Ratios and Equivalent Ratios

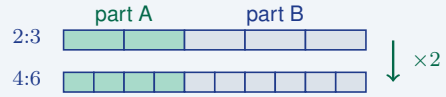
Name: _____	Date: _____	Score: _____ / 17

A **ratio** is simply a way of comparing two quantities—you can write it in words, with a colon, or as a fraction, but the idea is always the same: how much of one thing there is for another. The cool part? Two ratios are **equivalent** when they describe the same comparison at a different scale, like $1{:}3$ and $2{:}6$. Learning to spot and create equivalent ratios is the foundation for everything else in this chapter—unit rates, proportions, and scale drawings all build on this one idea. Get comfortable with ratios now and the rest will feel like a natural next step!

Key Concepts & Quick Review

Writing a ratio: order matters. "3 cats to 5 dogs" $= 3{:}5 = \frac{3}{5}$ (not $5{:}3$).

Equivalent ratios: multiply or divide both terms by the same number. $\frac{2}{3} = \frac{4}{6} = \frac{10}{15}$. **Simplest form:** divide both terms by their GCF. $\frac{18}{24} = \frac{3}{4}$ (GCF $= 6$).



Equivalent ratios keep the same comparison.

Examples

① A bag has 15 red marbles and 10 blue marbles. Write the ratio of red to blue marbles in simplest form. Then find two equivalent ratios.

Think It Through: Start with the ratio red to blue: $15{:}10$. To simplify a ratio, treat it like a fraction and divide both parts by the same number. The greatest common factor of 15 and 10 is 5, so dividing both by 5 gives $3{:}2$. To make equivalent ratios, multiply both parts by the same number. Multiplying by 2 gives $6{:}4$, and multiplying by 3 gives $9{:}6$. The important idea is that equivalent ratios keep the same comparison.

Answer: $3{:}2$; *equivalent ratios include* $6{:}4$ *and* $9{:}6$

② A recipe calls for 2 cups of flour for every 3 cups of oats. A baker wants to make a larger batch using 9 cups of oats. How many cups of flour does she need?

Think It Through: Line up the ratio so the same kinds of quantities match: flour over oats equals flour over oats. That gives $\frac{2}{3} = \frac{x}{9}$. Since the oats went from 3 to 9, they were multiplied by 3. To keep the ratio equivalent, multiply the flour part by 3 too: $2 \times 3 = 6$. So the baker needs 6 cups of flour. In ratio problems, whatever happens to one part must happen to the other part as well.

Answer: 6 *cups of flour*

Practice Problems

Write each ratio in simplest form, or find the missing value to complete the equivalent ratio.

1. $\frac{6}{9} =$ _____
2. $\frac{15}{20} =$ _____
3. $\frac{8}{12} =$ _____
4. $\frac{14}{21} =$ _____
5. $\frac{10}{25} =$ _____
6. $\frac{24}{36} =$ _____
7. $\frac{3}{4} = \frac{?}{12}$ _____
8. $\frac{2}{5} = \frac{?}{20}$ _____
9. $\frac{7}{8} = \frac{?}{24}$ _____
10. $\frac{5}{6} = \frac{?}{30}$ _____
11. $\frac{?}{9} = \frac{4}{3}$ _____
12. $\frac{18}{?} = \frac{3}{5}$ _____
13. $\frac{32}{40} =$ _____
14. $\frac{45}{60} =$ _____
15. $\frac{1}{3} = \frac{?}{15}$ _____

Study Tips

- **Order matters** in a ratio. "Boys to girls" and "girls to boys" are different ratios — always read the problem carefully.
- To check if two ratios are equivalent, **cross-multiply** and see if the products are equal: $\frac{3}{4} = \frac{9}{12}$ because $3 \times 12 = 4 \times 9 = 36$.
- Always simplify a ratio by finding the **GCF** of both terms — just like simplifying a fraction.

Word Problems

16. A school survey found that for every 4 students who prefer math, 7 students prefer English. If 280 students prefer English, how many prefer math? Write a ratio equation and solve. _____

17. A map uses a scale where 3 centimeters represents 45 kilometers. Write the ratio of centimeters to kilometers in simplest form. Then determine how many centimeters on the map would represent 120 kilometers.

_____

Answer Keys

1) $\frac{2}{3}$
2) $\frac{3}{4}$
3) $\frac{2}{3}$
4) $\frac{2}{3}$
5) $\frac{1}{3}$
6) $\frac{2}{3}$
7) 9
8) 8
9) 21
10) 25
11) 12
12) 30
13) $\frac{4}{5}$
14) $\frac{3}{4}$
15) 5
16) 160 students prefer math
17) Ratio $1:15$; $120\,km$ is $8\,cm$ on the map

Step-by-Step Explanations

Strategy: For Converting Between Fractions, Decimals, and Percents, choose the most natural bridge: divide for decimals, use 100 for percents, and simplify fractions. The important rational-number habit is choosing the relationship before doing arithmetic.

Practice 1: $\frac{1}{4} =$ **Answer:** 0.25

In the opening example, remember that percent means per hundred, and use place value or division to move between forms.

Practice 15: 30%= **Answer:** $\frac{3}{10}$

For the end-of-set item, remember that percent means per hundred, and use place value or division to move between forms.

Word-problem notes:

16. Answer: Discount: $0.375 = 37.5\%$; sale price $= \$40$; tax rate $= 0.08$; final price $= \$43.20$.

First convert the discount fraction: $\frac{3}{8} = 0.375 = 37.5\%$. Now find the discount amount by multiplying the original price by 0.375: $64 \times 0.375 = 24$. Subtract that from the original price to get the sale price: $64 - 24 = 40$. Next write 8% as the decimal 0.08, and find the tax: $40 \times 0.08 = 3.20$. Add the tax to the sale price, giving a final cost of \$43.20. This problem shows how decimals and percents are used in shopping all the time.

17. Answer: 20 students passed; rate $= 62.5\% = 0.625$; above 90%: 12 students.

To find how many students passed, take $\frac{5}{8}$ of 32: $\frac{5}{8} \times 32 = 20$. That means 20 students passed. The passing rate is then $\frac{20}{32} = 0.625 = 62.5\%$. Now look only at the students who passed. If 60% of those 20 students scored above 90%, then calculate $0.60 \times 20 = 12$. So 12 students scored above 90%. The key is to keep track of which group each percent is talking about.

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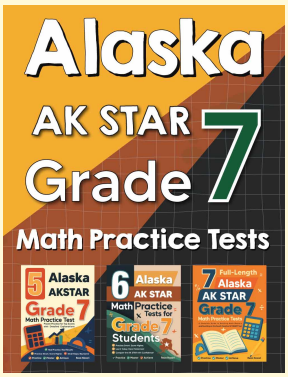

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