

# Grades 2 to 5: Nemeth Code Symbols for Fractions and Spatial Problems, Instructional Tools, Materials, and Technology

## Lesson 2: Spatial Arrangements



University of South Carolina Upstate, Fall 2020

# Lesson 2 Objectives

Participants will be able to read and write addition, subtraction, and multiplication spatially aligned problems that include:

- multi-digit numbers with and without commas
- decimals
- money
- simple fractions
- mixed numbers

# Spatial Arrangements (Vertical) Problems for Addition and Subtraction

$$\begin{array}{r} 280 \\ +15 \\ \hline 295 \end{array}$$

- Numbers must align in spatial arrangements.
- There are no numeric indicators in spatial problems.
- The addition or subtraction sign goes one cell to the left of the widest number above the separation line.
- The separation line (•••••) is one cell longer on either side of the widest part of the problem.
- You must have a blank line above and below a spatial arrangement.

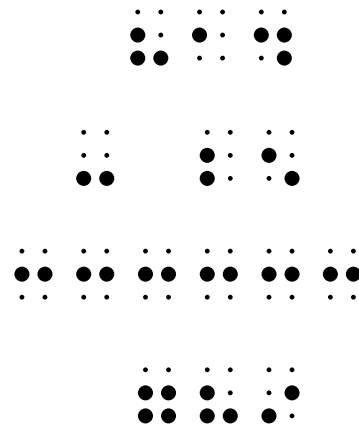
# Anatomy of a Spatial Problem

$$\begin{array}{r} 814 \\ - 25 \\ \hline 789 \end{array}$$

Minuend (top number)

Minus sign one cell left of widest number

Answer aligned with numbers in problem

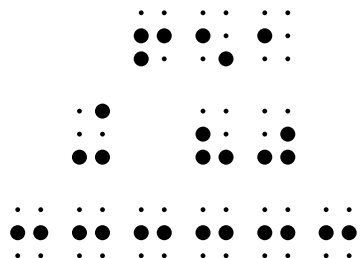


Separation line, one cell wider than widest part of problem

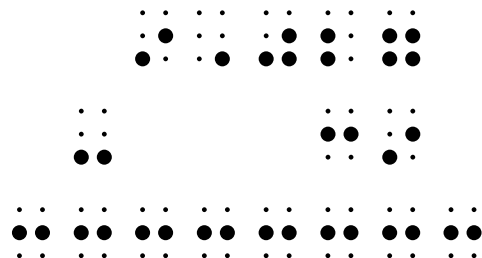
# Examples of Spatial Problems

When spatial arrangements are placed side-by-side, insert 1 cell (or 2) between the end of one separation line and the beginning of the next separation line.

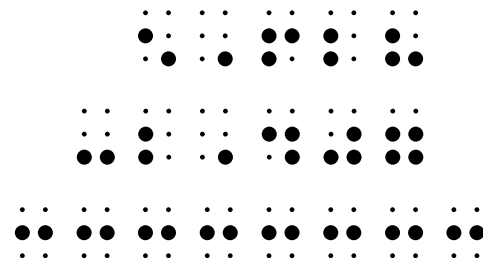
$$\begin{array}{r} 651 \\ + 80 \\ \hline \end{array}$$



$$\begin{array}{r} 9,027 \\ - 39 \\ \hline \end{array}$$



$$\begin{array}{r} 5,628 \\ - 2,407 \\ \hline \end{array}$$

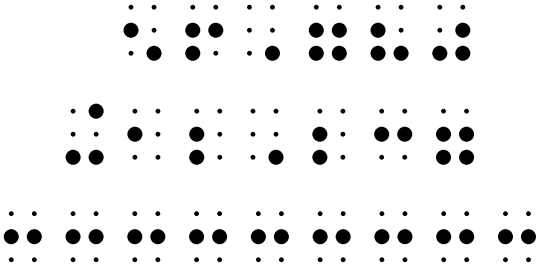


# Anatomy of a Spatial Problem with Commas

$$\begin{array}{r} 56,780 \\ + 12,237 \\ \hline \end{array}$$

Addend (top number)

Plus sign one cell left of widest number



Separation line, one cell wider than widest part of problem

Commas aligned

# Activity 2A

Interline the spatial problems.

The image displays four distinct spatial problems, each composed of three rows of black dots on a white background. The first problem (leftmost) has a top row of three 2x2 squares, a middle row of a 2x2 square followed by a 2x2 square, and a bottom row of a single long horizontal line of 12 dots. The second problem has a top row of three 2x2 squares, a middle row of a 2x2 square followed by a 2x2 square, and a bottom row of a single long horizontal line of 12 dots. The third problem has a top row of three 2x2 squares, a middle row of a 2x2 square followed by a 2x2 square, and a bottom row of a single long horizontal line of 12 dots. The fourth problem (rightmost) has a top row of three 2x2 squares, a middle row of a 2x2 square followed by a 2x2 square, and a bottom row of a single long horizontal line of 12 dots.

# Activity 2A: Answer Key

$$\begin{array}{r} 836 \\ + 57 \\ \hline \end{array}$$

$$\begin{array}{r} 375 \\ - 169 \\ \hline \end{array}$$

$$\begin{array}{r} 6,047 \\ - 889 \\ \hline \end{array}$$

$$\begin{array}{r} 5,786 \\ + 3,604 \\ \hline \end{array}$$

Braille representation of the addition problem  $836 + 57$ . The numbers are arranged in three rows: 836, + 57, and a blank line for the answer. The Braille uses standard digits and the plus sign.

Braille representation of the subtraction problem  $375 - 169$ . The numbers are arranged in three rows: 375, - 169, and a blank line for the answer. The Braille uses standard digits and the minus sign.

Braille representation of the subtraction problem  $6,047 - 889$ . The numbers are arranged in three rows: 6,047, - 889, and a blank line for the answer. The Braille uses standard digits, a comma for thousands, and the minus sign.

Braille representation of the addition problem  $5,786 + 3,604$ . The numbers are arranged in three rows: 5,786, + 3,604, and a blank line for the answer. The Braille uses standard digits, a comma for thousands, and the plus sign.



## Activity 2B

Transcribe the following spatial addition and subtraction problems.

$$\begin{array}{r} 2030 \\ - 920 \\ \hline \end{array}$$

$$\begin{array}{r} 3,024 \\ + 267 \\ \hline \end{array}$$

$$\begin{array}{r} 23 \\ 46 \\ + 12 \\ \hline \end{array}$$

# Activity 2B: Answer Key

$$\begin{array}{r} 2030 \\ - 920 \\ \hline \end{array}$$

$$\begin{array}{r} 3,024 \\ + 267 \\ \hline \end{array}$$

$$\begin{array}{r} 23 \\ 46 \\ + 12 \\ \hline \end{array}$$

Braille representation of the subtraction problem  $2030 - 920$ . The numbers are arranged in three rows: 2030, - 920, and a horizontal line. Each digit is represented by a Braille cell.

Braille representation of the addition problem  $3,024 + 267$ . The numbers are arranged in three rows: 3,024, + 267, and a horizontal line. Each digit and the comma are represented by a Braille cell.

Braille representation of the addition problem  $23 + 46 + 12$ . The numbers are arranged in four rows: 23, 46, + 12, and a horizontal line. Each digit and the plus sign are represented by a Braille cell.

# Numbered Problems

Opening Nemeth Code Indicator

There must be one cell between the end of a problem number and the start of the separation line.

Blank line above and below a problem.

Nemeth Terminator

Add or subtract.

35.	32	36.	94
	<u>+20</u>		<u>-7</u>
37.	403	38.	11
	<u>-246</u>		<u>-8</u>

Use one or two cells between the end of a separation line and start of the next problem number.

# Spatial Arrangements for Multiplication

*Just as with addition and subtraction:*

- Numbers must align in spatial arrangements.
- The separation line (∴∴∴∴) is one cell longer on either side of the widest part of the problem.
- You must have a blank line above and below a spatial arrangement.

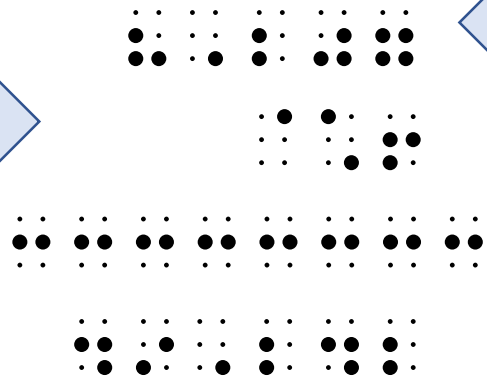
*The difference:*

The multiplication cross goes one cell to the left of the multiplier.

# Anatomy of a Multiplication Problem

$$\begin{array}{r} 8,207 \\ \times \quad 6 \\ \hline 49,242 \end{array}$$

Multiplication cross one cell left of the multiplier (bottom number)



Minuend (top number)

Separation line, one cell wider than widest part of problem (in this case the answer)

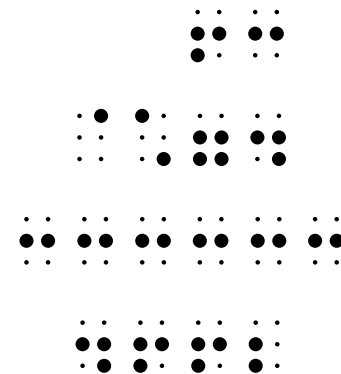
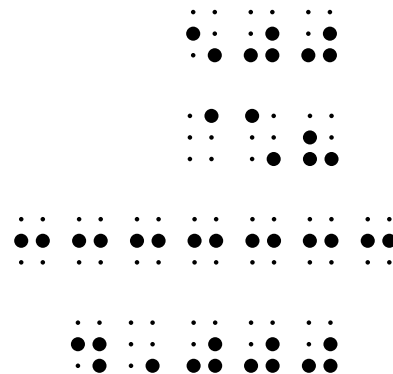
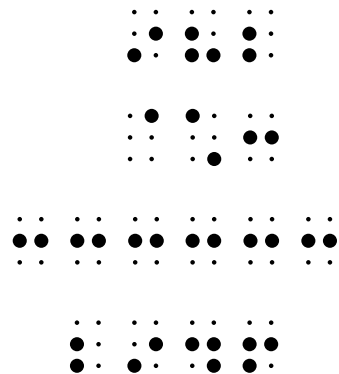
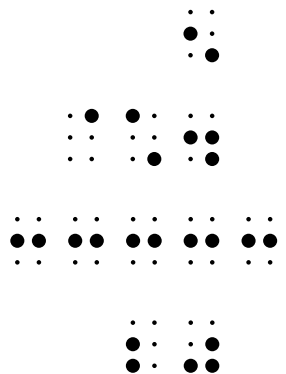
# Examples of Multiplication Problems

$$\begin{array}{r} 5 \\ \times 4 \\ \hline 20 \end{array}$$

$$\begin{array}{r} 982 \\ \times 3 \\ \hline 2946 \end{array}$$

$$\begin{array}{r} 500 \\ \times 8 \\ \hline 4,000 \end{array}$$

$$\begin{array}{r} 63 \\ \times 74 \\ \hline 4662 \end{array}$$



# Spatial Arrangement for Problems that Include Decimals or Money

- The dollar sign is ( : : ) and the decimal point is ( : ).
- Follow the print to determine if the plus or minus goes to the left of the dollar sign or directly below the dollar sign.
- If placed below the dollar sign, align plus and minus sign with the second cell of the dollar sign.
- Decimal points are aligned with decimal points.

# Examples of Spatial Problems with Dollar Signs and Decimals

5. 
$$\begin{array}{r} \$4.82 \\ - 2.10 \\ \hline \end{array}$$

6. 
$$\begin{array}{r} \$900 \\ + 75 \\ \hline \end{array}$$

7. 
$$\begin{array}{r} 19.60 \\ - 10.20 \\ \hline \end{array}$$

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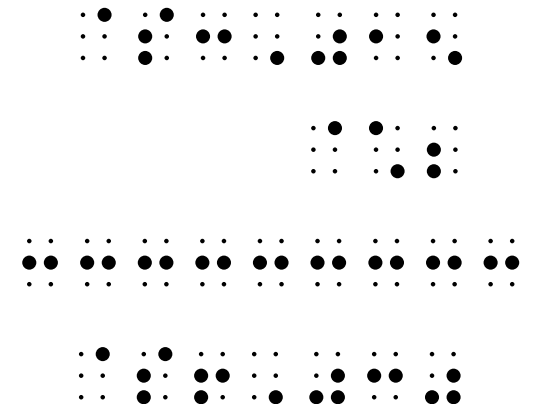
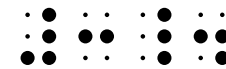
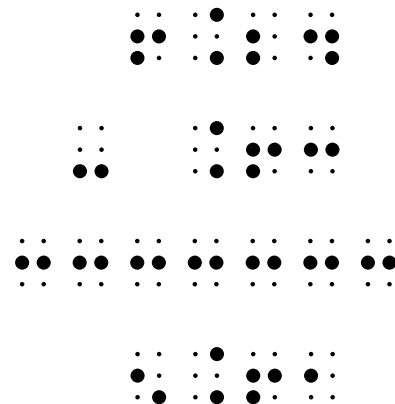
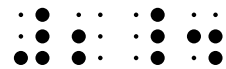
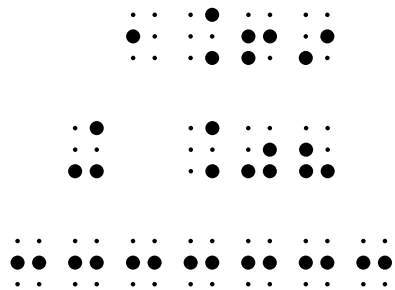
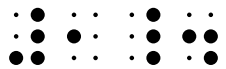


# More Examples of Spatial Problems with Dollar Signs and Decimals

1. 
$$\begin{array}{r} 1.69 \\ + .08 \\ \hline \end{array}$$

2. 
$$\begin{array}{r} 6.24 \\ - .63 \\ \hline 5.61 \end{array}$$

3. 
$$\begin{array}{r} \$3,015 \\ \times 2 \\ \hline \$6,030 \end{array}$$



# Two Last Examples – Spatial Arrangements with Dollar Signs and Decimals

$$\begin{array}{r} \$61.00 \\ \times \quad 40 \\ \hline \end{array}$$

Braille representation of the multiplication problem \$61.00 x 40. The Braille uses a 4x10 grid of dots to represent the numbers and symbols, including a dollar sign and a decimal point.

$$\begin{array}{r} 5.2 \\ \times 6 \\ \hline \end{array}$$

Braille representation of the multiplication problem 5.2 x 6. The Braille uses a 4x10 grid of dots to represent the numbers and symbols, including a decimal point.

# Activity 2C

Interline the following directions and problems.

The image displays a series of Braille patterns for interlining practice. The patterns are arranged in several rows and columns. The first row contains the number 1. The second row contains the number 2. The third row contains the numbers 3, 4, 5, and 6. The fourth row contains the numbers 7, 8, and 9. The fifth row contains the plus sign, minus sign, multiplication sign, and division sign. The sixth row contains the numbers 1 through 9. The seventh row contains the numbers 1 through 9. The eighth row contains the numbers 1 through 9. The ninth row contains the numbers 1 through 9. The tenth row contains the numbers 1 through 9. The eleventh row contains the numbers 1 through 9. The twelfth row contains the numbers 1 through 9. The thirteenth row contains the numbers 1 through 9. The fourteenth row contains the numbers 1 through 9. The fifteenth row contains the numbers 1 through 9. The sixteenth row contains the numbers 1 through 9. The seventeenth row contains the numbers 1 through 9. The eighteenth row contains the numbers 1 through 9. The nineteenth row contains the numbers 1 through 9. The twentieth row contains the numbers 1 through 9. The twenty-first row contains the numbers 1 through 9. The twenty-second row contains the numbers 1 through 9. The twenty-third row contains the numbers 1 through 9. The twenty-fourth row contains the numbers 1 through 9. The twenty-fifth row contains the numbers 1 through 9. The twenty-sixth row contains the numbers 1 through 9. The twenty-seventh row contains the numbers 1 through 9. The twenty-eighth row contains the numbers 1 through 9. The twenty-ninth row contains the numbers 1 through 9. The thirtieth row contains the numbers 1 through 9. The thirty-first row contains the numbers 1 through 9. The thirty-second row contains the numbers 1 through 9. The thirty-third row contains the numbers 1 through 9. The thirty-fourth row contains the numbers 1 through 9. The thirty-fifth row contains the numbers 1 through 9. The thirty-sixth row contains the numbers 1 through 9. The thirty-seventh row contains the numbers 1 through 9. The thirty-eighth row contains the numbers 1 through 9. The thirty-ninth row contains the numbers 1 through 9. The fortieth row contains the numbers 1 through 9. The forty-first row contains the numbers 1 through 9. The forty-second row contains the numbers 1 through 9. The forty-third row contains the numbers 1 through 9. The forty-fourth row contains the numbers 1 through 9. The forty-fifth row contains the numbers 1 through 9. The forty-sixth row contains the numbers 1 through 9. The forty-seventh row contains the numbers 1 through 9. The forty-eighth row contains the numbers 1 through 9. The forty-ninth row contains the numbers 1 through 9. The fiftieth row contains the numbers 1 through 9.

# Activity 2C: Answer Key

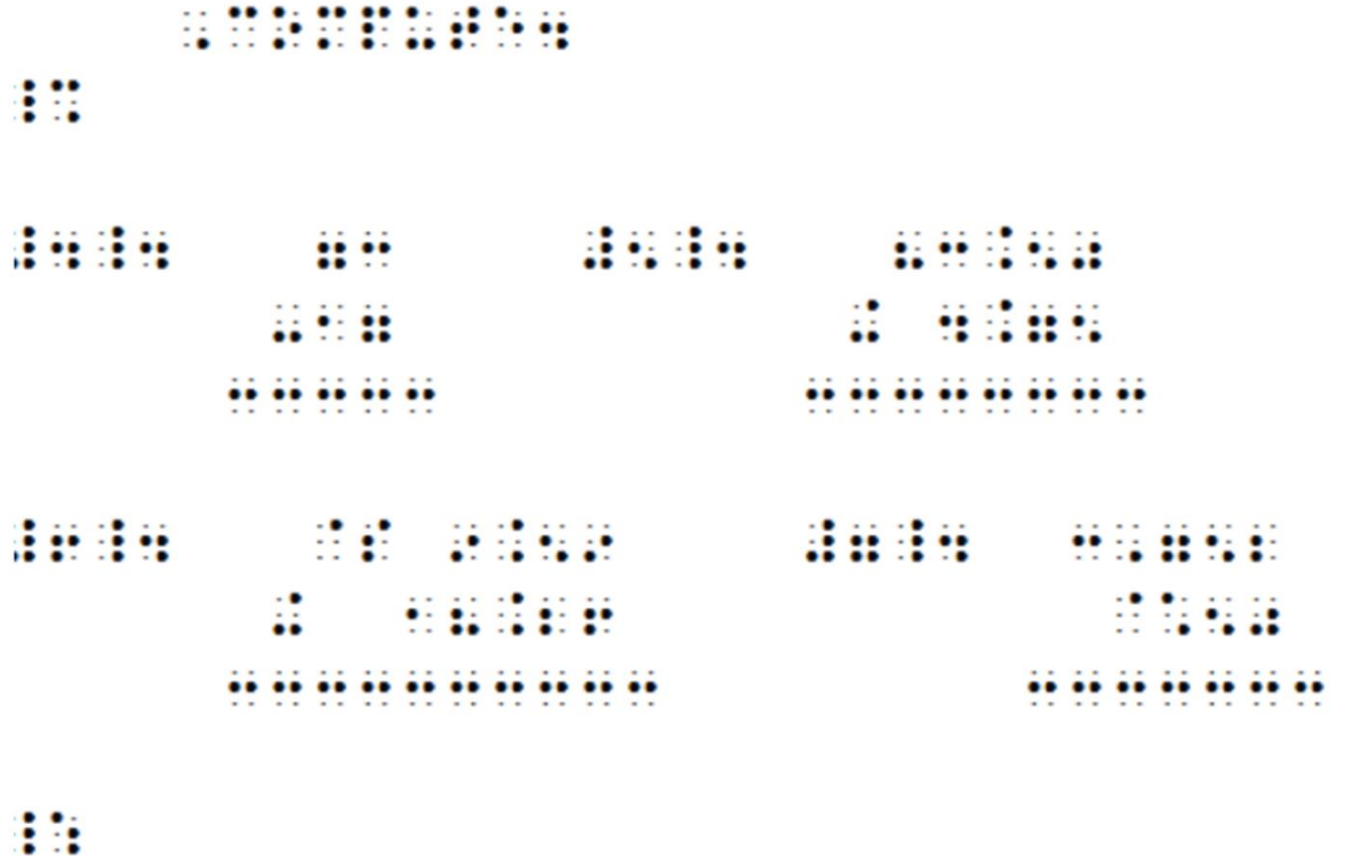
Compute.

$$\begin{array}{r} 4. \quad 73 \\ \quad -17 \\ \hline \end{array}$$

$$\begin{array}{r} 5. \quad 83.50 \\ \quad + 4.75 \\ \hline \end{array}$$

$$\begin{array}{r} 6. \quad \$9.59 \\ \quad +18.26 \\ \hline \end{array}$$

$$\begin{array}{r} 7. \quad 3,752 \\ \quad \times 50 \\ \hline \end{array}$$



# Activity 2D

Transcribe the following spatial problems.

$$\begin{array}{r} 4. \quad \$510 \\ - \quad 25 \\ \hline \quad \$485 \end{array}$$

$$\begin{array}{r} 5. \quad 2560 \\ \times 20 \\ \hline \end{array}$$

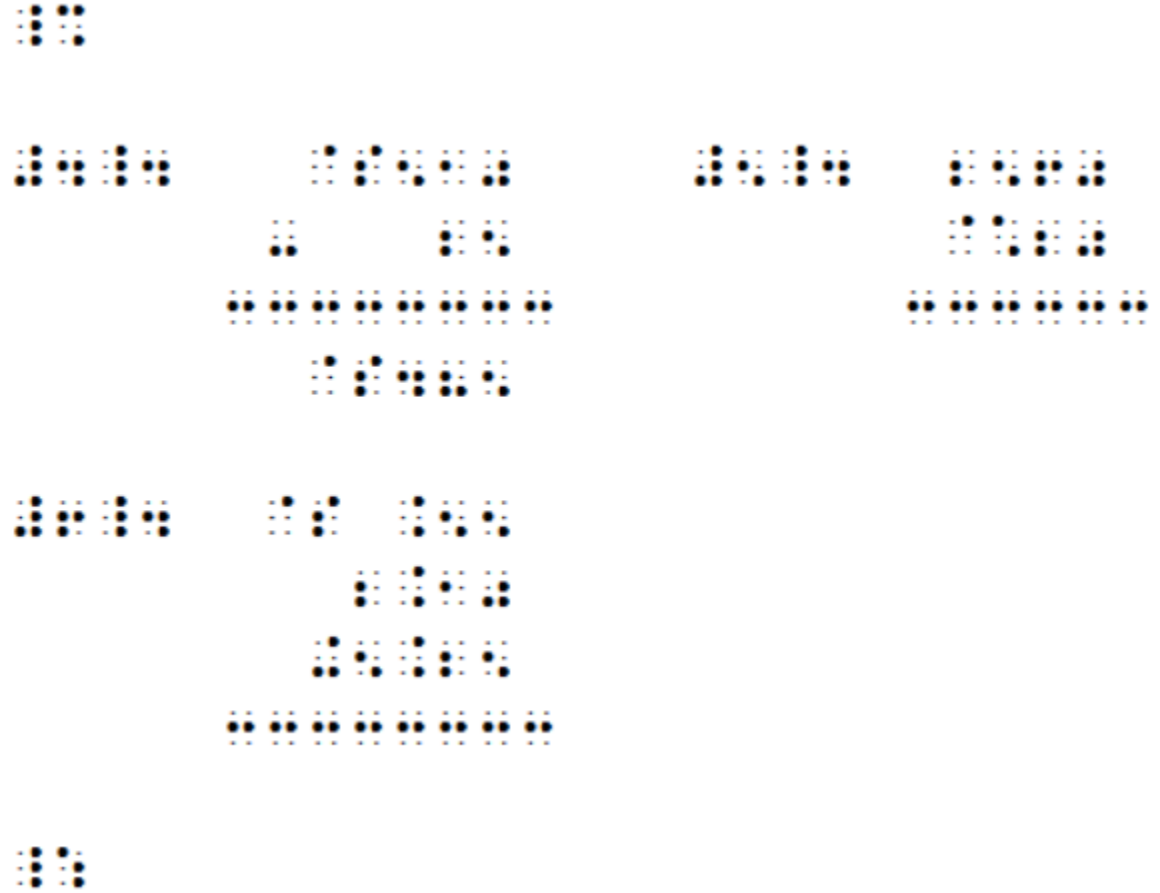
$$\begin{array}{r} 6. \quad \$ .55 \\ \quad 2.10 \\ + 5.25 \\ \hline \end{array}$$

# Activity 2D: Answer Key

4. 
$$\begin{array}{r} \$510 \\ - \quad 25 \\ \hline \$485 \end{array}$$

5. 
$$\begin{array}{r} 2560 \\ \times 20 \\ \hline \end{array}$$

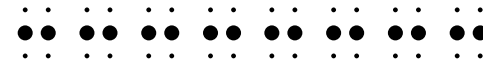
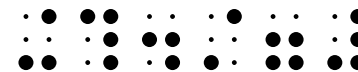
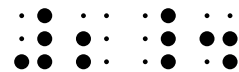
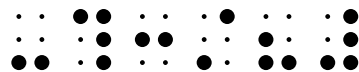
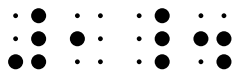
6. 
$$\begin{array}{r} \$ \quad .55 \\ \quad 2.10 \\ + 5.25 \\ \hline \end{array}$$



# Spatially Aligned Problems with Simple Fractions

- Set up spatially aligned fraction problems the same way you setup other spatial problems BUT also align: open fraction indicators, fraction lines, and closing fraction indicators.

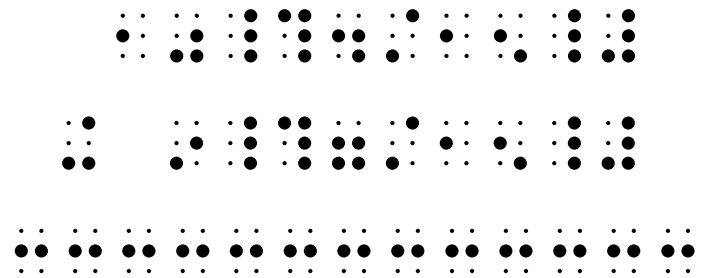
$$1. \quad \begin{array}{r} \frac{1}{2} \\ - \frac{3}{8} \\ \hline \end{array} \qquad 2. \quad \begin{array}{r} \frac{1}{7} \\ + \frac{4}{7} \\ \hline \end{array}$$



# Spatially Aligned Problems with Mixed Numbers

- Whole numbers, fraction indicators, and horizontal fraction lines are aligned vertically in each problem.
- The numeric indicator is not to be used in front of the whole number of the mixed number in spatially arranged problems.

$$\begin{array}{r} 10\frac{4}{15} \\ + 9\frac{7}{15} \\ \hline \end{array}$$



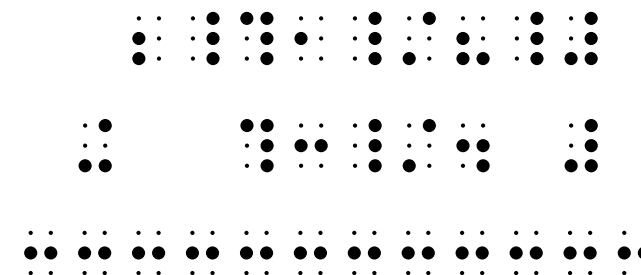
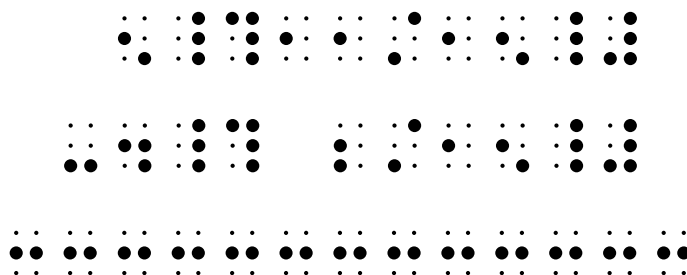
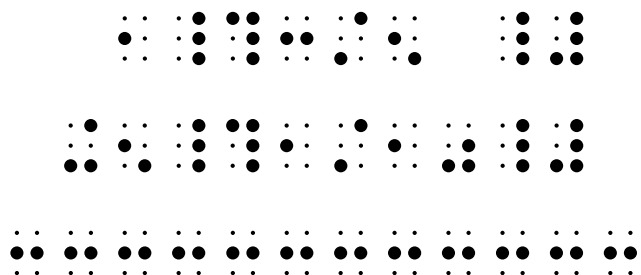


# Examples of Spatial Problems with Mixed Numbers and Simple Fractions

$$\begin{array}{r} 1\frac{3}{5} \\ + 5\frac{1}{10} \\ \hline \end{array}$$

$$\begin{array}{r} 5\frac{11}{15} \\ - 4\frac{2}{15} \\ \hline \end{array}$$

$$\begin{array}{r} 2\frac{1}{8} \\ + \frac{3}{4} \\ \hline \end{array}$$



# Activity 2E

Transcribe the following problems:

$$\begin{array}{r} 3. \quad 23\frac{13}{21} \\ - 10\frac{5}{21} \\ \hline \end{array}$$

$$\begin{array}{r} 4. \quad 49\frac{6}{50} \\ + 8\frac{27}{50} \\ \hline \end{array}$$

$$\begin{array}{r} 5. \quad \frac{1}{16} \\ + \frac{5}{8} \\ \hline \end{array}$$

# Activity 2E: Answer Key

$$3. \quad \begin{array}{r} 23\frac{13}{21} \\ - 10\frac{5}{21} \\ \hline \end{array}$$

$$4. \quad \begin{array}{r} 49\frac{6}{50} \\ + 8\frac{27}{50} \\ \hline \end{array}$$

$$5. \quad \begin{array}{r} \frac{1}{16} \\ + \frac{5}{8} \\ \hline \end{array}$$

Braille representation of the subtraction problem:  $23\frac{13}{21} - 10\frac{5}{21}$ . The numbers are represented by the Braille digits 2, 3, 1, 3, 2, 1, 1, 0, 5, 2, 1.

Braille representation of the addition problem:  $49\frac{6}{50} + 8\frac{27}{50}$ . The numbers are represented by the Braille digits 4, 9, 6, 5, 0, 8, 2, 7, 5, 0.

Braille representation of the addition problem:  $\frac{1}{16} + \frac{5}{8}$ . The numbers are represented by the Braille digits 1, 1, 6, 5, 8.