Nemeth Code Symbols Used in High School and Strategies for Supporting Math Learning

Lesson 1: Symbols for Advanced Math, Part 1

PROJECT
INSPIRE

1

1

Objectives

Participants will be able to:

- Read and write problems containing
    1. vertical bars (e.g., absolute value, set notation)
    2. brackets and braces (e.g., function notation and interval notation)
    3. the infinity symbol
    4. the hollow dot
    5. angle brackets
- Read and write math word problems that require use of the opening Nemeth Code indicator, the Nemeth Code terminator, and the single-word switch indicator.

2

2

Absolute Value Review

⠰⠆ ⠰⠆ absolute value | |

Remember that a number enclosed in vertical bars does not need a numeric indicator.

⠸⠈⠴⠒⠸⠈ $\left|-8\right|$ Read: absolute value of negative 8

⠤⠸⠼⠂⠸ $-\left|4\right|$ Read: negative absolute value of 4

⠒⠬⠸⠭⠸⠭⠸ $3+\left|x\right|$ Read: three plus the absolute value of x

⠸⠒⠭⠤⠋⠸ $\left|3x-6\right|$

    Read: absolute value of 3x minus 6 close absolute value

28. Is $-\left|-7\right|$ positive?

⠼⠃⠓⠲ ⠜⠎⠀ ⠤⠸ ⠤⠶⠏⠸⠲ ⠨⠎ ⠏⠕⠎⠊⠞⠊⠧⠑⠳

3

More Uses of the Vertical Bar

⠸⠸ | vertical bar

    ⠸⠧⠸ $\left|v\right|$ Read: magnitude of v

    ⠸⠸⠋⠸⠸ $\left\|f\right\|$ Read: norm of f

    ⠸⠈⠁⠸ $\left|A\right|$ Read: determinant of matrix A

  ⠸⠈⠉⠸ ⠐⠶ ⠤⠓ $\left|C\right|=-8$

Read: The determinant of matrix C equals negative eight.

    ⠸⠸⠛⠤⠓⠸⠸ $\left\|g-h\right\|$

Read: the norm of g minus h

4

More Uses of the Vertical Bar (Continued)

⠐⠳ | Read: such that

- Usually used within set notation

- Must be a space before and after the vertical bar in Nemeth Code.

⠨⠷⠭ ⠐⠳ ⠭ ⠐⠅ ⠼⠃⠨⠾ $\{x \mid x < 2\}$

Read: the set of all x such that x is less than 2

⠨⠷⠭ ⠐⠳ ⠭ ⠀⠁⠑⠀ ⠼⠴⠨⠾ $\{x \mid x \geq 0\}$

Read: the set of all x such that x is greater than or equal to 0

5

Symbols Used in Function Notation and Interval Notation

⠷   open (left) parentheses (
⠾   close (right) parentheses)
⠈⠷   open (left) bracket [
⠈⠾   close (right) bracket]
⠠⠿   infinity ∞
⠤⠠⠿   negative infinity -∞

6

6

Expanded Use of Grouping Symbols
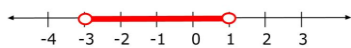
- Function notation

  ⠿⠿⠿⠿⠿ f(x)   Read: f of x

  ⠿⠿⠿⠿⠿ ⠿⠿ ⠿⠿⠿⠿⠿⠿⠿ $f(x) = 2(x - 7)$

- Interval notation

Open Interval	Closed Interval
does not include its endpoints	includes its endpoints
⠿⠿⠿⠿⠿ ⠿⠿ $(-3, 1)$	⠿⠿⠿⠿⠿ ⠿⠿ $[-3, 1]$
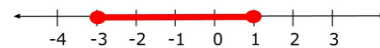
  Half-open or Half-closed Intervals
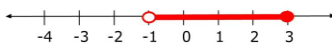
  ⠿⠿⠿⠿⠿ ⠿⠿ $(-1, 3]$ ⠿⠿⠿⠿⠿ ⠿⠿ $[2, \infty)$

7

Activity 1A

Braille the problems.

1. $4|x + 3| - 7$

2. $\{x \mid x \neq -2\}$

3. $|B| = 68$

4. $[-5, 9]$

5. $(-\infty, 6]$

8

Activity 1A: Answer Key

1. $4|x + 3| - 7$

⠿⠿
⠿⠿⠿⠿ ⠿⠿⠿⠿⠿⠿⠿⠿⠿⠿

2. $\{x \mid x \neq -2\}$

⠿⠿⠿⠿ ⠿⠿⠿⠿ ⠿ ⠿ ⠿⠿⠿⠿ ⠿⠿⠿⠿⠿⠿

3. $|B| = 68$

⠿⠿⠿⠿ ⠿⠿⠿⠿⠿ ⠿⠿⠿ ⠿⠿⠿⠿

4. $[-5, 9]$

⠿⠿⠿⠿ ⠿⠿⠿⠿⠿⠿ ⠿⠿⠿⠿

5. $(-\infty, 6]$

⠿⠿⠿⠿ ⠿⠿⠿⠿⠿⠿ ⠿⠿⠿⠿ ⠿⠿

Hollow Dot

⠿⠿⠿ ∘ The hollow dot is used for degrees and composite functions.

⠿⠿⠿⠿⠿⠿⠿⠿ 90°

When reading a function, say "of" when you reach the hollow dot or an opening parenthesis.

⠿⠿⠿⠿⠿⠿⠿⠿ $f \circ g \circ h$ Read: f of g of h

⠿⠿⠿⠿⠿⠿⠿⠿⠿⠿ $(g \circ f)(x)$ Read: g of f of x

⠿⠿⠿⠿⠿⠿⠿⠿⠿⠿ ⠿⠿⠿ ⠿⠿⠿⠿⠿⠿⠿⠿ $(f \circ g)(x) = f(g(x))$

Read: f of g of x equals f of g of x.

Angle Brackets

⠀⠀⠀ ⠀⠀⠀ $\langle \rangle$ angle brackets ⠀⠀⠀⠀⠀⠀ ⠀⠀⠀⠀⠀⠀ $\langle x, y \rangle$

Read: open angle bracket x comma y close angle bracket

⠀⠀⠀⠀⠀⠀ ⠀⠀⠀⠀⠀⠀⠀⠀⠀ $\langle 5, 45° \rangle$

Read: open angle bracket five comma forty-five degrees close angle bracket

⠀⠀ ⠀⠀ ⠀⠀⠀⠀⠀⠀ ⠀⠀⠀⠀⠀⠀ $v = \langle 3, -5 \rangle$

Read: v equals open angle bracket three comma negative five close angle bracket.

⠀⠀ ⠀⠀ ⠀⠀⠀⠀⠀⠀⠀ ⠀⠀⠀⠀⠀⠀ $A = \langle x_1, y_1 \rangle$

Read: A equals open angle bracket x sub one comma y sub one close angle bracket.

11

Opening and Closing Nemeth Indicators

- The opening Nemeth Code indicator ⠼⠹ begins Nemeth Code.

- The Nemeth Code terminator ⠼⠄ ends Nemeth Code.

- The opening Nemeth Code indicator can be placed at the end of a line of literary text **or** on its own line.

- The Nemeth Code terminator can also be placed after the math it ends **or** on its own line.

12

Single Words in Nemeth Code Within UEB Contexts

- Use the single-word switch indicator ⠨⠰ to avoid switching in and out of Nemeth Code for one word.

- Begin with a single word switch indicator.

- Braille the word in UEB.

- Even if a word **does not** have a contraction in it, you **must** use a single word switch indicator.

Watch the + and − signs!

⠰�
⠫⠩⠻⠐⠫ ⠒⠒ ⠰⠽⠀ ⠒⠒ ⠩⠂⠐⠫ ⠒⠒ ⠰⠽⠀ ⠽⠐⠫⠫⠻⠐⠽

13

Nemeth Indicators (Continued)

- When deciding where to place indicators, consider:
  - Consistency
  - Clarity for the braille reader
- If the math material and its switch indicators will fit on one braille line within current margins, this is the preferred layout.
- If not, the priority is not to divide the math expression. When only one code switch indicator will fit on the line with the math expression, either indicator may be placed on the line with the math.
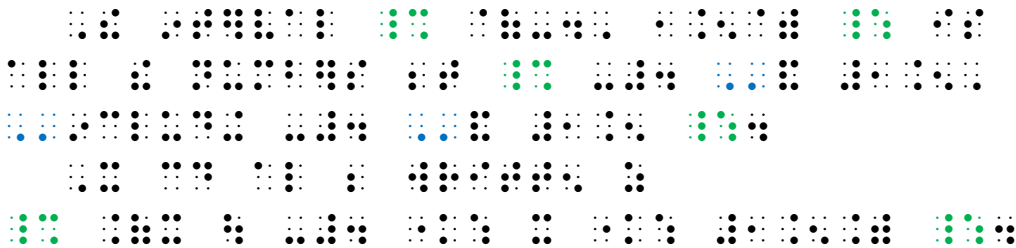
14

Examples of Switch Indicator Use

The interval $\left[-4, 1.5\right]$ is all the numbers between -4 and 1.5, including -4 and 1.5.

It could also be written as $\{x \mid -4 \le x \le 1.5\}$.
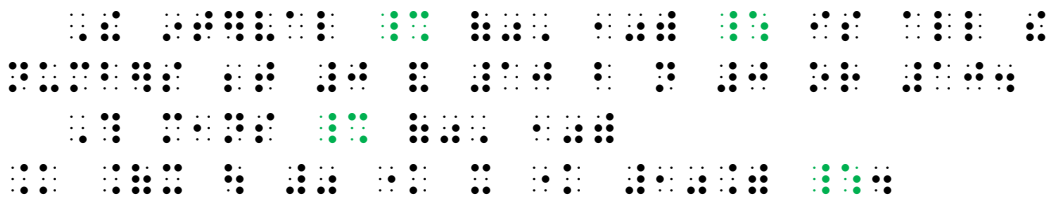
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Examples of Switch Indicator Use (Continued)

The interval $(0, 10)$ is all the numbers between 0 and 10 but not 0 or 10.

This means $(0, 10) = \{x \mid 0 < x < 10\}$.

16

16

Activity 1B

Interline the problems.

⠰⠂⠄⠲⠀⠠⠰⠈⠍⠶⠇⠇⠢⠲⠀⠘⠰⠢⠒⠰⠹⠕⠢⠶⠲⠀⠼⠔⠼⠔⠤⠇
⠀⠀⠀⠘⠰⠀⠼⠚⠶⠢⠲⠰⠄⠀⠘⠰⠀⠲⠰⠀⠰⠎⠒⠕⠍⠏⠇⠢⠰⠴⠲⠼⠴⠲⠶

⠰⠂⠄⠲⠀⠠⠰⠿⠲⠰⠿⠀⠘⠰⠀⠘⠰⠿⠒⠄⠴⠶⠕⠙⠶⠲⠀⠔⠢⠲⠶

⠰⠂⠂⠲⠀⠠⠰⠔⠀⠿⠰⠴⠍⠒⠢⠀⠼

⠀⠀⠀⠘⠰⠀⠿⠢⠠⠶⠀⠠⠰⠴⠰⠿⠿⠀⠿⠢⠢⠰⠀⠠⠼⠶⠶⠀⠢⠴⠶

⠰⠂⠶⠲⠀⠠⠰⠴⠂⠰⠿⠀⠈⠰⠿⠀⠼⠀⠘⠢⠰⠿⠰⠂⠼⠼⠶⠇⠿⠀⠼⠴⠀⠼

⠀⠀⠀⠘⠰⠀⠰⠒⠘⠢⠴⠰⠶⠀⠶⠲⠰⠶⠴⠶⠲⠔⠒⠢⠀⠔⠶⠢

Activity 1B: Answer Key

1. Angles whose measures total 90° are complementary.

⠰⠂⠄⠲⠀⠠⠰⠈⠍⠶⠇⠇⠢⠲⠀⠘⠰⠢⠒⠰⠹⠕⠢⠶⠲⠀⠼⠔⠼⠔⠤⠇
⠀⠀⠀⠘⠰⠀⠼⠚⠶⠢⠲⠰⠄⠀⠘⠰⠀⠲⠰⠀⠰⠎⠒⠕⠍⠏⠇⠢⠰⠴⠲⠼⠴⠲⠶

2. Find $(f \circ g)(x)$.

⠰⠂⠂⠲⠀⠠⠰⠿⠲⠰⠿⠀⠘⠰⠀⠘⠰⠿⠒⠄⠴⠶⠕⠙⠶⠲⠀⠔⠢⠲⠶

Activity 1B: Answer Key (Continued)

3. The domain of $f(x)$ is $[2, \infty)$.

⠼⠒⠲ ⠠⠹ ⠙⠕⠍⠁⠔ ⠷
⠐⠖ ⠋⠷⠭⠾ ⠬⠂⠋ ⠈⠷⠃⠂⠠ ⠠⠽⠿ ⠒⠾⠲

4. What is the rectangular form of $\langle 10, 60^\circ \rangle$?

⠼⠲⠲ ⠠⠺⠁⠞ ⠊⠎ ⠮ ⠗⠑⠉⠞⠁⠝⠛⠥⠇⠁⠗ ⠿⠍ ⠷
⠐⠶ ⠂⠴⠃⠎⠴⠴⠆ ⠿⠁⠎⠊⠴⠴⠘⠆⠴⠴ ⠒⠾⠲

Activity 1C
Transcribe the following quiz.

Algebra Quiz

Show all your steps.
1. Given $f(x) = 3x + 2$ and $g(x) = x + 5$, find $(f \circ g)(x)$.

2. Draw a graph of a function with a range of $\{y \,|\, y \geq -1\}$.

3. Describe the interval $(-3, 4]$ using set notation.

4. Is $-9\big|-3\big|$ positive or negative?

Activity 1C: Answer Key

⠰⠹�⠎⠍⠬�⠼⠼⠀⠰⠦⠟⠙⠦⠆⠒

⠰⠒⠎⠂⠀⠒⠝⠿⠀⠼⠃⠚⠀⠌⠑⠝⠷⠀
⠼⠛⠒⠄⠀⠰⠶⠿⠇⠲⠀⠎⠝⠀⠟⠞⠕⠶⠀⠒⠝⠀⠼⠫⠕⠃⠃⠀⠲⠠⠃
⠀⠀⠟⠷⠕⠶⠀⠒⠝⠀⠒⠲⠑⠂⠀⠂⠠⠝⠒⠴⠀⠾⠟⠒⠂⠟⠫⠫⠶⠩⠀⠒⠡⠂

⠼⠙⠒⠄⠀⠰⠒⠹⠃⠒⠙⠀⠂⠀⠟⠿⠒⠟⠴⠀⠓⠀⠂⠀⠟⠦⠏⠞⠒⠏⠀⠰⠀⠂
⠀⠀⠓⠒⠹⠿⠴⠀⠓⠀⠒⠞⠀⠒⠫⠃⠀⠓⠀⠰⠀⠒⠕⠂⠀⠠� ⠒⠒⠴⠀⠒⠡⠢

⠼⠛⠒⠄⠀⠰⠒⠕⠟⠒⠟⠶⠒⠴⠀⠆⠀⠰⠲⠟⠹⠇⠒⠇
⠀⠀⠒⠞⠀⠓⠠⠏⠒⠄⠀⠶⠲⠏⠀⠒⠒⠀⠰⠂⠋⠰⠀⠟⠒⠟⠀⠝⠕⠟⠋⠒⠎⠴

⠼⠓⠒⠄⠀⠰⠲⠣⠎⠀⠒⠞⠀⠰⠒⠰⠉⠷⠉⠫⠣⠀⠒⠡⠀⠟⠂⠟⠫⠒⠟⠇⠎⠀⠴⠏
⠀⠀⠒⠣⠟⠒⠹⠒⠏⠇⠢⠒