

Radicals Lesson 2

Radical Expressions with an Index

Important Note

For all braille examples, emboss the “L2-Radicals-Problems-Only.brf” file as a supplement to this lesson.

Background

After completing “Lesson 1 Radical Expressions,” you are ready to learn how to read and write a radical expression with an index other than 2.

Remember, the **radical expression** read as the nth root of x has three major components:

1. the **radical symbol** (it looks like a check mark in print),
2. the **index** (the small n tucked outside the radical symbol in print), and
3. the **radicand** (x, the quantity written beneath the horizontal bar of the radical symbol in print).

$$\sqrt[n]{x}$$

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. As we already learned, an index of 2 is the **square root**, and we usually don’t show the 2.

For this lesson, we are going to concentrate on learning how to read and write radical expressions with an index other than 2. All fractions in this lesson use a horizontal fraction line.

Basic Rules for Writing Indexed Radicals

When writing a radical with an index, you follow these simple steps. You would braille:

1. The index-of-radical indicator (dots 1-2-6) ⠠
2. The index of the radical
3. The radical symbol (dots 3-4-5) ⠚
4. The radicand, value inside/under a radical symbol, which you want to find the root of

5. The termination indicator (dots 1-2-4-5-6) ⠠

The following steps outline how to write the cube root of 27 in Nemeth Code:

1. Index-of-radical indicator (dots 1-2-6) ⠠
2. Three (dots 2-5) ⠠
3. Radical symbol (dots 3-4-5) ⠠
4. Twenty-seven (dots 2-3, dots 2-3-5-6) ⠠ ⠠
5. Termination indicator (dots 1-2-4-5-6) ⠠

$$\sqrt[3]{27}$$

⠠⠠⠠⠠⠠⠠

Basic Rules for Reading Indexed Radicals

For most radical expressions with an index, you will just say “the nth root of” and then read the radicand, where “n” stands for the designated index of the radical. Of course, we have already learned that we usually say “the cube root of” when the index is 3, instead of the third root.

Examples of Indexed Radicals

1. the cube root of sixty-four

$$\sqrt[3]{64}$$

⠠⠠⠠⠠⠠⠠⠠⠠

2. the seventh root of x

$$\sqrt[7]{x}$$

⠠⠠⠠⠠⠠⠠⠠⠠

3. the fifth root of open fraction one over thirty-two close fraction

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

4. the fourth root of zero point zero zero one six

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

However, things get a bit more complicated when you have something following the termination indicator. Notice that when reading the next two examples 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. the cube root of y minus one end root

$$\sqrt[3]{y-1}$$

6. the cube root of y end root minus one

$$\sqrt[3]{y} - 1$$

Activity Time for Indexed Radicals

Write the radical expressions from Examples 1 to 6.

1. the cube root of sixty-four
2. the seventh root of x
3. the fifth root of open fraction one over thirty-two close fraction
4. the fourth root of zero point zero zero one six
5. the cube root of y minus one end root
6. the cube root of y end root minus one

Basic Rules for Indexed Radicals with Superscripts

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 Examples 1 to 6 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.

Examples of Indexed Radicals with Superscripts

1. the seventh root of z to the seventh power end root

$$\sqrt[7]{z^7}$$

2. the fifth root of open parenthesis x minus two close parenthesis to the fifth power end root

$$\sqrt[5]{(x-2)^5}$$

3. the ninth root of two x y end root to the ninth power

$$\sqrt[9]{2xy}^9$$

4. the cube root of open fraction one over one hundred twenty-five close fraction z to the sixth power end root

$$\sqrt[3]{\frac{1}{125} z^6}$$

5. the fourth root of open fraction eighty-one x to the fourth power over sixteen y to the eighth power close fraction end root

$$\sqrt[4]{\frac{81x^4}{16y^8}}$$

6. the cube root of negative twenty-seven

$$\sqrt[3]{-27}$$

Activity Time for Indexed Radicals with Superscripts

Write the radical expressions from Examples 1 to 12.

1. the seventh root of z to the seventh power end root
2. the fifth root of open parenthesis x minus two close parenthesis to the fifth power end root
3. the ninth root of two x y end root to the ninth power
4. the cube root of open fraction one over one hundred twenty-five close fraction z to the sixth power end root
5. the fourth root of open fraction eighty-one x to the fourth power over sixteen y to the eighth power close fraction end root
6. the cube root of negative twenty-seven