

LESSON SLIDES

# Ratio and Proportion

Maths · Simplifying, sharing, unit rates, direct proportion and scale

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# By the end of this lesson you can

- 🎯 Write and simplify ratios
- 🎯 Explain how a ratio differs from a fraction
- 🎯 Share an amount in a given ratio
- 🎯 Use unit rates and direct proportion
- 🎯 Use scales on drawings and maps

# What is a ratio?

- A ratio compares the sizes of quantities
- 12 red beads and 8 blue beads: red to blue is 12 : 8
- Order matters: blue to red is 8 : 12
- A ratio can have three or more parts, such as 1 : 3 : 5

 **Example**

# Simplifying ratios

- 1 Divide every part by the highest common factor
- 2  $12 : 8 \rightarrow$  divide by 4  $\rightarrow 3 : 2$
- 3 Same units first:  $40 \text{ cm} : 2 \text{ m} = 40 : 200 = 1 : 5$
- 4 Clear decimals:  $1.5 : 2 \rightarrow$  multiply by 2  $\rightarrow 3 : 4$

# Ratio vs fraction

## Ratio: part to part

- Red : blue = 3 : 2
- Compares one part with another
- 3 red beads for every 2 blue

## Fraction: part of the whole

- Red =  $\frac{3}{5}$  of the beads
- Compares one part with the total
- $3 + 2 = 5$  parts in the whole

 **Example**

# Sharing in a ratio

- 1 Share EUR 350 in the ratio 2 : 5
- 2 Total parts:  $2 + 5 = 7$
- 3 One part:  $350 \div 7 = \text{EUR } 50$
- 4 Shares:  $2 \times 50 = \text{EUR } 100$  and  $5 \times 50 = \text{EUR } 250$
- 5 Check:  $100 + 250 = 350$

 **Example**

## Three parts, or one share known

- 1 Share 72 kg in the ratio 1 : 3 : 5
- 2 9 parts, so one part =  $72 \div 9 = 8$  kg
- 3 Shares: 8 kg, 24 kg and 40 kg
- 4 Boys : girls = 4 : 5 and there are 20 boys
- 5 One part =  $20 \div 4 = 5$ , so 25 girls

# Unit rates: how much for one?

- A unit rate is an amount per one unit
- 150 km in 2.5 hours:  $150 \div 2.5 = 60$  km/h
- USD 132 for 8 hours:  $132 \div 8 = \text{USD } 16.50$  per hour
- Divide by the quantity you want one of

 **Example**

## Best buy: compare unit prices

- 1 500 g of rice for GBP 2.40, or 750 g for GBP 3.45?
- 2 Per 100 g:  $2.40 \div 5 = \text{GBP } 0.48$
- 3 Per 100 g:  $3.45 \div 7.5 = \text{GBP } 0.46$
- 4 The 750 g bag is better value

# Direct proportion

- Both quantities change by the same factor
- Double one and the other doubles
- The ratio between them never changes
- Equation:  $y = kx$ , where  $k$  is the unit rate
- Graph: a straight line through  $(0, 0)$

 **Example**

# The unitary method

- 1 250 g of flour makes 10 biscuits
- 2 How much flour for 18 biscuits?
- 3 One biscuit:  $250 \div 10 = 25$  g
- 4 18 biscuits:  $25 \times 18 = 450$  g
- 5 Or scale up:  $18 \div 10 = 1.8$ , and  $250 \times 1.8 = 450$  g

# Proportional or not?

## Proportional

- 3 notebooks cost USD 4.50
- 5 notebooks cost USD 7.50
- USD 1.50 each both times

## Not proportional

- Taxi: EUR 3 fixed charge plus EUR 2 per km
- 1 km costs EUR 5, 2 km cost EUR 7
- Double the distance, but not double the fare

 **Example**

# Scale drawings and maps

- 1 Scale 1 : 50 means 1 cm on the plan is 50 cm in real life
- 2 A 3.5 m wall:  $350 \text{ cm} \div 50 = 7 \text{ cm}$  on the plan
- 3 Map scale 1 : 25,000:  $4 \text{ cm} \times 25,000 = 100,000 \text{ cm}$
- 4  $100,000 \text{ cm} = 1,000 \text{ m} = 1 \text{ km}$

# Common mistakes to avoid

- Writing the parts in the wrong order
- Dividing by one part instead of the total parts
- Mixing units, such as cm with m
- Adding instead of multiplying:  $2 : 3$  is not  $4 : 5$

 Quick check

**Ana and Ben share USD 45 in the ratio 4 : 5. How much does Ben get?**

**A** USD 25

**B** USD 20

**C** USD 9

**D** USD 36

# Key takeaways

- ✔ Simplify a ratio by dividing by the highest common factor
- ✔ Ratio is part to part; fraction is part to whole
- ✔ Sharing: total parts, one part, then multiply
- ✔ Unit rate = amount for one; compare unit prices
- ✔ Direct proportion: same factor, straight line through (0, 0)