Estimating with Benchmarks
A Lesson for Grades 3–5
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Overview of Lesson

In this lesson students will learn to understand a fraction as a number on the number line and represent fractions on a number line diagram. Students will use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.

Common Core State Standards for Mathematics

Grade 3

Number and Operations—3.NF

Understand a fraction as a number on the number line; represent fractions on a number line diagram.

Grade 5

Number and Operations—Fractions 5.NF

Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.

Materials

- Fraction Number Lines handout —1 per student

Vocabulary

estimate, benchmark, distance

Important Note

The number line is a representation that is based on distance from 0. When students are looking at fractions on the number line, it is important that they understand that the value of any number (fractions included) is determined by its distance from 0.
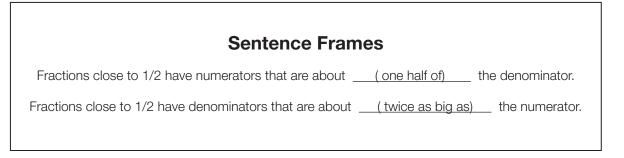
Introduction

1. Pass out the Fraction Number Lines handout, and ask students to look closely and make observations about what they see.

Fractions Close to 1/2

2. Guide students to make observations about fractions that are close to 1/2 by noticing the relationship between the numerators and denominators. (It may be helpful to have students draw a vertical line down the page to make 1/2 more obvious to them.)

3. Provide sentence frames to help students articulate their observations.

Sentence Frames

Fractions close to 1/2 have numerators that are about <u>(one half of)</u> the denominator.

Fractions close to 1/2 have denominators that are about <u>(twice as big as)</u> the numerator.

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4. Have a Ask students to identify all the fractions on the number lines that are close to 1/2 .

5. Ask students what they know about the sum of 1/2 + 1/2 . Ask students to estimate the sum of any two fractions that are close to 1/2. Help students see that the sum of any two fractions that are close to 1/2 is close to 1.

Exploration

1. Have students write equations using two fractions from the table below. The two fractions should be chosen so that their sum is close to 1. Students should also explain how they know the sum of their two fractions is close to 1. For example, 4/9 + 5/8 is close to 1 because both 4/9 and 5/8 are very close to 1/2, and 1/2 + 1/2 = 1.

1/2	7/8	3/6
11/12	5/9	2/4
15/16	7/16	8/9
4/8	3/8	5/6
5/8	4/9	9/16

Fractions Close to 1

2. Have students make observations about fractions that are close to 1 by noticing the relationship between the numerators and denominators. (It may be helpful to have students draw a vertical line down the page to make 1 more obvious to them.)

3. Provide sentence frames to help students articulate their observations.

Sentence Frames

Fractions close to 1 have   __(large)__   numerators and   __(large)__   denominators.

Fractions close to 1 have numerators and denominators that are   __(close together)__ .

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4. Have students write equations using two fractions from the table. The two fractions should be chosen so that their sum is close to 2. For example, 5/6 + 7/8 is close to 2 because both 5/6 and 7/8 are close to 1, and 1 + 1 = 2.

Fractions Close to 0

5. Guide students to make observations about fractions that are close to 1/2 by noticing the relationship between the numerators and denominators. (It may be helpful to have students draw a vertical line down the page to make 1/2 more obvious to them.)

6. Provide sentence frames to help students articulate their observations.

Summary

1. Ask individual students to report their observations about fractions close to 1/2 and fractions close to 1.

2. Provide sentence frames to help students articulate their observations.

3. If time allows, provide some "Guess My Fraction" problems for students. For example, say, "My fraction is close to 1/2. Its denominator is 5. What's my fraction?" (This question may have more than one correct response, such as "5/12" or "5/9.") Or say, "My fraction is close to 1. Its numerator is 11. What's my fraction?" Make sure to ask students to explain how they used the clues to determine the fraction.

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Fraction Number Lines

0   1
←——→

$\frac{0}{2}$ $\frac{1}{2}$ $\frac{2}{2}$
←——→

$\frac{0}{3}$ $\frac{1}{3}$ $\frac{2}{3}$ $\frac{3}{3}$
←——→

$\frac{0}{4}$ $\frac{1}{4}$ $\frac{2}{4}$ $\frac{3}{4}$ $\frac{4}{4}$
←——→

$\frac{0}{6}$ $\frac{1}{6}$ $\frac{2}{6}$ $\frac{3}{6}$ $\frac{4}{6}$ $\frac{5}{6}$ $\frac{6}{6}$
←——→

$\frac{0}{8}$ $\frac{1}{8}$ $\frac{2}{8}$ $\frac{3}{8}$ $\frac{4}{8}$ $\frac{5}{8}$ $\frac{6}{8}$ $\frac{7}{8}$ $\frac{8}{8}$
←——→

$\frac{0}{12}$ $\frac{1}{12}$ $\frac{2}{12}$ $\frac{3}{12}$ $\frac{4}{12}$ $\frac{5}{12}$ $\frac{6}{12}$ $\frac{7}{12}$ $\frac{8}{12}$ $\frac{9}{12}$ $\frac{10}{12}$ $\frac{11}{12}$ $\frac{12}{12}$
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