

Rational Number Project

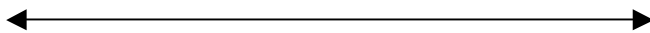
Fraction Operations and Initial Decimal Ideas Lesson 21: Overview	Materials
Students use patty paper (an area model) to multiply two fractions.	<ul style="list-style-type: none"> • Patty Paper (5 per student) • Student Pages A & B • Two colors of pencils (or markers) for each student • Transparencies 1-5

Teaching Actions

Warm Up

Problem A:

Use a number line to find the product $\frac{2}{3} \times 21$



Problem B:

Explain a way to multiply $\frac{3}{5} \times 40$ without using the number line.

Problem C:

Becky earns \$12 an hour grading math homework. How much will she earn if she works $\frac{5}{6}$ of an hour?

Large Group Introduction

1. Ask the students to solve the following problem:
(Transparency 1)

Jed has $\frac{1}{2}$ of a tray of brownies left over from his birthday party. Jed is hungry and eats $\frac{2}{3}$ of the left over brownie. How much of one tray of brownies did Jed eat?

Comments

The goal of the warm up is to review the previous day of work and focus student thinking on partitioning.

When you discuss the warm-up Problem A emphasize that multiplying 21 by two-thirds can be done by dividing 21 by 3 and multiplying by 2. This is an operator interpretation for fractions.

Students may say that one-third of 21 is 7 so two-thirds of 21 is 14 (2×7).

For Problem B, one-fifth of 40 is 8 so three-fifths of 40 is 24 (3×8).

When you review the problems you may want to spend some time estimating results before asking kids to state solution strategies.

Let the students choose how they solve this problem. Encourage students to draw pictures to show how they found the answer. Have one or two students share their pictures how they solved the problem.

Teaching Actions

2. Work as a class to solve the problem again using patty paper. Begin by telling them that one piece of patty paper represents one tray of brownies. Ask them to take the patty paper and fold in half to represent one-half a tray of brownies. Have them shade one-half using the lighter shade of color.



Explain that the shaded region represents the leftover brownies.

Have them fold the patty paper so that only the shaded part is shown.



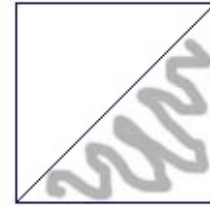
Ask the students to shade in the amount that Jed ate using a darker color.



This shaded amount represents two-thirds of the one-half. Ask them to explain how this shows the part of one tray of brownies that Jed ate. [Students need to open the patty paper and rename the double-shaded amount when compared to the whole

Comments

Some students may fold the patty paper in half diagonally. Although this approach works and could work for doing multiplication it is difficult to find two-thirds of the one-half tray of brownies when folded this way.



In this problem it is important to focus on the unit. The original unit is the tray of brownies. When the students shade in one-half they shade in one-half of the patty paper square.

When the students shade in the two-thirds of this leftover piece they are using the one-half shaded region as the new unit.

They are shading in two-thirds of the one-half. This highlights the importance of students' flexibility of unit. In this problem the unit is changing.

Teaching Actions

patty paper].



or

Ask a few students to explain how the patty paper shows the answer. Be sure to focus on the unit. [It may be easier for students to see the answer if they draw in lines to show that the patty paper is folded into 6 equal parts].

Write the multiplication sentence that can be used to represent this problem.

$$\frac{2}{3} \times \frac{1}{2} = \frac{2}{6} \text{ or } \frac{1}{3}$$

- Ask students to solve the following problem using patty paper. (Transparency 2)

Ernesto is very particular about the pan pizza he makes for his family. He puts pepperoni on three-fourths of the pizza. He puts sausage on one-fourth of the pepperoni part. How much of the pizza has both pepperoni and sausage?

Use patty paper to find the answer and complete the multiplication sentence below.

$$\underline{\hspace{2cm}} \times \frac{3}{4} = \underline{\hspace{2cm}}$$

Comments

When students answer this question and state that $\frac{2}{6}$ or $\frac{1}{3}$ of one tray of brownies are shaded they are now using the entire piece of patty paper as the unit.

Some students may fold the paper differently but should still get the same answer.

Be sure to explain that the multiplication sentence states that they are finding two-thirds of a group of one-half.

Students will fold the paper in different ways.

One way to show the solution is to represent the three-fourths using vertical folds.

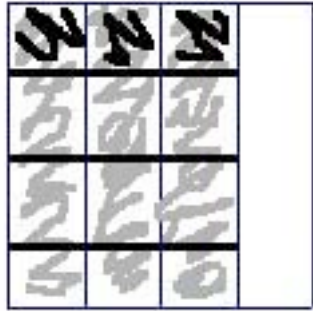


Fold paper so that only the three-fourths is showing (the amount of pizza with pepperoni). This helps focus attention on the new unit.



(new unit: three-fourths of a pizza)

Teaching Actions



(black is one-fourth of the three-fourths pepperoni part of the pizza)

$$\frac{1}{4} \times \frac{3}{4} = \frac{3}{16}$$

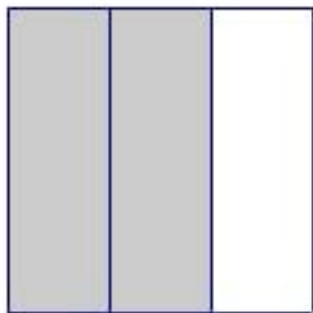
You may need to extend the three horizontal lines to show the 16 equal sized pieces that the unit is partitioned.

Small Group/Partner Work

- Assign Student Pages A & B.

Wrap Up

- Review select problems from the Student Pages.
 - Show the picture below. Tell the students that they will be finding a multiplication problem for what you will draw next. (Transparency 3)



Separate the two-thirds into 5 equal sized pieces by drawing four horizontal lines. Shade in 4-fifths of the two-thirds. Ask the

Comments

Then fold horizontally to find one-fourth of the pepperoni part of the pizza.

- Your picture should look like this when you draw in the horizontal lines:



$$\frac{4}{5} \times \frac{2}{3} = \frac{8}{15}$$

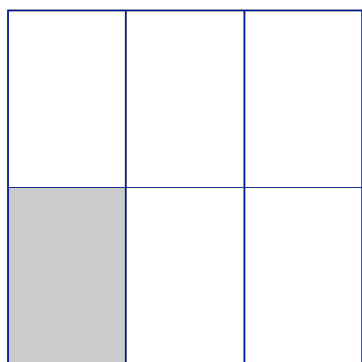
[You may want to draw in the horizontal lines all the way across to verify that the answer is in fifteenths].

Teaching Actions

students to write down the multiplication sentence that corresponds to this picture.

$$\left(\frac{4}{5} \times \frac{2}{3} = \frac{8}{15}\right)$$

- B) Ask the students to write down a multiplication sentence when you shade in two-thirds of the picture of one-sixth shown below. (Transparency 4)



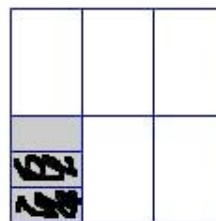
$$\frac{2}{3} \times \frac{1}{6} = \frac{2}{18}$$

Translations:

- Real-world to picture
- Real-world to written symbol
- Picture to written symbol
- Real-world to manipulative
- Written symbol to manipulative

Comments

- B) The picture should look like this:



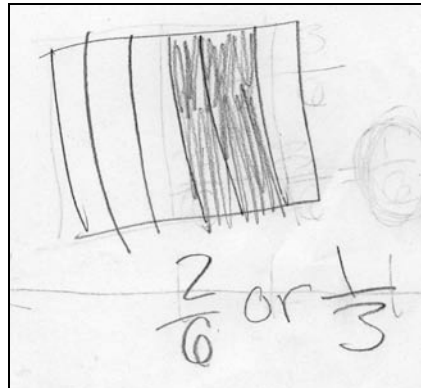
Additional Notes to the Teacher
Lesson 21

Jed Problem

Jed has $\frac{1}{2}$ of a tray of brownies left over from his birthday party. Jed is hungry and eats $\frac{2}{3}$ of the left over brownie. How much of one tray of brownies did Jed eat?

The Jed problem will be new to the students. This is the first time they will multiply a fraction by a fraction. The solution strategy that you will want to look for is when students partition the one-half tray of brownies into thirds. This results in pieces that are one-sixth the size of the original tray of brownies. Jed eats two of these pieces so he ends up eating two-sixths of a tray of brownies.

Many of the students were able to solve the problem by drawing a picture. Two of the pictures are shown below. Note how both students took two-thirds of the half tray that was remaining. They also partitioned the other half of the tray into thirds to make all the pieces the same size. They then had to make the entire tray of brownies the unit to answer the amount of one tray that Jed ate.

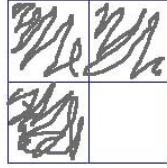


One of the most difficult aspects of multiplication of fractions is the changing of the unit within the steps of solving the problem. Be sure to pay close attention to this as your students work through the various examples.

Ernesto Problem

Ernesto is very particular about the pan pizza he makes for his family. He puts pepperoni on three-fourths of the pizza. He puts sausage on one-fourth of the pepperoni part. How much of the pizza has both pepperoni and sausage?

Some students may fold and shade the patty paper as shown below when they solve the Ernesto problem.



They can still correctly find one-fourth of three-fourths using this picture. Students who draw the three-fourths this way typically partition each fourth into fourths again and shade in one fourth of each fourth. They will still be able to find the product as three-sixteenths of one pizza. In the next lesson the students will spend more time partitioning pictures that already are partitioned using vertical lines for the fraction amount in each group. You will encourage students to partition these amounts by drawing horizontal lines. The purpose of this approach is that it is easier to see why multiplying numerators and denominators help determine the product.

In this lesson you may allow the students to partition the patty paper in any way that makes sense to them.

Jed has $\frac{1}{2}$ of a tray of brownies left over from his birthday

party. Jed is hungry and eats $\frac{2}{3}$ of the left over brownie.

How much of one tray of brownies did Jed eat?

Ernesto is very particular about the pan pizza he makes for his family. He puts pepperoni on three-fourths of the pizza. He puts sausage on one-fourth of the pepperoni part. How much of the pizza has both pepperoni and sausage?

Write the multiplication sentence:

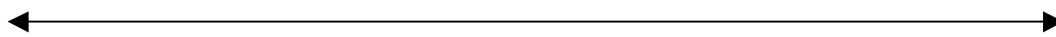
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Write the multiplication sentence:



Problem A:

Use a number line to find the product $\frac{2}{3} \times 21$

**Problem B:**

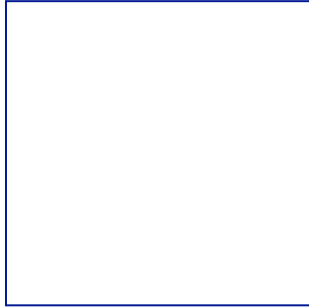
Explain a way to multiply $\frac{3}{5} \times 40$ without using the number line.

Problem C:

Becky earns \$12 per hour grading math homework. How much will she earn if she works $\frac{5}{6}$ of an hour?

Multiplying Fractions Using Patty-Paper

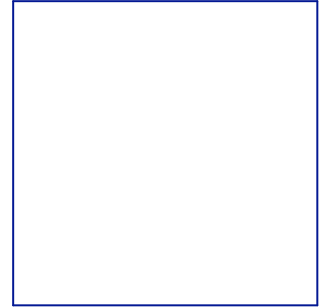
1. Shade in the fractional amounts of patty-paper pictures shown below.



$$\frac{1}{3}$$



$$\frac{3}{4}$$



$$\frac{3}{5}$$

2. Chimeng finds $\frac{1}{3}$ of a square cake out on the counter of his kitchen. He eats $\frac{1}{2}$ of this piece. What fraction of the entire cake did Chimeng eat? Use patty-paper to find your answer then shade in the picture below to show how you got your answer.



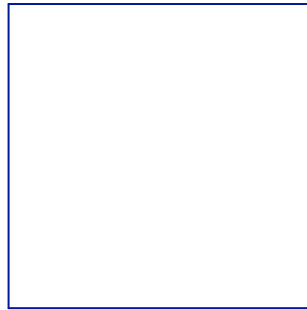
cake

Multiplication Sentence:

3. Use your patty paper to find the answer to the following question:

Christina is making a big square cookie. She puts blue M&M's on $\frac{1}{2}$ of the cookie. She puts peanuts on $\frac{2}{3}$ of the part of the cookie with blue M&M's. How much of the big cookie has both peanuts and blue M&M's?

Draw a picture to record your steps:



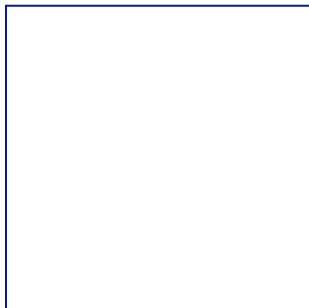
cookie

Multiplication Sentence:

4. Find the answer to the following problems using patty-paper. Write the multiplication sentences as word phrases and draw pictures to show answers.

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

___ group of $\frac{1}{4}$



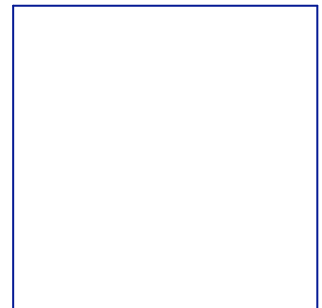
$$\frac{2}{3} \times \frac{1}{4} =$$

___ groups of ___



$$\frac{2}{3} \times \frac{3}{4} =$$

___ groups of ___



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: