

Ratios and Proportions

Ratio

- A ratio is a comparison of two quantities using division. A ratio of quantities a and b can be expressed as a to b , $a:b$, or a/b , where $b \neq 0$.
- Ratios are usually expressed in simplest form.

Examples

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- The ratio of football players to high schools in Montgomery County is 546:26. What is the ratio of football players to high schools written as a unit ratio.
- $\frac{\textit{number of football players}}{\textit{number of high schools}} = \frac{546}{26}$ or $\frac{21}{1}$

Extended Ratios

- Extended ratios can be used to compare three or more quantities.
- $a:b:c$ means that the ratio of the first two quantities is $a:b$, the ratio of the last two quantities is $b:c$, and the ratio of the first and last quantities is $a:c$.

Examples

- In a triangle, the ratio of the measures of three sides is 4:6:9, and its perimeter is 190 inches. Find the length of the longest side of the triangle.

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- $4x + 6x + 9x = 190$
- $19x = 190$
- $x = 10$
- $9(10) = 90$ in

Proportions

- A proportion is an equation that says two ratios are equal
- Equivalent fractions set equal to each other form a proportion
- $\frac{2}{3}$ *and* $\frac{6}{9}$ are equivalent fractions, $\frac{2}{3} = \frac{6}{9}$ is a proportion

Proportions

- Every proportion has two cross products.
- The cross products in $\frac{2}{3} = \frac{6}{9}$ are 2 times 9 and 3 times 6.
- The extremes of the proportion are 2 and 9, the means are 3 and 6.

$$\begin{array}{ccccc} \text{extreme} \rightarrow & a & = & c & \leftarrow \text{mean} \\ & \frac{a}{b} & = & \frac{c}{d} & \\ \text{mean} \rightarrow & b & & d & \leftarrow \text{extreme} \end{array}$$

- Extremes are on the outside, means are on the inside; $a:b = c:d$
- The product of the means equals the product of the extremes.

Equivalent Proportions

- Proportions will be equivalent as long as they have identical cross products.

$$\frac{a}{b} = \frac{c}{d}, \quad \frac{b}{a} = \frac{d}{c}, \quad \frac{a}{c} = \frac{b}{d}, \quad \frac{c}{a} = \frac{d}{b}$$

Examples

- Solve each proportion.

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- $2(9) = 6(3)$

- $18 = 18$

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- $3(75) = 5x$

- $225 = 5x$

- $45 = x$

Examples

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- $\frac{3x - 5}{4} = \frac{-13}{2}$

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- $(3x - 5)2 = 4(-13)$

- $6x - 10 = -52$

- $6x = -42$

- $x = -7$