Adding Fractions on Number Lines

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Fifth Grade   *Math*

Getting ready to add fractions? This lesson reviews how to add fractions with unlike denominators using number lines. Students will focus on understanding the process and reasoning behind each step.

Learning Objectives

Students will be able to add fractions with unlike denominators using a number line.

Materials and preparation

- Class set of Fraction Word Problems: Adding with Unlike Denominators worksheet
- Class set of Adding Fractions With Unlike Denominators worksheet
- Class set of whiteboard and markers
- Two class sets of copy paper
- Adding Fractions with the Same Denominator exercise (optional)
- Class set of Add Fractions on a Number Line #1 worksheet (optional)
- Adding Fractions with Unlike Denominators exercise (optional)
- Class set of Running with Word Problems: Practicing Adding Mixed Number Fractions worksheet (optional)

Key terms

- denominator
- numerator
- multiple
- least common multiple

Attachments

- Adding with Unlike Denominators Word Problem (PDF)
- Adding Fractions With Unlike Denominators (PDF)
- Add Fractions on a Number Line (PDF)
- Running with Word Problems: Practicing Adding Mixed Number Fractions (PDF)

Introduction *(5 minutes)*

- Provide a scenario for the students that involves **4/5 + 1/5**. For example, say, "There are two pies. Four-fifths of the pie left over is apple and one-fifth of the pie left over is pumpkin. How much pie is left over?" Ask students to solve for the problem on their whiteboards using whatever method they choose.
- Have students share their answers with their elbow partner. Gather their background knowledge by asking them questions about the numerator, denominator, and how they got their answer, and have them show whatever drawings they created.
- Ask for a volunteer to come to the board and solve the problem using a number line.
- Tell students that today they'll build on their understanding of adding fractions with like denominators to add fractions with unlike denominators.

EL

Beginning

- Allow students to use their home language (L1) or new language (L2) in their discussions.
- Read the scenario for them and have them draw visuals to represent the fractions listed in word problem.
- Have them copy the student markings on their whiteboard and speak to a sympathetic partner about what the markings represent.

Intermediate

- Write the academic language they can use throughout the lesson on the board as you introduce the language. For example, the words "fraction," "number lines," "numerator," and "denominator."
- Have them explain in partnerships how they solved the problem using academic language and transition words (e.g., "First, I ____").

Explicit Instruction/Teacher modeling *(10 minutes)*

- Remind students that the **denominator** is the bottom number of a fraction and represents the total number of pieces of the whole, while the **numerator** is the top number and represents some of the parts of the whole (e.g., two-fifths represents 2 pieces of the total 5 pieces).
- Write **2/7 + 3/14** on the board. Say, "The students have collected 2/7 of the total amount of money they need to go to the field trip. An anonymous donor gives them 3/14 of the total they need. How much money do they have so far for their field trip?"
- Explain that the denominator is different so they cannot add the numerators 2 and 3 together. Tip: draw a number line of 2/7 and 3/14 to show that the total parts, or whole (i.e., denominator), is different. If they added 3/14 to 2/7 it would add too much.
- Think aloud finding multiples for the denominators 7 (e.g., 7, 14, 21, 28, etc.) and 14 (e.g., 14, 28, 42, 56, etc.) and write them on the board. Explain to students that a **multiple** is the result of multiplying a number by an integer (e.g., **4 x 4 = 12** where 12 is the multiple).
- Consider the list of multiples and then circle the **least common multiple**, or the smallest multiple they have in common (i.e., 14). Then, think aloud how to change the 7 in the denominator to 14 (i.e., multiplying 7 by 2) and multiply by the number 2 on the top and bottom so that you get a new expression of **4/14 + 3/14**.
- Draw the addition problem on a number line and model how to add the fractions together. Always ask if the problem can be simplified. Compare the final answer to what the answer would have been if you added the fractions using unlike denominators.

EL

Beginning

- Give students vocabulary cards and allow them to draw visuals for the new terms. Define the term "denominator," "multiple," and "least common multiple," and provide an everyday example to help them understand the terms. Provide reference materials in their L1 to look up new terms.
- Have them copy the teacher markings on whiteboards or scratch paper. If they work better with manipulatives, have them use fraction bars above their number lines to help them visualize the partitioned number lines.

Intermediate

- Provide vocabulary cards for the key terms and ask students to rephrase the definitions as they go in partners.
- Have ELs restate the meaning of least common multiple and discuss the relationship to multiples themselves.

Guided Practice *(25 minutes)*

- Ask students to turn and talk to their elbow partners about why it's important to change the denominators so that they are the same. Write some of their responses on the board.
- Provide a scenario for the students that involves **3/4 + 1/2**. For example, say, "You are going to make a cupcake recipe and you want to know the total amount of dry ingredients that will be in the bowl. You

have 1/2 cups of sugar and 3/4 cups of flour. How many cups of dry ingredients are in the bowl so far?"
- Ask students to work in partners to draw a visual to represent the equations on their whiteboards. Then, ask them to solve the problem using their whiteboards. Allow them to share their answers with new partners, and adjust their answers as necessary. Finally, choose volunteers to share their own answer with the class and explain their process.
- Have a volunteer explain how to add fractions when they have different denominators. They should understand the following steps:
  1. Check to make sure the denominator is the same.
  2. If the denominators are not the same, find the least common multiple for the denominators.
  3. Multiply the denominators and numerators by the same number that will make the denominator equal to the least common multiple.
  4. Add the fractions using a number line.
- Write the steps on the board for students to reference as they work with their partners to complete the Fraction Word Problems: Adding with Unlike Denominator worksheet. Distribute copy paper to show their work using a number line.
- Choose students to share their answers aloud.

EL

Beginning

- Have students work with sympathetic partners that can understand their L1.
- Encourage them to use the vocabulary cards for assistance in their discussions with their partners and the following sentence frame:
  - "It's important to add like or common denominators because ____."

Intermediate

- Have them restate key information students shared during their explanations.
- Write the steps without their number on four separate index cards and scramble them. Then, ask students to put them back in the correct order and explain the steps.

Independent working time *(13 minutes)*

- Distribute the Adding Fractions With Unlike Denominators worksheet and ask students to complete the problems on their own. Remind them to use the steps written on the board if they get stuck and do not know what to do next. Have them use their copy paper to draw their number lines.
- Allow one student to share a problem and ask the other students to critique the process the presenter used to add the problem. Review the rest of the answers with the class and offer corrections and support as necessary.

EL

Beginning

- Pair students with sympathetic partners that know their L1 so they can use their L1 in their explanations.
- Place students into a small, teacher-led group that encourages students to explain their rationale for each step they take while finding the least common denominator.

Intermediate

- Provide the following sentence stems:
  - "The answer is incorrect/correct because ____."
  - "I like how ____ solved the problem because ____."
  - "One improvement for the answer is ____."

Related books and/or media

- Find interactive books for each child's level.

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Differentiation

Support:

- Ask students to add fractions with like denominators before adding fractions with unlike denominators. Use the Add Fractions on a Number Line #1 worksheet or the Adding Fractions with the Same Denominator exercise as support.
- Have students multiply the denominators by each other and then do the same to the numerators instead of finding the least common multiple. For example, with **2/3 + 1/4**, you can multiply the numerator and denominator in two-thirds by the number 4 and multiply the numerator and denominator in one-fourth by the number 3 to get a new equation of **8/12 + 3/12**.
- Allow them work in a small, teacher-led group with manipulatives as they create their common multiples and add the fractions. Have them use manipulatives to represent the fractions they're adding.
- Provide sentence frames and a key words list for the student explanations throughout the lesson.

Enrichment:

- Pair students with struggling learners and ask them to explain their process to them.
- Have them create fraction word problems and switch with another student. Then, have them solve each other's word problems.
- Use the Adding Fractions with Unlike Denominators exercise for additional practice with adding fractions.
- Challenge students who are ready to work with mixed numbers to complete the worksheet Running with Word Problems: Practicing Adding Mixed Number Fractions instead of the worksheet Adding Fractions With Unlike Denominators. Pair off students that completed the same activity. Allow students who worked with the mixed numbers to present one problem where they model how they added on the number line.

Assessment *(5 minutes)*

- Write the following word problem on the board and ask students to solve it on their copy paper: "Margot has 1/2 of her bookshelf empty. She wants to fill an additional 1/3 of the bookshelf. How much of the bookshelf is full?"
- Assess students on their ability to create fractions with the same denominator and then add the total. If students struggle to create an expression, create the expression for them after drawing a picture to represent the problem. Then, have them solve the equation using their number line to show their answer.

EL

Beginning

- Read the word problem to the students and have them draw a visual to represent the fraction. Write out the problem for them and have them solve it using their drawings.

Intermediate

- Allow students to share their answers in partners before sharing them with the class.
- Provide a sentence frame for when they share their equivalent fraction: "My equivalent fractions are ____."

Review and closing *(2 minutes)*

- Ask students to explain why it's important to only add fractions that have the same denominators.
- Explain that understanding how to add simple fractions correctly will help them when they have to add mixed fractions.

EL

Beginning

- Allow students to share their explanations with their partners before sharing with the whole class. Allow

them to use drawings and their vocabulary terms in their descriptions.

Intermediate

- Provide sentence frames for students' explanations:
  - "It's important to have common denominators when adding fractions because ___."
  - "You need to make sure to have the same denominators because ___."

Fraction Word Problems:
➕ *Adding* with *Unlike Denominators*

When you add fractions with unlike denominators, first you need to make the denominators equal.

Example: $\dfrac{1}{3}$ + $\dfrac{1}{2}$ ← *numerator*

← *denominator*

1. **Multiply each fraction by the other fraction's denominator.**

- **Multiply both the numerator and the denominator of $\dfrac{1}{3}$ by 2.** $\dfrac{1}{3}$ x $\dfrac{2}{2}$ = $\dfrac{2}{6}$ ← *denominator*

  Notice that now the denominator is equal to 6.

  (Remember: any number over itself is equal to 1! Since we multiplied by the equivalent of 1, $\dfrac{1}{3}$ is equal to $\dfrac{2}{6}$.)

- **Multiply both the numerator and the denominator of $\dfrac{1}{2}$ by 3.** $\dfrac{1}{2}$ x $\dfrac{3}{3}$ = $\dfrac{3}{6}$ ← *denominator*

  Notice that now the denominator is equal to 6.

2. **Now you have $\dfrac{2}{6}$ and $\dfrac{3}{6}$. Add them together.** $\dfrac{2}{6}$ + $\dfrac{3}{6}$ = $\dfrac{5}{6}$

Solve the word problems by adding fractions.

Mr. Snail walked $\dfrac{1}{6}$ mile in the morning and $\dfrac{2}{7}$ mile in the evening. How many miles did he walk in total?

1. **Multiply each fraction by the other fraction's denominator.**

Multiply $\dfrac{1}{6}$ by $\dfrac{7}{7}$. $\dfrac{1}{6}$ x $\dfrac{7}{7}$ = $\boxed{}$ Multiply $\dfrac{2}{7}$ by $\dfrac{6}{6}$. $\dfrac{2}{7}$ x $\dfrac{6}{6}$ = $\boxed{}$

2. **Now you get** $\boxed{}$ **and** $\boxed{}$ 3. **Add them together.** $\boxed{}$ + $\boxed{}$ = $\boxed{}$

Read the question below and use another piece of paper to find the answer. Show your work.

Mr. Snail weighs $\dfrac{2}{5}$ pound and Ms. Butterfly weighs $\dfrac{3}{8}$ pound. How much do they weigh together?

Name _____ Date _____

Adding Fractions With Unlike Denominators

You can add fractions with unlike denominators. Start by making equivalent fractions using the least common denominator, and then add the fractions. Let's try it! Solve $\frac{2}{3} + \frac{1}{4}$.

First, find the least common denominator. The least common denominator (LCD) is the smallest common multiple of both denominators. For this problem, the LCD is 12. Now, multiply to make equivalent fractions with a denominator of 12.

$$\frac{2 \times 4}{3 \times 4} = \frac{8}{12} \qquad \frac{1 \times 3}{4 \times 3} = \frac{3}{12}$$

Next, add the fractions. Add the numerators and keep the denominator the same. Make sure your answer is in simplest form.

$$\frac{8}{12} + \frac{3}{12} = \frac{11}{12}$$

Try it yourself! Add. Show your work and write your final answer in simplest form.

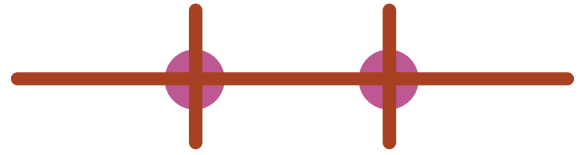|	
$\frac{1}{5} + \frac{1}{2} =$	$\frac{3}{8} + \frac{1}{4} =$
$\frac{1}{6} + \frac{2}{3} =$	$\frac{5}{12} + \frac{1}{3} =$
$\frac{3}{4} + \frac{1}{7} =$	$\frac{2}{3} + \frac{1}{5} =$
$\frac{5}{8} + \frac{1}{6} =$	$\frac{3}{4} + \frac{2}{9} =$

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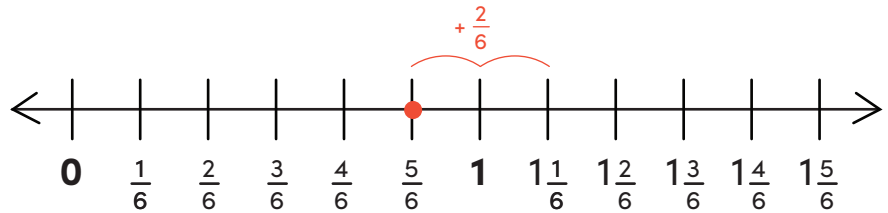
Name: _____

Date: _____

Add Fractions on a Number Line #1
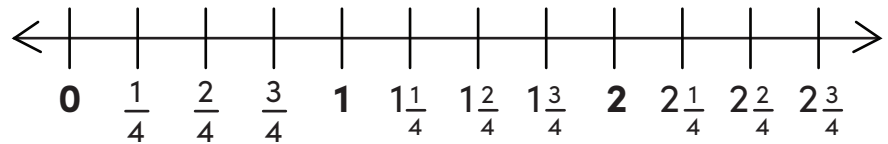
Directions: Use each number line to add the fractions.

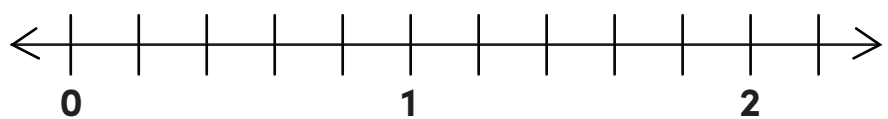Remember to fill in the missing numbers on the blank number lines!

Example: $\dfrac{5}{6} + \dfrac{2}{6} = 1\dfrac{1}{6}$

$+\dfrac{2}{6}$

$0 \quad \dfrac{1}{6} \quad \dfrac{2}{6} \quad \dfrac{3}{6} \quad \dfrac{4}{6} \quad \dfrac{5}{6} \quad 1 \quad 1\dfrac{1}{6} \quad 1\dfrac{2}{6} \quad 1\dfrac{3}{6} \quad 1\dfrac{4}{6} \quad 1\dfrac{5}{6}$

a. $\dfrac{1}{4} + \dfrac{5}{4} =$ [ ]

$0 \quad \dfrac{1}{4} \quad \dfrac{2}{4} \quad \dfrac{3}{4} \quad 1 \quad 1\dfrac{1}{4} \quad 1\dfrac{2}{4} \quad 1\dfrac{3}{4} \quad 2 \quad 2\dfrac{1}{4} \quad 2\dfrac{2}{4} \quad 2\dfrac{3}{4}$

b. $\dfrac{3}{5} + \dfrac{2}{5} =$ [ ]

$0 \qquad\qquad 1 \qquad\qquad 2$

c. $\dfrac{5}{8} + \dfrac{1}{8} =$ [ ]

d. $\dfrac{2}{3} + \dfrac{4}{3} =$ [ ]

e. $1\dfrac{1}{2} + \dfrac{1}{2} =$ [ ]
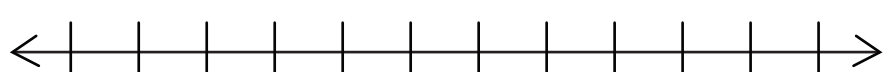
**Challenge!**

f. $\dfrac{5}{6} + \dfrac{2}{3} =$ [ ]

Running with Word Problems:
Practicing Adding Mixed Number Fractions

Name: _____   Date: _____

Read and solve the following word problems below. Show your calculations for each exercise.

1. In an upcoming cross-country relay race, Milo planned to run 2 and 1/8 miles and Portia planned to run 4 and 3/5 miles. How many combined miles did Milo and Portia plan to run?

2. In the second race of the meet, Hazel planned to run 5 and 2/7 miles and Eli planned to run 1 and 1/8 miles. How many miles did Hazel and Eli plan to run all together?

3. Zoe's relay team has sprint drills for 2/8 of an hour, while Demarius' junior varsity squad has a conditioning run planned for 1 and 6/8 hours. How many hours, combined, will Demarius' and Zoe's groups be training?
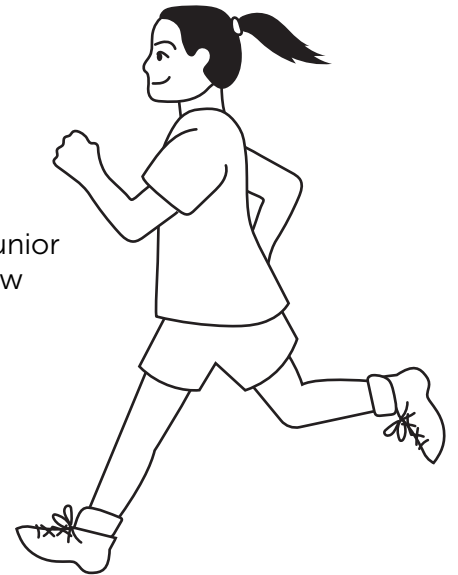
Running Further

Directions: *Answer the following questions using pictures, words and symbols.*

A. What do problems #1 and #2 have in common?

B. How are problems #1 and #2 different than #3?

C. What clues do sums give us about addends?

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