

Name: _____

Date: _____

Ratios and Proportions

1. Ratios

Ratios compare two quantities.

Can be represented using $:$ or as a fraction.

3 cups of water per 2 cups of rice.

$3:2$ or $\frac{3}{2}$ represent the same ratio.

2. Proportions

An equation is **proportional** if two ratios are equal.

$\frac{2}{4} = \frac{3}{6}$ is a proportion, since both reduce to $\frac{1}{2}$.

3. Solving Proportions

Proportions can be solved in three main ways.

Identifying a pattern (\times or \div)

Using unit rates

Cross-multiplication

$$\frac{2}{5} = \frac{x}{15}$$

Since $5 \times 3 = 15$, $2 \times 3 = 6$.

Therefore, $x = 6$.

This method is best if a pattern is easy to see.

$$\frac{2}{5} = \frac{x}{15}$$

The unit rate is $2 \div 5 = 0.4$, so $15 \times 0.4 = 6$. Therefore, $x = 6$.

This method is better if a pattern is not so easy to see, but requires the variable to be in the numerator.

$$\frac{2}{5} = \frac{x}{15}$$

Multiply each numerator by the opposite denominator.

$$15 \times 2 = 5 \times x$$

$$30 = 5x$$

Isolate x by dividing.

$$\frac{30}{5} = \frac{5x}{5}$$

$$6 = x$$

Therefore, $x = 6$.

This method works in all cases, but is longer than using a pattern.

4. Examples

A. Solve $\frac{4}{x} = \frac{20}{35}$.

There is a pattern in the numerators. Since $20 \div 4 = 5$, $35 \div 5 = 7$. Therefore, $x = 7$.

B. Solve $\frac{18}{12} = \frac{x}{10}$.

Since a pattern is not clear in the denominators, use either unit rates or cross-multiplication.

Method 1: Unit Rates

The unit rate is $18 \div 12 = 1.5$, so $10 \times 1.5 = 15$.

Therefore, $x = 15$.

Method 2: Cross-multiplication

Multiply each numerator by the opposite denominator.

$$18 \times 10 = 12 \times x$$

$$180 = 12x$$

Isolate x by dividing.

$$\frac{180}{12} = \frac{12x}{12}$$

$$15 = x$$

Therefore, $x = 15$.