Lesson: Multiplication of Fractions
Math Academy – Day 08
Student Notes

Goals:

- Draw multiplication as area models
- Demonstrate multiplication of fractions with models, drawings, equations
- Solve real world problems involving addition, subtraction, multiplication and division of fractions
- Create the standard algorithm for multiplication of fractions

Prerequisite Knowledge:

- Understand meaning of multiplication
- Know single digit multiplication tables
- Understand equivalent fractions

Activities:

1. Consider the following scenario:

   Tamika has bought a sheet cake for herself. Her sister eats a fourth of the cake. Then, Tamika eats 1/3 of the remaining cake. What fraction of the original sheet cake did Tamika eat?

   a. Draw a picture that represents this scenario.

   b. Discuss with your partner the result. Report the result as a fraction (either proper or improper).

   c. Which operation(s) is/are used in this problem?

   d. Write an expression that represents this scenario.

e. Whole Class Discussion: What expressions were found in part (d)? How do we know what operation(s) that we are dealing with?

2. For each of the following problems, identify which scenarios represent multiplication? Do not compute or solve each problem.

   a. Phillip is making 1/2 of a recipe. The full recipe calls for 1/3 cup of water. How much water should Phillip use?

   b. 3/4 of the students in Ms Johnson's class are doing a science project. 1/4 of the children doing the science project have completed it. How many children have completed the science project?

   c. ⅓ of the people in class have brown hair. 1/4 of the people with brown hair also have curly hair. What fraction of people in class have curly brown hair?

   d. Ryan put ⅔ of a bag of candies in a batch of cookies that he made. Ryan ate ⅓ of the batch of cookies. What fraction of the bag of candies did he eat?

   e. A recipe calls for ⅔ cup of sugar. You want to make ⅓ of a recipe. How much sugar do you need?

3. Consider the following scenario:

Betsy has triplets that like to play soccer. This year, she decides to make each one of them a pair of soccer shorts. Each pair of shorts requires ¾ a yard of fabric. How much fabric does Betsy need to buy in order to make her triplets each a pair of shorts?

a. Draw a picture that represents this scenario.

b. Discuss with your partner the result. Report the result as a fraction (either proper or improper).

c. Which operations could be used in this problem?

d. Write as many different expressions that represents this scenario as you can.

e. Whole Class Discussion: What expressions were found in part (d)? How do we know which operations that we are dealing with?

4. In problem #3, we discussed the problem $3 \times \frac{3}{4}$. Working with your partner, compute $3\frac{1}{2} \times \frac{3}{4}$. How does this change the problem in #3?

5. Consider the following scenario:

A cupcake recipe that makes 12 cupcakes calls for 1 and 2/3 cups of flour.
Jimmy needs to make 18 cupcakes.
How much flour does Jimmy need to use to make 18 cupcakes?

   a. Draw a picture that represents this scenario.

b. Write a multiplication problem that represents this scenario.

c. Write the result. Be ready to share out what you and your partner came up with.

d. Whole Class Discussion: What did groups come up with? What are ways to think about and solve this problem?

6. Whole Class Discussion: How we were taught to multiply fractions procedurally? Is reduction of fractions involved? If so, when?

7. On day 04 homework, you tried an Order of Operations problem without being introduced to the OOO (order of operations). For the remainder of the class, we will be discussing and computing problems that involve the order of operations. Mr. Geil posted the following problem on the board: $13 - 7 + 4$. Half the class found the result to be 2 while the other half found the result to be 10. Which result is correct? What mistake did the other group make?

8. Teacher-led discussion on the OOO: What is the proper order of operations? Where does PEMDAS lead people in the wrong direction?

9. Working by yourself, compute: $25 \div 5 \cdot 5$. Be prepared to share your result with the class.

10. Working by yourself, compute: $6 - 2\left(\frac{1}{2} + \frac{3}{4}\right)$. Be prepared to share your result with the class.

Lesson: Multiplication of Fractions
Math Academy – Day 08
Instructor Notes

Goals:

- Draw multiplication as area models
- Demonstrate multiplication of fractions with models, drawings, equations
- Solve real world problems involving addition, subtraction, multiplication and division of fractions
- Create the standard algorithm for multiplication of fractions

Prerequisite Knowledge:

- Understand meaning of multiplication
- Know single digit multiplication tables
- Understand equivalent fractions

Lesson Materials:

- Student Notes for Day 08

Lesson Breakdown:

Activity	Size of Group	Time in Activity Total Time: 115 minutes
Tamika's Scenario	Partners except for part d which is a whole class discussion	15 minutes
Identifying Multiplication Story Problems	Partners	10 minutes
Betsy's Scenario	Partners except part d which is a whole class discussion	15 minutes
Extending Betsy's Scenario	Partners	10 minutes
Break	Whole Class	5 minutes
Jimmy's Scenario	Partners, except part d is whole class discussion	20 minutes
Algorithm for Multiplying Fractions	Whole Class Discussion	10 minutes
Which result is correct and why?	Partners	10 minutes
OOO	Teacher-led discussion	10 minutes
Two OOO computation problems	Individual	5 minutes each 10 minutes total

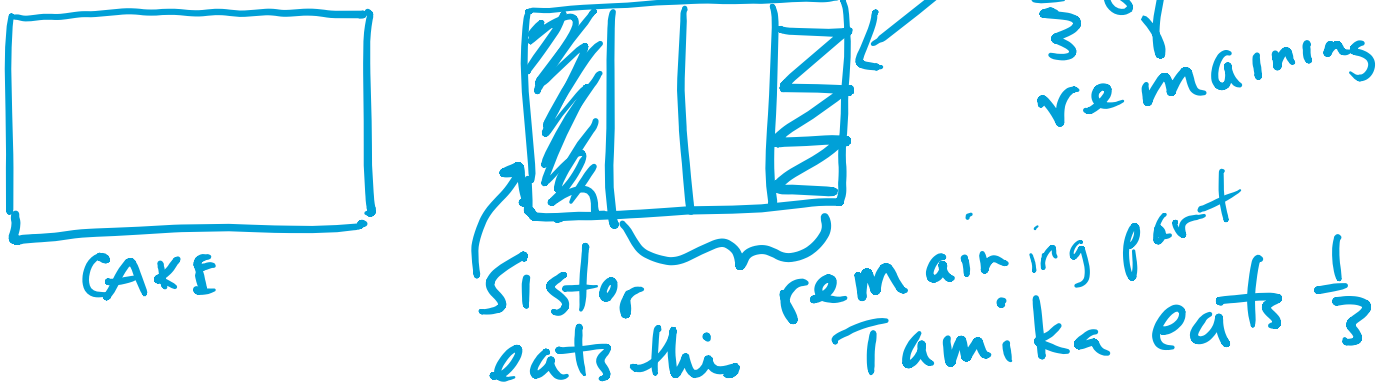
---

Activities:

2. Consider the following scenario:

Tamika has bought a sheet cake for herself. Her sister eats a fourth of the cake. Then, Tamika eats 1/3 of the remaining cake. What fraction of the original sheet cake did Tamika eat?

a. Draw a picture that represents this scenario.



b. Discuss with your partner the result. Report the result as a fraction (either proper or improper).

Tamika ate $\frac{1}{4}$ of the cake

c. Which operation(s) is/are used in this problem?

Multiplication (also subtraction $1-\frac{1}{4}=\frac{3}{4}$)

d. Write an expression that represents this scenario.

$\frac{3}{4}\cdot\frac{1}{3}$ or $\frac{3}{4}\left(\frac{1}{3}\right)$ or $\frac{3}{4}*\frac{1}{3}$ or

$\frac{1}{3}\cdot\frac{3}{4}$ or $\frac{1}{3}\left(\frac{3}{4}\right)$ etc.

e. Whole Class Discussion: What expressions were found in part (d)? How do we know what operation(s) that we are dealing with?

Varies

11. For each of the following problems, identify which scenarios represent multiplication? Do not compute or solve each problem.

    f. Phillip is making 1/2 of a recipe. The full recipe calls for 1/3 cup of water. How much water should Phillip use?

Yes $\frac{1}{2} \times \frac{1}{3}$ recipe amount in a recipe

    g. 3/4 of the students in Ms Johnson's class are doing a science project. 1/4 of the children doing the science project have completed it. How many children have completed the science project?

No. Doesn't tell how many children.

    h. ⅓ of the people in class have brown hair. 1/4 of the people with brown hair also have curly hair. What fraction of people in class have curly brown hair?

Yes.

    i. Ryan put ⅔ of a bag of candies in a batch of cookies that he made. Ryan ate ⅓ of the batch of cookies. What fraction of the bag of candies did he eat?

Yes

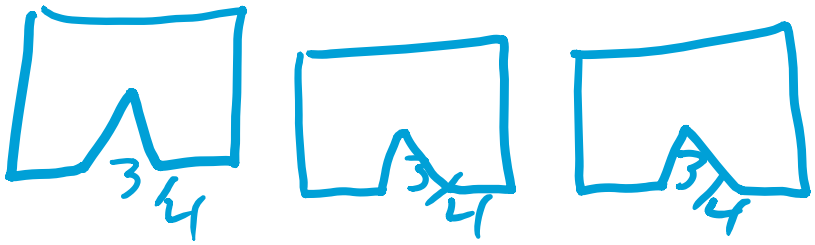
    j. A recipe calls for ⅔ cup of sugar. You want to make ⅓ of a recipe. How much sugar do you need?

Yes

12. Consider the following scenario:

Betsy has triplets that like to play soccer. This year, she decides to make each one of them a pair of soccer shorts. Each pair of shorts requires ¾ a yard of fabric. How much fabric does Betsy need to buy in order to make her triplets each a pair of shorts?

    a. Draw a picture that represents this scenario.



b. Discuss with your partner the result. Report the result as a fraction (either proper or improper).

$3\left(\frac{3}{4}\right) = \frac{3}{1}\left(\frac{3}{4}\right) = \frac{9}{4}$ of a yard or $\frac{3}{4}+\frac{3}{4}+\frac{3}{4}$

c. Which operations could be used in this problem?

Addition or Multiplication

d. Write as many different expressions that represents this scenario as you can.

$\frac{3}{4}+\frac{3}{4}+\frac{3}{4}$ or $3\left(\frac{3}{4}\right)$ or $3*\frac{3}{4}$ etc

e. Whole Class Discussion: What expressions were found in part (d)? How do we know which operations that we are dealing with?

This goes back to the meaning of mult. Repetitive addition of like amount.

13. In problem #3, we discussed the problem $3 \times \frac{3}{4}$. Working with your partner, compute $3\frac{1}{2} \times \frac{3}{4}$. How does this change the problem in #3?

This would be like making $3\frac{1}{2}$ pairs of shorts

could do:

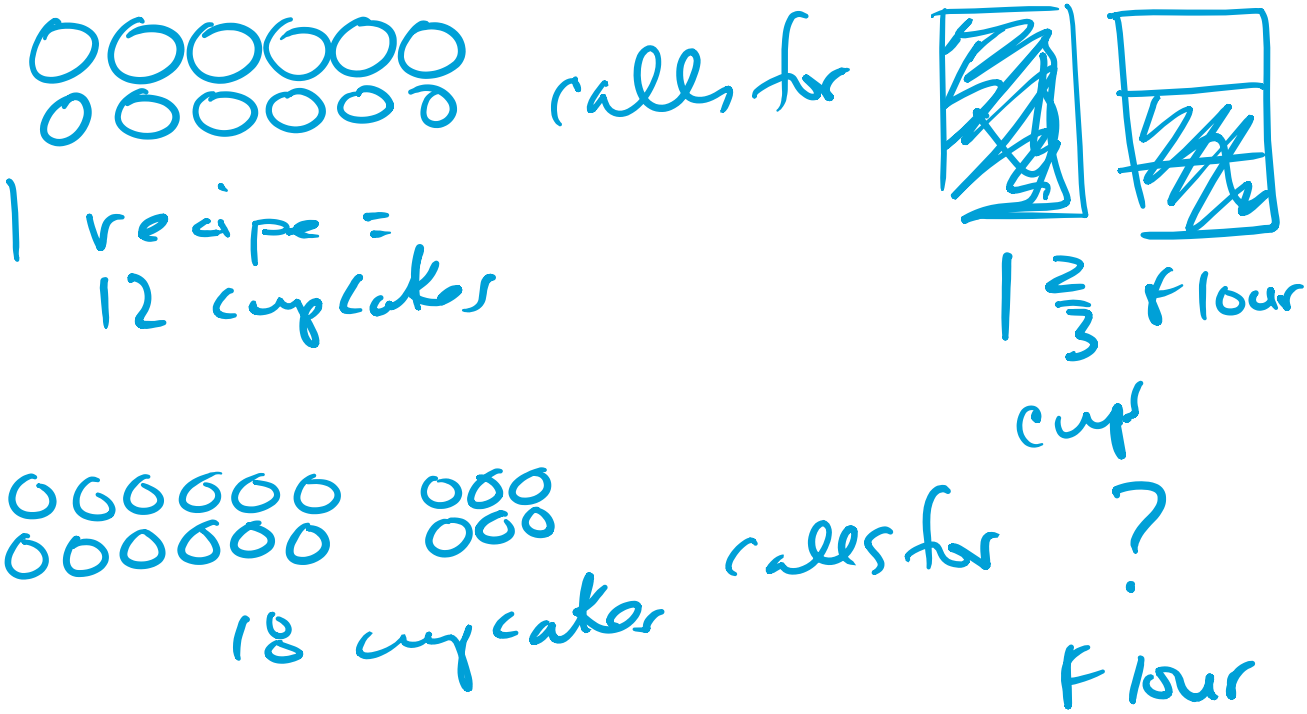
$3 \times \frac{3}{4} + \frac{1}{2} \times \frac{3}{4} = \frac{9}{4} + \frac{3}{8} = \frac{18}{8} + \frac{3}{8} = \frac{21}{8} = 2\frac{5}{8}$

$3\frac{1}{2} \times \frac{3}{4} = \frac{7}{2} \times \frac{3}{4} = \frac{21}{8} = 2\frac{5}{8}$

14. Consider the following scenario:

A cupcake recipe that makes 12 cupcakes calls for 1 and 2/3 cups of flour.
Jimmy needs to make 18 cupcakes.
How much flour does Jimmy need to use to make 18 cupcakes?

a. Draw a picture that represents this scenario.



b. Write a multiplication problem that represents this scenario.

18 cupcakes is $1\frac{1}{2}$ batches. So
$1\frac{1}{2} \times 1\frac{2}{3}$

c. Write the result. Be ready to share out what you and your partner came up with.

$\frac{3}{2} \times \frac{5}{3} = \frac{5}{2} = 2\frac{1}{2}$ cups of flour

d. Whole Class Discussion: What did groups come up with? What are ways to think about and solve this problem?

- varies could do $\frac{18}{12}$ instead of $1\frac{1}{2}$
- could even use a proportion

15. Whole Class Discussion: How we were taught to multiply fractions procedurally? Is reduction of fractions involved? If so, when?

- mult. straight across
- cross cancel or reduce if possible
- common denom not necessary but also not incorrect.

16. On day 04 homework, you tried an Order of Operations problem without being introduced to the OOO (order of operations). For the remainder of the class, we will be discussing and computing problems that involve the order of operations. Mr. Geil posted the following problem on the board: $13 - 7 + 4$. Half the class found the result to be 2 while the other half found the result to be 10. Which result is correct? What mistake did the other group make?

$13-7+4=$

$6+4=10$

Correct

$13-7+4=$

$13-11=2$

common error

Didn't go left to right

17. Teacher-led discussion on the OOO: What is the proper order of operations? Where does PEMDAS lead people in the wrong direction?

( )

Powers (exponents)

× & ÷ left to right

+ & − left to right

PEMDAS leads students to believe you must before divide & add before subtract

18. Working by yourself, compute: 25 ÷ 5 · 5. Be prepared to share your result with the class.

25 ÷ 5 · 5 =

5 · 5 = 25

Some will do this

25 ÷ 5 · 5 =

25 ÷ 25

= 1

common error

19. Working by yourself, compute: $6 - 2\left(\frac{1}{2} + \frac{3}{4}\right)$. Be prepared to share your result with the class.

$$6 - 2\left(\frac{1}{2} + \frac{3}{4}\right) =$$

$$6 - 2\left(\frac{2}{4} + \frac{3}{4}\right) = 6 - 2\left(\frac{5}{4}\right)$$

$$= 6 - \frac{10}{4}$$

$$= \frac{24}{4} - \frac{10}{4}$$

$$= \frac{14}{4} = \frac{7}{2}$$

1. Amber enjoys making scones. She has a recipe that calls for ¾ of a pound of butter. The recipe makes 9 scones. She has a trip coming up and would like to take 36 scones with her to share with friends along the way. How much butter will she need to make the 36 scones?

a. Draw a picture of the scenario.

b. Find the result.

2. How is the procedure for multiplication of fraction different than addition and subtraction of fractions?

3. Compute each:

a. $3 + 4 \times 8 - 8$

b. $(3 + 4) \times 8 - 8$

c. $5\frac{3}{5} - \left(\frac{2}{5} + \frac{2}{3}\right)$

d. $\left(\frac{1}{2} \cdot \frac{4}{5}\right) + 6 - \frac{3}{10}$

e. $5 \times 4 - 2 \div 2$

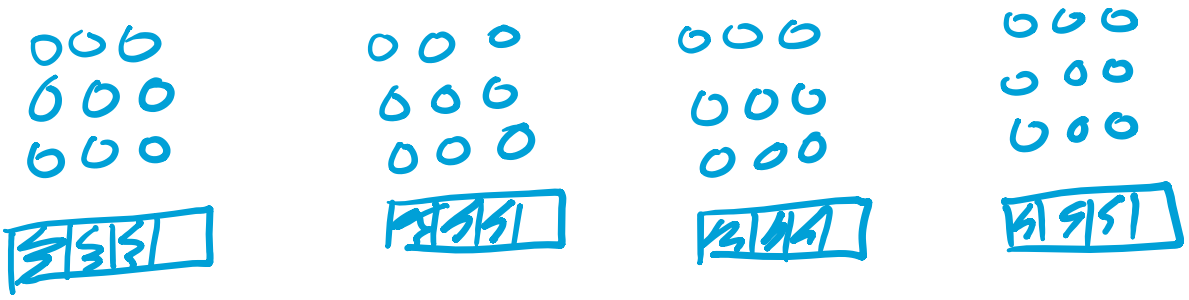
f. $22 - (20 - 3 \times 4 - 5) + 0 \div 4$

MATHPH-700 Math Academy
Day 08 Homework – Multiplication of Fractions
Solutions

Name: _____

1. Amber enjoys making scones. She has a recipe that calls for ¾ of a pound of butter. The recipe makes 9 scones. She has a trip coming up and would like to take 36 scones with her to share with friends along the way. How much butter will she need to make the 36 scones?

c. Draw a picture of the scenario.



d. Find the result.

$4 \times \frac{3}{4} = \frac{4}{1} \times \frac{3}{4} = \frac{12}{4} = 3$ lbs

2. How is the procedure for multiplication of fraction different than addition and subtraction of fractions?

In addition and subtraction you must find common denominators. In multiplication you do not need to.

In addition and subtraction the denominator does not change

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

In multiplication the denominator changes.

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

3. Compute each:

b. $3 + 4 \times 8 - 8$

1st

$3 + 32 - 8$

now left to right

$35 - 8 = 27$

b. $(3 + 4) \times 8 - 8$

1st

2nd $7 \times 8 - 8$

$56 - 8 = 48$

c. $5\frac{3}{5} - \left(\frac{2}{5} + \frac{2}{3}\right)$

$5\frac{3}{5} - \left(\frac{6}{15} + \frac{10}{15}\right)$

$5\frac{3}{5} - \frac{16}{15}$

$\frac{28}{5} - \frac{16}{15}$

$\frac{84}{15} - \frac{16}{15} = \frac{68}{15}$

d. $\left(\frac{1}{2} \cdot \frac{4}{5}\right) + 6 - \frac{3}{10}$

$\frac{4}{10} + 6 - \frac{3}{10}$

$\frac{4}{10} + \frac{60}{10} - \frac{3}{10}$

$\frac{64}{10} - \frac{3}{10} = \frac{61}{10}$

e. $5 \times 4 - 2 \div 2$

$20 - 1$

19

f. $22 - (20 - 3 \times 4 - 5) + 0 \div 4$

$22 - (20 - 12 - 5) + 0 \div 4$

$22 - (8 - 5) + 0 \div 4$

$22 - (3) + 0 \div 4$

$22 - 3 + 0 = 19$