

# Fraction Strips to Number Sentences: Adding Fractions

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<b>Strand:</b>	Computation and Estimation
<b>Topic:</b>	Estimating and adding to find sums for fractions and mixed numbers with like and unlike denominators.
<b>Primary SOL:</b>	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.
<b>Related SOL:</b>	4.5ac

## Materials

- Individual Fraction Strips (attached)
- Target Sums Master, two per page (attached)
- Fraction Sums Recording Sheet (attached)
- Partnering Up and Adding Fractions (attached)
- Centimeter cubes
- Plastic storage bags (quart size), one for each student

## Vocabulary

*addition, common factors, common multiples, estimation, factor, fraction, greatest common factor (GCF), improper fraction, least common denominator, least common multiple (LCM), like denominators, mixed number, unlike denominators, simplify, simplest form, sum*

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

*Note: Before undertaking this activity, make a complete set of fraction strips—one strip each for one whole (1 unit), two halves, three thirds, four fourths, and so forth—for each student. Copy each sheet of the attached fraction strips on a different color of card stock and cut out the strips. Although it may be easier to manage the strips when left in complete-strip format, students will benefit from being able to have separate unit fractions for the work in this lesson.*

1. This lesson builds on previous introductory work using fraction circles and fraction strips to add unlike fractions. Prepare students to continue developing their understanding about adding unlike fractions using the word problem to provide a context. Write the following problem on the board and make a set of fraction strips available for each pair of students. This can also be projected under a demonstration tool (e.g., document camera, digital display), if you have one.

*The class decorated buttons with ribbon for students to wear on Earth Day. The teacher bought several strips of ribbon all the same length for students to cut what they needed. There are two partial strips remaining. One strip has  $\frac{5}{12}$  of the ribbon left, and the other strip has  $\frac{1}{3}$  of the ribbon left. How much of an original strip does the class have left to work with?*

- a. Ask a volunteer to read the problem. Encourage students to develop a plan to solve the problem by asking the following questions:
    - What is the story in this problem?
    - What information was provided in the story?
    - What is the question or problem the story is asking you to figure out?
    - What operation (i.e., addition, subtraction, multiplication, division) do you think is the best to use to solve the problem? How do you know?
    - About how much of an original or whole ribbon strip do you think is left?
  - b. Now ask questions to encourage students to think about carrying out the mathematics to find a solution, such as:
    - What is challenging about adding the fractional amounts left in each strip? (different denominators)
    - What is the first thing we have to do and why? (find a common denominator so we can add like-size fractional parts)
    - If our denominators are 12 and 3, how can we find the common denominator? (least common multiple by listing multiples for 12 and 3 or find the least common multiple by using fractions strips)
    - Once we know the least common denominator, what do we need to do? (Find the numerator for  $\frac{1}{3}$  so that the new fraction has a denominator of 12 and is equivalent to  $\frac{1}{3}$ ).
    - How can we find the numerator? (The fraction strips show that it takes four  $\frac{1}{12}$  to make  $\frac{1}{3}$  which means that  $\frac{1}{3} = \frac{4}{12}$ ).
  - c. Now take a few minutes and work with a partner to try to solve the problem with numbers first. Record your work, then check your work with the fraction strips and revise if needed. Circulate around the room to make note of students' understandings and confusions. Identify a couple of students' work you want to use for the whole-class discussion.
  - d. Use the students' work to have the class discuss the process for finding the sum, first with numbers, and then connect the work with numbers and the mathematics in the work with fraction strips. Record the number sentences to capture the thinking. (e.g., we need to find  $\frac{1}{3} + \frac{5}{12}$ , so first we find that  $\frac{1}{3} = \frac{(1 \times 4)}{(3 \times 4)}$ , so  $\frac{1}{3} = \frac{4}{12}$ . Now we can say  $\frac{4}{12} + \frac{5}{12} = \frac{9}{12}$  and then simplify  $\frac{9}{12}$  to an equivalent fraction, because 3 is a factor of 9 and 12. The  $\frac{(9 \div 3)}{(12 \div 3)} = \frac{3}{4}$ .) The discussion should bring out the connections between the symbolic recording of the thinking process to using fraction strips. Have students record the symbolic work and also draw a pictorial representation of solving the problem with the fraction strips in their mathematics journals. Then ask students to describe the connections between the two representations.
2. Prepare the one half-page copy of the Target Sum Master for projection and the one-half page copy of the Target Sum Master for each student. Introduce the game Target Sum. Tell students they will get a centimeter cube and a copy of the Target Sum Master. They will use their centimeter cube to mark the location on the number line that shows a reasonable estimate for the sum of two numbers.

- a. Distribute one-centimeter cubes to mark estimates and the Target Sum Student Master for each student. Present students with the following three whole-number addition problems, one at a time, and have them use their centimeter cubes to mark the location on the first number line that shows a reasonable estimated sum. Ask them to be prepared to justify their estimates. Once students have marked their estimates, have them share and justify their estimates with a shoulder partner. Students will likely have little difficulty locating actual sums versus estimated sums with these examples.
    - Estimate the sum of 7 added 13.
    - Estimate the sum of 14 and 9.
    - Estimate the sum of  $12 + 17$ .
  - b. Have students look at the second number line. Ask them to discuss what value is represented at the center mark on the number line. Students should share that the location is  $\frac{1}{2}$  because the line is halfway between zero and 1. Label the tick mark. Present the following fraction-addition problems one at the time and follow the same discussion protocol as in step 2a. With fractions, students may be able to decompose fractions to make the estimation easier to do mentally. At this time, do not allow students to use any concrete manipulatives in order to push for this mental strategy. Facilitate a discussion after each problem to have several students share their strategy, and ask for different strategies after the first student shares.
    - Estimate the sum of  $\frac{1}{2}$  and  $\frac{1}{2}$ .
    - Estimate the sum of  $\frac{1}{2}$  and  $\frac{1}{4}$ .
    - Estimate the sum of  $\frac{1}{8}$  and  $\frac{1}{4}$ .
  - c. Have students look at the third number line. Ask them to discuss what value is represented at both of the unlabeled tick marks on the number line. Students should share that the locations are  $\frac{1}{2}$  and  $1\frac{1}{2}$ , respectively, because the first tick mark is halfway between zero and 1 and the second tick mark is halfway between 1 and 2. Label the tick marks. Present the following fraction adds one at the time and follow the same discussion protocol as in step 2a. Still do not allow students to use any concrete manipulatives in order to push for the aforementioned mental decomposition strategy and ask students to share their strategies.
    - Estimate the sum of  $\frac{2}{9}$  and  $\frac{1}{3}$ .
    - Estimate the sum of  $\frac{5}{6}$  and  $\frac{5}{12}$ .
    - Estimate the sum of  $1\frac{1}{2}$  and  $\frac{3}{8}$ .
3. Ask the following question to students to discuss with a partner: *“How can the decomposition of a fraction be helpful for estimating sums or finding actual sums?”* Once students reflect on the work completed with the Target Sums game, ask them to

consider these questions throughout the rest of the lesson: *“Why is determining equivalent fractions helpful for finding actual sums? How can this work be done using fraction models and number sentences?”*

4. At this time, distribute a complete set of Fraction Strips to each student, but ask them to try the problems first without the strips and then use the strips to check and revise their work, if needed. Allow a few minutes for free exploration with the fraction strips by asking students to find which fractions have the most equivalences.
5. Tell students you are going to project three addition problems with fractions that have unlike denominators that the class will work on together to prepare them for partner work. Provide the students with three copies of the Fraction Sums Recording Sheet to capture mathematical representations and problem solving to check their work with numbers. Have students work on problems one at the time and discuss each problem using the Fraction Sums Recording Sheet.
  - Find the sum of  $\frac{2}{5}$  and  $\frac{7}{10}$ .
  - Find the sum of  $\frac{3}{4}$  and  $\frac{1}{3}$ .
  - Find the sum of  $1\frac{1}{2}$  and  $\frac{3}{8}$ .
6. Students will work in pairs to solve the problems on the Partnering Up to Add Fractions handout. Each pair will need one pencil, several sheets of notebook paper, one set of fraction strips, and one Partnering Up and Adding Fractions work sheet. Partners will alternate the roles of being the describer and the writer. The describer will tell the writer what to record on paper. They should follow the sequence of steps on the Target Sum Master Sheet to record the work on their own paper. As each step is written down or each picture is recorded, both partners will think about whether the mathematics is correct. At the end of each problem, partners change roles. The teacher will circulate to listen in on the conversations and note misconceptions to address in class.
7. Close the lesson by having students respond to the following questions: *“Why is it necessary to find common denominators when adding unlike fractions and/or mixed numbers?” “How can you find the common denominator? Explain the process.”* Have students’ stand-up, hand-up, pair-up in order to establish a partner. When discussions are completed, pick a few pairs to share their responses.

### Assessment

- **Questions**
  - How can these addends —  $1\frac{1}{8} + 1\frac{1}{4}$  — be decomposed so that the computation is easier to do mentally?
  - Explain how fraction models can be used to find the sum of  $\frac{3}{4}$  and  $\frac{5}{6}$ . Draw a representation of your hands-on work with models, use words to explain your drawing, and write a number sentence to show the sum.
  - Explain the thinking process with numbers to find the sum of  $\frac{3}{4}$  and  $\frac{5}{6}$ . Use numbers and number sentences to record your thinking through finding the sum

for this problem. Use words to help explain number sentences and why you took certain steps.

- **Journal/writing prompts**

- Pick two fraction addends. What are some strategies that can be used to estimate the sum of these addends?
- Can a number line be used to find common denominators of fractions? Why or why not? Use  $\frac{3}{8}$  and  $1\frac{1}{2}$  to model.

- **Other Assessments**

- Why do you need fractions with common denominators in order to add them together?
- How is it possible to add two proper fractions together and end up with an answer greater than 1?

### **Extensions and Connections**

- When students are proficient with finding sums of proper fractions and mixed numbers, extend this work to practice strategies to ensure sums are in simplest form.
- Some students may be able to operate with improper fractions and mixed numbers with larger whole-number parts. Differentiate problem sets accordingly for these students.
- Ask students to write contextual problems where adding fractions is required.

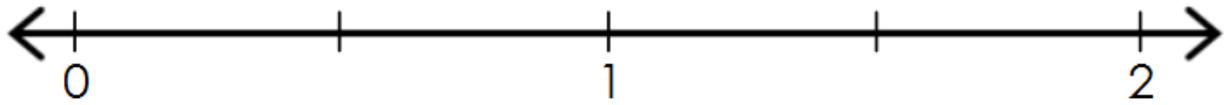
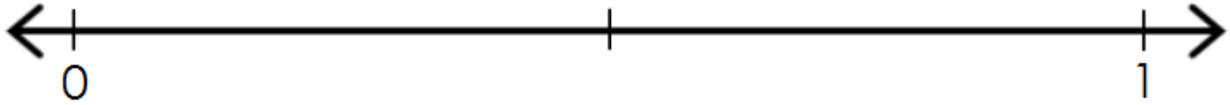
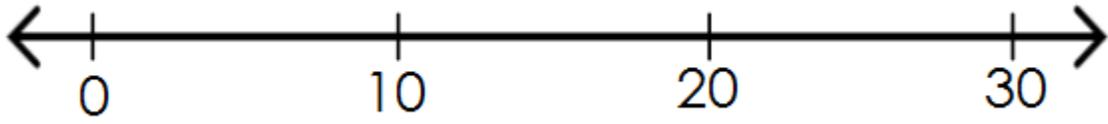
### **Strategies for Differentiation**

- Students with processing disabilities may need extended work with unit fractions and working exclusively with manipulatives before moving to representing their work with drawings and number sentences.
- Allow students to work with other fraction manipulatives, such as fraction circles, to help determine common denominators.
- Allow students to use less-complex fractions.
- Have vocabulary cards posted in the room.
- Display an anchor chart with the process for adding unlike fractions.
- Reduce the number of problems students are given at one time.

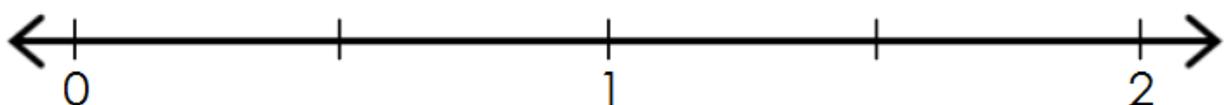
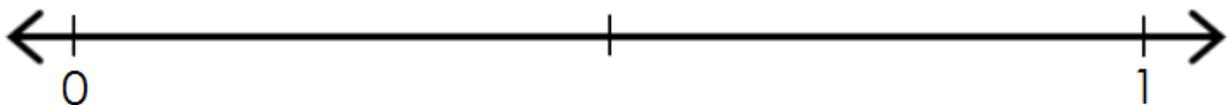
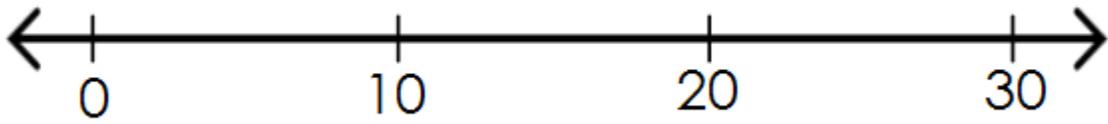
**Note: The following pages are intended for classroom use for students as a visual aid to learning.**

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### Target Sums Master



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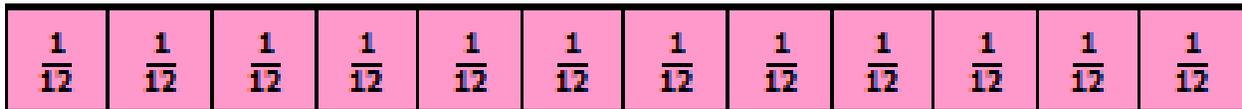
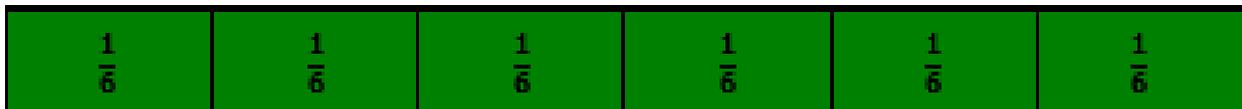
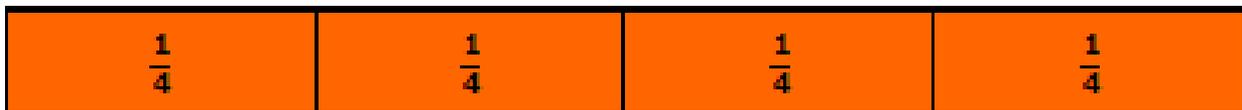
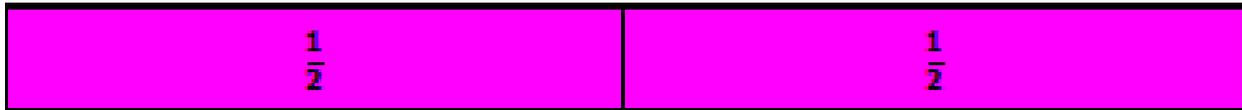


## Fraction Sums Recording Sheet

Find the sum of _____ and _____.	
<p><b>Estimated Sum</b></p> 	<p><b>Actual Sum</b></p> <p>Record your thinking process with numbers.</p>         <p>Record your model with fraction strips to check your work.</p>

Find the sum of _____ and _____.	
<b>Explain Your Thinking</b>	<b>Explain Your Thinking with Numbers and how the fraction strips are related.</b>

## Individual Fraction Strips



## Partnering Up and Adding Fractions

Partners will work together to add the following fractions. Each pair will need one pencil, several sheets of notebook paper, one set of fraction strips, and one Partnering Up and Adding Fractions work sheet. Partners will alternate the roles of being the describer and the writer. The describer will tell the writer what to record on paper. Set the work up on your own paper the way it was set up on the Target Sum Master sheet and do the work in the following order.

- Estimate the sum.
- Find the solution using numbers and number sentences.
- Find the solution using fraction strips.
- Remember to leave answers as proper fractions or mixed numbers in lowest terms.
- Compare answers and revise as necessary.

As each step is written down or each picture is recorded, both partners will think about whether the mathematics is correct. At the end of each problem, change roles as you move to the next problem.

Solve the following:

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

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

3.  $\frac{2}{3} + \frac{3}{4}$

4.  $\frac{5}{12} + 1\frac{1}{3}$

5.  $1\frac{3}{10} + \frac{2}{5}$