

# Brick Math Lesson of the Month

## December 2023

# Understanding Fraction Division

## *from Fraction Division Using LEGO® Bricks*

### Teacher's Lesson Guide

Ask students what it means to multiply whole numbers. Discuss how the solution gets larger when you multiply two whole numbers (example:  $3 \times 4 = 12$ ).

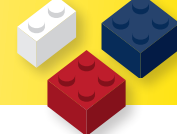
Ask students what it means to divide whole numbers. Discuss how the solution gets smaller when you divide two whole numbers (example:  $12 \div 4 = 3$ ).

Ask students what they think it means to divide two fractions. Many will answer that the solution will be smaller than the two products. This is a misconception, because students associate multiplying with repeated addition, which increases with each factor iteration, and they associate division with repeated subtraction, which decreases with each iteration.

Show the problem  $16 \div 8 = 2$

Discuss the meaning of this math sentence: How many groups of 8 are there in 16 (*answer: 2*)?

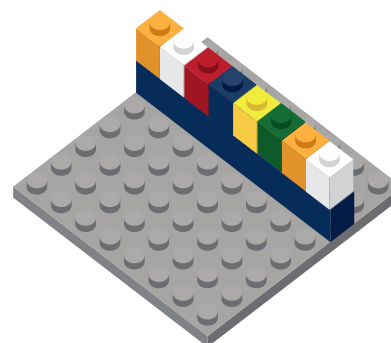
Tell students that this thinking can also work with fractions.



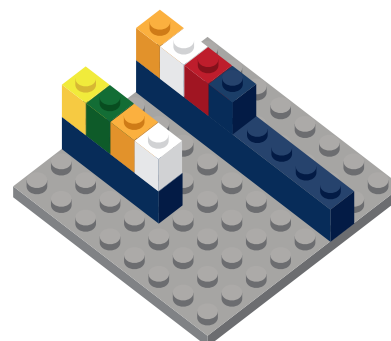
**Problem #1:  $\frac{1}{2} \div \frac{1}{8}$**

1. Discuss the problem as a real-world scenario: Envision a flatbread pizza cut into 8 pieces.

Place a 1x8 brick on a baseplate to represent the pizza. Ask students how many pieces of pizza there are (*answer*: 8). Place eight 1x1 bricks on the top of the 1x8 brick to represent the 8 pieces of pizza.



2. Since the problem calls for only half the pizza, make a model that shows  $\frac{1}{2}$  of the pizza. Since 4 is  $\frac{1}{2}$  of 8, use a 1x4 brick to show the half-pizza. Move 4 of the 1x1 bricks onto the 1x4 brick to show the pieces in that half. Have students build and draw this model.



3. Ask students how many pieces are in the half (*answer*: 4 whole pieces). Therefore, the solution to  $\frac{1}{2} \div \frac{1}{8}$  is the whole number 4. *Note*: Students should include the quantifier *pieces* when they explain the solution to the pizza problem.

4. Explain how this relates to the reciprocal by referring to the whole number problem,  $16 \div 8 = 2$ . Use multiplication to see how that answer is correct by using the reverse:  $2 \times 8 = 16$ .

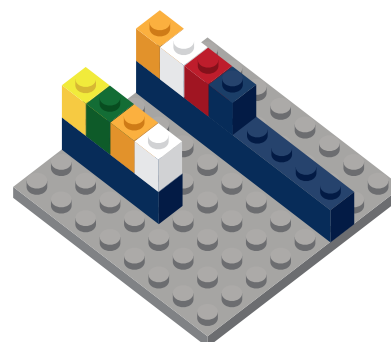
Students should know that  $16 \div 8$  is the same as  $\frac{16}{8}$  when written as a fraction. This fraction means  $\frac{16}{1} \times \frac{1}{8} = \frac{16 \times 1}{1 \times 8}$

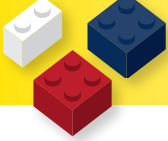
5. In the fraction problem, the model shows this process:  $\frac{1}{2} \div \frac{1}{8} = 4$  whole pieces

This can be reversed using the commutative property for multiplication as  $4 \times \frac{1}{8} = \frac{1}{2}$ . If the problem is written like a whole number multiplication problem using the reverse, the fraction is called the *reciprocal*. For example; the reciprocal of 2 is  $\frac{1}{2}$  because  $\frac{2}{1} \times \frac{1}{2} = 1$  whole.

This would look like:  $\frac{4}{1} \times \frac{1}{8} = \frac{4}{8} = \frac{1}{2}$

Looking at the model, 4 sets of  $\frac{1}{8}$  (four 1x1 bricks) is the same as  $\frac{1}{2}$  in the original model. The model shows 8 studs divided into two parts. Each part has 4 pieces.



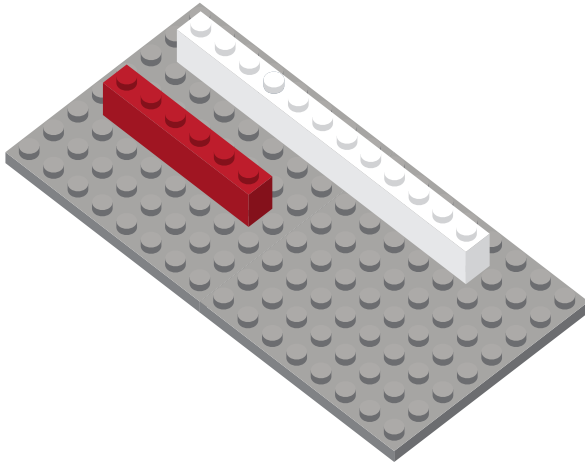


6. Rewrite the division problem using the reciprocal of  $\frac{1}{8}$  (which is  $\frac{8}{1}$ ) to show the mathematical procedure for solving the problem.  $\frac{1}{2} \div \frac{1}{8} = \frac{1}{2} \times \frac{8}{1} = \frac{8}{2} = 4$

**Problem #2:  $\frac{1}{2} \div \frac{1}{12}$**

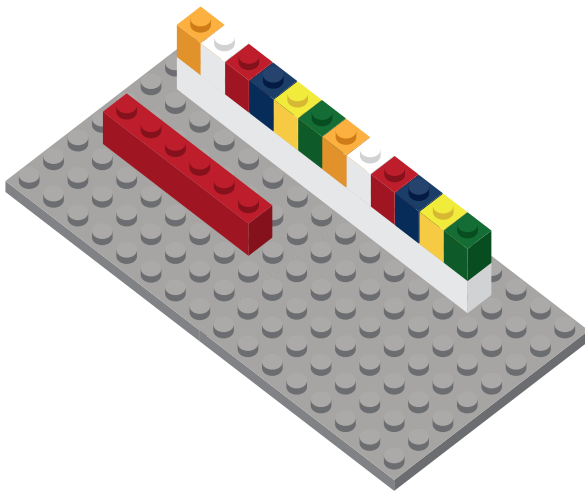
**Step 1:** Place a brick with 12 studs on a baseplate (*answer:* use a 1x12 or 2x6 brick).

**Step 2:** Determine what brick is equivalent to  $\frac{1}{2}$  of the 12 studs (*answer:* a 1x6 brick).

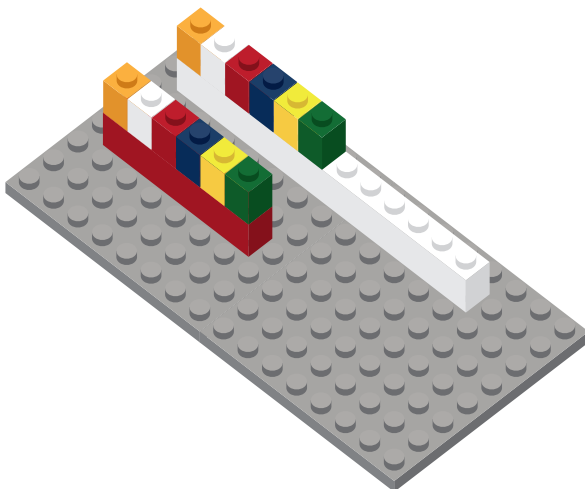


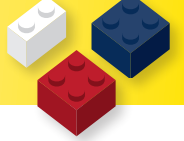
**Step 3:** Discuss the problem as a real-world scenario: If the 1x12 brick represents a carton of eggs, how many eggs are in the carton (*answer:* 12)?

Place twelve 1x1 bricks on top of the 12 studs to show each egg. This shows that there are  $\frac{12}{12}$  in the whole.



**Step 4:** Move  $\frac{1}{2}$  of the 1x1 bricks to the model to show  $\frac{1}{2}$  of the carton of eggs.





**Step 5:** Count the number of 1x1 bricks on the  $\frac{1}{2}$  model  
(*answer:* 6).

**Step 6:** Write the solution to the problem. Explain the solution.

(*Answer:*  $\frac{1}{2}$  of the carton x  $12/1$  individual eggs =  $12/2$ )

$$\frac{1}{2} \div \frac{1}{12} = 6$$

A carton of 12 divided into 2 sets = 6 eggs in each set)

This problem shows that the reciprocal of  $\frac{1}{12}$ , which is  $12/1$ , when multiplied by  $\frac{1}{2}$  is equivalent to 6. Using the multiplicative inverse of  $\frac{1}{12}$  makes the math simple.

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**Student's Workbook Pages**

**1.** When you multiply whole numbers, what happens to the solution?

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**2.** When you divide two whole numbers, what happens to the solution?

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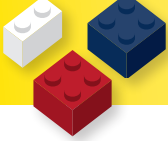
**3.** What do you think will happen to the solution if you multiply two fractions or divide two fractions?

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4. What does this math sentence mean?  $16 \div 8 = 2$

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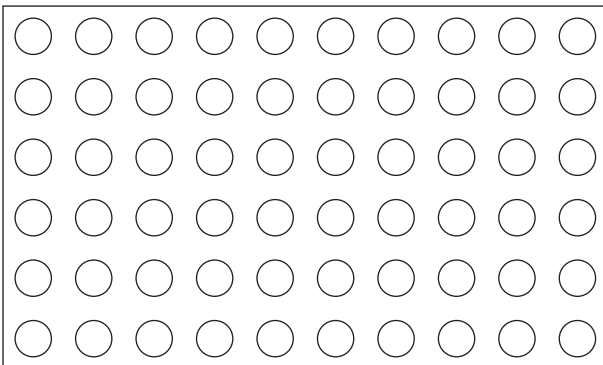
**Problem #1:  $\frac{1}{2} \div \frac{1}{8}$**

1. Envision a flatbread pizza cut into 8 pieces.

Place a 1x8 brick on a baseplate to represent the pizza.

How many pieces of pizza are there? \_\_\_\_\_ Place eight 1x1 bricks on the top of the 1x8 brick to represent the 8 pieces of pizza.

2. Since the problem calls for only half the pizza, make a model that shows  $\frac{1}{2}$  of the pizza. Since 4 is  $\frac{1}{2}$  of 8, use a 1x4 brick to show the half-pizza. Move 4 of the 1x1 bricks that are on the 1x8 brick over to the top of the 1x4 brick to show the pieces in that half. Build this model and draw it.



3. How many pieces are in the half-pizza? \_\_\_\_\_ This is the solution to  $\frac{1}{2} \div \frac{1}{8}$ .

What is the solution? \_\_\_\_\_

(Be sure to use a “quantifier” or a word that tells you what the number means.)



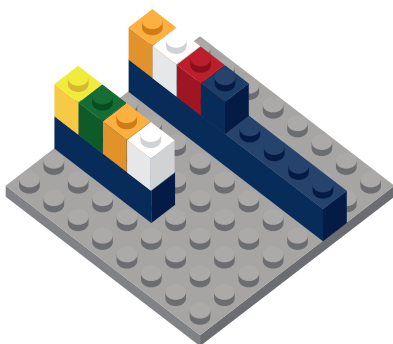
4. Refer to the whole number problem:  $16 \div 8 = 2$ . Use multiplication to see how that answer is correct by using the reverse:  $2 \times 8 = 16$ .

$16 \div 8$  is the same as  $\frac{16}{8}$  when written as a fraction. This fraction means  $\frac{16 \times 1}{1 \times 8}$

5. Using the commutative property for multiplication, the problem  $\frac{1}{2} \div \frac{1}{8} = 4$  can be reversed to  $4 \times \frac{1}{8} = \frac{1}{2}$ . If the problem is written like a whole number multiplication problem using the reverse, the fraction is called the *reciprocal*. For example, the reciprocal of 2 is  $\frac{1}{2}$  because  $2 \times \frac{1}{2} = 1$  whole.

This math sentence can be expressed as:  $4 \times \frac{1}{8} = \frac{4}{8} = \frac{1}{2}$

Looking at the model, 4 sets of  $\frac{1}{8}$  (four 1x1 bricks) is the same as  $\frac{1}{2}$  in the original model. The model shows 8 studs divided into two parts. Each part has 4 pieces.



6. Rewrite the division problem using the reciprocal of  $\frac{1}{8}$  ( $\frac{8}{1}$ ) to show the mathematical procedure for solving the problem.

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### Problem #2: $\frac{1}{2} \div \frac{1}{12}$

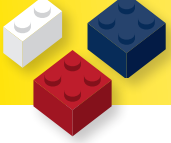
**Step 1:** Place a brick with 12 studs on a baseplate.

**Step 2:** Determine what brick is equivalent to  $\frac{1}{2}$  of the 12 studs.

**Step 3:** Think about the problem as a real-world scenario: If the 12-stud brick represents a carton of eggs, how many eggs are in the carton?

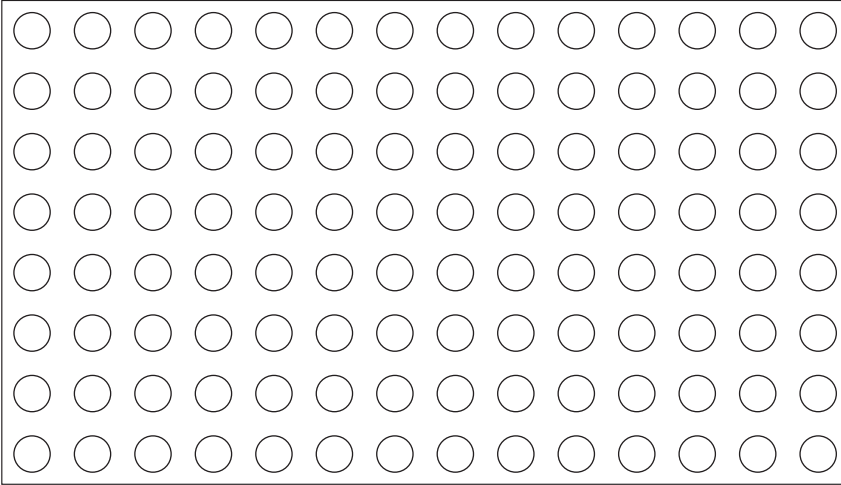
Place twelve 1x1 bricks on top of the 12 studs to show each egg. This shows that there are  $\frac{12}{12}$  in the whole.

**Step 4:** Move  $\frac{1}{2}$  of the 1x1 bricks to the model to show  $\frac{1}{2}$  of the carton of eggs.



**Step 5:** Count the number of 1x1 bricks on the  $\frac{1}{2}$  model

**Step 6:** Write the solution to the problem. Draw your model and explain the solution.



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