Rational Number Project

Fraction Operations and Initial Decimal Ideas	Materials
Lesson 4: Overview	• Fraction Circles for students and teacher
Students use fraction circles to construct their own plan for adding two fractions. Students explain their plan and show a way to record the steps of their plan symbolically.	• Student Pages A, B, C, D • Transparency 1

Teaching Actions

Comments

Warm Up

Find a fraction between $\frac{4}{5}$ and 1.   Explain how you know that it is a fraction bigger than $\frac{4}{5}$ and less than 1.

Large Group Introduction

1. Explain that the important part of today's lesson is for them to be able to solve addition problems using fraction circles, to explain what they are doing with fraction circles to add fractions, and to record their actions with the circles using symbols.

2. Present this story problem to the class:

    Raven ate 1 piece of pizza from a personal size pizza cut into 6 equal parts. Later on she ate a 1 more piece from a personal size pizza cut into 4 equal parts. [Assume same-size pizzas]. How much of one personal size pizza did she eat?

3. Before showing this problem with fraction circles, ask students to estimate a reasonable range for this sum: Is the answer $> \frac{1}{2}$ or $< \frac{1}{2}$? >1 or < 1?

4. Suggest that some students might say the sum is $\frac{2}{10}$. Ask why that is unreasonable.

A deep understanding of fraction addition and subtraction involves the following:
   • Student understands the need for a common denominator
   • Student is able to model the operation with fraction circles and explain her actions with the circles
   • Student can connect actions with the circles to symbols, explaining the connections
   • Student can work in a meaningful way with symbols only
   • Student can estimate a reasonable sum or difference

Note: Different students will need different amounts of time to develop a deep understanding for fraction addition/subtraction.

The sum is $< \frac{1}{2}$. $\frac{1}{6} < \frac{1}{4}$ and another $\frac{1}{4}$ is needed for $\frac{1}{2}$.

Address the incorrect strategy of adding numerators and denominators right away. Don't settle for students saying, "It's wrong because you have to find common denominators". Determine it is an

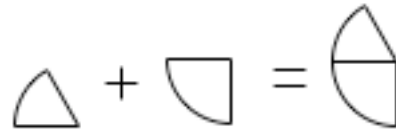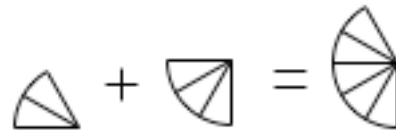| Teaching Actions	Comments
	unreasonable sum by estimation.
5. Model the problem using fraction circles by placing 1 blue piece and 1 pink on the black circle. Ask students to use their fraction circles to set up the problem.	
6. Ask: How can you find the exact amount of the whole circle covered by one pink and one blue piece? State: Right now I see that $\frac{1}{6}$ and $\frac{1}{4}$ together cover part of the circle, but I want to know what this amount is as one fraction.	You are building a need for finding common denominators. To do this, students hopefully will suggest that you exchange pink and blue pieces for equal amounts using the same color.

7. Lead class discussion to these steps for using fraction circles to add fractions:
 	
   • Set up the problem with the fraction circles using the black circle as the unit.
   • Look for a way to show both fractions using the same color pieces.
   • Building on fraction equivalence ideas, show $\frac{1}{6}$ using 12ths (reds) and show $\frac{1}{4}$ using 12ths (reds).
   • Cover the black circle with the amount equivalent to each fraction. From that picture see that $\frac{5}{12}$ of the circle is covered.
	The idea of the same denominator is represented concretely by using the same color pieces to show each fraction in the problem.
	
	$\frac{1}{6}+\frac{1}{4}$
	
	1 pink = 2 reds
	1 blue = 3 reds
	
	2 reds + 3 reds = 5 reds

8. Ask students how to record each step with symbols. Phrase the request as wanting a record of what they did with the fraction circles. Elicit several ways for using symbols.	Some students may keep the problem in horizontal form and write the equivalent fractions underneath them; others may rewrite the problem in vertical form with the equivalent fractions to the right.
9. Repeat for $\frac{1}{3}+\frac{1}{4}$ and $\frac{3}{5}+\frac{1}{15}$ if needed. [Some students may be ready for independent practice while others may need to see a few more examples worked out with your guidance].	Some students may use arrows to show change from the original fraction to the equivalent one. At this point be open to different ways, but encourage students to be neat to avoid errors. The major goal is to use fraction

 Lesson 4

| Teaching Actions	Comments
Small Group/Partner Work	circles to add fractions and to verbalize this process.
10. Student Pages A, B, and C provide students practice adding fractions with fraction circles. While students work on this, teacher should move from group to group and have students explain how to use the fraction circles to add fractions. Use Student Page D as extensions for those who finish before others.	Students' idea of recording with symbols may be interpreted in different ways on Student Page 4A. Some will write in words; some will draw pictures; some will write a number sentence. See Additional Notes for the Teacher Lesson 4 for examples of students' work.
11. Take note as to how students record their actions with fraction circles with symbols. Select different ways to share during large group discussion.	
Wrap Up	It is important that students can verbalize how to use the fraction circles and make connections to symbols.
12. Work through selected problems. For each problem have students show how they recorded the steps with the circles symbolically.	At this point make it explicit that recording in symbols means writing a number sentence.

Translations:
- Real life to verbal
- Real life to concrete to verbal to symbols
- Symbols to verbal to concrete to symbols

Lesson 4

These examples of students' work come from Student Page A. Students interpreted the directions to record what they did with the circles using symbols differently. Students used pictures, words and symbols. For students who did use symbols note the different ways students recorded the steps to add fractions. Expect variety, but do encourage students to be neat so they are clearly communicating the steps taken to solve the problem.

$$\frac{3^6}{4} + \frac{5}{8} = \frac{11}{8}$$
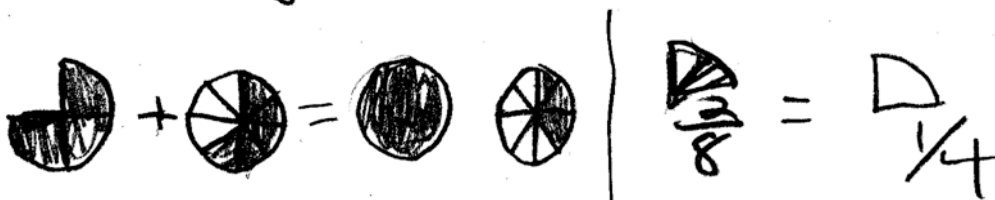
$$\frac{11}{8} = \square \frac{1}{4}$$

Solve with the fraction circles and then record what you did with circles using symbols.

$$\frac{11}{8} \ or \ 1\frac{3}{8}$$

$$\frac{3}{4} + \frac{5}{8}$$

$$\frac{6}{8} + \frac{5}{8} \qquad 1\frac{3}{8}$$

$$\frac{5}{8}$$
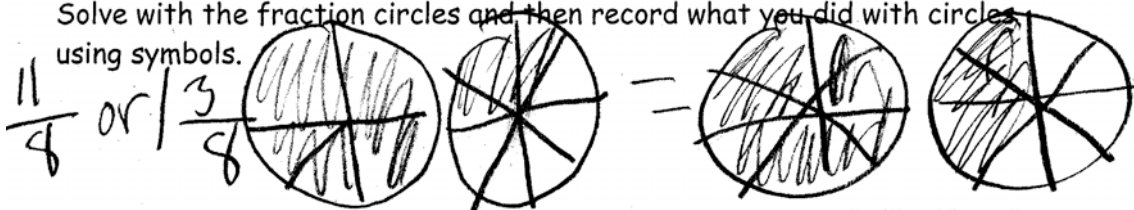
$$\frac{3}{4} + \frac{2}{8} = 1 \qquad 1 + \frac{3}{8} = 1\frac{3}{8}$$

$$\frac{1}{3} + \frac{1}{12} =$$

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

1/3 + 1/12 = 5/12

Solve with the fraction circles and then record what you did with circles using symbols. 5/12   I tried matching how many 12ths would fit in 1/3

$$\frac{1}{3} + \frac{1}{12}$$
$$\downarrow \qquad \downarrow$$
4/12 + 1/12 = 5/12

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

1/3 = 4/12   4/12 + 1/12 = 5/12

Put red   I put 1/3 and 1/12 on the circle and over them and they equaled 5/12

Below find examples of student work from class work involving adding fractions. These students need to be encouraged to show their work more clearly as this type of recording easily leads to errors. One way to do this is to show how other students record their work.

Solve this problem. Show your work.

$$\frac{3}{5} + \frac{1}{3} =$$

Solve this problem using equivalent fractions with 16ths as the denominator.

$$\frac{5}{8} + \frac{1}{4} =$$

©RNP 2009

Raven ate 1 piece of pizza from a personal size pizza cut into 6 equal parts. Later on she ate 1 more piece from a personal size pizza cut into 4 equal parts. [Assume same-size pizzas].

How much of one personal size pizza did she eat?

Estimate:

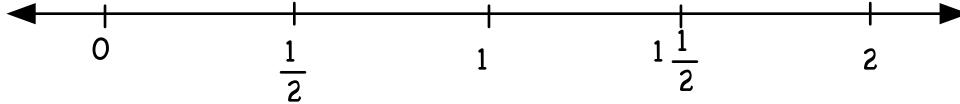Record of what we did with the fraction circles:

Find a fraction between $\dfrac{4}{5}$ and 1.

Explain how you know that it is bigger than $\dfrac{4}{5}$ and less than 1.

Adding Fractions with Fraction Circles

$$\frac{1}{3} + \frac{1}{12} =$$

Estimate first by putting an X on the number line showing about where the answer would be on this line.

Solve with the fraction circles and then record what you did with circles using symbols.
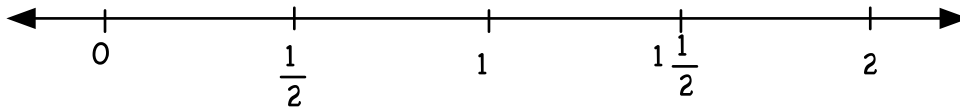
$$\frac{3}{4} + \frac{5}{8} =$$

Estimate first by putting an X on the number line showing about where the answer would be on this line.

Solve with the fraction circles and then record what you did with circles using symbols.

Fraction Addition

Use your fraction circles to model each problem. Record what you do with the circles with symbols.

1. Mario ran $\frac{1}{4}$ of a mile and then rested a few minutes. He then ran $\frac{3}{8}$ of a mile more. How far did he run altogether?	2. $$\begin{array}{r} \dfrac{1}{6} \\[2mm] \dfrac{1}{4} \\[2mm] + \rule{1.5cm}{0.4pt} \end{array}$$
3. $\frac{5}{12}$ of the whole class finished the spelling test and went to the playground. $\frac{1}{4}$ of the whole class finished soon after and joined the others in the playground. What fraction of the class is now on the playground? What fraction of the class is left inside?	4. $$\begin{array}{r} \dfrac{1}{3} \\[2mm] \dfrac{1}{6} \\[2mm] + \rule{1.5cm}{0.4pt} \end{array}$$

5.

$$\frac{2}{3} + \frac{1}{4} =$$

6. JoAnna spent $\frac{2}{9}$ of her whole allowance at the movie and $\frac{1}{3}$ of her whole allowance on a new shirt. She spent $\frac{1}{9}$ of her whole allowance on candy. What fraction of her allowance did she spend in all?

7.

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

8.

$$\frac{1}{12} + \frac{1}{6} =$$

Extensions

1. You have 3 pounds of candy hearts. You plan on putting them into baggies that are $\frac{1}{3}$ pound each. How many baggies can you make? Draw a picture that represents the problem.

2. You have $25. You plan on spending $\frac{3}{5}$ of your money on a birthday present for your mom. How much will you spend on her present? Draw a picture that represents the problem.

3. I spent $24 on a present for my sister. This was $\frac{3}{4}$ of all the money I had in my wallet? How much money did I have before I bought the present? Draw a picture that represents the problem.

Post Lesson Reflection

Lesson_____

1) Number of class periods allocated to this lesson: _____

2) Student Pages used: _____

3) Adaptations made to lesson: (For example: added extra examples, eliminated certain problems, changed fractions used)

4) Adaptations made on Student Pages:

5) To improve the lesson I suggest: