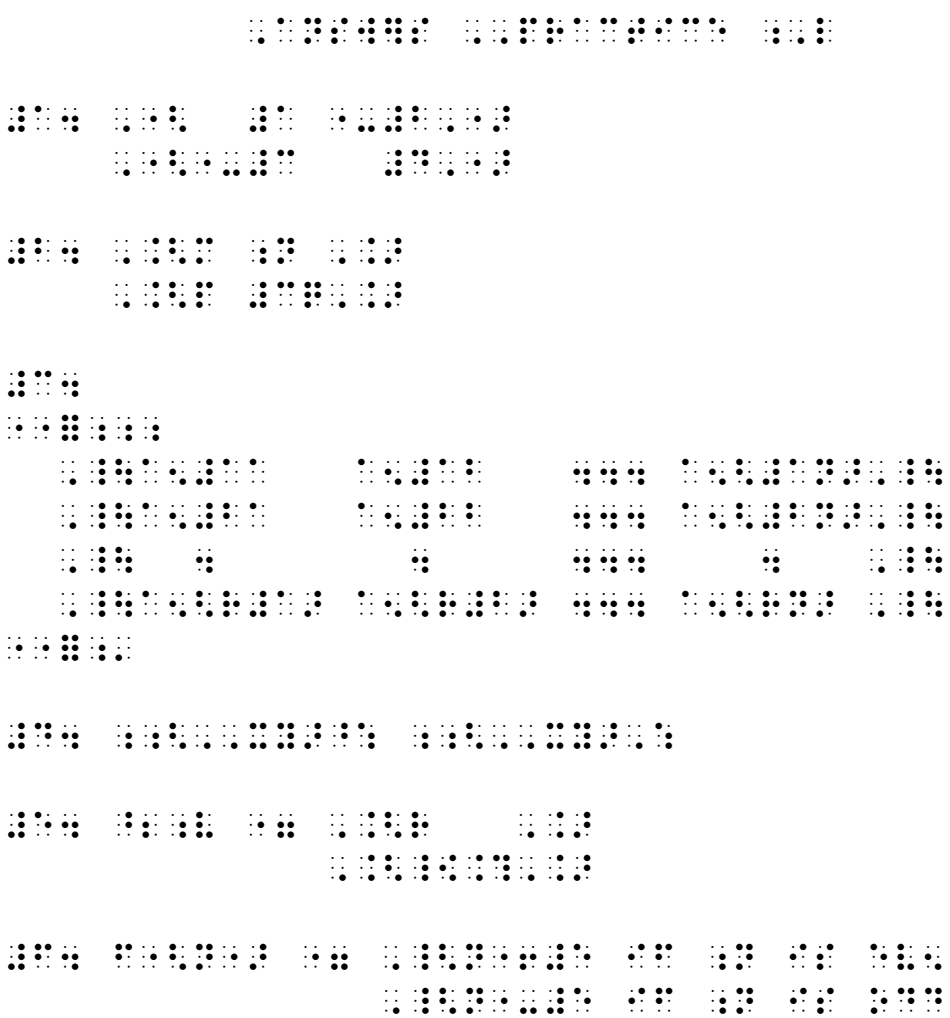
2. $\begin{bmatrix} m & n \\ p & 3q \end{bmatrix}$

3. $\begin{vmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \cdot & \cdot & \cdots & \cdot \\ a_{r1} & a_{r2} & \cdots & a_{rn} \end{vmatrix}$

4. $\overrightarrow{XY}$ $\underline{XY}$

5. $\boldsymbol{v} = \begin{bmatrix} r \\ \angle\theta \end{bmatrix}$

6. $f(n) = \begin{cases} n+5 \text{ if } n \text{ is even} \\ n-5 \text{ if } n \text{ is odd} \end{cases}$

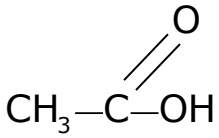


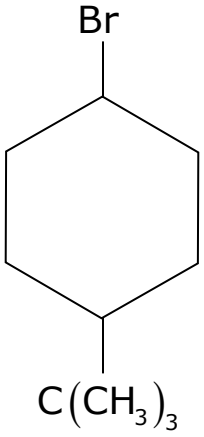
M. CHEMISTRY [16]

When transcribing chemistry, refer to 16.2 for capitalization. Subscripts and superscripts for atomic mass numbers are in 16.3 and for electronic configuration are in 16.4. Examples of chemical equations are shown in 16.5. Print uses various methods of showing electrons which may be represented by the corresponding UEB signs as illustrated in 16.6. Structural formulae are covered in 16.7. Note that there are UEB symbols given in 16 which are used for line bonds. Refer to 16: Line Mode in the Rulebook for the transcription of lines in structural formulae.

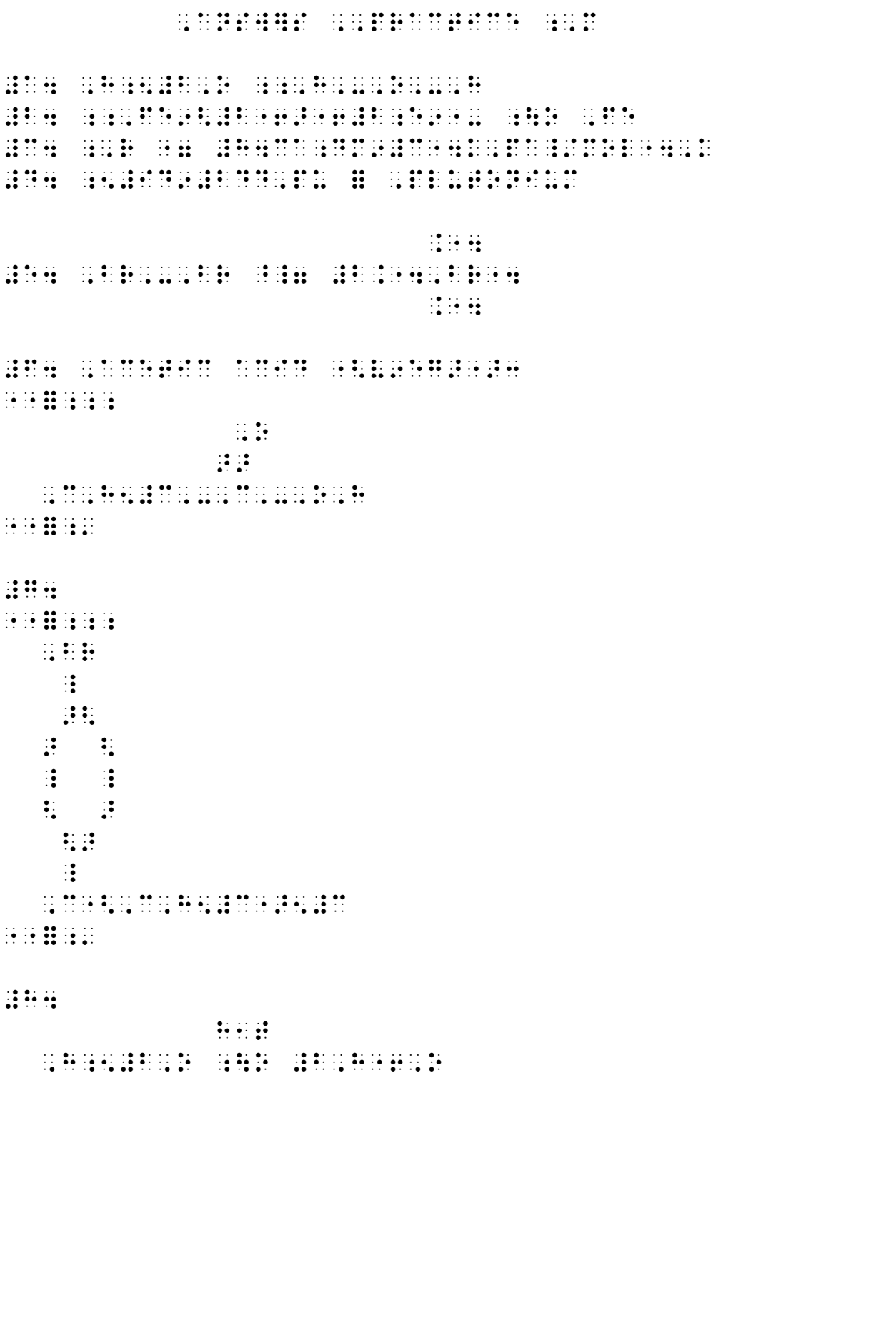
PRACTICE M

1. H_2O H—O—H
2. $Fe^{2+} + 2e^- \rightarrow Fe$
3. $R = 8.31 dm^3 \cdot kPa/mol \cdot K$
4. $^{244}_{94}Pu$ for Plutonium
5. $Br—Br \rightleftharpoons 2 : \ddot{\underset{\cdot\cdot}{Br}} \cdot$
6. Acetic acid (vinegar):



7. 

8. $H_2O \xrightarrow{heat} 2H + O$



N. COMPUTER NOTATION [17]

17.1 gives a definition of computer notation and explains what is meant by "displayed" and "inline". The line arrangement for displayed computer notation and its spacing are discussed in 17.2. Use uncontracted braille for displayed computer notation and any associated excerpts [17.3].

PRACTICE N

This example of a C++ program was found at http://www.cs.indiana.edu/~sabry/teaching/intro/fa96/code/prime.C. It is used to check if a number is prime.

```
#include <iostream.h>

int smalldiv (int n) {
  int count;
  count = 2;

  while (count < n && n % count != 0) {
    count = count + 1;
  }
  return(count);
}

int main () {
  int n;
  cout << "Enter a natural number: ";
  cin >> n;
  if (n == smalldiv(n)) {
    cout << n << " is a prime number" << endl;
  }
  else {
    cout << n << " is not a prime number" << endl;
  }
  Return(0);
}
```