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LESSON 2

Solving Proportions

7.RP.2.a–c, 7.RP.3

A cross product is the product of the denominator of one fraction and the numerator of the other. If the cross products of two ratios are equal, they form a proportion.

$\frac{4}{6} \stackrel{?}{=} \frac{10}{15}$

$6 \cdot 10 \stackrel{?}{=} 4 \cdot 15$

$60 = 60$

To simplify ratios, divide the numerator and the denominator by their greatest common factor.

Variables, or letters such as *n* or *x,* are often used to represent unknown quantities in proportions.

A **proportion** shows that two ratios are equal. To see if two ratios form a proportion, simplify each ratio to see if they are equal.

Train A was on time $\frac{16}{20}$ of the time. Train B was on time $\frac{24}{30}$ of the time. Are these ratios proportional?

Simplify $\frac{16}{20}$: $\frac{16 \div 4}{20 \div 4} = \frac{4}{5}$

Simplify $\frac{24}{30}$: $\frac{24 \div 6}{30 \div 6} = \frac{4}{5}$

Both ratios simplify to $\frac{4}{5}$, so yes, they are proportional.

Proportions can be used to solve problems.

The ratios of times that trains C and D were on time are proportional. Train C was on time 15 out of 20 times this month. Train D ran 36 times this month. How many of these times was train D on time?

Write a proportion to show the two ratios are equal. Let *x* represent the unknown quantity.

$$\frac{15}{20} = \frac{x}{36}$$

Write the cross products.

$$20 \cdot x = 15 \cdot 36$$

Simplify and solve for *x*.

$$20x = 540$$
$$x = 540 \div 20 = 27$$

Train D was on time 27 times.

SAMPLE

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Read each problem. Circle the letter of the best answer.

SAMPLE The lengths and widths of two rectangles are proportional. One rectangle is 6 inches by 8 inches. What could be the dimensions of the other rectangle?

A 4 inches by 6 inches

B 6 inches by 9 inches

C 9 inches by 12 inches

D 12 inches by 18 inches

The correct answer is C. The dimensions of the given rectangle form the ratio $\frac{6}{8}$, which simplifies to $\frac{3}{4}$. Write and simplify a ratio for each answer choice to see which equals this. Choice A = $\frac{4}{6} = \frac{2}{3}$. Choice B = $\frac{6}{9} = \frac{2}{3}$. Choice C = $\frac{9}{12} = \frac{3}{4}$. Choice D = $\frac{12}{18} = \frac{2}{3}$. Only choice C simplifies to $\frac{3}{4}$.

1 To make a certain shade of purple paint, different parts of red paint are mixed with different parts of blue paint. The table below shows this relationship.

Parts Red	6	8	12	16
Parts Blue	15	20	30	40

What is the ratio of parts red to parts blue?

A 2 parts red to 3 parts blue

B 2 parts red to 5 parts blue

C 3 parts red to 5 parts blue

D 3 parts red to 10 parts blue

2 Randall wrote the proportion below to find *n*, the cost of 3 pounds of fruit.

$$\frac{6}{5} = \frac{n}{3}$$

Which equation can be used to find *n*?

A $n = \frac{6}{5 \cdot 3}$

B $n = \frac{5 \cdot 3}{6}$

C $n = \frac{5}{6 \cdot 3}$

D $n = \frac{6 \cdot 3}{5}$

3 Which of the following ratios forms a proportion with $\frac{12}{16}$?

A $\frac{8}{12}$

B $\frac{16}{20}$

C $\frac{18}{24}$

D $\frac{24}{30}$

4 An elevator travels directly up 27 floors in 90 seconds. How many floors can this elevator travel directly up in 60 seconds?

A 18

B 21

C 40

D 200

5 This table shows the relationship between the cups of flour used to make muffins.

Cups of Flour	2	3	4
Number of Muffins	12	18	24

How many muffins can be made with 7 cups of flour?

A 13

B 30

C 36

D 42

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Read each problem. Write your answer.

SAMPLE A car travels 270 miles on 15 gallons of gas. How many gallons of gas are needed for this car to travel 100 miles?

Answer _____

Set up a proportion that compares miles traveled to gallons of gas used. Let x represent the unknown number of gallons: $\frac{270}{15} = \frac{100}{x}$. Cross multiply and then solve for x: $270 \cdot x = 15 \cdot 100$, $270x = 1{,}500$, $x = 1{,}500 \div 270 = 5\frac{5}{9}$ gallons.

6 Which of the following ratios are proportional?

$\frac{9}{12}$ $\frac{12}{15}$ $\frac{16}{20}$ $\frac{20}{24}$ $\frac{24}{35}$

Answer _____

7 This table shows proportional relationships.

12	20	24	48
3	5	6	12

What is the ratio that is common throughout this table, written in simplest form?

Answer _____

8 Clearance items in a store are all marked down proportionally. A shirt with an original price of $32 is on clearance for $12. What is the clearance price of a shirt with an original price of $40? Show your work.

Answer _____

SAMPLE

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Read each problem. Write your answer to each part.

9 A recipe calls for 3 parts water to 2 parts oats. Misty mixes $\frac{3}{4}$ cup of water with $\frac{1}{2}$ cup of oats.

Write a ratio for each pair of numbers. Are the ratios equal?

Part A Is Misty following this recipe?

Answer _____

Part B Explain how you know your answer is correct.

_____

_____

_____

10 A video store charges the same fee each day a video is returned late. Craig returned a video 4 days late and paid a $3 fee.

Part A Write a proportional equation that can be used to find the late fee for a video that is returned 7 days late.

Answer _____

Part B What is the fee for a video that is returned 7 days late? Explain how you know.

_____

_____

_____

SAMPLE

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