

# Fraction Riddles: Adding and Subtracting Fractions

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<b>Strand:</b>	Computation and Estimation
<b>Topic:</b>	Adding and subtracting fractions and mixed numbers
<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>	4.5a, c

## Materials

- Sets of fraction strips (attached) or another linear/measurement model
- Sets of fraction circles or another region/area model (optional)
- Poster paper for wall artifact (optional)
- Fraction Chart A (attached)
- Fraction Riddle Recording Sheet A (attached)
- Fraction Chart B (attached)
- Fraction Riddle Recording Sheet B (attached)
- Fraction Chart C (attached)
- Fraction Riddle Recording Sheet C (attached)
- Blank Fraction Riddle Recording Sheet (attached)

## Vocabulary

*add, common factors, common multiples, denominator, difference, estimation, factor, fraction, greatest common factor (GCF), improper fraction, least common denominator, least common multiple (LCM), mixed number, multiple, numerator, simplify, simplest form, subtract, sum*

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

*Note: In this activity, students continue their practice of adding and subtracting fractions, improper fractions, and mixed numbers. Although linear/measurement models are provided, as an option consider having students experience the game using region/area models.*

1. Group students in like-ability pairs to compute with fractions, improper fractions, and/or mixed numbers. Give each partnership a linear/measurement model, such as the fraction strips, or, as an option, students may use a region/area model.
2. Tell students you are going to read them a riddle about a fraction. Possible fractions that may be used to solve the riddle are listed on the Fraction Chart. At this time, display Fraction Chart A. Tell students that they may use their manipulatives and work together to find as many *different* possible solutions to the riddles as they can. Remind them that they may only use fractions from the chart. Pose the first riddle to the class: "I have two

fractions whose sum is more than  $\frac{1}{2}$  but less than 1. What two fractions from the chart might I have?" Allow partnerships to work out possible solutions. Monitor and facilitate student conversations, and pay attention to student solutions during this time, noting several different ones for sharing with the whole group.

3. Bring students back as a whole group for discussion. Select at least three student partnerships to share their solutions, their method of problem-solving, and proof that their solution is valid. You may want to have students share in order from least sophisticated to most sophisticated mathematics work. When partnerships share, be sure to represent their solution on a wall artifact or on the board. While some partnerships may naturally represent their solution as a number sentence, it is possible that many will not. With each solution, be sure to inquire about representation of the solution as a number sentence, similar to the following. Ask, *"What are some flexible ways each of these solutions could be represented as number sentences (equations)?"* Write number-sentence options on the wall artifact/board. For example, if students select  $\frac{1}{2}$  and  $\frac{1}{4}$  from the Fraction Chart, possible representations for the solution could be:  $\frac{1}{2} + \frac{1}{4} = \frac{3}{4}$  or  $\frac{1}{4} + \frac{1}{2} = \frac{3}{4}$  or  $\frac{3}{4} = \frac{1}{2} + \frac{1}{4}$  or  $\frac{3}{4} = \frac{1}{4} + \frac{1}{2}$ , etc... Then ask why halves and fourths added together equal fourths. This discussion should bring out the ideas that only like sizes of parts can be added together, so the common denominator is fourths. Because  $\frac{1}{2} = \frac{2}{4}$ , then we are really adding  $\frac{2}{4}$  and  $\frac{1}{4}$ .
4. Pose riddle 2: "I have two fractions whose difference is less than  $\frac{1}{2}$ . What two fractions from the chart might I have?" Monitor student work and discuss solutions similar to the procedure in step 2 with the first riddle.
5. Students will now work together in partnerships to solve additional fraction riddles. Provide each student with one of the differentiated game boards and corresponding fraction riddles recording sheet. Chart A is designed for students proficient with computations with proper fractions with like and unlike denominators. Chart B is designed for students proficient with computations with proper fractions, improper fractions, and mixed numbers. Chart C is designed for students proficient with computations with mixed numbers, some of which may require determining common denominators which may not be one of the denominators of the pair of fractions selected (e.g., denominators of 8 and 3 versus 8 and 4). At your discretion, model for students how to represent their work on their recording sheet before partnerships begin the activity. Have partnerships read each riddle on their recording sheet together. On their individual recording sheets, students will independently solve the riddle by picking two fractions from the Fraction Chart. Problem-solving should be documented in the center column of the recording sheet. Once both partners have documented their strategy and solution, they share their representation, strategy and solution. After sharing, students record their partner's strategy in the third column of the recording sheet to reflect on their partner's strategy and have a record of this strategy in the event they can use it for a different riddle. Partners work in this way to complete all four riddles on their recording sheets.

6. Close the activity by bringing students together as a whole group. Select a partnership and one representation on their recording sheet to share. This selection could reflect an example of excellent written representation, an interesting problem-solving strategy, or anything you would like to bring to light from student work.

### Assessment

- **Questions**
  - How could a number line ranging from zero to 1 be used to show possible answers to the riddles? Explain.
  - Select one of the fraction riddles. Explain whether there is more than one correct answer to the riddle. How do you know?
- **Journal/writing prompts**
  - Make up a riddle using any two fractions from the Fraction Chart. Demonstrate as many solutions as possible.
  - Andre wrote the following riddle for Fraction Chart Addition: *I have two fractions whose difference is greater than 1. What two fractions from the chart might I have?*  
  
Are there any pairs of fractions in the chart to answer this riddle? Why or why not?
- **Other Assessments**
  - Assess students' reasoning to determine whether they are thinking mathematically and making reasonable choices or whether they are just guessing. Monitor students as they work through the riddles on their recording sheet. What solutions did they document? Did the student provide accurate written support to justify possible solutions?
  - If students have written their own riddles, assess the riddles that students created for their partners. Are they reasonable? Are there any possible solutions for the riddle on the Fraction Chart?

### Extensions and Connections

- Have students take turns answering each riddle, and cross out the fractions on the Fraction Chart as they use them in their solutions, eliminating them from selection, and narrowing down choices on the chart.
- Using the Blank Fraction Riddle Recording Sheet, create additional riddles for Fraction Chart A, B, or C and have partnerships solve them.

### Strategies for Differentiation

- Some students with processing difficulties may benefit from adapted Fraction Charts where only 10 fractions, improper fractions, or mixed numbers are presented instead of 20.
- Fraction Charts A, B, and C are differentiated for varying computational abilities. For Fraction Chart C, some students may be able to select mixed numbers where finding

differences require regrouping of the whole number. This exceeds the minimum standard of the aligned SOL.

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

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Fraction Chart A

$\frac{7}{8}$	$\frac{5}{12}$	$\frac{3}{4}$	$\frac{1}{3}$
$\frac{2}{5}$	$\frac{8}{9}$	$\frac{5}{8}$	$\frac{2}{4}$
$\frac{1}{8}$	$\frac{1}{4}$	$\frac{2}{6}$	$\frac{7}{12}$
$\frac{1}{9}$	$\frac{4}{5}$	$\frac{3}{8}$	$\frac{3}{10}$
$\frac{9}{10}$	$\frac{1}{2}$	$\frac{1}{5}$	$\frac{6}{8}$

Fraction Riddles Recording Sheet A

<b>Fraction Riddle</b>	<b>Solution</b>	<b>Other Possible Solution</b>
<p><i>I have two fractions whose sum is less than <math>\frac{1}{2}</math>. What two fractions from the chart might I have?</i></p>		
<p><i>I have two fractions whose difference is greater than <math>\frac{1}{2}</math> but less than 1. What two fractions from the chart might I have?</i></p>		
<p><i>I have two fractions whose sum is greater than 1. What two fractions from the chart might I have?</i></p>		
<p><i>I have two fractions whose difference is between <math>\frac{1}{4}</math> and <math>\frac{2}{4}</math>. What two fractions from the chart might I have?</i></p>		

Fraction Chart B

$\frac{4}{3}$	$\frac{5}{12}$	$\frac{3}{2}$	$2\frac{3}{4}$
$1\frac{7}{8}$	$\frac{6}{4}$	$3\frac{9}{10}$	$\frac{5}{6}$
$\frac{7}{10}$	$1\frac{3}{4}$	$\frac{1}{3}$	$2\frac{7}{12}$
$1\frac{8}{9}$	$\frac{3}{5}$	$1\frac{2}{3}$	$\frac{3}{8}$
$\frac{1}{2}$	$1\frac{5}{8}$	$\frac{2}{9}$	$2\frac{4}{5}$

Fraction Riddles Recording Sheet B

<p><b>Fraction Riddle</b></p>	<p><b>Solution</b></p>	<p><b>Other Possible Solution</b></p>
<p><i>I have two fractions whose difference is greater than <math>\frac{1}{2}</math> but less than 1. What two fractions from the chart might I have?</i></p>		
<p><i>I have two fractions whose sum is less than <math>\frac{1}{2}</math>. What two fractions from the chart might I have?</i></p>		
<p><i>I have two fractions whose difference is equal to 1. What two fractions from the chart might I have?</i></p>		
<p><i>I have two fractions whose sum is greater than <math>1\frac{1}{2}</math>. What two fractions from the chart might I have?</i></p>		



Fraction Chart C

$1\frac{7}{9}$	$1\frac{1}{10}$	$5\frac{1}{2}$	$1\frac{3}{4}$
$2\frac{3}{12}$	$1\frac{1}{6}$	$1\frac{2}{3}$	$3\frac{1}{5}$
$2\frac{5}{12}$	$1\frac{2}{7}$	$2\frac{2}{8}$	$2\frac{5}{6}$
$3\frac{1}{5}$	$4\frac{3}{6}$	$1\frac{2}{6}$	$3\frac{1}{4}$
$1\frac{1}{4}$	$2\frac{1}{3}$	$2\frac{9}{11}$	$2\frac{3}{8}$

**Fraction Riddles Recording Sheet C**

<b>Fraction Riddle</b>	<b>Solution</b>	<b>Other Possible Solution</b>
<p><i>I have two fractions whose sum is between 1 and 2. What two fractions from the chart might I have?</i></p>		
<p><i>I have two fractions whose difference is between 0 and <math>\frac{1}{2}</math>. What two fractions from the chart might I have?</i></p>		
<p><i>I have two fractions whose sum is greater than 6. What two fractions from the chart might I have?</i></p>		
<p><i>I have two fractions whose difference is less than 2. What two fractions from the chart might I have?</i></p>		

**Blank Fraction Chart**


**Fraction Strips — One Whole (One Unit)**

<b>1</b>
<b>1</b>
<b>1</b>
<b>1</b>
<b>1</b>

**Fraction Strips—Halves**

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

Fraction Strips—Fourths

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

Fraction Strips—Eighths

$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$

Fraction Strips—Fifths

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



Fraction Strips—Tenths

$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$
$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$
$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$
$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$
$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$

Fraction Strips—Thirds

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

Fraction Strips—Sixths

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

Fraction Strips—Ninths

$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$
$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$
$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$
$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$
$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$

Fraction Strips—Twelfths

$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$
$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$
$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$
$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$
$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$