Radicals Lesson 3
Adding and Subtracting Radical Expressions

Important Note

For all braille examples, emboss the “L3-Radicals-Problems-Only.brf” file as a supplement to this lesson.

Background

After completing “Lesson 1 Radical Expressions” and “Lesson 2 Radical Expressions with an Index,” you are ready to learn how to read and write the Nemeth Code used in adding and subtracting **radical expressions**.

As a quick review, when writing a **square root**, you follow three simple steps. You would braille:

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

The following steps outline how to write the principal square root of 4 in Nemeth Code:

1. Radical symbol (dots 3-4-5) ($\sqrt{\ }$) ⠜
2. Four (dots 2-5-6) ⠲
3. Termination indicator (dots 1-2-4-5-6) ⠻

$\sqrt{4}$

⠜⠲⠻

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 Multiplication by Juxtaposition

Before we begin to practice how to read and write problems involving adding and subtracting radical expressions, we need to learn how to read and write a number followed by a radical expression. Since there is a convention in algebra of denoting multiplication by **juxtaposition** (putting symbols side by side), there is no need to use a multiplication sign between the number and this radical expression. However, a multiplication dot is sometimes used for clarification, and we may say the word “times” whether the multiplication sign is present or not.

In all of the examples for this lesson, when you hear the word times, practice juxtaposition by not using the multiplication sign and putting the symbols side by side instead. Also, no space should be left between a radical and a variable, number, fraction, sign of grouping, a braille indicator, or another radical.

Examples for Multiplication by Juxtaposition

1. three square root of two

   $3\sqrt{2}$

   ⠼⠂⠸⠲ ⠼⠒⠜⠆⠻

2. three cube root of two

   $3\sqrt[3]{2}$

   ⠼⠆ ⠸⠲   ⠼⠒⠣⠒⠜⠆⠻

Activity Time for Multiplication by Juxtaposition

Write the problems from Examples 1 and 2.

1. three square root of two
2. three cube root of two

Basic Rules for Adding and Subtracting Radicals

We can add any two real numbers. For example, the sum of 3 and the square root of 2 can be written as 3 plus the square root of 2.

$3+\sqrt{2}$

⠼⠒⠬⠜⠆⠻

No simplification is possible. However, if we have **like radical terms** (terms that have the same index and radicand), we can use the **distributive property** to simplify, and then combine like radical terms. The distributive property states that for any real numbers a, b, and c, a times open parenthesis b plus c close parenthesis equals a b plus a c.

$a(b+c)=ab+ac$

Examples of Adding and Subtracting Radicals

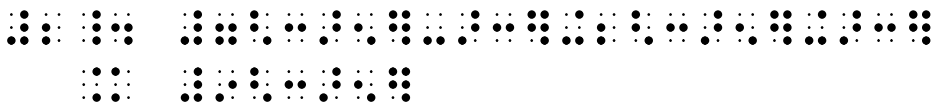
1. Four times the square root of three end root plus two times the square root of three end root equals open parenthesis four plus two close parenthesis times the square root of three end root equals six times the square root of three end root.

   $4\sqrt{3}+2\sqrt{3}=(4+2)\sqrt{3}=6\sqrt{3}$

   ⠼⠂ ⠸⠲   ⠼⠲⠜⠒⠻⠬⠆⠜⠒⠻   ⠨⠅   ⠷⠲⠬⠆⠾⠜⠒⠻
   ⠨⠅   ⠼⠖⠜⠒⠻

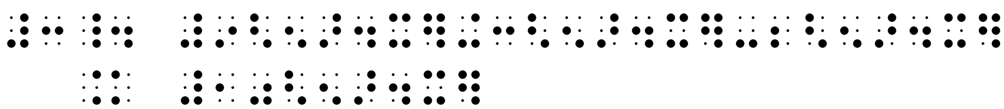
2. Seven cube root of five end root minus the square root of three end root plus two cube root of five end root plus the square root of three end root equals nine cube root of five end root.

$$7\sqrt[3]{5}-\sqrt{3}+2\sqrt[3]{5}+\sqrt{3}=9\sqrt[3]{5}$$



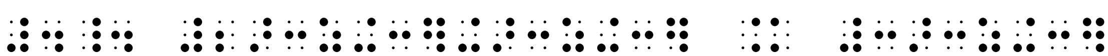
3. Nine times the fifth root of four x end root plus three times the fifth root of four x end root minus two times the fifth root of four x end root equals ten times the fifth root of four x end root.

$$9\sqrt[5]{4x}+3\sqrt[5]{4x}-2\sqrt[5]{4x}=10\sqrt[5]{4x}$$



4. Two square root of three z plus three end root plus the square root of three z plus three end root equals three square root of three z plus three end root.

$$2\sqrt{3z+3}+\sqrt{3z+3}=3\sqrt{3z+3}$$



Activity Time for Adding and Subtracting Radicals

Write the problems from Examples 1 to 4.

1. Four times the square root of three end root plus two times the square root of three end root equals open parenthesis four plus two close parenthesis times the square root of three end root equals six times the square root of three end root.
2. Seven cube root of five end root minus the square root of three end root plus two cube root of five end root plus the square root of three end root equals nine cube root of five end root.
3. Nine times the fifth root of four x end root plus three times the fifth root of four x end root minus two times the fifth root of four x end root equals ten times the fifth root of four x end root.
4. Two square root of three z plus three end root plus the square root of three z plus three end root equals three square root of three z plus three end root.