

Warm Up

Lesson Presentation

Lesson Quiz

Objective

Apply proportional relationships to rates, similarity, and scale.

Vocabulary

ratio

proportion

rate

similar

indirect measurement

$$10 : 8$$

$$\frac{10}{18} = \underline{.55} \quad \frac{8}{18} = \underline{.44}$$

Recall that a **ratio** is a comparison of two numbers by division and a **proportion** is an equation stating that two ratios are equal. In a proportion, the cross products are equal.

Cross Products Property

WORDS	NUMBERS	ALGEBRA
The cross products of a proportion are equal.	$\frac{3}{5} = \frac{9}{15}$ $3(15) = 5(9)$ $45 = 45$	For real numbers a , b , c , and d , where $b \neq 0$ and $d \neq 0$: If $\frac{a}{b} = \frac{c}{d}$, then $ad = bc$.

If a proportion contains a variable, you can cross multiply to solve for the variable. When you set the cross products equal, you create a linear equation that you can solve by using the skills that you learned in Lesson 2-1.

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Example 1: Solving Proportions

Solve each proportion.

A. $\frac{16}{p} = \frac{24}{12.9}$

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$206.4 = 24p$ Set cross products equal.

$\frac{206.4}{24} = \frac{24p}{24}$ Divide both sides.

$8.6 = p$

B. $\frac{14}{88} = \frac{c}{132}$

$\frac{14}{88} = \frac{c}{132}$

$88c = 1848$

$\frac{88c}{88} = \frac{1848}{88}$

$c = 21$

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Because percents can be expressed as ratios, you can use the proportion $\frac{\text{percent}}{100} = \frac{\text{part}}{\text{whole}}$ to solve percent problems.

$\frac{\text{is}}{\text{of}} = \frac{\%}{100}$

Remember! Percent is a ratio that means *per hundred*.

For example:
 $30\% = 0.30 = \frac{30}{100}$

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Example 2: Solving Percent Problems

Part = 22.5
 whole = 100

A poll taken one day before an election showed that 22.5% of voters planned to vote for a certain candidate. If 1800 voters participated in the poll, how many indicated that they planned to vote for that candidate?

What is 22.5% of 1800

$\frac{x}{1800} = \frac{22.5}{100}$

405

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Check It Out! Example 2

At Clay High School, 434 students, or 35% of the students, play a sport. How many students does Clay High School have?

What is 35% of 434
 434 is 35% of what?
 $\frac{434}{x} = \frac{35}{100}$ $43,400 = 35x$
 $x = 1240$

A **rate** is a ratio that involves two different units. You are familiar with many rates, such as miles per hour (mi/h), words per minute (wpm), or dollars per gallon of gasoline. Rates can be helpful in solving many problems.

Example 3: Fitness Application

Ryan ran 600 meters and counted 482 strides. How long is Ryan's stride in inches? (Hint: 1 m ≈ 39.37 in.)

Use a proportion to find the length of his stride in meters.

$\frac{600 \text{ m}}{482 \text{ strides}} = \frac{x \text{ m}}{1 \text{ stride}}$ Write both ratios in the form $\frac{\text{meters}}{\text{strides}}$
 $600 = 482x$ Find the cross products
 $x \approx 1.24 \text{ m}$

$\frac{482}{600} = \frac{x}{1}$
 $\frac{1}{600} = \frac{x}{482}$

Example 3: Fitness Application continued

Convert the stride length to inches.

$\frac{39.37 \text{ in.}}{1 \text{ m}}$ is the conversion factor.
 $\frac{1.24 \text{ m}}{1 \text{ stride length}} \cdot \frac{39.37 \text{ in.}}{1 \text{ m}} \approx \frac{49 \text{ in.}}{1 \text{ stride length}}$

Ryan's stride length is approximately 49 inches.

Check It Out! Example 3

Luis ran 400 meters in 297 strides. Find his stride length in inches.

Similar figures have the same shape but not necessarily the same size. Two figures are **similar** if their corresponding angles are congruent and corresponding sides are proportional.

Reading Math

The ratio of the corresponding side lengths of similar figures is often called the *scale factor*.

Example 5: Nature Application

The tree in front of Luka's house casts a 6-foot shadow at the same time as the house casts a 22-foot shadow. If the tree is 9 feet tall, how tall is the house?

Sketch the situation. The triangles formed by using the shadows are similar, so Luka can use a proportion to find h the height of the house.

Tree
House

$$\frac{6}{22} = \frac{9}{x} \quad (x=33)$$

$$6x = 198$$

