

Notes for the Teacher

Students construct and add fractions with the same denominators on a number line to find different combinations of fractions that sum to 1.

Objectives:

- Students will use a number line model to explore fractions.
- Students will understand the relationship between the visual representation of fractions and their symbolic forms.
- Students will add fractions with the same denominators.
- Students will develop strategies for finding two or more fractions that add up to 1.

Common Core Mathematical Practices: (1) Make sense of problems and persevere in solving them; (2) Reason abstractly and quantitatively; (3) Construct viable arguments and critique the reasoning of others; (5) Use appropriate tools strategically; (7) Look for and make use of structure.

Common Core State Content Standards: 3.NF1, 2; 4.NF3

Grade Range: Grades 3–4

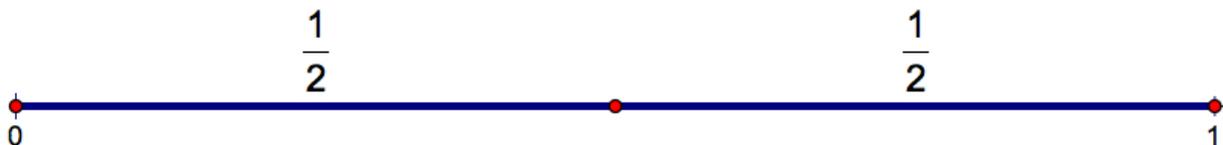
Introduce:

Use a projector to show sketch page “Halves” and distribute the worksheet. Follow worksheet step 1 to demonstrate how to make $\frac{1}{2}$. Notice that the segment of length $\frac{1}{2}$ appears after you’ve clicked the number 1 and clicked the number 2. You can then move the segment and click to place it so that its left endpoint coincides with 0 on the first number line. (Notice that the number line will highlight in red when the segment is aligned properly.)

Ask, “What fraction can we add to $\frac{1}{2}$ to make 1?” (another segment of length $\frac{1}{2}$)

Use the **Make Fraction** tool to make another segment of length $\frac{1}{2}$. Move the segment so its left endpoint coincides with the right endpoint of the existing segment. When the points highlight, click to place the segment. The two segments now span from 0 to 1 on the number line, indicating that their combined lengths equal 1. Ask, “What number sentence can we write to represent the fractions on the number line and their sum?”

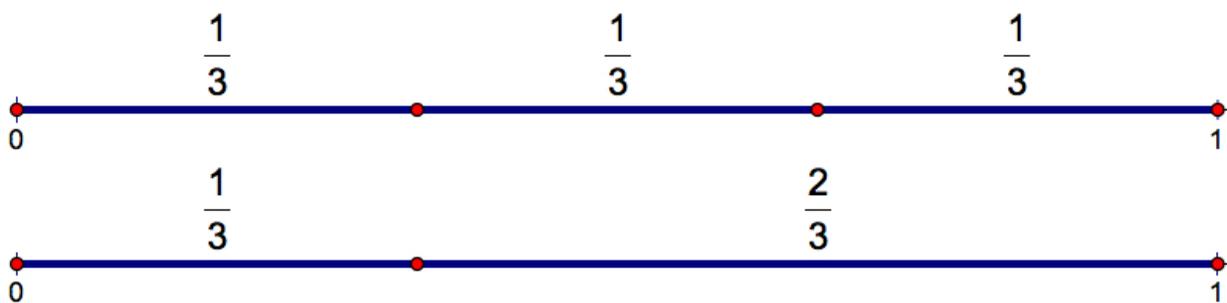
$(\frac{1}{2} + \frac{1}{2} = 1)$ Help students make the connection between the fraction number line model and the number sentence.



Ask students whether there are any other fractions with a denominator of 2 that add up to 1. Some students may suggest $\frac{2}{2} + \frac{0}{2} = 1$. This is an astute response. Explain that, while this is correct, all fractions must be greater than 0 for this activity. Students should decide that $\frac{1}{2} + \frac{1}{2} = 1$ is the only way to express a sum of 1 using the denominator 2.

Now go to sketch page “Thirds” and repeat the process using 3 as the denominator. Ask students what fractions with a denominator of 3 add up to 1. Construct each sum on a separate number line so that they appear one below the other. Have students keep track of the number sentences on their worksheet as you write them on the board.

$(\frac{1}{3} + \frac{2}{3} = 1; \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = 1)$. You may need to suggest to students that they can use more than two addends.



Discuss how $\frac{1}{3} + \frac{2}{3} = 1$ is similar to $\frac{2}{3} + \frac{1}{3} = 1$. Both statements use the same fractions but in a different order. Explain that for the purposes of this activity, $\frac{1}{3} + \frac{2}{3}$ and $\frac{2}{3} + \frac{1}{3}$ will be considered the same. If students are familiar with the commutative property of addition ($a + b = b + a$), make the connection to these two sums.

Explore:

Assign students to partners and send them in pairs to the computers. Students should begin on page “Fourths.” Encourage them to construct as many fractions that sum to 1 as possible using a denominator of 4 and to write the related number sentences on their worksheets.

Observe students as they work. Their approaches may be different. Some students may start by building fractions with a numerator of 1 (unit fractions): $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = 1$.

Then they may swap out equivalent fractions. For example, they may replace two $\frac{1}{4}$ s with $\frac{2}{4}$ ($\frac{2}{4} + \frac{1}{4} + \frac{1}{4} = 1$ and $\frac{2}{4} + \frac{2}{4} = 1$) or replace three $\frac{1}{4}$ s with $\frac{3}{4}$ ($\frac{3}{4} + \frac{1}{4} = 1$). Other students may start with $\frac{3}{4}$ or $\frac{2}{4}$ and then decompose the fractions into unit fractions.

Suggest such approaches to students who appear to be haphazardly selecting fractions to use. Be sure to explore these different strategies during the whole-class discussion.

Have students go to page “Fifths” and “Sixths” and make fractions with denominators of 5 and 6 that add up to 1. For both pages, students will be able to construct only a subset of the possible answers because there aren’t enough number lines on the sketch pages. As you circulate, make sure students record their lists of number sentences and their explanations on the worksheet.

Note: If students build a fraction they do not want or if they place a fraction incorrectly, they can undo their work by choosing **Edit | Undo Make Fraction**.

Discuss:

Call students together to discuss and summarize what they’ve learned. Have students share the different sums of 1 they found for fourths and fifths. Then use a projector to show sketch page “Sixths.” Have volunteers come to the computer and make fractions with a denominator of 6 that add up to 1. Encourage students to find at least eight different ways. Since there is only room for building five sums on the sketch page, list other number sentences on the board. Encourage students to explain their thinking as they show their solutions.

Ask, “How do you know your fractions add up to 1?” Students will likely explain that the sum of the numerators in each addition statement is equal to the denominator.

Ask students to share their strategies for finding sums of 1. Here are some sample replies:

- *We knew that $1 + 1 + 1 + 1 + 1 + 1 = 6$, so we made each fraction equal to $\frac{1}{6}$. Then we decided to use 2 as a numerator. Since $2 + 2 + 2 = 6$, we made each fraction equal to $\frac{2}{6}$.*
- *We replaced pairs of fractions with single fractions. For example, we replaced $\frac{1}{6} + \frac{1}{6}$ with $\frac{2}{6}$.*
- *We knew the sum of the numerators must equal the denominator to make a fraction equal to 1. So, we thought about different ways to add numerators to equal the denominator.*

Related Activities:

- *Time-Saver Games Part One—Adding Fractions*
- *Time-Saver Games Part Two—Adding Fractions*
- *Fractions on a Number Line—Addition and Subtraction Games*
- *Fractions on a Number Line—Adding with Unlike Denominators*
- *Measuring with Fractions—Fractions on a Number Line*

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