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

Lesson 3: Symbols for Advanced Math, Part 3

Objectives

Participants will be able to:

• Read and write problems containing
1. superscripts
2. subscripts
3. radicals with an index
4. functions
5. Greek letters

• Use the five step rule for Sigma notation

Superscript Review and Expansion

⠱ superscript indicator (dots 4-5)

⠐ baseline indicator (dot 5)

- No baseline indicator is needed if a space follows a superscript or if it is at the end of a line.

- If an exponent is raised to another exponent, the superscript indicator is used twice instead of once before the second exponent.

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

$$f^{-1}(x)$$ Read: f inverse of x

$$e^{x^2}$$ Read: e to the x squared power

Subscript Review (No Indicator)

⠰ subscript indicator (dots 5-6)

A variable or function with a numeric subscript does not use a subscript indicator.

⠠⠁ ⠀⠐⠶ � $A = \dfrac{h}{2}\left(b_1 + b_2\right)$

Read: A equals open fraction h over 2 close fraction open parenthesis b sub 1 plus b sub 2 close parenthesis.

⠷⠭⠂⠠⠀⠽⠂⠾ $\left(x_1, y_1\right)$ Read: the ordered pair x sub 1 y sub 1

� H_2O Read: H 2 O

Examples of Subscripts and Use of the Subscript and Baseline Indicators

⠰   subscript indicator (dots 5-6)

⠁⠔⠊ a_i Read: a sub i

⠁⠔⠝⠖⠂ ⠨⠅ ⠁⠔⠝⠐⠬⠲ $a_{n+1} = a_n + 4$

Read: a sub n plus 1 equals a sub n baseline plus 4.

⠁ ⠨⠅ ⠷⠧⠔⠋⠐⠤⠧⠔⠊⠐⠌⠞⠾ $a = \dfrac{v_f - v_i}{t}$

Read: a equals open fraction v sub f baseline minus v sub i baseline over t close fraction.

Examples of Logarithms with and without a Subscript Indicator

⠇⠇ ⠇⠒⠇⠶⠒ ⠏⠶⠏ ⠒⠒⠶⠒ ⠇⠶ $\log_b a$

Read: log base b of a

⠇⠇ ⠒⠒⠶⠶⠶⠒   ⠶⠶ $\log_2 x$

Read: log base 2 of x

Logarithms denoted by log or ln are functions and should be followed by a space.		
If the log is followed by a subscript, the space comes after that subscript.		

⠇⠇ ⠶⠶   ⠶⠶   ⠶⠶⠶   ⠇⠒⠇⠶⠒⠏⠶⠏   ⠶⠶ $\ln x = \log_e x$

Read: natural log of x equals log base e of x

Activity 3A

Braille the following problems.

1. $f^{-1}(x) = \dfrac{x + 7}{2}$

2. $\log 10^{x^2} = x^2$

3. $x_r = \dfrac{y^2}{z}$

4. H_2SO_4

Activity 3A: Answer Key

1. $f^{-1}(x) = \dfrac{x+7}{2}$

2. $\log 10^{x^2} = x^2$
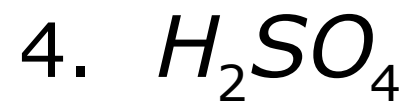
Activity 3A: Answer Key (Continued)

3. $x_r = \dfrac{y^2}{z}$

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4. H_2SO_4

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Radicals Review (Square Roots)

⠨ radical symbol

⠨ termination symbol
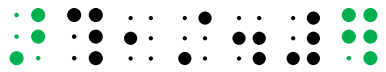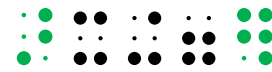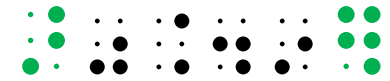
$$\sqrt{\dfrac{1}{4}} \qquad \sqrt{25} - 3 \qquad \sqrt{x+7} \qquad \sqrt{0.49}$$

Radicals with an Index

⠿   index-of-radical indicator
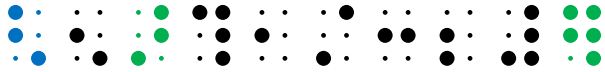
⠩⠖⠒⠼⠿ $\sqrt[3]{64}$

Read: the cube root of 64

⠩⠶⠛⠒⠶⠓⠒⠶⠶ $\sqrt[7]{x} + 3$

Read: the 7th root of x end root plus 3
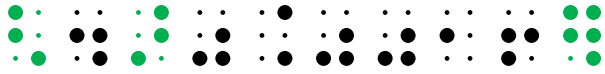
Radicals with an Index (Continued)

$$\sqrt[5]{\dfrac{1}{32}}$$

Read: the 5th root of open fraction 1 over 32 close fraction end root

$$\sqrt[4]{0.0016}$$

Read: the 4th root of zero point zero zero one six

Activity 3B

Interline the problems.

⠰⠃

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⠼⠃⠄⠀⠎⠊⠛⠝⠊⠋⠊⠉⠁⠝⠞⠇⠽⠀⠞⠕⠀⠁⠝⠎⠺⠑⠗

⠼⠉⠄⠀⠞⠕⠀⠑⠭⠏⠇⠁⠊⠝⠀⠞⠕⠀⠞⠓⠑

⠼⠙⠄⠀⠁⠀⠞⠕⠀⠞⠗⠁⠝⠎⠏⠕⠗⠞⠁⠞⠊⠕⠝

⠼⠑⠄⠀⠁⠝⠙⠎⠕⠍⠑⠞⠓⠊⠝⠛⠀⠞⠕⠀⠞⠓⠑⠀⠞⠕

⠼⠋⠄⠀⠞⠓⠑⠀⠍⠑⠁⠝⠊⠝⠛⠀⠕⠋⠀⠞⠓⠑⠀⠺⠕⠗⠙⠀⠊⠝⠞⠑⠗

⠇⠊⠝⠑⠀⠊⠎⠀⠞⠕

⠉⠕⠍⠍⠥⠝⠊⠉⠁⠞⠑⠀⠎⠕⠍⠑⠞⠓⠊⠝⠛⠀⠞⠕

Activity 3B: Answer Key

1. $f^{-1}(x) = \sqrt[3]{x} - 2$

⠠⠝⠀

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2. $x^3 - 6x^2 + 12x - 8 = (x-2)^3$

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3. $\ln e^{x^6} = x^6$

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Activity 3B: Answer Key (Continued)

4. $a_n = 2(a_{n-1} + 3)$

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5. $\sqrt[8]{x^{16}} = x^2$

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6. The midpoint of (x_1, y_1) and (x_2, y_2) is $\left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2} \right)$.

⠰�ⓣ⠓⠑⠀⠍⠊⠙�⠕⠊⠝⠞⠀⠷⠀⠭⠂⠀�⠀⠽⠂⠾⠀⠁⠝⠙⠀
    ⠐⠶⠀⠷⠭⠢⠀�⠀⠽⠢⠾⠀⠊⠎⠀
    ⠷⠷⠭⠂⠐⠖⠭⠢⠾⠌⠼⠃⠂⠷⠽⠂⠐⠖⠽⠢⠾⠌⠼⠃⠾⠲

Functions

⠎⠊⠝ sin (sine)

⠉⠕⠎ cos (cosine)

⠞⠁⠝ tan (tangent)

⠇⠕⠛ log (log)

⠇⠝ ln (natural log)

- Note that e is often used with ln.
- Do not use the English Letter Indicator in a function.

Examples of Functions

⠿ ⠿ ⠿ ⠿⠿⠿⠿⠿ $\sin 45°$ Read: sine of 45 degrees
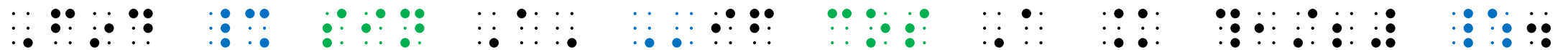
⠿⠿⠿ ⠿⠿ $\cos A$ Read: cosine of A

⠿⠿⠿ ⠿⠿⠿⠿ $\tan 2B$ Read: tangent of 2B

⠿⠿⠿⠿ ⠿⠿⠿ $\log_2 8$ Read: log base 2 of 8

⠿⠿ ⠿⠿⠿⠿ $\ln e^6$ Read: natural log of e to the 6th power

Find $\sin A$, if $\cos A = \dfrac{1}{2}$.

⠿⠿⠿⠿ ⠿⠿ ⠿⠿⠿ ⠿⠿⠿ ⠿⠿⠿⠿ ⠿⠿⠿⠿ ⠿⠿ ⠿⠿ ⠿⠿⠿⠿⠿ ⠿⠿⠿

Greek Letters

⠨ Greek letter indicator

⠨⠁ alpha (lowercase) α

⠨⠃ beta (lowercase) β

⠨⠏ pi (lowercase) π

⠨⠹ theta (lowercase) θ

⠨⠘⠙ delta (uppercase) Δ

Examples with Greek Letters

$\cos 2\alpha$ Read: cosine of two alpha

$\beta = 30°$ Read: beta equals 30 degrees

$\langle 3, \pi \rangle$ Read: open angle bracket 3 comma pi close angle bracket

$\sec \theta = 2$ Read: secant of theta equals 2

$$m = \frac{\Delta y}{\Delta x}$$

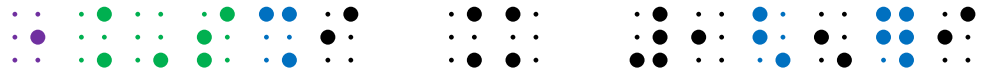Read: m equals open fraction delta y over delta x close fraction.

Find $\sin(\alpha - \beta)$.

Read: Find sine of open parenthesis alpha minus beta close parenthesis.

The Greek Letter Sigma

$$\sum_{i=1}^{5} i$$ Read: the sum from i=1 to 5 of i

Multipurpose indicator, sigma, directly under indicator, i = 1, directly over indicator, 5, termination indicator, i

Steps for Sigma Notation

Uses the Five-Step Rule

Step 1 ⠨ Multipurpose indicator

Step 2 ⠠⠠⠎ sigma (uppercase) Σ - Expression being modified

Step 3 ⠰ Directly under indicator

Step 4 ⠔ ⠊⠀⠐⠶ $i = 1$ Modifier

Step 3 ⠠ Directly over indicator

Step 4 ⠢ 5 Modifier

Step 5 �консь Termination indicator

Putting it together ⠨⠠⠠⠎⠰⠊⠐⠶⠀⠢⠼⠑⠀⠰⠰⠊⠐⠶ $\displaystyle\sum_{i=1}^{5} i$

Read: the sum from i=1 to 5 of i

Examples of Sigma Notation

$$\sum_{j=2}^{10} 5j - 3$$

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Read: the sum from j=2 to 10 of 5j minus 3

$$\sum_{i=0}^{\infty} 2\left(\frac{1}{3}\right)^{i}$$

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Read: the sum from i=0 to infinity of 2 open parenthesis open fraction 1 over 3 close fraction close parenthesis to the i power.

Activity 3C

Braille the problems.

1. $\cot x = \dfrac{\cos x}{\sin x}$

2. $\log_3 81 = 4$

3. $\log_b m^2 = 2\log_b m$

4. $\sin\theta = \cos\left(\dfrac{\pi}{2} - \theta\right)$

5. Find the sum. $\displaystyle\sum_{j=0}^{\infty}(0.6)^j$

6. The formula for work is $W = |F||D|\cos A$.

Problem 1: cot stands for cotangent and would be brailled: ⠉⠕⠞

Problem 6: A multipurpose indicator (dot 5) will be needed between two vertical bars where the first is a closing vertical bar and the second is an opening vertical bar.

Activity 3C: Answer Key

1. $\cot x = \dfrac{\cos x}{\sin x}$

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2. $\log_3 81 = 4$

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3. $\log_b m^2 = 2\log_b m$

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Activity 3C: Answer Key (Continued)

4. $\sin\theta = \cos\left(\dfrac{\pi}{2} - \theta\right)$

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5. Find the sum. $\displaystyle\sum_{j=0}^{\infty}(0.6)^{j}$

⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀

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6. The formula for work is $W = \left|F\right|\left|D\right|\cos A$.

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