

Lesson: Multiplication of Natural Numbers

Math Academy – Day 04

Student Notes

Goals:

- Define multiplication as groups consisting of equal number of objects
 - Draw multiplication as arrays and area models
 - Define Natural number products as rectangular areas
 - Use \cdot , \times , $*$, and/or parentheses symbols to represent multiplication
 - Rewrite multiplication problems with different multiplication symbols
 - Solve real world problems with equal groups, arrays, and/or area models
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Prerequisite Knowledge:

- Understanding of place value up to thousands
 - Understanding of numeric representations using base-ten blocks up to the thousands place
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Activities:

1. Working with a partner, show the following problem using the base-ten blocks. Draw your result below.

There are four sections of math academy being offered at MATC. If there are 15 students enrolled in each section, how many total students are enrolled in the math academy at MATC?

2. Working with your partner, write the problem using mathematical symbols. See how many different ways and different symbols you can come up with. Be prepared to share your ideas with the class.

3. Whole Class Discussion: In problem 1, what operation was being used? In this context, what is the purpose of this operation?

4. In the previous problem, we discussed one purpose for multiplication. In this problem, we will begin to look at multiplication in a different context. Draw a picture of the problem below. Be prepared to share your result/drawing with the class.

Maria is re-tiling her bathroom floor using square tiles that measure 1 square foot. Her rectangular bathroom is 8 feet wide by 9 feet long. How many square tiles are required for her to re-tile her bathroom floor? (Note: Although the sink and toilet are in the bathroom, a tile is required in this space for cutting purposes.)

5. With a partner discuss each of the following questions. Be prepared to share your thoughts and ideas with the class during the class discussion on these questions.

- How is multiplication being used in this problem?
- How is this context different than in problem 1?
- Can we relate the two representations for multiplication?

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Instructor Notes

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Prerequisite Knowledge:

- Understanding of place value up to thousands
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Lesson Materials:

- Baggies
 - Base-ten blocks
 - Colored pencils
 - Sheets of paper
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Preparation

- Sort and organize base-ten unit blocks into baggies with at least 1 flat, at least 15 rods, and at least 80 unit blocks.
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Lesson Breakdown:

Activity	Size of Group	Time in Activity Total Time: 55 minutes
Multiply 2 natural numbers using base-ten blocks	Groups of 2	20 minutes
Multiply 2 natural numbers using an array	Whole class	15 minutes
Compose a story problem using the multiplication of 2 natural numbers	Groups of 2	20 minutes

Activities:

8. Working with a partner, show the following problem using the base-ten blocks. Draw your result below.

There are four sections of math academy being offered at MATC. If there are 15 students enrolled in each section, how many total students are enrolled in the math academy at MATC?

The main idea of multiplication here is to see “groups of objects”. In this context students, should create 4 groups each with 15 objects in them. (Note: 15 groups of 4 objects is NOT the context of the problem.) We are looking for students to have on their desk:



9. Working with your partner, write the problem using mathematical symbols. See how many different ways and different symbols you can come up with. Be prepared to share your ideas with the class.

Looking for things like: 4×15 , $4 * 15$, $4 \cdot 15$, $4(15)$, $(4)(15)$, etc!

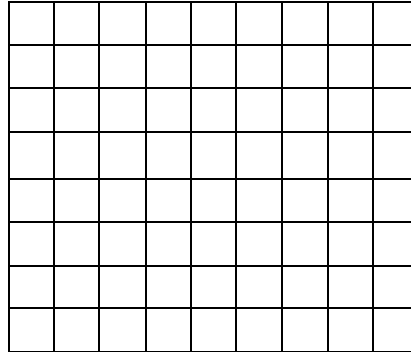
10. Whole Class Discussion: In problem 1, what operation was being used? In this context, what is the purpose of this operation?

Since it is valid that addition can be used in the problem, a valid response for students’ work would be $15+15+15+15$. We want them to arrive at the fact that multiplication is “fast addition” and that multiplication should be underlying operation for this problem. Here we have four groups of fifteen objects, therefore the purpose of this operation is as groups of same size.

11. In the previous problem, we discussed one purpose for multiplication. In this problem, we will begin to look at multiplication in a different context. Draw a picture of the problem below. Be prepared to share your result/drawing with the class.

Maria is re-tiling her bathroom floor using square tiles that measure 1 square foot. Her rectangular bathroom is 8 feet wide by 9 feet long. How many square tiles are required for her to re-tile her bathroom floor? (Note: Although the sink and toilet are in the bathroom, a tile is required in this space for cutting purposes.)

Looking for something like:



(looks almost like a square but is not)

12. With a partner discuss each of the following questions. Be prepared to share your thoughts and ideas with the class during the class discussion on these questions.
- How is multiplication being used in this problem?
 - How is this context different than in problem 1?
 - Can we relate the two representations for multiplication?

Here multiplication of two natural numbers represents an area. (Note: it is acceptable for students to think of this as arrays). The context is different because in problem 1, the multiplication represented groups of objects, and here we are specifically looking at multiplication as an area. We can relate the two by rearranging our groups into rows and columns (as we mentioned arrays), and then tightly compacting them so that there is no empty space between the tiles, and thus, we form an area.

13. With a partner, write a story problem that represents the problem $12 \cdot 13$. Each group will be sharing a story problem with the class. (Try to write new scenarios other than ones provided above. *Challenge: Write two story problems, one for each representation of multiplication discussed before.*)

The instructor should walk around the classroom ensuring that students are indeed using the operation of multiplication. For example, a problem like: Maria has 12 eggs and Pablo has 13 eggs, how many eggs do they have together? This problem, does NOT show multiplication. It is the operation addition. A problem like: Maria bought 12 baskets and each basket contains 13 eggs, how many eggs does she have altogether? This shows multiplication as groups of objects.

14. Your instructor will give you a story problem.
- Represent this problem in the two ways discussed previously (groups and area) using the base-ten blocks. Show your result to your instructor.

Choose one group's story problem to give to the entire class. We suggest that you choose a problem that represents groups of objects so that students have an additional opportunity to see how groups of objects and area models relate for multiplication.

- After your instructor has discussed the representation with you and your partner, create the area model of $12 \cdot 13$ using the least number of base-ten blocks. Draw your findings below and note the result of the multiplication problem.

Should have the following base-ten blocks alongside the result of 156. Note: it could also have the 12 going vertically with the 13 going horizontally and it would still be correct.

