LESSON 6.1

Study Guide
For use with pages 356–363

GOAL **Solve problems by writing and solving proportions.**

> ## Vocabulary
>
> If a and b are two numbers or quantities and $b \neq 0$, then the
>
> **ratio of a to b** is $\frac{a}{b}$.
>
> An equation that states that two ratios are equal, such as $\frac{a}{b} = \frac{c}{d}$, is
> called a **proportion.** The numbers b and c are the **means,** and the
> numbers a and d are the **extremes.**
>
> The **geometric mean** of two positive numbers a and b is the positive
> number x that satisfies $\frac{a}{x} = \frac{x}{b}$. So, $x^2 = ab$ and $x = \sqrt{ab}$.
>
> **A Property of Proportions**
>
> 1. **Cross Products Property:**
>
>   If $\frac{a}{b} = \frac{c}{d}$ where $b \neq 0$ and $d \neq 0$, then $ad = bc$.

EXAMPLE 1 ## Simplify ratios

Simplify the ratio.

  a. 81 cm : 3 cm   **b.** $\frac{9 \text{ ft}}{15 \text{ yd}}$

Solution

**a.** Write 81 cm : 3 cm as $\frac{81 \text{ cm}}{3 \text{ cm}}$.
Then divide out the units and simplify.

$$\frac{81 \text{ cm}}{3 \text{ cm}} = \frac{27}{1} = 27 : 1$$

b. To simplify a ratio with unlike units,
multiply by a conversion factor.

$$\frac{9 \text{ ft}}{15 \text{ yd}} = \frac{9 \text{ ft}}{15 \text{ yd}} \cdot \frac{1 \text{ yd}}{3 \text{ ft}} = \frac{9}{45} = \frac{1}{5}$$

EXAMPLE 2 ## Use extended ratios

The measures of the angles in △ABC are in the extended ratio of 2:3:5. Find the measures of the angles.

Solution

Sketch the triangle and use the extended ratio of
2 : 3 : 5 to label the angle measures as $2x°$, $3x°$,
and $5x°$. By the Triangle Sum Theorem,
$2x° + 3x° + 5x° = 180°$. So, $x = 18$.

The angle measures of the triangle are
$2(18°) = 36°$, $3(18°) = 54°$, and $5(18°) = 90°$.
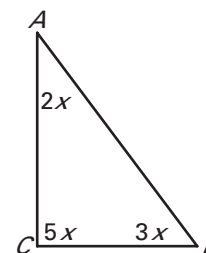
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Exercises for Examples 1 and 2

Simplify the ratio.

1. $\dfrac{60 \text{ mi}}{51 \text{ mi}}$

2. $7 \text{ cm} : 14 \text{ mm}$

3. A triangle's angle measures are in the extended ratio of $5 : 9 : 16$. Find the measures of the angles.

EXAMPLE 3 **Solve a proportion**

Solve the proportion $\dfrac{x}{8} = \dfrac{5}{4}$.

Solution

$\dfrac{x}{8} = \dfrac{5}{4}$ Write original proportion.

$4 \cdot x = 8 \cdot 5$ Cross Products Property

$4x = 40$ Multiply.

$x = 10$ Divide each side by 4.

EXAMPLE 4 **Find a geometric mean**

Find the geometric mean of 45 and 5.

Solution

$x = \sqrt{ab}$ Definition of geometric mean

$= \sqrt{45 \cdot 5}$ Substitute 45 for a and 5 and b.

$= \sqrt{225}$ Multiply.

$= 15$ Simplify.

The geometric mean of 45 and 5 is 15.

Exercises for Examples 3 and 4

Solve the proportion.

4. $\dfrac{a}{12} = \dfrac{5}{3}$

5. $\dfrac{6}{7} = \dfrac{30}{x}$

6. $\dfrac{9}{y} = \dfrac{3}{7}$

Find the geometric mean of the two numbers.

7. 3 and 27

8. 40 and 5

9. 6 and 15