

# Improving Teacher Quality Program

*Mathematics Within: Algebraic Processes and Its Connections to Geometry*

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**Broad Topic:** Fractions

**Subtopic:** Adding Fractions with unlike denominators

**Grade Level:** 4th/5th

**Time Frame:** 90 minutes

**Aim:** To explore and understand why denominators need to match before adding (or subtracting) a fraction.

## **Specific Objective:**

Using unmarked fraction circles and marked fraction bars, students will discover a method to add fractions with unlike denominators using equivalent fractions.

## **Materials/supplies:**

- unmarked paper fractions circles, 1 whole to 12/12. \*
- fractions bars, marked with values from 1 whole to 12/12.\*
- Impact Mathematics, Glencoe/McGraw-Hill, 2002, ISBN: 1-57039-850-X †
- Harcourt Math, Harcourt School Publishers, 2002, ISBN: 0-15-320761-2 †

**Vocabulary:** numerator, denominator, like and unlike denominator, equivalent fractions.

**NTCM Standards:** Number and Operations, Problem Solving, Reasoning and Proof, Communication, Connections, and Representation.

**Background:** This lesson assumes extensive prior discovery learning using fraction circles especially as it pertains to the concept of a "whole", i.e., that  $\frac{1}{2}$  being the whole,  $\frac{3}{6}$  will fit into it,  $\frac{2}{4}$  will fit into it and so on.

**Introduction:** Using one or both of the following "puzzles" allow students to work in groups to solve the puzzles.

*Puzzle 1:* Write the following on the board:

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

$$\frac{1}{4} + \frac{2}{4} =$$

>use actual fraction circle pieces for the fraction representations.

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\* manipulatives can be purchased plastic fraction pieces or teacher generated paper fraction pieces. Just be sure that each dominator has its own separate color.

† this lesson does not depend upon this specific curriculum. It can be adapted to your district's mandated math curriculum as it pertains to adding fractions with unlike denominators.

Allow students to use their personal circle fraction pieces to explore both problems. Students will discuss and write their conclusions in their math journals and be prepared to report to the rest of the class what they discovered.

-and/or-

*Puzzle 2:* Say to the students, "By now you are probably pretty good at using fraction pieces to add and subtract fractions with like denominators. But what do you do if you don't have your fractions pieces or if you want to add fractions with denominators other than 2, 3, 4, 6 or 12? Try to find this sum without using fraction pieces or writing anything --  $1/6 + \frac{3}{4}$ ."

Allow students time to work through the problem, ask them to record the following questions in their journals and be prepared to share: "Were you able to calculate the sum in your head? If so, what strategy did you use? If not, why did you find the problem difficult?"<sup>‡</sup>

**Discussion:** Approx time: 15 minutes

Gather the students back into a whole group and address one puzzle at a time. Ask the students to report their findings. Write each point on the board. Talk about all points and work through them to find a general consensus or rule; i.e., you can't add unlike denominators because you can't get an answer that makes sense.

**Body:** Approx time: 30 minutes.

In your prescribed math curriculum, turn to the topic on "Adding Unlike Fractions." Using the marked fraction bars, "prove" the discoveries made in the introduction (at this point, be sure and review/discuss equivalent fractions and the concept of a "whole"). After working through examples using the fraction bars, challenge students to do the adding without using manipulatives.

**Close:** Approx. time 15 minutes.

Review "big" discoveries from the work the students have done (i.e., that in order to add or subtract fractions, the denominators must match or the answer doesn't make sense).

**Assessment/Application:**

- Participation in group discovery work;
- Review of students' journals;
- Participation in whole class discussion/lesson;
- 80% success in individual fraction practice without manipulatives.

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<sup>‡</sup> Taken directly from page 157, Impact Mathematics, Glencoe/McGraw-Hill, 2002

Addition:  $\frac{1}{3} + \frac{1}{2} = ?$  Can you draw a picture using graph paper that shows this?

1. Make a rectangle showing each fraction.
2. How many units do I need to show  $\frac{1}{3}$ ?  $\frac{1}{2}$ ?
3. How could I shade each fraction?



4. How many units make up my new whole? 6

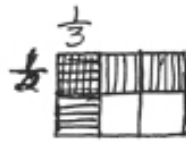
a. how many sixths are there in  $\frac{1}{3}$ ? 2

$$\frac{1}{3} + \frac{1}{2}$$

b. how many sixths are there in  $\frac{1}{2}$ ? 3

$$\rightarrow \frac{2}{6} + \frac{3}{6} = \frac{5}{6}$$

Subtraction:  $\frac{1}{2} - \frac{1}{3}$



How many units make up my new whole? 6

a. how many sixths in  $\frac{1}{2}$ ? 3

$$\frac{1}{2} \rightarrow \frac{3}{6}$$

b. how many sixths in  $\frac{1}{3}$ ? 2

$$\begin{array}{r} \frac{1}{2} \rightarrow \frac{3}{6} \\ - \frac{1}{3} \rightarrow \frac{2}{6} \\ \hline \frac{1}{6} \end{array}$$

So,  $\frac{1}{2} - \frac{1}{3} = \frac{1}{6}$

**Extensions/Enrichment:**

- Fraction area models: How do you think you could use these for addition, subtraction, multiplication, and division?
- Connect equivalent fractions to proportions:  $\frac{1}{2} = \frac{3}{6}$ . In other words, 1 out of 2 is equivalent to 3 out of 6. Do the same with decimals and percentage.
- Harcourt Mighty Math--Fraction Fireworks: Grade 4 & 5 -- students create fireworks in this computer game. The fractions are proportionate to the colors used. For example, they may be asked to add  $\frac{2}{8}$  and  $\frac{1}{2}$  and then launch the sum.

Part 1

1. Choose level L, M, or T.
2. Answer at least 5 questions.
3. Draw pictures to record your work.
4. Write in your math journal about how you came up with your answer.

Make your own fireworks.

Part 2

1. Calculate the following fractions:
  - $\frac{1}{4} + \frac{1}{4}$
  - $\frac{5}{12} + \frac{3}{12}$
  - $\frac{2}{7} + \frac{3}{7}$
  - $\frac{3}{10} + \frac{3}{5}$
  - $\frac{1}{3} + \frac{1}{4}$
  - $\frac{1}{2} + \frac{1}{5}$
2. Select the "Explore" box.
3. Make each sum or difference.
4. Draw pictures to record your work.
5. Write in your math journal about how you came up with your answer.