

Teacher Guide: Adding Fractions



Learning Objectives

Students will...

- Add fractions with like denominators.
- Add fractions with unlike denominators.
- Find the lowest common denominator (LCD) of a set of fractions.
- Use fraction tiles to model addition of fractions.



Vocabulary

denominator, equivalent, fraction, least common denominator, numerator, sum



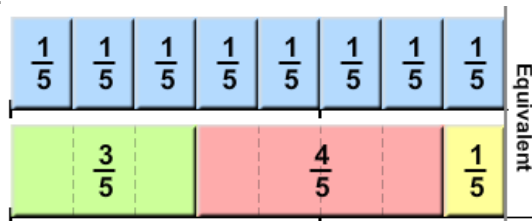
Lesson Overview

The *Adding Fractions* Gizmo™ allows students to explore the addition of fractions using fraction tiles. The Gizmo features the “Fractionator,” a fraction-tile-making gadget. Students can make fraction tiles by setting the numerator and denominator (up to 12) and clicking **Make tile**.

Fraction tiles can be placed on two number lines. Sums on top are shown as improper fractions (numerator greater than denominator). Sums on the bottom are shown as mixed numbers.

The Student Exploration sheet contains three activities:

- Activity A – Students add fractions with like denominators.
- Activity B – Students add fractions with unlike denominators and explore the usefulness of common denominators.
- Activity C – Students add fractions with unlike denominators.



Suggested Lesson Sequence

1. **Pre-Gizmo activity** (🕒 10 – 20 minutes)
Adding fractions with like denominators is fairly straightforward. What is trickier, though, is adding fractions with unlike denominators. To do this, students will first need to convert the fractions to equivalent fractions with like denominators.

A solid understanding of equivalent fractions will be important to the lessons in the *Adding Fractions* Gizmo. Therefore it would be a good idea to use the *Equivalent Fractions* Gizmo with your students first. (See **Selected Web Resources** on page 3 of this document for a link.) Practice finding equivalent fractions with your students, using the Gizmo and also by hand. Here are some sample challenges:

- Find as many fractions equivalent to $\frac{1}{2}$ as you can.
- Find the fraction with a denominator of 12 that is equivalent to $\frac{1}{2}$.

2. **Prior to using the Gizmo** (🕒 10 – 15 minutes)
Before students are at the computers, pass out the Student Exploration sheets and ask them to complete the Prior Knowledge Questions. Discuss answers as a class. The questions are designed to set up the thinking of fraction addition: Two ninths plus three ninths is five ninths, just as two cats plus three cats gives you five cats. See the **Mathematical Background** below for more information.

3. **Gizmo activity** (🕒 15 – 20 minutes per activity)
Assign students to computers. Students can work individually or in small groups. Have students work part of the Student Exploration sheet using the Gizmo. Alternatively, you can use a projector and do the Exploration as a teacher-led activity.

It may be overwhelming for students to do all of the activities in the Student Exploration in one sitting. We recommend starting with the first page of the Student Exploration sheet (Prior Knowledge Questions and Gizmo Warm-up) and working through the activities in order. Extend the lesson if you want using the extensions below. Return to the Gizmo and the unused activities in future class periods to reinforce the concepts.

4. **Extending the Gizmo** (🕒 15 – 20 minutes each)
Here are some suggestions for extending the activities in the Student Exploration sheet:

Activity A Extension – Practice number sense and fraction sense by giving students challenges such as this: Using only a denominator of 9, create a sum that is greater than $\frac{1}{2}$ and less than 1. [Any sum that equals $\frac{5}{9}$, $\frac{6}{9}$, $\frac{7}{9}$, or $\frac{8}{9}$ satisfies this. Model these in the Gizmo and compare them to fraction tiles of one half and one to verify this.]

Activity B Extension – Give students more problems to solve by hand first, and then verify their answers in the Gizmo. Example: Darren, Tony, and Jason share a pizza with 8 pieces. Darren eats $\frac{1}{8}$ of the pizza, Tony eats $\frac{1}{4}$ of it, and Jason eats $\frac{1}{2}$ of it. How much of the pizza did they eat? [Answer: $\frac{1}{8} + \frac{1}{4} + \frac{1}{2} = \frac{1}{8} + \frac{2}{8} + \frac{4}{8} = \frac{7}{8}$ of the pizza.]

Activity C Extension – Be sure that students can add fractions with a least common denominator (LCD) greater than 12 (greatest value you can model in the Gizmo). Ask questions to check. For example, what is $\frac{1}{4} + \frac{1}{5}$? [Answer: $\frac{1}{4} + \frac{1}{5} = \frac{5}{20} + \frac{4}{20} = \frac{9}{20}$.]

5. **Follow-up activity** (🕒 20 – 30 minutes)
Launch the *Modeling Fractions* Gizmo (see link in Web Resources below). Model two fractions (perhaps $\frac{2}{3}$ and $\frac{3}{5}$) in the Gizmo. First compare them – which is greater? Then, instead of adding them, ask what the *difference* between the fractions is. This requires the LCD, just as adding does. After students have tried this on their own, they can turn on **Compare fractions using LCD** at the bottom of the Gizmo to check their answers.



Mathematical Background

The most common mistake that students make when adding fractions is to add denominators just as they add the numerators. The wrong equation below “just looks right” to many students:

$$\text{Wrong: } \frac{2}{9} + \frac{3}{9} = \frac{5}{18} \qquad \text{Correct: } \frac{2}{9} + \frac{3}{9} = \frac{5}{9}$$

But why is the equation on the left wrong? An effective way to address this misconception is to refer to fractions by their names, in words. That’s when fraction addition begins to make sense.

What does 2 ninths plus 3 ninths equal? The sum is 5 ninths. Say it in words to see why:

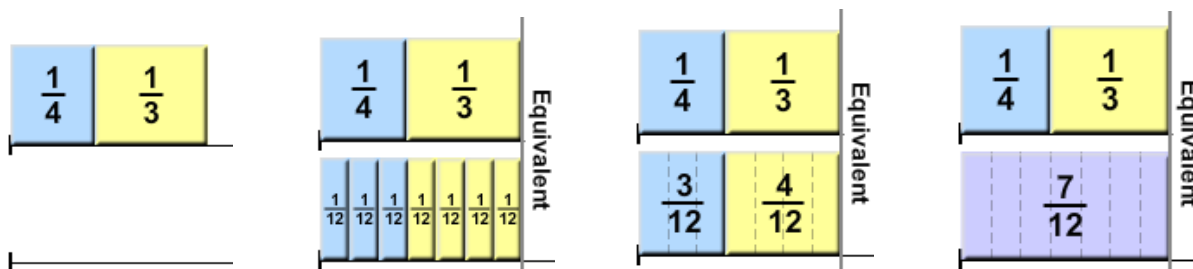
- 2 cats plus 3 cats equals 5 cats.
- 2 dollars plus 3 dollars equals 5 dollars.
- 2 ninths plus 3 ninths equals 5 ninths.

It is trickier to add fractions with unlike denominators. The first key is to be able to convert the given fractions to equivalent fractions. For example, to find the sum $\frac{1}{4} + \frac{1}{3}$, students will need to come up with fractions equivalent to both addends.

$$\frac{1}{4} = \frac{2}{8}, \frac{3}{12}, \frac{4}{16}, \frac{5}{20}, \frac{6}{24}, \text{ etc.} \qquad \frac{1}{3} = \frac{2}{6}, \frac{3}{9}, \frac{4}{12}, \frac{5}{15}, \frac{6}{18}, \text{ etc.}$$

Notice that the denominator 12 shows up in both lists above. This is the least common denominator (LCD) for these two fractions. You can then use the LCD of 12 to rewrite the given sum $\frac{1}{4} + \frac{1}{3}$ as the equivalent sum $\frac{3}{12} + \frac{4}{12}$. This makes it clear that $\frac{1}{4} + \frac{1}{3} = \frac{7}{12}$.

Here is how you can model this process using the *Adding Fractions Gizmo*:



Selected Web Resources

Modeling Fractions Gizmo: <http://www.explorellearning.com/gizmo/id?1006>

Equivalent Fractions Gizmo: <http://www.explorellearning.com/gizmo/id?1012>

Fractions Greater than One Gizmo: <http://www.explorellearning.com/gizmo/id?1037>

Adding fractions manipulative: http://nlvm.usu.edu/en/NAV/frames_asid_106_g_2_t_1.html

Adding fractions: <http://www.themathpage.com/ARITH/add-fractions-subtract-fractions-1.htm>