

7-1

Ratios and Proportions



Vocabulary

Review

1. Write a *ratio* to compare 9 red marbles to 16 blue marbles in three ways.

9 to $\frac{\text{input}}{16}$:

In simplest form, write the *ratio* of vowels to consonants in each word below.

2. comparison

$\frac{\text{input}}{\text{input}}$

3. geometry

to

4. ratio

:

5. Cross out the *ratio* that is NOT equivalent to 12 to 8.

6 : 2 9 to 6 $\frac{24}{16}$ 48 : 32

Vocabulary Builder

proportion (noun) pruh PAWR shun

Other Word Form: proportional (adjective)

Definition: A **proportion** is an equation stating that two ratios are equal.

Examples: $\frac{2}{3} = \frac{8}{12}$ and $\frac{1}{2} = \frac{5}{10}$ are **proportions**.

A **proportion** always includes an **equal** sign, =.

Use Your Vocabulary

6. Write 3 or 6 to make each *proportion* true.

$\frac{2}{3} = \frac{\text{input}}{9}$ $\frac{\text{input}}{4} = \frac{6}{8}$ $\frac{1}{3} = \frac{2}{\text{input}}$ $\frac{5}{\text{input}} = \frac{10}{6}$

Underline the correct word to complete each sentence.

7. Distance on a map is proportion / proportional to the actual distance.

8. The number of ounces in 3 lb is in proportion / proportional to the number of ounces in 1 lb.

Key Concept Properties of Proportions

Cross Products Property In a proportion $\frac{a}{b} = \frac{c}{d}$, where $b \neq 0$ and $d \neq 0$, the product of the **extremes** a and d equals the product of the **means** b and c .

$$\frac{a}{b} = \frac{c}{d}$$

$$a \cdot d = b \cdot c$$

$$ad = bc$$

Equivalent Forms of Proportions

Property 1

$$\frac{a}{b} = \frac{c}{d} \text{ is equivalent to}$$

$$\frac{b}{a} = \frac{d}{c}$$

Property 2

$$\frac{a}{b} = \frac{c}{d} \text{ is equivalent to}$$

$$\frac{a}{c} = \frac{b}{d}$$

Property 3

$$\frac{a}{b} = \frac{c}{d} \text{ is equivalent to}$$

$$\frac{a+b}{b} = \frac{c+d}{d}$$

9. Identify the *means* and *extremes* in the proportion $\frac{2}{3} = \frac{4}{x}$.

Means and

Extremes and

Identify the *Property of Proportions* each statement illustrates.

10. If $\frac{3}{12} = \frac{1}{4}$, then $\frac{3}{1} = \frac{12}{4}$.

11. If $\frac{4}{5} = \frac{8}{10}$, then $4(10) = 5(8)$.

12. If $\frac{1}{3} = \frac{3}{9}$, then $\frac{3}{1} = \frac{9}{3}$.

13. If $\frac{3}{4} = \frac{x}{y}$, then $\frac{7}{4} = \frac{x+y}{y}$.



Problem 1 Writing a Ratio

Got It? A bonsai tree is 18 in. wide and stands 2 ft tall. What is the ratio of the width of the bonsai to its height?

14. The bonsai is in. wide and in. tall.

15. Write the same ratio three different ways.

width of bonsai to height of bonsai

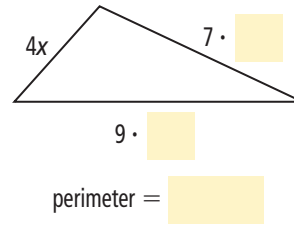
<p>Write using the word "to."</p> <p><input type="text"/> to <input type="text"/></p>	<p>Write as a fraction.</p> <p><input type="text"/> — <input type="text"/></p>	<p>Write using a colon.</p> <p><input type="text"/> : <input type="text"/></p>
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Problem 3 Using an Extended Ratio

Got It? The lengths of the sides of a triangle are in the extended ratio 4 : 7 : 9. The perimeter is 60 cm. What are the lengths of the sides?

16. Label the triangle at the right. Use the extended ratio to write an expression for each side length.
17. Complete the model to write an equation.



Relate the sum of the side lengths is the perimeter

Write $4x + [] + []$ = 60

18. Use the justifications below to find the value of x .

$$4x + [] + [] = 60$$

Write the equation.

$$[] \cdot x = 60$$

Combine like terms.

$$\frac{[] \cdot x}{[]} = \frac{60}{[]}$$

Divide each side by $[]$.

$$x = []$$

Simplify.

19. Use the value of x to find each side length.

$$4x = 4 \cdot []$$
$$= []$$

$$7[] = 7 \cdot []$$
$$= []$$

$$[] = [] \cdot []$$
$$= []$$

20. The lengths of the sides of the triangle are $[]$ cm, $[]$ cm, and $[]$ cm.



Problem 4 Solving a Proportion

Got It? Algebra What is the solution of the proportion $\frac{9}{2} = \frac{a}{14}$?

21. Write a justification for each statement below.

$$\frac{9}{2} = \frac{a}{14}$$

$$9(14) = 2a$$

$$126 = 2a$$

$$\frac{126}{2} = \frac{2a}{2}$$

$$a = 63$$



Problem 5 Writing Equivalent Proportions

Got It? Use the proportion $\frac{x}{6} = \frac{y}{7}$. What ratio completes the equivalent proportion $\frac{6}{x} = \frac{\blacksquare}{\blacksquare}$? Justify your answer.

22. Use the diagram at the right. Draw arrows from the x and the 6 in the original proportion to the x and the 6 in the new proportion.

$$\frac{x}{6} = \frac{y}{7} \qquad \frac{6}{x} = \frac{\blacksquare}{\blacksquare}$$

23. Circle the proportion equivalent to $\frac{a}{b} = \frac{c}{d}$ that you can use.

$$\frac{b}{a} = \frac{d}{c}$$

$$\frac{a}{c} = \frac{b}{d}$$

$$\frac{a+b}{b} = \frac{c+d}{d}$$

24. Complete: $\frac{x}{6} = \frac{y}{7}$ is equivalent to $\frac{6}{x} = \frac{\blacksquare}{\blacksquare}$.



Lesson Check • Do you UNDERSTAND?

Error Analysis What is the error in the solution of the proportion at the right?

25. Circle the means of the proportion. Then underline the extremes.

$$\frac{3}{4} = \frac{7}{x}$$

26. Write each product.

Means

$$\blacksquare \cdot \blacksquare = \blacksquare$$

Extremes

$$\blacksquare \cdot \blacksquare = \blacksquare$$

27. What is the error in the solution of the proportion?

28. Now solve the proportion correctly.

$$\frac{7}{3} = \frac{4}{x}$$
$$28 = 3x$$
$$\frac{28}{3} = x$$



Math Success

Check off the vocabulary words that you understand.



proportion



means



extremes



Cross Products Property

Rate how well you can *solve proportions*.

Need to review

0 2 4 6 8 10



Now I get it!