Fraction Strips: What is the Meaning of Addition?

Strand: Computation and Estimation

Topic: Adding fractions and mixed numbers with like and unlike denominators.

Primary SOL: 4.5 The student will
b) add and subtract fractions and mixed numbers having like and unlike denominators*
* On the state assessment, items measuring this objective are assessed without the use of a calculator.

Related SOL: 4.5ac

Materials

- Unlabeled Fraction Strips (attached)
- Extension Graphic Organizer (attached)
- Individual Fraction Strips (attached)
- Scissors
- Colored pencils or thin markers
- Markers
- Plastic food storage bags, at least quart size
- Sticky notes
- Chart paper or large sheets of paper

Vocabulary

addition, common denominator, denominator, equation, equal to, equivalent, fraction, improper fraction, least common multiple, like denominators, mixed number, number sentence, numerator, part, represent, simplify, sum, unlike denominators, whole

Student/Teacher Actions: What should students be doing? What should teachers be doing?

1. Arrange students in groups of 2–3. Distribute sticky notes. Ask students to use the sticky notes to individually write down facts about fractions, one fact per sticky note. As an option for later assessment, have students put their initials on the backs of the sticky notes so they may be identified later for individual assessment of prior knowledge. Possible questions to get students thinking may include, but are not limited to:
    - What do you remember about fractions from previous grades?
    - What connections to fractions can you make to experiences you've had out of school?
    - What models have you used to represent fractions?
    - What does the numerator and denominator of a fraction tell you?
2. Distribute chart paper or large sheets of paper to student groups. Have students place their sticky notes on the chart paper. Ask students to spend a few minutes walking from

group to group, reading their peers' fraction ideas and taking note of anything they did not remember to include on their sticky notes.

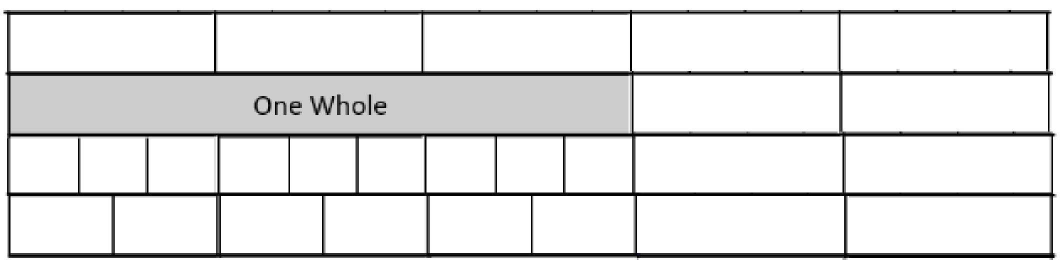
3. Have students return to their assigned groups. In round-robin format, student groups discuss the ideas about fractions they wrote or saw on other students' sticky notes. Encourage students to discuss candidly and be free to agree with, disagree with, or question ideas peers wrote as ideas are shared. Collect chart paper and post in the room or save the work for later. Encourage students to revise, remove, or add additional ideas on sticky notes throughout the remainder of the lesson.
4. Give each student the Unlabeled Fraction Strips handout. Ask students to work in their groups to attempt to name the fractions represented. At this time, however, ask students to not write labels on the handout. As students work, monitor conversations to note ideas that students already have and where there are confusions. Also note things you did not hear that are important fraction ideas. Consider asking questions as students have misconceptions or need clarifications on the ideas they are discussing.
   - Are some pieces the same size? How can you be sure?
   - How did you decide the fraction each strip illustrates?
   - What would be the unit fraction name for the first part of a strip?
   - How can each part of a strip be named symbolically? What does each part of the fraction symbol mean?
   - How many of each size part does it take to equal one-whole?
5. Display a copy of the Fraction Strip handout using a demonstration tool (e.g., document camera, digital display). Because this is review material, the teacher should think about the students' general conversations to determine what ideas need clarification. There may be some students who need more intense intervention, and that can be addressed one-on-one at a different time. Pick one of the fraction strips to discuss the name of each size part of the strip. It will be helpful if students begin to think about the unit fraction and that a fraction such as $\frac{3}{8}$ means that there are three $\frac{1}{8}$ in that part of the strip. Record the fractions you are discussing on the board as a review of how to write a fraction symbolically. Use a horizontal fraction bar, and encourage students to do the same. During the discussion, the following ideas should come out:
   - Some fraction pieces, such as $\frac{2}{3}$ and $\frac{4}{6}$, are the same size and length, which means they represent the same amount. Some are different lengths, so they do not represent the same amount.
   - The number of pieces it takes to make the same length as one whole represents the denominator, or bottom number, of the fraction because it takes that many unit fraction pieces to cover the whole. If the denominator is 8, for example, it takes eight $\frac{1}{8}$ to construct one whole and that idea can be represented as $\frac{8}{8}$ = 1.
   - The number of pieces that are identified to make the whole (e.g., 1, 2, 3, 4, 5, …), represents the numerator or top number of the fraction.

5. Guide a discussion to facilitate students writing the corresponding fraction symbols on their models or shading their models. You may want to consider a consistent label color for the models so that models are easier to locate (e.g., halves are labeled in green or

the entire model is shaded green and labeled in pencil, or the entire model is shaded green without a label). Once this is done, and checked, students can cut out their models and put them into a sealable plastic baggie.

6. Ask, *"Is it possible to represent a fraction using the sum of different-sized pieces?"* Use your fraction strips to model the fraction $\frac{5}{3}$. See what solutions students come up with. Pose the following questions after each is modeled and discussed. Bring into the conversation that the fraction is being decomposed in a variety of ways, using a variety of fraction piece sizes.
    - What are some ways to decompose $\frac{5}{3}$ using both thirds and sixths?
    - What are some ways to decompose $\frac{5}{3}$, using both ninths and thirds?
    - Are there any other fraction pieces that could be used to represent the decomposition of $\frac{5}{3}$?

    Once multiple ways to decompose $\frac{5}{3}$ have been discovered and discussed, make connections to how these decompositions can be connected to ways to combine parts to find a total of $\frac{5}{3}$, and write this total as a number sentence. A few of the solutions are pictured below.



$\frac{5}{3}$

$\frac{5}{3} = 1\frac{2}{3}$

$\frac{9}{9} + \frac{2}{3} = 1\frac{2}{3}$

$\frac{2}{3} + \frac{6}{6} = 1\frac{2}{3}$

7. Guide at least one more example with students, gradually releasing the work to the students to try with a partner.
    - Decompose 1 whole using eighths and fourths. Write a corresponding addition number sentence.
    - Decompose $\frac{5}{3}$ using thirds and fourths. Write a corresponding addition number sentence.
    - Decompose 1 whole using fifths, halves, and/or tenths. Write a corresponding addition number sentence.
    - Decompose $\frac{12}{4}$ using halves and eighths. Write a corresponding addition number sentence.
    - Decompose $\frac{6}{8}$ using halves and fourths. Write a corresponding addition number sentence.
8. Have students pick one of their solutions from today's work. Ask them to represent their solution using a drawing of fraction models with labels. Have them include in this written artifact as many corresponding addition number sentences as possible.

9. Close the lesson by asking students to refer back to their sticky notes from the beginning of the activity. Help them reflect on the concepts that were demonstrated in the activity. Ask students to verbalize the concepts learned in this activity, including pictorial representations, if applicable, and add new sticky notes. Students can also remove or revise sticky notes.

Assessment

- **Questions**
  - Draw a model and write the symbol for an example of a proper fraction and an improper fraction. Use these examples to describe the meaning of the numerator and denominator of both fractions.
  - Write a number sentence using fourths and halves so that the total is $1\frac{1}{4}$. Draw a representation to prove your number sentence is true.
  - Use your fraction strips and words to explain why $\frac{3}{5} + \frac{1}{2} = \frac{7}{10}$.
- **Journal/writing prompts**
  - Reflect on one of the fraction addition examples you worked on with a partner during the lesson. Write three “I discovered …” statements about adding fractions.
  - Use fraction models to find the sum of $\frac{1}{4}$ and $\frac{5}{12}$. Represent your work with a drawing and a number sentence.
- **Other Assessments**
  - Review written statements on sticky notes from the beginning of the lesson and after the lesson. Use the information to formatively assess fraction number sense.
  - Monitor student work during the lesson. Can students use the fraction strips to determine common denominators in order to add fractions? Do students recognize equivalent fractions and when a sum could be simplified?
  - Do “My Favorite No.” Have students solve $1\frac{2}{3} + \frac{3}{4} =$ on a slip of paper and tell them not to write their name on the paper. Monitor students as they complete the problem. Allow students to use fraction strips, if needed. Choose one paper that has a common misconception or error on it. You may also solve the problem yourself, but do so by replicating a common error that you see students do. Project this “mistake” using a demonstration tool if you have one. Begin a discussion by asking, *“Is this the correct answer? What is correct about the way the problem is solved? Where is the mistake in the solution? How can we fix it?”* Encourage discussion to understand that if the answer is incorrect there may be one error that caused the final answer to be incorrect.
  - Make an exit ticket by folding a piece of paper into four sections and having students respond to the following questions:

A fraction is…	Write an addition of fraction number sentence equation using either =, <, or >.
You are sharing a candy bar among yourself and three friends. What fraction does each person get?	A question I still have about fractions is:

Extensions and Connections

- Have students create a list of things that come in halves, thirds, fourths, fifths, sixths, eighths, ninths, tenths, or twelfths. Ask students to have a goal to list at least two things for each fraction word.
- Present students with word-problem scenarios that require finding a missing addend, such as: Libby has a carton of a dozen eggs that is $\frac{1}{6}$ empty. How many eggs are in the carton if the carton holds 12 eggs?
- Support students to transfer what they learned from working with the fraction strips to working with a number line.
- Investigate what denominators of fractions a ruler can be helpful when solving addition and subtraction problems.

What is the word form of this fraction?	What is the meaning of the numerator and denominator of the fraction?
In what ways can the fraction be decomposed?	How can the decomposition be represented as a number sentence?

$$\frac{7}{12}$$

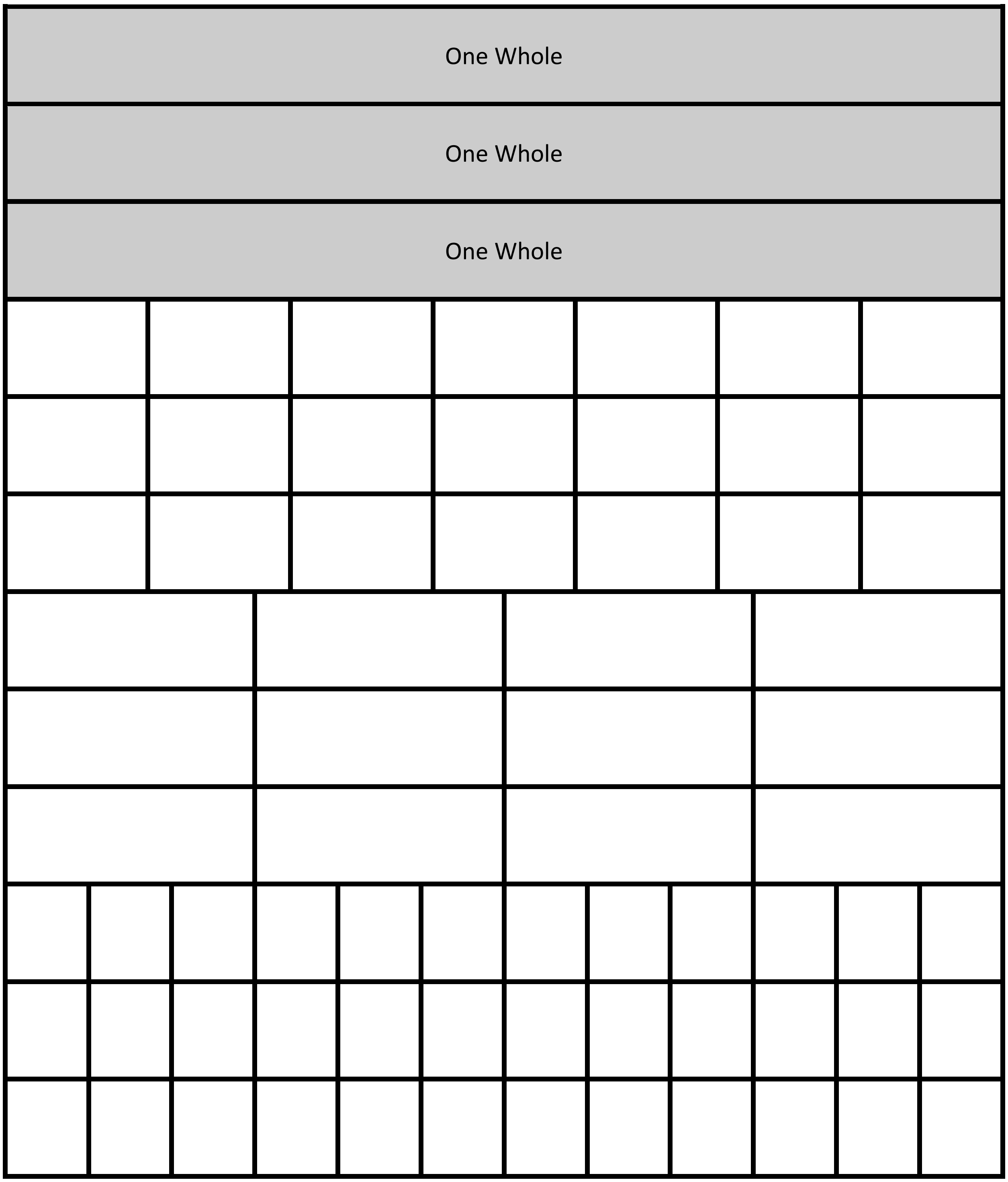
- Given a fraction, students create a small poster similar to the following. (Extension Graphic Organizer master attached)

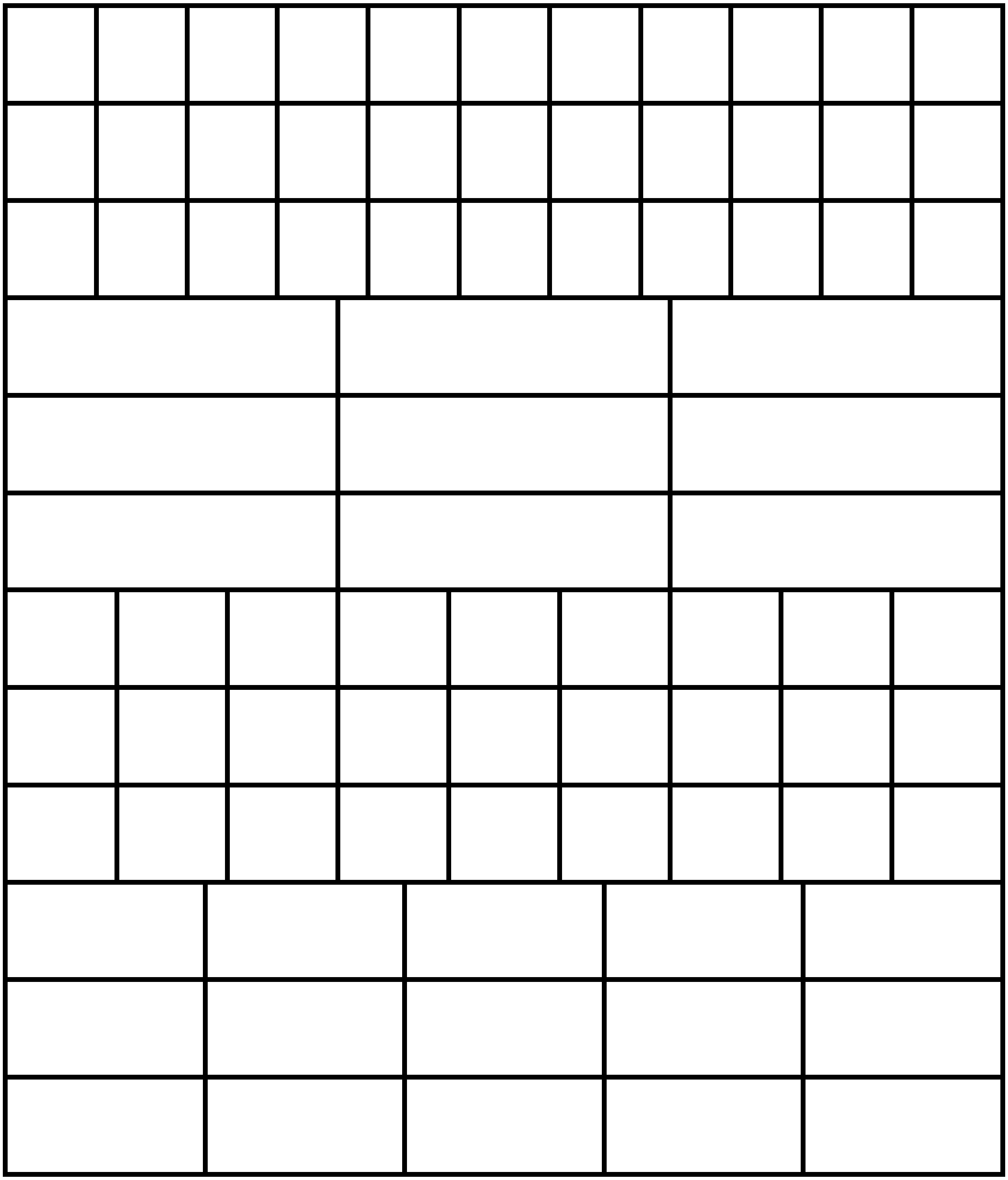
Strategies for Differentiation

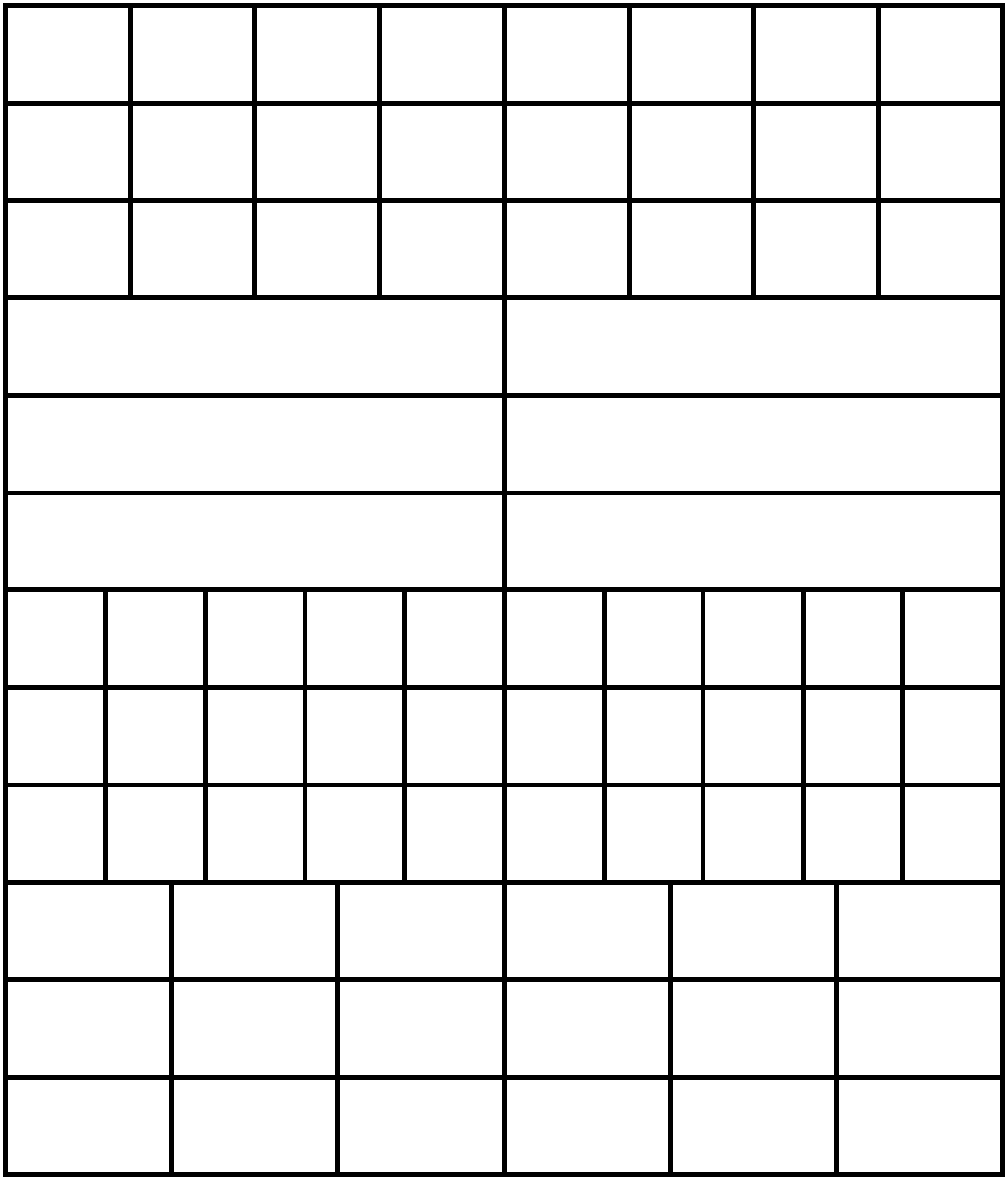
- Use individual fraction strips.
- Allow students to use fraction circles or squares if they do not comprehend the fraction strips.
- Allow students to draw representations if it aids in their computation and mathematical thinking.
- Students can do fewer problems.
- If needed, allow students to work in pairs when folding strips to aid in any fine-motor-skill coordination issues.
- Mount a poster on a wall of fraction strips divided into halves, fourths, thirds, and eighths for visual reference.
- Access the National Library of Virtual Manipulatives to investigate adding fractions.

Note: The following pages are intended for classroom use for students as a visual aid to learning.

Unlabeled Fraction Strips







Extension Graphic Organizer

What is the word form of this fraction?	What is the meaning of the numerator and denominator of the fraction?
In what ways can the fraction be decomposed?	How can the decomposition be represented as a number sentence?

Individual Fraction Strips

One Whole

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

$\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$

$\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$

$\frac{1}{5}$ $\frac{1}{5}$ $\frac{1}{5}$ $\frac{1}{5}$ $\frac{1}{5}$

$\frac{1}{6}$ $\frac{1}{6}$ $\frac{1}{6}$ $\frac{1}{6}$ $\frac{1}{6}$ $\frac{1}{6}$

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