Teacher Guide: Equivalent Fractions

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.
- Express fractions in simplest form.

Vocabulary

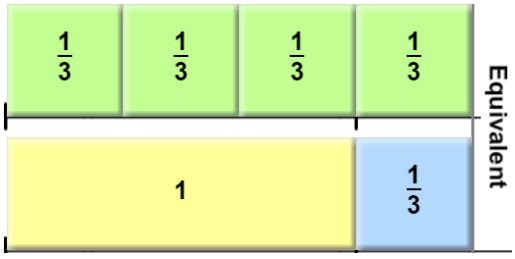
denominator, equivalent, fraction, numerator, simplify, unit fraction, whole

Lesson Overview

The *Equivalent Fractions* Gizmo™ provides a platform for the exploration of fractions using fraction tiles. Students create tiles whose sizes are determined by the values of fractions. Fractions can be compared by adding and removing tiles from two number lines.

The Student Exploration sheet contains three activities:

- Activity A – Students explore the roles of numerators and denominators.
- Activity B – Students explore equivalent fractions.
- Activity C – Students simplify fractions.



Suggested Lesson Sequence

1. **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. Have students share answers and invite some to draw their answers on the board. Specifically, ask students to describe the bottom row of their tiling in terms of parts of a whole.

2. **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.

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

Activity A Extension – Have students create tiles that meet size constraints, using what they have learned about numerators and denominators. For example, create a tile that is larger than $\frac{1}{5}$ and smaller than $\frac{4}{5}$. Or create a tile that is smaller than $\frac{1}{8}$.

Activity B Extension – Have students explore mathematically what makes two fractions equivalent. For example, start with a $\frac{1}{4}$ tile on the top row in the Gizmo. Place $\frac{1}{8}$ tiles on the bottom until they are equivalent. How many does it take? Ask the students, if it takes two $\frac{1}{8}$ tiles ($\frac{2}{8}$) to equal $\frac{1}{4}$, then how many $\frac{1}{8}$ tiles would it take to equal $\frac{3}{4}$? Have students make a prediction and discuss how they found the answer (e.g. multiply the numerator and denominator both by 2 to get $\frac{3}{4} = \frac{6}{8}$). Model the solution in the Fractionator. Repeat the activity with other equivalent fractions.

Activity C Extension – In the *Equivalent Fractions* Gizmo, set up the following scenario for your students. Tiler Tim sells the tiles below in boxes of six tiles. Teresa asks for 2 yellow, 3 green, and 1 pink tile (drag these to the bottom row in the Gizmo). What fraction of Teresa's tiles are yellow (or green, etc.)? Be sure to have students express their answers in simplest form. You can vary this activity by selecting different combinations of tiles for different customers or starting with a different collection of tiles.

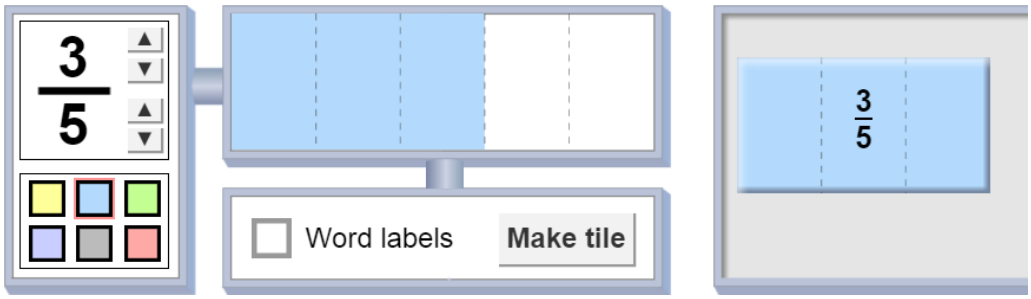
Another way to extend students' work with the Gizmo is class discussion. After students are done with their activity, discuss the following questions:

- How many different ways can you create a whole with the Fractionator?
- Can you think of a fraction that is larger than any fraction that can be made by the Fractionator? If so, what fraction? If not, why not?
- How can you tell when a fraction is in simplest form?

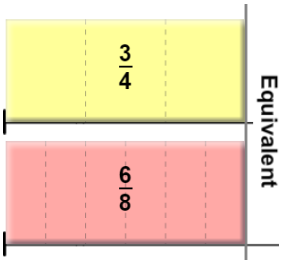
4. **Follow-up activity: Physical fraction tiles** (20 – 30 minutes)
Have students make their own fraction tiles by cutting them out of paper. Have students label all the fraction tiles with the appropriate fraction. Before cutting the tiles out you may want to discuss how the size of a denominator affects the size of a unit fraction. After cutting the tiles out you can give students a variety of challenges. For example, use 4 fractions that are not all the same to make a whole. Or use 3 of the same fraction to make a half. See the "Rainbow Fraction Tile" activity in the resources section below for more ideas.

Mathematical Background

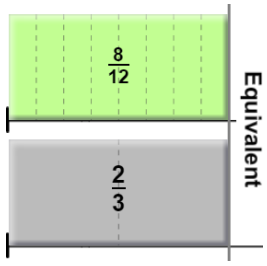
Fractions consist of two numbers, a *numerator* on top and a *denominator* below. The denominator of a fraction represents the number of equally-sized parts that a whole has been divided into. The numerator represents the number of parts of that whole that are selected. For example, in the Fractionator below the whole tile is divided into 5 parts. Of these, 3 are selected, so the shaded area represents the fraction $\frac{3}{5}$.



The Fractionator presents a concrete model for equivalent fractions as tiles of the same size. For example, in the fractions on the right you can see that eighths are half the size of fourths, so three fourths ($\frac{3}{4}$) is equivalent to six eighths ($\frac{6}{8}$). It is also important for students to understand the mathematical method for finding equivalent fractions – multiplying the numerator and denominator by the same number (in this case 2).



Simplifying fractions is another way to create equivalent fractions. Simplification uses division to ensure that the resulting numerator and denominator are smaller (simpler). For example, to simplify $\frac{8}{12}$, divide the top and bottom by 4 to get the equivalent fraction $\frac{2}{3}$.



It is also possible to divide both 8 and 12 both by 2. The result ($\frac{4}{6}$) is equivalent to $\frac{8}{12}$ but it is not in simplest form. To guarantee simplest form, divide the numerator and denominator of a fraction by their greatest common divisor (GCD), or be prepared to take more than one step to simplify.

Selected Web Resources

Rainbow Fraction Tile Activity: http://www.learningresources.com/text/pdf/0615INS.pdf
Fraction Tiles Virtual Manipulative: http://www.abcya.com/fraction_tiles.htm
Explanation of Equivalent Fractions: http://www.mathsisfun.com/equivalent_fractions.html
Explanation of Simplifying Fractions: http://www.mathsisfun.com/simplifying-fractions.html
Simplifying Fractions Game: http://www.funbrain.com/fract/index.html
Modeling Fractions (Area Models) Gizmo: http://www.explorelearning.com/gizmo/id?1006