Enough Room: Adding and Subtracting Fractions

Strand: Computation and Estimation

Topic: Solving problems involving addition and subtraction with fractions and mixed numbers.

Primary SOL: 5.6 The student will
a) solve single-step and multistep practical problems involving addition and subtraction with fractions and mixed numbers.

Related SOL: 5.2ab

Materials

- One-inch grid paper
- Colored tiles
- 12 by 12 Grids (attached)
- Enough Room? activity sheet (attached)

Vocabulary

area, common denominator, improper fraction, like denominator, mixed number, proper fraction, simplest form, unlike denominator

Student/Teacher Actions: What should students be doing? What should teachers be doing?

1. Write the following problem on the board: Haley is going to help her uncles paint one of the large activity rooms in the local community center. Someone donated $1\frac{2}{3}$ gallons of paint, and someone else donated $2\frac{3}{4}$ gallons of the same color paint. How much paint will they have to start painting? If it takes $3\frac{3}{4}$ gallons to paint the activity room, how much paint will be left?
    a) Ask for a volunteer to read the problem. Ask for another volunteer to explain the story in the problem.
    b) As students work on the problem, circulate around the room, taking note of which students need assistance. Also, make note of which students' work you want to use for the class discussion. You may decide to model working the problem yourself and ask students to explain what you are doing.
    c) During the discussion, bring out the following ideas: What operations did you use and why? Why do we need to find common denominators in order to add and subtract?

d) Write the following on the board:

$$1\frac{2}{3}$$
$$+\ 2\frac{3}{4}$$
$$\underline{\qquad\qquad}$$

Ask, "How can we add $1\frac{2}{3}$ and $2\frac{3}{4}$?" Students may recall learning to fractions with unlike denominators in Grade 4. Students will need to focus on adding the fractions first, then the whole numbers.

e) Starting with the fractions in the problem, ask students to recall each step in adding fractions with unlike denominators:

1) Find the least common denominator (LCD) for $\frac{2}{3}$ and $\frac{3}{4}$. One way to do this is to list multiples of each denominator to find the least common multiple.
   a. Multiples of 3: 3, 6, 9, **12**, 15…..
   b. Multiples of 4: 4, 8, **12**, 16….

   The LCD of 3 and 4 is 12.

2) Rewrite equivalent fractions for $\frac{2}{3}$ and $\frac{3}{4}$ with the denominator of 12. Ask, *"How many twelfths are equivalent to $\frac{2}{3}$? To $\frac{3}{4}$?"*

f) Review the process of finding equivalent fractions. Record the following on the board as students record these notes in their mathematics journals. It may be helpful to use colors to emphasize the multiplication steps. Once the mixed numbers are rewritten with the LCD, add the fractions.

$$1\frac{\mathbf{2x4}}{\mathbf{3x4}} = 1\frac{8}{12}$$
$$+\ 2\frac{\mathbf{3x3}}{\mathbf{4x3}} = 2\frac{9}{12}$$
$$\underline{\qquad\qquad\qquad\qquad}$$
$$3\frac{17}{12}$$

Discuss the improper fraction $\frac{17}{12}$. Ask, *"Is this more or less than one whole gallon? Why or why not? How much paint is there in all?"* Discuss converting improper fractions to mixed numbers. Emphasize $\frac{17}{12}$ is an improper fraction and the equivalent mixed number is $1\frac{5}{12}$.

g) Write a number sentence to answer the first question in the problem:

$3\frac{17}{12} = 3 + 1\frac{5}{12} = 4\frac{5}{12}$

Haley's uncles started with $4\frac{5}{12}$ gallons of paint.

h) Remind students that there was a second question: How much paint will be left over if it takes $3\frac{3}{4}$ gallon to paint the room? Ask students to estimate first and share some of their estimates. Clarify the operation they will need if they want to find an exact answer. Then have students work independently on the problem using their notes and consulting with an elbow partner. Circulate around the room and identify students you want to show their work on the board. Also note who is having trouble at various steps of the problem, particularly who can transfer their knowledge of regrouping with whole numbers to regrouping with mixed numbers. When students have finished, invite several students to show their work and use that to facilitate a discussion about the process for solving the problem and how to record the work.

Solution:

- Rewrite the fractions with the LCD. In this problem, the LCD is 12.

$$4\frac{5}{12} = 4\frac{5}{12}$$

$$-3\frac{3x3}{4x3} = -3\frac{9}{12}$$

- We cannot subtract $\frac{9}{12}$ from $\frac{5}{12}$, so $4\frac{5}{12}$ will need to be regrouped. The whole number 4 can be renamed $3\frac{12}{12}$. (Ask students if they can explain why.) Adding $3\frac{12}{12}$ and $\frac{5}{12}$ equals $3\frac{17}{12}$. Solution:

$$4\frac{5}{12} = \quad 4\frac{5}{12} = 3\frac{12}{12} + \frac{5}{12} = 3\frac{17}{12}$$

$$-3\frac{3x3}{4x3} = -3\frac{9}{12} = -3\frac{9}{12} \quad = -3\frac{9}{12}$$

$$\frac{8}{12}$$

Remind students to check that fractions are in simplified form. Both 8 and 12 have 4 as a factor, so these numbers can be divided by 4.

$\frac{8\div\mathbf{4}}{12\div\mathbf{4}} = \frac{2}{3}$ Thus, there will be $\frac{2}{3}$ of a gallon of paint left over.

2. Distribute grid paper and colored tiles. Have students use the tiles to create all possible rectangles with an area of 12, and record each rectangle on grid paper. They should draw rectangles that are 1 by 12, 2 by 6, and 3 by 4. Discuss why a 2-by-6 rectangle and 6-by-2 rectangle both have the same area.

3. Have students use colored tiles to show several different fractional parts by coloring the rectangles on the grid paper. Color $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$, and $\frac{1}{12}$ in each of the rectangles using different colors for each. Next ask them to outline rectangles on their grid paper and label $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{6}$, $\frac{5}{8}$, $2\frac{1}{2}$, $3\frac{3}{5}$.
4. Have students share some of their fractional parts and discuss, as a class, how the drawing for $\frac{2}{3}$ and $\frac{4}{6}$ are similar and different. How are the drawings for the mixed numbers $2\frac{1}{2}$, $3\frac{3}{5}$ similar and different from the proper fractions?
5. Distribute the Enough Room? Recording sheet (attached), and have students complete the activity, working individually or in pairs. When students complete the task, form groups of two or three students, and have students share their rooms.

Assessment

- **Questions**
  - What are some other situations in which you need to add and subtract fractions?
  - How can you recognize that a fraction is equal to more than one?
  - What are some examples of fractions that are equal to more than one, and what are different ways of expressing them?
  - How can the answer to $2\frac{5}{8}$ plus $3\frac{4}{7}$ be at least 6?
- **Journal/writing prompts**
  - Explain what must be true about the denominators of two fractions in order for you to add or subtract them. Why?
  - Write a story problem about someone in a situation where they need to add or subtract fractions.
  - After the pizza party there was $\frac{1}{2}$ of a small pepperoni pizza and $\frac{1}{3}$ of a large cheese pizza left over. Maria said there was $\frac{5}{6}$ of a pizza left over. Shawn disagreed with Maria. Who is correct and why?
- **Other Assessments**
  - Scott and Megan ordered two pizzas. They were each cut into 10 equal pieces. Megan ate $\frac{3}{5}$ of one of the pizzas, and Scott ate $\frac{7}{10}$ of the other pizza. Draw a picture to find out how much pizza is left after they finished eating and then record your work with numbers and number sentences.
  - Angie has $2\frac{2}{3}$ cups of glitter. She used $\frac{5}{6}$ of a cup of glitter on a picture. She gave $1\frac{1}{3}$ cups of glitter to her friend. How much glitter does Angela have left?

Extensions and Connections

- John and Sharon added another room, the same size as room A in the Enough Room? activity, as a playroom for their children. What furniture and toys would fit in the room and what are their fractional parts?
- Tell students that you want to make a border for a bulletin board in the classroom using ribbon. Have each student bring in a piece of ribbon, and have some extra ribbon strips for students who do not have the materials at home. Have students use a meter as the unit for measuring. For example, the length of ribbon might be $\frac{1}{2}$ meter or $\frac{7}{10}$ meter. Have students measure the bulletin board and figure out by adding the pieces of ribbon to see whether they have enough to complete the border. If they have enough to go around once, have them add to determine whether they have enough ribbon to go around the border more than once and/or how much ribbon is left over.

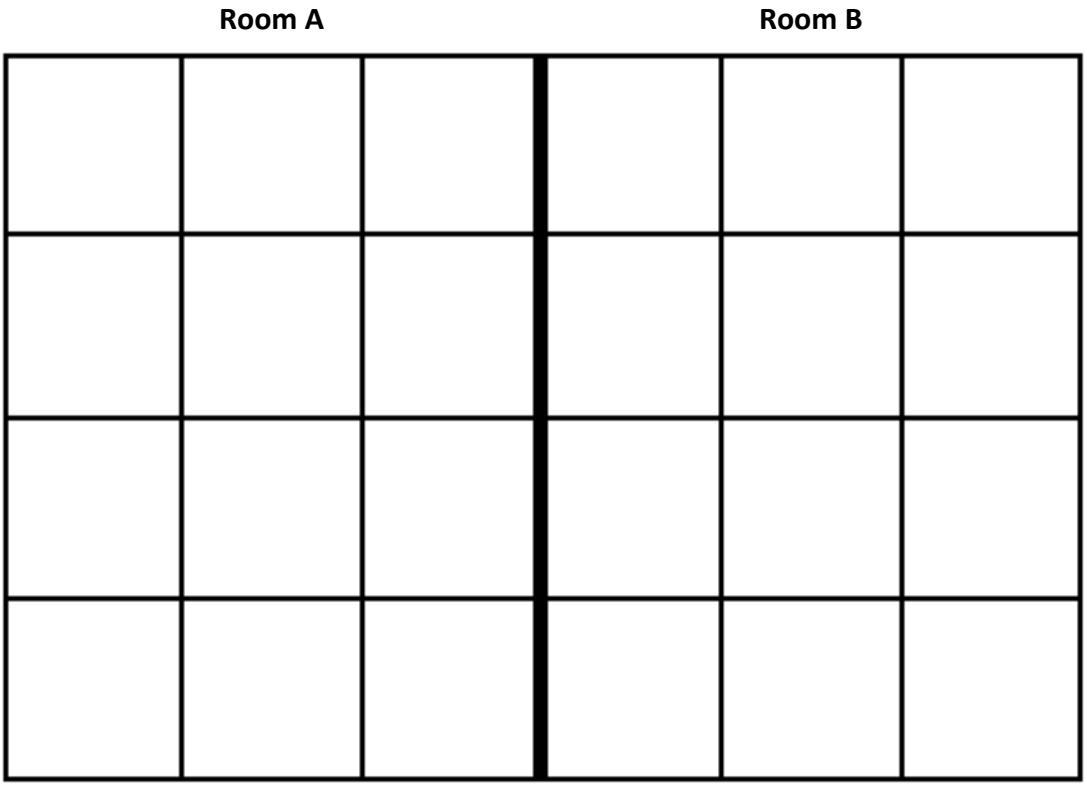
Strategies for Differentiation

- Make a simpler problem by using one room with 12 squares and 10-by 12-grid paper (attached).
- Make a larger problem by using one room with 36 squares.
- Determine whether the furniture be arranged in more than one way and show your work.

Note: The following pages are intended for classroom use for students as a visual aid to learning.

Enough Room?

Name _____ **Date** _____



John and Sharon are moving into a new home, but the upstairs bedrooms were too small. Each of the rooms has only 12 square units, as represented in the picture above. They decided to take out the wall between the two rooms. Before moving in, they want to determine how to arrange the furniture in the room and how much floor space they will need. They also want a representation of the floor plan so they can use it on the move-in day.

The bed that they brought takes up $\frac{2}{4}$ of room A. The nightstand is equal to $\frac{1}{12}$ of room A. A mirrored dresser takes $\frac{1}{4}$ of room B. Another dresser is equal to $\frac{2}{12}$ of room B. They also bought a rug that will takes up $1\frac{1}{2}$ of the floor space. Furniture can be placed on top of the rug.

1. Outline the placement of the rug and furniture and then label the furniture and rug in the grid above.

2. How much of both rooms will be taken up with furniture and rug when they move in? Show your calculations using numbers and number sentences.

3. Sharon wants to have a closet with sliding doors built into room B. It will take up $\frac{1}{6}$ of room B. How much room will be left after that? Show your calculations with numbers and number sentences.

4. The couple inherited another piece of furniture; what size does it have to be to fit? (Remember to leave room to walk.)

10-by-12 Grids