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# 22 Multiplication and Division Word Problems

**LESSON 22** Multiplication and Division Word Problems 4.AT.2, 4

**1 Introduction**

Multiplication comparison problems can be solved using multiplication or division. Some word clues that tell you to use multiplication to compare are *How many times more?* and *How many times as many?*

Tyrell has 4 tennis balls. David has 3 times as many tennis balls. How many tennis balls does David have?

You can draw a diagram to help you think about the problem.

Tyrell (T) 

4
---

 $D = 3 \times T$   
 David (D) 

4	4	4
---	---	---

 $D = 3 \times 4 = 12$

The problem tells you that Tyrell has 4 tennis balls, so  $T$  is 4. You also know that 3 times this number is equal to the number of balls David has, so write the equation  $D = 3 \times 4$ . Then multiply. David has 12 tennis balls.

Be careful not to confuse a comparison that uses multiplication with a comparison that uses addition. Problems involving addition do not have the clue word *times* in them. For example, the problem might say that Tyrell has 4 tennis balls and David has 12 tennis balls. How *many more* tennis balls does David have than Tyrell? This question asks for a comparison using subtraction.

Sometimes you have to use the inverse operation to solve a problem.

David has 3 times as many tennis balls as Tyrell. David has 12 tennis balls. How many tennis balls does Tyrell have?

You can write the equation as  $3 \times T = D$ , or  $3 \times T = 12$ . You know that division is the opposite of multiplication, so you can divide 12 by 3 to find  $T$ .

$D \div 3 = T$   
 $12 \div 3 = 4$

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## Objective

To use multiplication and division to solve multiplicative comparison word problems

## 1 Introduction

Review the concept of multiplicative comparison. Students should recognize *how many times more* and *how many times as many* as clues to multiplication. Work through the example on the page, demonstrating how the model represents the parts of the comparison. Then contrast multiplicative comparison with comparisons made using addition or subtraction; emphasize that *more than* suggests an addition problem, whereas *times more than* suggests multiplication. Finally, extend the discussion to the use of the inverse operation to solve a problem. Discuss the final example on the page. Students should recognize that if the unknown is a factor, then they can divide the product by the other factor to find the unknown.

## Think About It

Students should recognize that an inverse operation is the opposite, so the inverse can be used to make sure that the three numbers in a problem are the same in both operations. For example, if  $3 \times 4 = 12$ , then  $12 \div 4 = 3$ .

**Think About It**

How can you use the inverse operation to check your answer? Use an example.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**2 Focused Instruction**

**A model can help you understand a problem.**

Raj buys a pair of socks and a pair of pants at the mall. The pants cost 4 times as much as the socks. The socks cost \$6. How much do the pants cost?

What number do you not know? the cost of the pants

Is the cost of the socks less than or more than the cost of the pants?  
less than

What is the cost of the socks? \$6

In the space below, draw a bar to stand for the cost of the socks.

Socks: 

\$6
-----

Pants: 

\$6	\$6	\$6	\$6
-----	-----	-----	-----

 = 24

How many sock bars are equal to the cost of the pants? 4

In the space above, draw enough sock bars to equal the cost of the pants.

Write an equation to show the relationship between the cost of the socks and the cost of the pants.  $4 \times 6 = P$

Complete the model above with the cost of the pants. The pants cost \$24

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## Indiana Academic Standards

**4.AT.2** Recognize and apply the relationships between addition and multiplication, between subtraction and division, and the inverse relationship between multiplication and division to solve real-world and other mathematical problems.

**4.AT.4** Solve real-world problems with whole numbers involving multiplicative comparison (e.g., by using drawings and equations with a symbol for the unknown number to represent the problem), distinguishing multiplicative comparison from additive comparison. [In grade 4, division problems should not include a remainder.]

## Vocabulary

**array:** a model using rows and columns of symbols or shapes

**2 Focused Instruction**

First, students read a real-world problem, identify the relationship between the given numbers, and draw a model to represent it. They then write and solve an equation.

Next, students read a second real-world problem and organize the information in it with the help of leading questions. They identify the operation needed and write an equation to represent the relationship between the numbers. Then they solve for the unknown.

Conclude the Focused Instruction section by having students write and solve equations for two problems.

**3 Guided Practice**

Students should complete the Guided Practice section on their own. Offer assistance as needed, pointing out the reminder and hint boxes along the right side of the page.

**Connections to Process Standards for Mathematics**

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.

**Extension Activity**

As a class activity, compile a chart of facts about local wildlife, such as the average weight, length, speed, and so on. Ask students to write comparison statements to describe one animal in terms of another. For example, "The average weight of a rabbit is 2 pounds. The average weight of a groundhog is 6 times as much. How much does a groundhog weigh?" Direct students to write their statements on sheets of construction paper and illustrate them with pictures of the animals in question and the answer at the bottom. Post the illustrations to share with the class.

**2 Focused Instruction** Lesson 22

**Use word clues to help you solve this problem.**

Alex and Aaron both collect baseball cards. Alex has 8 times as many baseball cards as Aaron. If Alex has 96 baseball cards, how many baseball cards does Aaron have?

What word clues do you not know? the number of baseball cards Alex has

Complete these sentences with the information you do know.

Alex has 96 cards.

Alex has 8 times as many cards as Aaron.

What word clues tell you what operation to use? times as many

Choose which operation you will use. addition multiplication

Write an equation you can solve, using C for the unknown.

$B \times C = 96$

Write an equation using the inverse operation to solve for the unknown, C.

$96 \div 8 = C$

How many cards does Aaron have? 12

**Remember that the inverse of multiplication is division. For addition, the inverse is subtraction.**

**Use what you know about multiplication and division to answer these questions.**

1 Jane is measuring a planter to put on the porch. She finds that the planter is 3 times as long as it is wide. The planter is 24 inches long. What equation can you use to find the unknown width of the planter, W?

$3 \times W = 24$

2 In art class, Caitlyn drew 5 times as many pictures as Tanya did. Caitlyn drew 15 pictures. Write and solve an equation to find how many pictures Tanya drew.

$5 \times T = 15; 15 \div 5 = 3$  pictures

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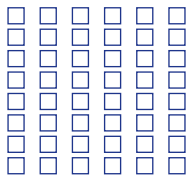
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**3 Guided Practice** Lesson 22

**Solve the following problems.**

1 There are 6 cheese crackers in a single-serving pack. A box of these packs holds 8 times as many cheese crackers as a single-serving pack.

**Part A** Draw an array to model this problem.



**Part B** How many cheese crackers are in a box?

**Answer** 48 cheese crackers

2 Meryem solved the following problem.

Jon ran 3 laps around the track. Guy ran 6 times as many laps as Jon. How many laps did Guy run?

She wrote the equation  $3 \times G = 6$  to find how many laps Guy ran. Then she solved it for  $G = 2$ , so Guy ran 2 laps. Is Meryem's solution correct? Explain your answer.

no; Her equation should be  $3 \times 6 = G$ . The number of laps Guy ran is unknown, but it is equal to 6 times as many laps as Jon ran, which is 3. The number of laps Guy ran is 18.

**Is the number 6 a product or a factor?**

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**4** Independent Practice

Lesson 22

Solve the following problems.

- 1 Victoria biked 4 miles on Monday. On Tuesday, she biked twice as far. How many miles did she bike on Tuesday? **DOK 2**  
**4.AT.4**
- A 2  
B 4  
**C 8**  
D 12

- 2 At a zoo, one gorilla is 4 feet tall. A giraffe at the same zoo is 4 times as tall as the gorilla. How tall is the giraffe? **DOK 1**  
**4.AT.4**
- Answer 16 feet

- 3 At a fruit stand, a box has 8 apples. A crate has 10 times as many apples as a box. Which statements are correct? Select the **two** correct answers. **DOK 3**  
**4.AT.4**
- A The box has 2 fewer apples than the crate.  
B The crate has 78 more apples than the box.  
**C The crate has 80 apples.**  
D The expression  $8 + 10$  gives the number of apples in the crate.  
**E The expression  $8 \times 10$  gives the number of apples in the crate.**

- 4 Mike finds an unusual bug outside. The bug is 5 times as long as it is wide. The bug is 10 centimeters long. How wide is the bug? Write and solve an equation. Show your work. **DOK 2**  
**4.AT.2, 4**
- $5 \times w = 10$   
 $10 \div 5 = 2$
- Answer 2 centimeters

**4** Independent Practice Answer Rationales

1 The phrase *biked twice as far* calls for multiplying Monday's distance, 4, by 2, so the equation that represents the problem is  $2 \times 4 = 8$ . Choice C is correct. Choice A is incorrect because it divides 4 by 2 instead of multiplying. Choice B is incorrect; it is the number of miles Victoria biked on Monday. Choice D is incorrect because it combines the miles ridden Monday with the miles ridden Tuesday.

2 To find the height of the giraffe, multiply. If the gorilla is 4 feet tall and the giraffe is 4 times that, then  $4 \times 4 = G$ ;  $G = 16$  feet.

3 If a crate has 10 times as many apples as a box, then it has  $10 \times 8 = 80$  apples. Choices C and E are correct. Choice E shows the expression with the factors reversed, using the commutative property. Choice A is incorrect; it subtracts the number of apples in a box from the other factor, 10. Choice B is incorrect; if the crate has 80 apples and the box has 8, then  $80 - 8 = 72$ , the difference in the number of apples. Choice D is incorrect; it simply adds the two numbers given in the problem.

4 The width,  $w$ , of the bug is unknown. Its length, 10 centimeters, is equal to 5 times its width,  $10 = 5 \times w$ . Divide the bug's given length by 5:  $10 \div 5 = W = 2$  centimeters.

5 Since bus A has twice as many students as bus B, then bus B would have half as many as bus A; the total cannot be higher than 48. Shona is incorrect because 48 must be the product.

6 **PART A** A bar model should represent the number of sit-ups Layla can do with one bar labeled 5. Beneath it should be six bars of the same length in a row to represent 6 *times as many*.

**PART B** Layla needs to do 6 times as many sit-ups as the number she can do now:  $6 \times 5$ . This is set equal to the unknown number,  $t$ , for  $6 \times 5 = t$ . To solve the equation, multiply for  $t = 30$  sit-ups.

**4** Independent Practice

Lesson 22

- 5 Shona read the following problem. **DOK 3**  
**4.AT.4**

Two buses are taking campers to summer camp. Bus A has twice as many students as bus B. Bus A has 48 students. How many students are on bus B?

Shona wrote the equation  $2 \times 48 = n$ , where  $n$  represents the number of students on bus B. She says there are 96 students on bus B. Is she correct? Explain how you know.  
**no; Bus B has to have more students than bus A. The equation should be  $B = 48 \div 2 = 24$ .**

- 6 Layla does 5 sit-ups in gym class. She needs to do 6 times as many sit-ups to get a fitness award. **DOK 2**  
**4.AT.2, 4**

**Part A** Draw a bar model to compare the number of sit-ups Layla can do to the number of sit-ups she needs to do for the award.

$\frac{5}{5 \quad 5 \quad 5 \quad 5 \quad 5 \quad 5} = 30$

**Part B** Write and solve an equation to find how many sit-ups Layla needs to do for the award. Show your work.

$6 \times 5 = t$   
 $t = 30$

Answer 30 sit-ups