How to Read and Write a Radical Expression

Background

A **radical expression** is defined as any expression containing a **radical symbol** $\sqrt{\ }$. In print, a horizontal bar or vinculum usually extends the radical symbol $\sqrt{\ }$ over an expression called the **radicand**. In print, a radical can also have an **index** placed to the left and slightly above the radical symbol.

To summarize, the **radical expression** $\sqrt[n]{x}$ has three major components, the **radical symbol** (it looks like a check mark in print), the **index** (the small n tucked outside the radical symbol), and the **radicand** (x, the quantity written beneath the horizontal bar of the radical symbol in print).

An index of 5 means that we are looking for the fifth root. An index of 3 means that we are looking for the cube root. An index of 2 is the square root, and we usually don't show the 2.

The most common radical is the **square root.** A radical symbol with no indicated root index shown is understood to indicate the positive square root or **principal square root**. Whereas, to name the **negative square root** of a number, we would use $-\sqrt{\ }$.

For this lesson, we are going to concentrate on these simple radicals where the index is not shown, but they are understood to indicate principal square roots.

Basic Rules for Writing a Square Root

When writing a square root, you follow three simple steps. You would braille:

1. ⠨ (dots 3-4-5) the radical symbol ($\sqrt{\ }$)
2. the radicand, value inside/under a radical symbol, which you want to find the root of
3. ⠸⠱ (dots 1-2-4-5-6) the termination indicator

So to write $\sqrt{4}$ (the principal square root of 4) in Nemeth Code, you would write:

⠨⠼⠙⠸⠱ or radical symbol, four, termination indicator.

Basic Rules for Reading a Square Root

To keep the terminology simple, from here on out "the square root" of a number refers ONLY to the principal square root. So, for most square roots you will just say “the square root of” and then read the radicand.

Examples

1. $\sqrt{25}$ would be read: the square root of twenty-five.

2. $\sqrt{x}$ would be read: the square root of x.

3. $\sqrt{\frac{1}{4}}$ would be read: the square root of one-fourth.

4. $\sqrt{0.49}$ would be read: the square root of zero point four nine.

However, things get a bit more complicated when you have something following the termination indicator. Notice that when reading the next two problems we included the words “end root” to indicate where the radicand ends. Otherwise it would be very difficult to tell whether the minus one was inside/under the radical or not.

5. $\sqrt{y-1}$ would be read: the square root of y minus one end root.

6. $\sqrt{y}-1$ would be read: the square root of y end root minus one.

As we have already seen, the radicand doesn’t always have to be a specific number. The radicand could contain one or more variables and these variables could even have **superscripts** or **exponents**. Notice below in Problems 7 to 11 that we need to use the **superscript indicator** (dots 4-5) to start the exponent and the **baseline indicator** (dot 5) in order to show that the exponent has ended and that we have returned to baseline.

7. $\sqrt{z^2}$ would be read: the square root of z squared end root.

8. $\sqrt{z}^2$ would be read: the square root of z end root squared.

9. $\sqrt{x^2+y^2}$

would be read: the square root of x squared plus y squared end root.

10. $\sqrt{\frac{1}{9}z^2}$ would be read: the square root of one-ninth z squared end root.

11. $\sqrt{\frac{81x^4}{36y^6}}$

would be read: the square root of open fraction eighty-one x to the fourth power over thirty-six y to the sixth power close fraction end root.

The radicand could also contain one or more variables with **subscripts**, such as when using the **distance formula** to find the distance between two points on the coordinate plane. In Problem 12, we also need to use the **superscript indicator** (dots 4-5) to start the exponent and the **baseline indicator** (dot 5) in order to show that the exponent has ended and that we have returned to baseline.

12. $\sqrt{(x_1-x_2)^2+(y_1-y_2)^2}$

would be read: the square root of open parenthesis x sub one minus x sub two close parenthesis squared plus open parenthesis y sub one minus y sub two close parenthesis squared end root.

Please note that when a numeric subscript is used with a variable, the subscript indicator is not used, and subsequently the baseline indicator must not be used to return to the baseline after the subscript.

Activity time: See if you can re-create the radical expressions in examples 1 to 12.