

# Fractions Lesson 2

## Simple Fractions

### with Signs of Operation and Comparison

### with Variables

## Important Note

For all braille examples, emboss the "L2-Fractions-V-Problems-Only.brf" file as a supplement to this lesson.

## Background

After completing "Lesson 1 Simple Fractions," you are ready to learn how to use simple fractions with signs of operation and comparison in a linear format.

As a quick review, fractions with a horizontal fraction line use the following Nemeth symbols:

- Opening simple fraction indicator (dots 1-4-5-6) ⠠
- Horizontal fraction line (dots 3-4) ⠬
- Closing simple fraction indicator (dots 3-4-5-6) ⠡

The following steps outline how to write the simple fraction 1 over 8 in Nemeth Code:

1. Opening simple fraction indicator (dots 1-4-5-6) ⠠
2. One (dot 2) ⠠
3. Horizontal fraction line (dots 3-4) ⠬
4. Eight (dots 2-3-6) ⠠
5. Closing simple fraction indicator (dots 3-4-5-6) ⠡

⠠⠠⠬⠠⠡

Notice that the **numerator** of 1 is to the left of the fraction line, and the **denominator** of 8 is to the right.

## Basic Rules with Signs of Operation

In this lesson, we will first learn how to write problems that contain simple fractions with one of the four basic operation signs: addition, subtraction, multiplication, and division.

The four basic operations use the following Nemeth symbols:

- Plus sign (dots 3-4-6) (+)
- Minus sign (dots 3-6) (−)
- Multiplication cross (dot 4, dots 1-6) (×)
- Multiplication dot (dots 1-6) (·)
- Division (divided by) sign (dots 4-6, dots 3-4) (÷)

When writing a problem that contains two simple fractions with an operation sign between them, you would write the first fraction, immediately followed by the operation sign, immediately followed by the second fraction as one continuous flow of braille cells. There would be no spaces.

## Examples with Signs of Operation

1. three-fourths plus one-fourth

$$\frac{3}{4} + \frac{1}{4}$$

2. five-eighths divided by three-eighths

$$\frac{5}{8} \div \frac{3}{8}$$

3. thirty-three hundredths minus eleven-fiftieths

$$\frac{33}{100} - \frac{11}{50}$$

A 5x10 grid of dots representing a 50-letter alphabet. The first 26 letters are formed by black dots, and the last 24 letters are formed by white dots on a black background.

4. five-sevenths times (multiplication cross) seven-eighths

$$\frac{5}{7} \times \frac{7}{8}$$

## Activity Time with Signs of Operation

Write the fraction problems with signs of operation from Examples 1 to 4:

1. three-fourths plus one-fourth
2. five-eighths divided by three-eighths
3. thirty-three hundredths minus eleven-fiftieths
4. five-sevenths times (multiplication cross) seven-eighths

## Examples with Signs of Operation and Variables

The numerator and denominator don't always have to be a specific number. We could have an unknown number in either the numerator or the denominator or both. These unknown numbers are written as letters called **variables**. The numerator or denominator or both could also contain signs of operation.

1. open fraction three over y close fraction times (multiplication dot) open fraction y over four close fraction

$$\frac{3}{y} \cdot \frac{y}{4}$$

2. open fraction x over y close fraction divided by open fraction x over y close fraction

$$\frac{x}{y} \div \frac{x}{y}$$

3. open fraction x plus y over x minus y close fraction times (multiplication dot) open fraction one over x plus y close fraction

$$\frac{x+y}{x-y} \cdot \frac{1}{x+y}$$

## Activity Time with Signs of Operation and Variables




Write the fraction problems with signs of operation and variables from Examples 1 to 3:

1. open fraction three over y close fraction times (multiplication dot) open fraction y over four close fraction
2. open fraction x over y close fraction divided by open fraction x over y close fraction
3. open fraction x plus y over x minus y close fraction times (multiplication dot) open fraction one over x plus y close fraction

## Basic Rules with Signs of Comparison

Next, we will learn how to write simple fractions using one of the three basic comparison signs: the equals sign, less than sign, and greater than sign.

These three basic comparison signs use the following Nemeth symbols:

- Equals sign (dots 4-6, dots 1-3) (=) 
- Less than sign (dot 5, dots 1-3) (<) 
- Greater than sign (dots 4-6, dot 2) (>) 

When writing two simple fractions with a sign of comparison between them, you would write the first fraction, space, the comparison symbol, space, and then the second fraction. Unlike a sign of operation, there should be a space on either side of a comparison symbol in Nemeth Code.

## Examples with Signs of Comparison

1. One-third is less than two-thirds.

$$\frac{1}{3} < \frac{2}{3}$$

2. Four-sevenths equals twelve twenty-firsts.

$$\frac{4}{7} = \frac{12}{21}$$

3. Eight-ninths is greater than eighty-eight hundredths.

$$\frac{8}{9} > \frac{88}{100}$$

## Activity Time with Signs of Comparison

Write the fraction problems with signs of comparison from Examples 1 to 3:

1. One-third is less than two-thirds.
2. Four-sevenths equals twelve twenty-firsts.
3. Eight-ninths is greater than eighty-eight hundredths.

## Examples with Signs of Comparison and Variables

The numerator and denominator don't always have to be a specific number. We could have a variable in either the numerator or the denominator or both. These variables could even have **superscripts** or **exponents**. The numerator or denominator or both could also contain signs of operation.

Notice in Example 1 that we need to use the **baseline indicator** (dot 5) in order to show that the exponent has ended and that we have returned to baseline. This occurs four times: once in the numerator of both fractions (immediately before the horizontal fraction line) and once in the denominator of both fractions (immediately before the closing simple fraction indicator).

1. Open fraction four y squared over y squared close fraction is greater than open fraction three x squared over x squared close fraction.

$$\frac{4y^2}{y^2} > \frac{3x^2}{x^2}$$

2. Open fraction two x over four x close fraction is less than open fraction ten x over fifteen x close fraction.

$$\frac{2x}{4x} < \frac{10x}{15x}$$

The figure consists of 10 diagrams arranged in two rows of five. Each diagram shows a pattern of black dots on a grid. The patterns are complex and fractal-like, with the number of dots increasing from left to right in each row. The patterns are composed of small clusters of dots that are connected to form larger, more intricate shapes. The overall structure of the patterns suggests a recursive or self-similar growth process.

## Activity Time with Signs of Comparison and Variables

Write the fraction problems with signs of comparison and variables from Examples 1 and 2:

1. Open fraction four y squared over y squared close fraction is greater than open fraction three x squared over x squared close fraction.
2. Open fraction two x over four x close fraction is less than open fraction ten x over fifteen x close fraction.

## Examples with Signs of Operation and Comparison

Finally, let's take a look at a couple of fraction problems involving both a comparison sign and one or more operation signs.

1. One-fifth plus open fraction six minus two over five close fraction equals one.

$$\frac{1}{5} + \frac{6-2}{5} = 1$$

The figure consists of 10 sub-diagrams arranged horizontally, each showing a 5x5 grid of dots. Black dots represent the presence of a variable at a specific time and location. The sequence shows a pattern that starts as a small cluster of dots on the left and grows and moves towards the right over time.

2. Sixty-three hundredths times (multiplication dot) twenty-five eighty-fourths is greater than one-sixteenth.

$$\frac{63}{100} \cdot \frac{25}{84} > \frac{1}{16}$$

## Activity Time with Signs of Operation and Comparison

Write the fraction problems with signs of operation and comparison from Examples 1 and 2:

1. One-fifth plus open fraction six minus two over five close fraction equals one.
2. Sixty-three hundredths times (multiplication dot) twenty-five eighty-fourths is greater than one-sixteenth.

## Examples with Signs of Operation and Comparison and Variables

1. Open fraction y plus one over y plus one close fraction equals open fraction y plus three over y plus three close fraction.

$$\frac{y+1}{y+1} = \frac{y+3}{y+3}$$

2. Open fraction  $x$  plus two over three close fraction minus open fraction  $x$  minus one over four close fraction is less than five-twelfths.

$$\frac{x+2}{3} - \frac{x-1}{4} < \frac{5}{12}$$

The figure consists of 10 sub-diagrams arranged in a single row, each showing a 5x5 grid of dots. Black dots represent the state of the system at each time step. The pattern evolves from left to right:

- Diagram 1: A small cluster of 4 dots in the top-left corner.
- Diagram 2: The cluster grows to 6 dots.
- Diagram 3: The cluster grows to 8 dots.
- Diagram 4: The cluster grows to 10 dots.
- Diagram 5: The cluster grows to 12 dots.
- Diagram 6: The cluster grows to 14 dots.
- Diagram 7: The cluster grows to 16 dots.
- Diagram 8: The cluster grows to 18 dots.
- Diagram 9: The cluster grows to 20 dots.
- Diagram 10: The cluster grows to 22 dots.

## Activity Time with Signs of Operation and Comparison and Variables

Write the fraction problems with signs of operation and comparison and variables from Examples 1 and 2:

1. Open fraction y plus one over y plus one close fraction equals open fraction y plus three over y plus three close fraction.
2. Open fraction x plus two over three close fraction minus open fraction x minus one over four close fraction is less than five-twelfths.