Multiplicative Comparison

Student Probe

Tom ran 4 laps of the football field. Sam ran 5 times as many laps of the football field as Tom. How many laps did Sam run?

Answer: 20

Lesson Description

In this lesson students will solve multiplicative comparison problems in which one quantity is described in terms of another. Students are expected to write a number sentence to illustrate the problem.

Rationale

Generally, multiplication problems involve some sort of quantity such as the number of groups, the number of objects in a group, the price, or the rate. Multiplicative comparison problems involve the comparison of two quantities in which one is described in terms of the other. Additionally, the operation required to solve these problems may be either multiplication or division. Problems of this type also lay the groundwork for multiplication and division of fractions. As with all computational skills, embedding them in simple contexts helps student remain more engaged in the mathematics.

Preparation

Prepare copies of Comparison Problems for each student.

At a Glance

What: Interpret a comparison problem as a multiplication equation.
Common Core State Standard: CC.4.OA.1. Interpret a multiplication equation as a comparison. Represent verbal statements of multiplicative comparisons as multiplication equations.
Mathematical Practices:
Make sense of problems and persevere in solving them.
Reason abstractly and quantitatively.
Who: Students who cannot interpret a multiplication equation as a comparison.
Grade Level: 4
Prerequisite Vocabulary: multiply, divide, equation
Prerequisite Skills: Knowledge of multiplication facts
Delivery Format: Individual, pairs or small group
Lesson Length: 15-30 minutes
Materials, Resources, Technology: None
Student Worksheets: Comparison Problems

Lesson

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
1. I have a package of pencils. The package costs five times more than a single pencil. One pencil costs 9¢. How much does the whole pack cost? How did you get that?	45¢, because $5 \cdot 9 = 45$	One pencil costs 9¢. Let's count by 9's: 9, 18, 27, 36, 45.
2. Chris ran 12 miles. Kevin ran 4 miles. How many times farther did Chris run than Kevin? How do you know?	Chris ran 3 times farther, because $12 = 3 \cdot 4$.	How many 4 mile runs would Kevin need to do to run the same distance as Chris?
3. Ellen bought 14 new markers. Jan bought half as many as Ellen. How many markers did Jan buy? How do you know?	7, because $14 \div 2 = 7$ or $14 = 7 \cdot 2$ or $\frac{1}{2} \cdot 14 = 7$.	Represent 14 markers. Have the student remove one half of them. How many are left?
4. Gene is 10 years old. His grandfather is six times as old as Gene. How old is his grandfather? How do you know?	60, because $10 \cdot 6 = 60$.	Gene is 10. Let's count by 10's: 10, 20, 30, 40, 50, 60.
5. Ann and Colleen baked cookies for the school bake sale. Colleen baked 24 cookies. Ann baked $1\frac{1}{2}$ times more cookies than Colleen. How many cookies did Ann bake? Show me how you know.	36, because $1\frac{1}{2} \cdot 24 = 36$ or $\frac{1}{2} \cdot 24 = 12$ and $24 + 12 = 36$.	Represent 24 cookies. Have the student show one half (12) of the cookies. Add the 12 cookies to the 24.
6. Repeat with additional problems.		

Teacher Notes

1. To solve these problems students must understand the meaning of phrases such as “six times more”, or “half as many”.
2. Use manipulatives when possible to provide students with concrete examples.
3. Display the number sentences students use to solve the problems.
4. Ask students to record their work on paper. Monitor the strategies students use to solve the problems, making sure the student chooses multiplication over repeated addition.

Variations

A table can be used to help students keep track of the relationship being duplicated in the problem situation. In the problem--Tom ran 4 laps of the football field. Sam ran 5 times as many laps of the football field as Tom. How many laps did Sam run?

Tom’s Laps	1	2	3	4
Sam’s Laps	5	10	15	20

Formative Assessment

A truck is twice as heavy as a car. The car weighs 3,000 pounds. How much does the truck weigh?

Answer: 6000 pounds

References

Marjorie Montague, Ph.D. (2004, 12 7). *Math Problem Solving for Middle School Students With Disabilities*. Retrieved April 25, 2011, from The Iris Center.

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Van de Walle, J. A., & Lovin, L. H. (2006). *Teaching Student-Centered Mathematics Grades 5-8 Volume 3.* Boston, MA: Pearson Education, Inc.

Multiplicative Comparison

1. A red umbrella costs $8.00. A green umbrella costs 3 times as much as the red umbrella. How much does the green umbrella cost?

2. A rubber band is 6 cm long. How long will the rubber band be if it is stretched to be 3 times as long?

3. The giraffe in the zoo is 4 times as tall as the gorilla. The gorilla is 4 feet tall. How tall is the giraffe?

4. Tom has 8 baseball cards. Jorge has 6 times as many cards. How many baseball cards does Jorge have?

5. Lisa has four CDs, Cynthia has three times as many as Lisa, and Megan has half as many as Lisa. How many CDs do Cynthia and Megan have?

6. A factory has 4 times as many workers as a grocery store. The grocery store has 8 workers. How many workers does the factory have?

7. Sam picked 7 apples. Lucy picked 6 times as many apples as Sam. How many apples did Lucy pick?

8. Paula has 20 coins in her coin collection. Tony has 5 times as many coins as Paula. How many coins does Tony have?

9. This month Peter saved 4 times as much money as last month. Last month he saved $8. How much money did Peter save this month?

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