The Panda Math Tutor

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Ratio, Rate and Proportion

IGCSE Mathematics

The Panda Math Tutor

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1 Introduction to Ratio, Rate and Proportion

Note

Ratio, rate, and proportion are among the most widely used mathematical tools in everyday life — from cooking recipes and currency exchange to engineering, science, and finance. These concepts are closely related and build naturally on each other.
In this chapter, we will explore:

- Understanding and simplifying ratios
- Dividing quantities in a given ratio
- Rates and unit rates
- Direct proportion and its graph
- Inverse proportion and its graph
- Percentage as a proportional tool
- Applications to real-world problems

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2 Ratio

Definition

A **ratio** is a comparison of two or more quantities of the same kind, written using a colon (:) or as a fraction.

$$a : b \quad \text{or} \quad \frac{a}{b}$$

Ratios have **no units** — the quantities being compared must be in the **same unit** before writing a ratio.
Example: If a bag contains 3 red and 5 blue balls, the ratio of red to blue is 3 : 5.

Warning

Units must match!
To find the ratio of 50 cm to 2 m, first convert to the same unit:
2 m = 200 cm
Ratio = 50 : 200 = 1 : 4

Never write $50 : 2$ — this gives a completely wrong answer!

2.1 Simplifying Ratios

Method

How to Simplify a Ratio

Step 1: Ensure all quantities are in the **same unit**

Step 2: Divide every part of the ratio by the **Highest Common Factor (HCF)**

Step 3: Check that the simplified ratio uses whole numbers (or integers)

For ratios involving fractions or decimals:

- **Decimals:** Multiply all parts by a suitable power of 10 to clear decimals, then simplify
- **Fractions:** Multiply all parts by the LCM of all denominators, then simplify

Example

Simplify the following ratios:
(a) $24 : 36$
(b) $1.5 : 4.5$
(c) $\frac{3}{4} : \frac{5}{8}$

Solution:
(a) $\text{HCF}(24, 36) = 12$

$$24 : 36 = (24 \div 12) : (36 \div 12) = \mathbf{2 : 3}$$

(b) Multiply both parts by 10 to remove decimals:

$$1.5 : 4.5 = 15 : 45$$

$\text{HCF}(15, 45) = 15$

$$15 : 45 = 1 : 3 \implies \mathbf{1 : 3}$$

(c) LCM of denominators 4 and 8 is 8. Multiply both parts by 8:

$$\frac{3}{4} : \frac{5}{8} = 6 : 5 \implies \mathbf{6 : 5}$$

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