

# Fractions Lesson 5

## Mixed Numbers

### with Signs of Operation and Comparison

## Important Note

For all braille examples, emboss the "L5-Fractions-Problems-Only.brf" file as a supplement to this lesson.

## Background

After completing "Lesson 2 Simple Fractions with Signs of Operation and Comparison" and "Lesson 4 Mixed Numbers," you are ready to learn how to write problems in a linear format using mixed numbers with signs of operation and comparison.

As a quick review, mixed numbers use the following Nemeth symbols:

- Numeric indicator to write the whole number (dots 3-4-5-6) ⠠
- Opening mixed number indicator (dots 4-5-6, dots 1-4-5-6) ⠰
- Horizontal fraction line (dots 3-4) ⠨
- Diagonal fraction line (dots 4-5-6, dots 3-4) ⠧
- Closing mixed number indicator (dots 4-5-6, dots 3-4-5-6) ⠠

The following steps outline how to write the mixed number one and one-half (which has a horizontal fraction line) in Nemeth Code:

1. Numeric indicator (dots 3-4-5-6) ⠠
2. One (dot 2) ⠠
3. Opening mixed number indicator (dots 4-5-6, dots 1-4-5-6) ⠰
4. One (dot 2) ⠠
5. Horizontal fraction line (dots 3-4) ⠨
6. Two (dots 2-3) ⠠
7. Closing mixed number indicator (dots 4-5-6, dots 3-4-5-6) ⠠

$$1\frac{1}{2}$$

Now let's write the mixed number one and one-half (which has a diagonal fraction line).

$1\frac{1}{2}$






The following steps (very similar to the ones above) outline how to write this in Nemeth Code:

numeric indicator, one, opening mixed number indicator, one, diagonal fraction line, two, closing mixed number indicator.

## Basic Rules with Signs of Operation

In this lesson, we will first learn how to write problems that contain mixed numbers with 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) (÷) 

With the following examples that contain one or more mixed numbers, you will notice that the previous rules explained about spacing of linear problems involving operation signs apply when mixed numbers are included in the problem. Spaces are still not used on either side of the sign of operation. Furthermore, the numeric indicator is not repeated after the sign of operation.

Also, if the fraction line is horizontal in print, then a horizontal fraction line is used in braille. If the fraction line is diagonal in print, then a diagonal fraction line is used in braille.

## Examples with Signs of Operation

1. two and three-fourths plus five and one-fourth with horizontal fraction lines

$$2\frac{3}{4} + 5\frac{1}{4}$$

The figure shows a sequence of 10 diagrams, each representing a 5x5 grid of dots. The dots are black, and the background is white. The sequence shows a pattern of dots that starts as a small cluster and grows into a larger, more complex shape over 10 steps. The pattern is composed of several connected components that evolve over time.

2. thirty-two and five-eighths divided by three-eighths with horizontal fraction lines

$$32\frac{5}{8} \div \frac{3}{8}$$

3. five minus four and nine-tenths with a diagonal fraction line

$$5 - 4 \frac{9}{10}$$

4. fifty-six and three-sevenths times (multiplication dot) eight and two-fifths with diagonal fraction lines

$$56 \frac{3}{7} \cdot 8 \frac{2}{5}$$

The figure shows a sequence of 10 diagrams, each representing a 5x5 grid of dots. The dots are black, and the background is white. The sequence shows a pattern of dots that starts as a small cluster and grows into a larger, more complex shape over 10 steps. The pattern is composed of several connected components that evolve over time.

5. nine and three-fifths times (multiplication cross) six with a horizontal fraction line

$$9\frac{3}{5} \times 6$$

## Activity Time with Signs of Operation

Write the mixed number problems with signs of operation from Examples 1 to 5:

1. two and three-fourths plus five and one-fourth with horizontal fraction lines
2. thirty-two and five-eighths divided by three-eighths with horizontal fraction lines
3. five minus four and nine-tenths with a diagonal fraction line
4. fifty-six and three-sevenths times (multiplication dot) eight and two-fifths with diagonal fraction lines
5. nine and three-fifths times (multiplication cross) six with a horizontal fraction line

## Basic Rules with Signs of Comparison

Next, we will learn how to write problems that contain mixed numbers using 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) (>) ⠠⠠⠠⠠⠠⠠⠠⠠

With the following examples that contain one or more mixed numbers, you will notice that the previous rules explained about spacing of linear problems involving comparison signs apply when mixed numbers are included in the problem. Spaces are still used both left and right of the sign of comparison.

Also, if the fraction line is horizontal in print, then a horizontal fraction line is used in braille. If the fraction line is diagonal in print, then a diagonal fraction line is used in braille.

## Examples with Signs of Comparison

- Two and one-third is less than two and two-thirds with horizontal fraction lines.

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

2. Seven and three-eighths equals seven and six-sixteenths with diagonal fraction lines.

$$7\frac{3}{8} = 7\frac{6}{16}$$

The figure consists of 10 small diagrams arranged horizontally, each showing a grid of dots. Black dots represent the 'on' state of a system, while white dots represent the 'off' state. The sequence shows a pattern that starts as a small cluster of 5 dots in the first diagram and grows into a larger, more complex shape by the 10th diagram, which contains 25 dots. The growth is non-linear and appears to follow a specific rule, possibly related to the cellular automaton mentioned in the text.

3. Five and four-sevenths equals five and twelve twenty-firsts with horizontal fraction lines.

$$5\frac{4}{7} = 5\frac{12}{21}$$

4. Six and eight-ninths is greater than six hundred eighty-eight hundredths with horizontal fraction lines.

$$6\frac{8}{9} > \frac{688}{100}$$

The figure consists of 10 sub-diagrams, each showing a 10x10 grid of dots. Black dots represent the 'on' state of a cell, while white dots represent the 'off' state. The sequence shows a pattern that starts as a small cluster of 5 dots in the top-left corner (Diagram 1) and grows into a large, complex shape that fills most of the grid by Diagram 10. The growth is non-linear and appears to be the result of a cellular automaton rule.

5. Nine is less than ten and one-seventh with a diagonal fraction line.

$$9 < 10 \frac{1}{7}$$

## Activity Time with Signs of Comparison

Write the mixed number problems with signs of comparison from Examples 1 to 5:

1. Two and one-third is less than two and two-thirds with horizontal fraction lines.
2. Seven and three-eighths equals seven and six-sixteenths with diagonal fraction lines.
3. Five and four-sevenths equals five and twelve twenty-firsts with horizontal fraction lines.
4. Six and eight-ninths is greater than six hundred eighty-eight hundredths with horizontal fraction lines.
5. Nine is less than ten and one-seventh with a diagonal fraction line.

## Examples with Signs of Operation and Comparison

Finally, let's take a look at a couple of mixed number problems involving both a comparison sign and an operation sign.

1. Six and three-fourths plus eight and one-fourth equals fifteen with diagonal fraction lines.

$$6\frac{3}{4} + 8\frac{1}{4} = 15$$

2. Forty-six and two-thirds divided by five-thirds is less than twenty-nine with horizontal fraction lines.

$$46\frac{2}{3} \div \frac{5}{3} < 29$$

The figure consists of 10 sub-diagrams, each showing a 5x5 grid of dots. The dots are black, and the background is white. The sequence shows a pattern growing from a single dot at (1,1) in the top-left corner. The growth follows a specific rule, likely related to the Sierpinski triangle, where the pattern is replicated and scaled. The diagrams are labeled 1 through 10, showing the progression of the pattern.

## Activity Time with Signs of Operation and Comparison

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

1. Six and three-fourths plus eight and one-fourth equals fifteen with diagonal fraction lines.
2. Forty-six and two-thirds divided by five-thirds is less than twenty-nine with horizontal fraction lines.