

Teacher Guide: Fraction Artist 1



Learning Objectives

Students will...

- Understand that a fraction represents a relationship between a part and the whole.
- Understand that the denominator of a fraction represents the number of equal parts the whole has been divided into.
- Understand that the numerator of a fraction is the number of parts being referred to.
- Compare the sizes of different fractions.
- Develop an understanding of equivalent fractions.



Vocabulary

denominator, fraction, numerator



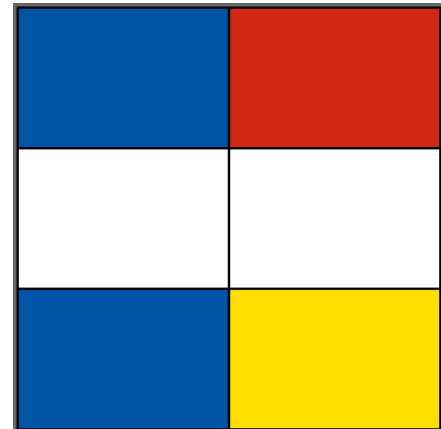
Lesson Overview

The *Fraction Artist 1* Gizmo™ introduces and reinforces basic understanding of fractions. To get the most out of this Gizmo, students should have at least some prior experience with fractions in symbolic form. (Note: *Fraction Artist 2* uses the same Gizmo, but the activities are a bit more advanced. See **Selected Web Resources** on page 3 for the link.)

In *Fraction Artist 1*, students create modern-art-style paintings by dividing and coloring a square canvas. They then study the fractional sizes of their paintings' sections.

The Student Exploration sheet contains three activities:

- Activity A – Students experiment with dividing the canvas into equal-sized sections.
- Activity B – Students create paintings based on a set of instructions.
- Activity C – Students create paintings that demonstrate one-half equivalencies.



Suggested Lesson Sequence

1. **Pre-Gizmo activity** (🕒 10 – 15 minutes)
Introduce students to the life and work of artist Piet Mondrian. (See **Selected Web Resources** for helpful links.) Ask them for their reactions to his art and then have them describe any mathematics they see in his paintings.
2. **Prior to using the Gizmo** (🕒 10 – 15 minutes)
Before students are at the computers, pass out the Student Exploration sheets and ask students to complete the Prior Knowledge Questions. Discuss student answers as a class. At this point, letting students share how they thought about the questions is more valuable than “going over” the correct answers. After the discussion, if possible, use a projector to introduce the Gizmo and demonstrate its basic operations.

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) plus one of the three activities. 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)
Here are some suggestions for extending the activities in the Student Exploration sheet:

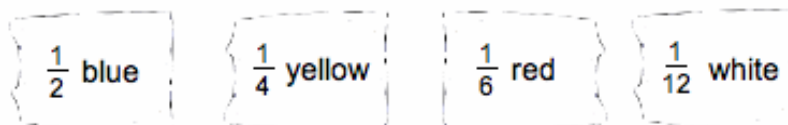
Activity A Extension – In this activity, students experimented with dividing the canvas into different numbers of equal sections. As a follow-up, challenge them to divide the canvas into four *unequal* sections. Ask them if they think it's acceptable to call the four unequal sections "fourths." (Be sure you conclude that discussion with students knowing that the four sections must be equal in order to be fourths.) Do the same thing with five, seven, and eight sections.

Activity B Extension – You can use students' paintings to compare the values of two unit fractions. Ask your class which is bigger, $\frac{1}{4}$ or $\frac{1}{3}$. (Some students will choose one-fourth because four is bigger than three.) Then pair them up. Have one student in each pair make a painting that is one-fourth blue and the other make a painting that is one-third blue. Then ask, "Which painting has the larger blue section? What fraction is really bigger, one-fourth or one-third?"

Activity C Extension – This activity showed that one-half is equivalent to two-fourths, four-eighths, and three-sixths. Challenge your students to use paintings to find other fractions that are equal to one-half. Have students share their paintings with the class, and use their paintings to create a classroom list of fractions that are equal to one-half.

Another way to extend students' work with the Gizmo is class discussion. After students are done with their activity, discuss the following questions:

- What does it mean when a painting is $\frac{2}{3}$ yellow?
 - What would a painting look like that is $\frac{4}{4}$ blue?
 - If a painting is red and white, and $\frac{3}{4}$ of the painting is red, what fraction is white?
5. **Follow-up activity: Painting Puzzle** (🧠 30 – 40 minutes)
Gerhard the fraction artist left detailed instructions for some paintings, but his dog Richter chewed them up. All that remains are four scraps of paper:



Put students in pairs or small groups. Their job is to create paintings that match the torn-up instructions. There is no way to tell how many paintings Gerhard wanted. The instructions could be for four separate paintings, or they could be for fewer. Challenge the students to match the instructions with as few paintings as possible.

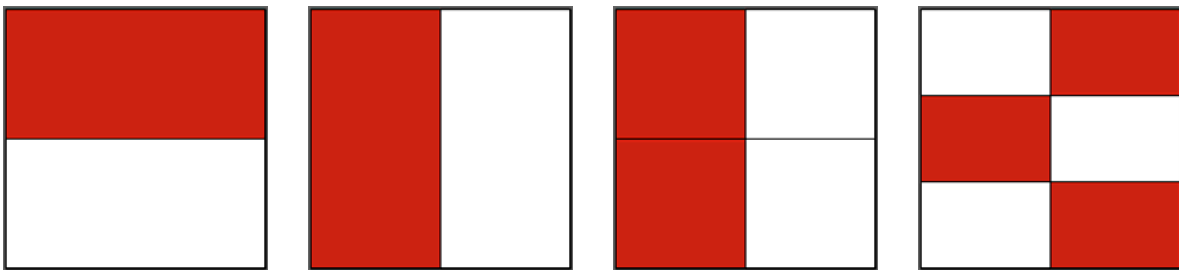
It's possible to do this in a single painting, but don't tell students this at first. When a group has worked out a solution that uses two, three, or four paintings, challenge them to find another way that uses fewer paintings. At the end of the activity, have students share their paintings and discuss the fraction equivalencies they found.



Mathematical Background

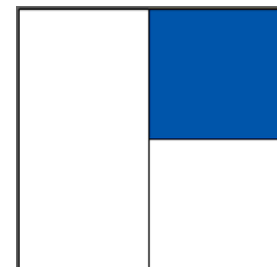
Students need to know that the denominator of a fraction represents the number of *equal*-sized pieces that an object is divided into and that the numerator represents a subset of that total.

This Gizmo allows students to create their own representations for fractions and to explore equivalent representations for the same fraction. For example, a student could create any of the paintings below to represent one-half. (Note that the Gizmo's **Inspect Colors** option displays the fraction for a color in simplest form.)



The **Divide canvas** tools help students build an understanding of the relationships between different unit fractions. For example, to make fourths, they need to first make halves and then divide them into two equal sections each. And then to make eighths, they need to divide the fourths into two equal sections each. Doing this helps break common misconceptions about the size of fractions. If students know that they make eighths by dividing fourths in half, it will help them understand why one-eighth is less than one-fourth.

This Gizmo also helps students see the importance of equal-sized sections. For example, the painting to the right is not one-third blue because the three sections are not of equal size. (In fact, it is one-fourth blue, because it would take four pieces of this size to cover the painting.) Activities that emphasize this point and offer a more advanced treatment of fractions in general can be found in the *Fraction Artist 2* Gizmo.



Selected Web Resources

Fraction Artist 2 Gizmo: <http://www.explorelearning.com/gizmo/id?1001>

Information about Piet Mondrian: <http://www.artchive.com/artchive/M/mondrian.html>

Modern Art at the Metropolitan Museum: http://www.metmuseum.org/Works_of_art/modern_art

More math/art activities: <http://www.morethanmath.org/>

Activity studying one-half: <http://pbskids.org/cyberchase/games/fractions/>