Inverse Relationship between Multiplication and Division

Student Probe

Bailee had 8 cartons of eggs. There were 12 eggs in each carton. She wrote the number sentence 8 x 12 = 96 to show how she figured out the total number of eggs.

How could you rewrite the number sentence as a division number sentence?

Write all the multiplication and division facts in the fact family for this problem.

If the student cannot write the related division sentence and facts, he needs this lesson.

Lesson Description

This lesson was written to help students develop an understanding of the inverse relationship between multiplication and division and to be able to apply it (Fact Families).

Rationale

Multiplication and division are very closely related. Fluency and computation skills can be obtained with greater understanding when students see the relationship. When students use what they know to figure out what they do not know, connections are made that provide for better understanding. When these ideas are presented in a problem-solving format instead of memorizing facts, students develop a meaningful sense of operations which contributes to their success. Learning fact families will be much easier and have more meaning. When a student grasps the relationship between multiplication and division, he will have a better understanding of algebraic concepts.

At a Glance

What: Inverse relationship between Multiplication and Division

Common Core State Standard: CC.3.OA.6. Understand division as an unknown-factor problem.

Mathematical Practices:
Make sense of problems and persevere in solving them.
Reason abstractly and quantitatively.
Model with mathematics.
Look for and express regularity in repeated reasoning.

Who: Students who cannot apply the relationship between multiplication and division.

Grade Level: 3

Prerequisite Vocabulary: array

Prerequisite Skills: meaning of multiplication and division, understanding of open number sentence

Delivery Format: small group, individual

Lesson Length: 20 minutes

Materials, Resources, Technology: prepared array cards for variation part of lesson
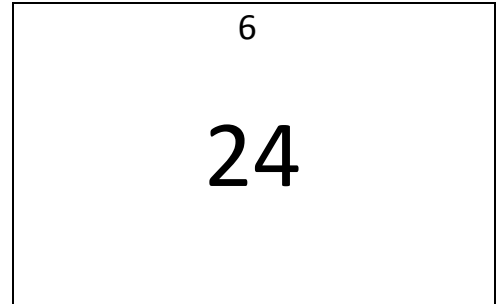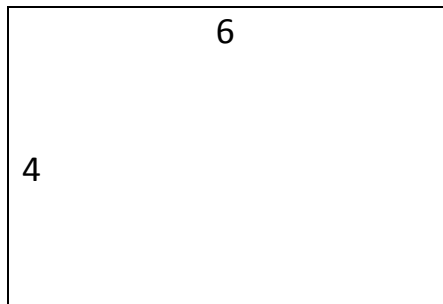
Student Worksheets: None

Preparation

Prepare array cards as follows:

One side of the array card should have the dimensions (row and column) given. The student must figure out the product, and then give the multiplication sentence that matches.

The other side of the array card should have one dimension given and the product. The student must figure out the missing dimension and write the division sentence that matches.

6
4

6
24

Lesson

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
1. Give student this problem: Noah had 3 buckets. Each bucket had 8 baseballs. How many baseballs did Noah have in all in the buckets? Write a multiplication number sentence that matches the story and solve the problem.	3 x 8 = 24	Reread the problem and model how to set up the number sentence and solve. Ask, "How many groups are there? (3) How many baseballs in each group? (8) So 3 groups of 8 is the same as 24. How many baseballs were there in all? (24) ".
2. Ask student to explain what each of the numerals in the number sentence represents.	The 3 tells the number of buckets. The 8 tells how many baseballs in each bucket. Twenty-four tells how many baseballs Noah had.	Reread the problem and ask questions to guide the student as in Step 1.

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
3. Give the student this problem: Peyton had 24 Wii games. He kept the games in 3 baskets. Each basket had the same number of games. How many games were in each basket? Write a division number sentence that matches the story and solves the problem.	24 ÷ 3 = 8	Reread the problem and model how to set up the number sentence and solve. Ask, "How many Wii games were there? (24) How many baskets did he divide the games into equally? (3) So 24 games divided equally into 3 groups equals 8 games in each basket. How many games were in each basket? (8) ".
4. Ask students to look at the two number sentences and compare. How are they alike? How are they different?	Possible examples of students' responses: Alike: Both equations use the same group of numbers (3, 8, 24). There are 3 groups of 8 things and a total of 24 things in each problem. Different: The first problem is a multiplication story and the second one is a division story. In the first problem, you know the two factors. In the second problem, one of the factors is missing.	Ask students guiding questions to help them see the similarities and differences in the two equations.
5. Ask student to write any more facts that are related to the two above facts.	8 x 3 = 24 and 24 ÷ 8 = 3.	Model how to write equations. If student does not understand that 3 x 8 = 8 x 3, refer to Commutative Property of Multiplication.

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
6. Ask student to give all the facts that go with 2 x 5 = 10.	2 x 5 = 10 5 x 2 = 10 10 ÷ 2 = 5 10 ÷ 5 = 2	Give a story problem to match each equation and let student model problem with manipulatives. Ask questions as in Step 1 to guide students to write the equations. Use the array cards and have the student write the fact that goes with it. Then have the student turn the card sideways and write the facts. For example, a 2 x 5 array (2 groups of 5) would become a 5 x 2 array (5 groups of 2) and the student would write 2 x 5 = 10 and 5 x 2 = 10. Do the same with the array that has a missing dimension. 10 divided into 2 equal groups (10 ÷ 2 = 5) and 10 divided into 5 equal groups (10 ÷ 5 = 2).
7. Follow Steps 1 – 6 and give additional problems as needed for practice. See Teacher Notes for sample problems.		

Teacher Notes

Additional practice problems:

Set 1:

1. Josh had 5 toy cars. Each toy car had 4 tires. How many tires were there in all?
2. Hannah had 20 beads to make necklaces. She put 4 beads on each necklace. How many necklaces can Hannah make if she uses all her beads?

Set 2:

1. There were 9 monkeys at the zoo. Each monkey had 2 bananas. How many bananas were there in all?
2. There were 18 apple slices. Mom put 2 apple slices on each plate. How many plates did she need for all the apple slices?

Variations
Use prepared array cards.

Shuffle the array cards so that some of the cards are showing both dimensions and some are showing the total and one dimension. Student takes the top card. If both dimensions are showing, he should give the product and write a multiplication number sentence to match. If the total and one dimension are showing, he should give the other dimension and write a division number sentence to match. Answers can be checked on the opposite side. Have student write the fact family for each array card. For example, for the 4 x 6 array, the student would write 4 x 6 = 24, 6 x 4 = 24, 24 ÷ 4 = 6, and 24 ÷ 6 = 4. Manipulate the array card to show each fact.

Formative Assessment
Max bought 15 packages of juice. Each package had 6 cartons of juice. He wrote the number sentence 15 x 6 = 90 to show how he figured out the total number of cartons of juice he bought. How could you rewrite the number sentence as a division number sentence? Write all the multiplication and division facts in the fact family for this problem.

References
Mathematics Preparation for Algebra. (n.d.). Retrieved Dec. 10, 2010, from Doing What Works: Van de Walle, John A., Karp, Karen S., and Bay-Williams, Jennifer M., (2010), *Elementary and Middle School Mathematics: Teaching Developmentally*, Boston, Allyn & Bacon