Nasco Education

LESSON PLAN

Math

Developed with Kristin Hotter

Adding and subtracting fractions

(including mixed numbers) using fraction squares

Volume 20 | Gr. 3-6

Time: 45 mins.

Content

Prior to this lesson, students should have a firm grasp of adding and subtracting fractions with like denominators. This lesson uses fraction squares to give a concrete visual representation of what happens when two fractions are added or subtracted. This lesson will also dive into what addition and subtraction with mixed numbers looks like.

Objectives

Students will...

- Solve addition and subtraction problems containing fractions with unlike denominators
- Analyze a variety of problems to determine what the sums and differences of those problems are
- Apply their prior knowledge of adding and subtracting fractions with like denominators

Materials

- Nasco's Fraction Squares Individual Set (**TB16620**) or Group Set (**TB16623**)
- Worksheet and answer key (attached with lesson plan download)

Common core state standards

CCSS.Math.Content.4.NF.B.3.A — Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.

CCSS.Math.Content.5.NF.A.1 — Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.
For example, $2/3 + 5/4 = 8/12 + 5/12 = 23/12$. (In general, $a/b + c/d = (ad + bc)/bd$.)

Introduction

Refresh students' memories by guiding them through a few problems that involve adding and subtracting fractions with like denominators.

1. Start with **¾ + ¾**. Ask what needs to be done with the denominator in this problem. *(Bring it over to be the denominator in the answer because the denominator remains the same.)* What about the numerators? *(Add them together to get 6.)* Since the answer, 6/4, is an improper fraction, students should know that they need to convert the answer into a mixed numeral *(1½)*. Now ask students if they can reduce the answer any further *(yes, to 1½)*.
2. Try another addition problem: **⅛ + ⅝**. Students should be able to come up with ⅞ for an answer. Once they have done so, they should be able to see that it doesn't need to be converted into a mixed numeral but that it can be reduced down to ¾.
3. Move on to a subtraction problem: **7/12 – 5/12**. As with addition, students should know that since the denominators are the same, their answer will also have 12 as the denominator. They can now subtract the numerators to give them the answer of 2/12, which can be reduced to ⅙.
4. Try one more subtraction problem, this one with a mixed numeral: **1⅝ – ⅞**. Students should start by changing 1⅝ into an improper fraction, 13/8. They can now see that 13/8 – ⅞ will give them 6/8, which can be reduced to ¾.

Activity 1

Addition

1. Hand out fraction squares to each student, then write **⅔ + ⅙** on the board. Students should notice right away that the denominators in this problem are different. Tell them that they will use the fraction squares to help them solve it.

2/3 + 1/6

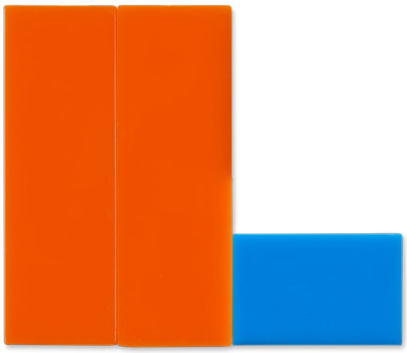

Figure 1

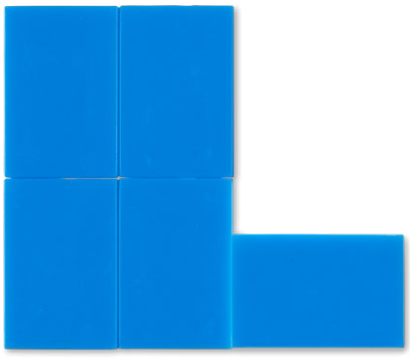

Figure 2

2. Students should use two orange fraction squares placed vertically to represent ⅔. They will use one light blue piece to represent ⅙. Tell students that they will be using the pieces to create a model that looks as much like a square as possible, so the ⅙ piece should be placed horizontally **(see Figure 1)**. NOTE: It is important to make the model created with the fraction pieces in a consistent manner. It works best to try and make as complete of a whole fraction square (one red square) as possible when lining up the fraction square pieces.
3. Tell students that when they are solving addition and subtraction problems containing fractions with unlike denominators, they need to find a common denominator for the two fractions. They can find the common denominator by finding the least common multiple (LCM) of the two denominators. In this case, the least common denominator of 3 and 6 is 6, meaning that the denominator in the answer will also be 6. Because of this, they will be working with the sixths fraction squares, or the light blue squares.
4. Since students already have one light blue piece in their model, they should determine how many more sixths pieces they will need to cover the ⅔ part of the model *(4)*, giving them ⅚ **(see Figure 2)**. This is the answer to the problem, and students should see that it can't be reduced.
5. Write **¾ + ⅚** on the board and have students make representations of the fractions with their fraction squares. Remind them to make models that look as close to a square as possible. They should use three yellow pieces placed vertically for ¾ and five light blue pieces placed horizontally for ⅚ **(see Figure 3)**.

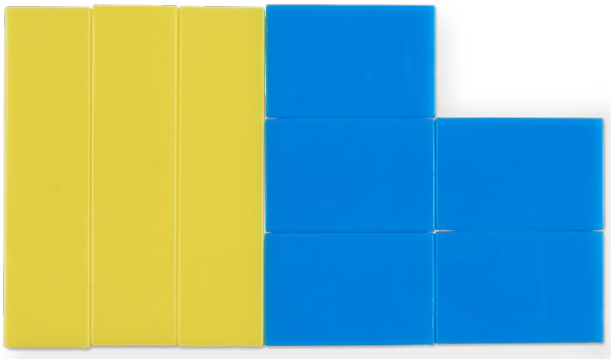

Figure 3

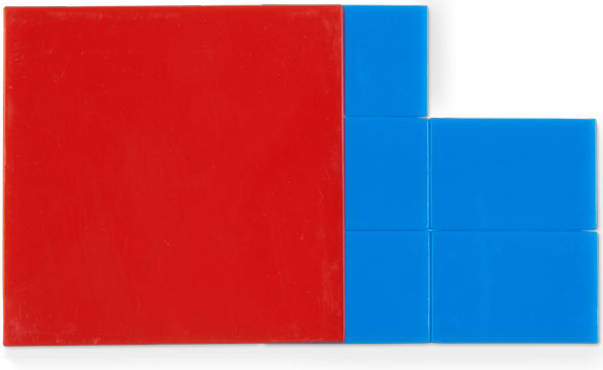

Figure 4

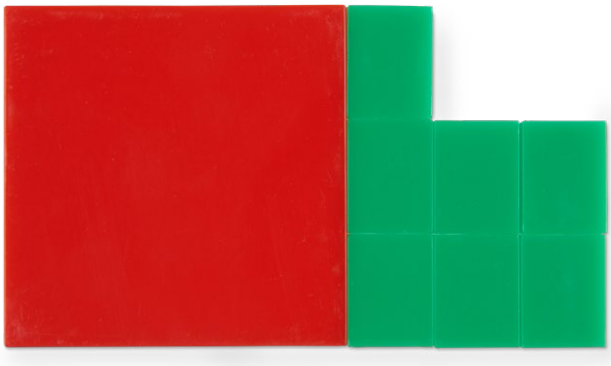

Figure 5

6. Next, students need to determine the LCM of the two denominators *(12)*, which can be represented by the light green twelfths pieces. Have students use their pieces to see how many pieces it takes to cover their model. They will quickly discover that they do not have enough to cover the model, so they need to use a piece that is equivalent to 12/12, which is the red square, which represents one whole **(see Figure 4)**.
7. Have students finish covering the model with light green pieces. Ask students how many twelfths pieces they need to cover the remaining portion of the model (7/12). The answer becomes 1 7/12, which is in lowest terms **(see Figure 5)**.

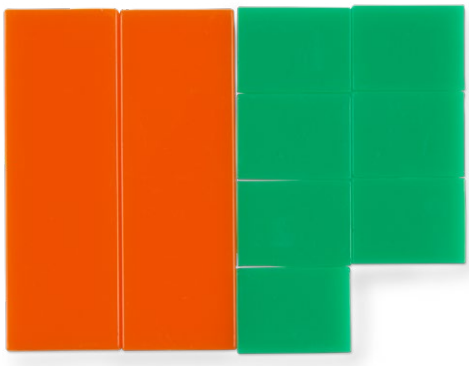

Figure 6

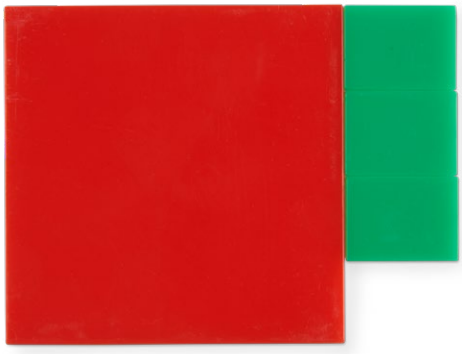

Figure 7

Check for understanding 1

Put the following problem on the board for students to solve independently using their fraction squares: **2/3 + 7/12**. Remind students that as they make their model, their goal is to make the pieces look as much like a square as possible. Have them create the model **(see Figure 6)**, then ask what they need to do next *(determine the LCM)*. Have them determine the LCM of 3 and 12 and see how many fraction pieces that correspond to the LCM it takes to cover their model. The LCM is 12, so they should have decided to use a red square to represent 12/12, as they don't have enough twelfths pieces otherwise. The final answer is 1 3/12 **(see Figure 7)**.

Activity 2

Subtraction

1. Begin with **3/4 – 1/6**. As with addition, students will use their fraction squares to represent the two fractions, but instead of placing them side by side, they will place the lesser fraction on top of the greater fraction, as they are trying to determine how much greater one fraction is than another. Therefore, students should use three yellow pieces to make 3/4, then place one light blue piece on top of the yellow pieces **(see Figure 8)**. Tell students that when they place one fraction model on top of the other, the model should be placed either vertically or horizontally, and the direction that it is placed is determined by seeing which way it lines up better with the first fraction. In this case, the 1/6 model lines up better with the 3/4 model when placed horizontally because the end of the 1/6 fraction piece lines up perfectly with the line between 2/4 and 3/4.
2. Proceed just as in addition by determining the LCM of the denominators, 6 and 4 *(12)*. Students can then use the light green twelfths pieces to cover the rest of the model **(see Figure 9)**. They should use seven pieces, giving them an answer of 7/12. Ask students to tell you what the major difference is between adding and subtracting fractions with unlike denominators *(With addition, the two types of fraction squares were placed side by side to make the model, whereas in subtraction, the second fraction is placed on top of the first fraction to make the model.)*

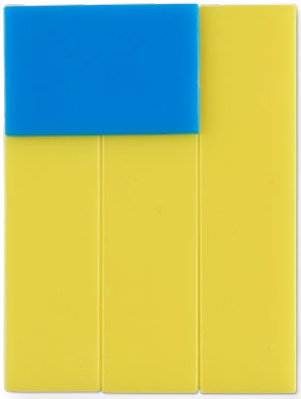

Figure 8

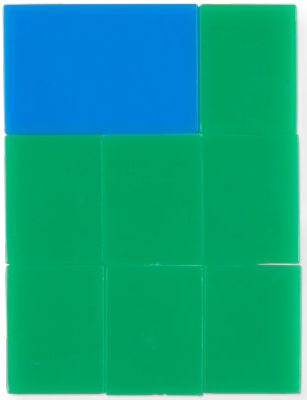

Figure 9

Figure 10

Figure 11

3. Work another problem together that involves a mixed numeral: **1⅗ – ⅘**. To create a model for 1⅗, students should use one red piece and three purple pieces. They should then use four dark green pieces to create ⅘ and place those pieces on top of the 1⅗ model **(see Figure 10)**.
4. Ask students to tell you the next step in the process *(determine the LCM of the two denominators)*. Since 10 is the LCM, they now need to determine how many tenths they will need *(cover the rest of the model that isn't already covered with the dark green fifths pieces)*. This requires five purple tenths pieces, making the answer to the problem ⅝ **(see Figure 11)**. Students should know that it needs to be reduced down to ½ for the final answer.

Check for understanding 2

Write **½ – ³⁄₁₀** on the board, then give students time to set up their model **(see Figure 12)**. Ask students which fraction goes on the bottom of the model and how they made it *(½ on the bottom, made with one pink piece)*. Now ask the same for ³⁄₁₀ (*three purple pieces placed on top of the pink piece*). Have them determine the LCM of 2 and 10 *(10)*. Have them finish completely covering the ½ model with purple pieces. It takes two more, giving the answer of ⅖ **(see Figure 13)**. Students should know that ²⁄₁₀ can be reduced to ⅕ for the final answer.

Figure 12

Figure 13

Intervention

- You may want to split this lesson into two parts. To allow students to fully grasp one concept at a time, teach the addition section one day and the subtraction lesson at another time.

Extension

- Ask students to create their own problems for a friend to solve.

Adding and subtracting fractions using fraction squares — **worksheet**

Volume 20

Directions: Solve the following problems using your fraction square pieces. Draw a picture for each model that you create.

1. $\frac{2}{5} + \frac{3}{10} =$ _____

2. $\frac{1}{3} + \frac{1}{2} =$ _____

3. $\frac{7}{8} + \frac{1}{2} =$ _____

4. $\frac{7}{12} + \frac{5}{6} =$ _____

5. $\frac{1}{3} + \frac{4}{6} =$ _____

6. $\frac{1}{5} + \frac{9}{10} =$ _____

7. $\frac{5}{8} - \frac{1}{4} =$ _____

8. $\frac{9}{10} - \frac{2}{5} =$ _____

9. $\frac{5}{6} - \frac{1}{2} =$ _____

10. $1\frac{1}{4} - \frac{7}{8} =$ _____

11. $1\frac{1}{12} - \frac{1}{2} =$ _____

12. $1\frac{2}{3} - \frac{5}{6} =$ _____

Adding and subtracting fractions using fraction squares — **answer key**

Volume 20

Directions: Solve the following problems using your fraction square pieces. Draw a picture for each model that you create.

1. $\frac{2}{5} + \frac{3}{10} = \frac{7}{10}$

2. $\frac{1}{3} + \frac{1}{2} = \frac{5}{6}$

3. $\frac{7}{8} + \frac{1}{2} = 1\frac{3}{8}$

4. $\frac{7}{12} + \frac{5}{6} = 1\frac{5}{12}$

5. $\frac{1}{3} + \frac{4}{6} = 1$

6. $\frac{1}{5} + \frac{9}{10} = 1\frac{1}{10}$

7. $\frac{5}{8} - \frac{1}{4} = \frac{3}{8}$

8. $\frac{9}{10} - \frac{2}{5} = \frac{1}{2}$

9. $\frac{5}{6} - \frac{1}{2} = \frac{1}{3}$

10. $1\frac{1}{4} - \frac{7}{8} = \frac{3}{8}$

11. $1\frac{1}{12} - \frac{1}{2} = \frac{7}{12}$

12. $1\frac{2}{3} - \frac{5}{6} = \frac{5}{6}$