Cambridge IGCSE · Mathematics (0580) · Notes

Ratio, proportion and rates

Read online at pastopic.com/cambridge/mathematics-0580/notes/ratio-proportion-and-rates

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Read first: Fractions, decimals, ordering and the four operations

What you need to know

Core and Extended have exactly the same content for this topic, so everything here is for both tiers. By the end of this topic you should be able to:

1. **Write a ratio in its simplest form**, including ratios with three parts, ratios with different units, decimals or fractions, and ratios in the form $1 : n$.
2. **Divide a quantity in a given ratio**, and work back from one share, or from the difference between two shares, to the others and the total.
3. **Use proportion and ratio in real situations**: scale a recipe up or down, use a map scale, and decide which size of a product is the best value.
4. **Use common rates**: hourly rates of pay, exchange rates between currencies, flow rates and fuel consumption.
5. **Use other rates** such as density, pressure and population density. The formula for these is always given in the question.
6. **Solve average speed problems** using speed $=$ distance $\div$ time, which you must know, with units such as km/h and m/s.

Understand it

What a ratio is

A ratio compares the sizes of two or more quantities. If a club has 18 boys and 33 girls, then boys : girls $=$ $18 : 33$. The order matters: girls : boys is $33 : 18$.

A ratio stays the same if you **multiply or divide every part by the same number**, just like the top and bottom of a fraction. So you simplify a ratio by dividing every part by the highest common factor (HCF):

- $18 : 33$: the HCF is 3, so $6 : 11$.
- $36 : 48 : 60$: the HCF is 12, so $3 : 4 : 5$. A three-part ratio works the same way; divide **all three** parts.

A ratio in its **simplest form** uses whole numbers with no common factor. Check by asking "does any number divide every part?".

Different units. Change to the same unit first, then drop the units. 45 cm : 2 m $= 45 : 200 = 9 : 40$.

Decimals and fractions. Multiply every part to clear them, then simplify.

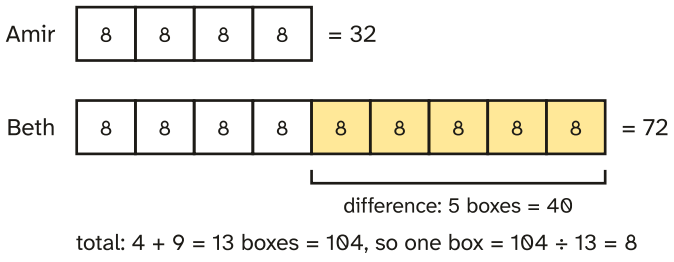
- $1.8 : 0.4$: multiply by 10 to get $18 : 4$, then divide by 2: $9 : 2$.
- $\frac{3}{4} : \frac{2}{5}$: multiply by 20 (a common denominator) to get $15 : 8$.

The form $1 : n$. Divide every part by the first part. Here n may be a decimal: $8 : 26 = 1 : \frac{26}{8} = 1 : 3.25$.

Map scales. A scale such as "1 cm represents 6 km" is a ratio with the same unit on both sides. 6 km $= 6 \times 1000 \times 100 = 600\,000$ cm, so the scale is $1 : 600\,000$: every length on the map is multiplied by $600\,000$ to give the real length.

Sharing in a ratio

Sharing in the ratio $4 : 9$ means cutting the amount into $4 + 9 = 13$ **equal parts**, then giving 4 parts to the first person and 9 parts to the second. A bar model shows this.



Amir and Beth share 104 sweets in the ratio $4 : 9$:

$$\text{one part} = \frac{104}{4 + 9} = 8, \qquad \text{Amir} = 4 \times 8 = 32, \qquad \text{Beth} = 9 \times 8 = 72.$$

Check: $32 + 72 = 104$.

The bar model shows every kind of sharing question. The key is to find **what one box is worth**:

You are told	It equals	So one part is
the **total**	all the boxes ($4 + 9 = 13$)	total $\div 13$
one share, e.g. Amir's	that person's boxes (4)	share $\div 4$
the **difference** between two shares	the extra boxes ($9 - 4 = 5$)	difference $\div 5$

Once you know one part, multiply to get anything else.

- **One share known.** In the ratio $2 : 11$ the smaller share is 26. One part $= 26 \div 2 = 13$, so the larger share is $11 \times 13 = 143$ and the total is $13 \times 13 = 169$.

- **Difference known.** In the ratio $3 : 8$ one share is 55 more than the other. The difference is $8 - 3 = 5$ parts, so one part $= 55 \div 5 = 11$. The shares are 33 and 88, and the total is 121.

Fractions and percentages from a ratio. In the ratio $4 : 9$, Amir gets $\frac{4}{13}$ of the total and Beth gets $\frac{9}{13}$. In letters, if the ratio is $E : G$, the fraction for the second person is $\dfrac{G}{E+G}$.

Two linked ratios. If red : blue $= 2 : 5$ and blue : green $= 3 : 4$, make the shared quantity (blue) the same in both. The lowest common multiple of 5 and 3 is 15, so multiply the first ratio by 3 and the second by 5: red : blue $= 6 : 15$ and blue : green $= 15 : 20$. So red : blue : green $= 6 : 15 : 20$. With 205 counters in all, one part is $205 \div 41 = 5$, giving 30, 75 and 100.

A ratio with a letter. If $x : (x + 6) = 3 : 5$, the two ratios are equal fractions, $\frac{x}{x+6} = \frac{3}{5}$. Cross-multiply: $5x = 3(x + 6)$, so $2x = 18$ and $x = 9$.

Proportion

Two quantities are in **direct proportion** if doubling one doubles the other: a recipe, the cost of fuel, the flour for a number of cakes. The safest method is the **unitary method**: find the amount for **one**, then multiply.

5 pancakes use 140 g of flour. One pancake uses $140 \div 5 = 28$ g, so 13 pancakes use $13 \times 28 = 364$ g.

Best value. Compare the same thing for each size: the cost of the same amount (for example per 100 g), or the amount you get per cent.

Pack	Cost per 100 g	Grams per cent
400 g for \$2.72	$272 \div 4 = 68$ cents	$400 \div 272 = 1.4706$
650 g for \$4.29	$429 \div 6.5 = 66$ cents	$650 \div 429 = 1.5152$

The 650 g pack is better value: it costs less per 100 g (and gives more grams per cent).

Inverse proportion. Sometimes more of one thing means **less** of the other. 8 workers take 9 days to paint a building: that is $8 \times 9 = 72$ worker-days of work. 6 workers would take $72 \div 6 = 12$ days.

Rates

A **rate** tells you how much of one thing there is **per one** of another: dollars per hour, litres per minute, grams per cm³. Every rate question uses one of three forms:

$$\text{rate} = \frac{\text{amount}}{\text{time (or other unit)}}, \qquad \text{amount} = \text{rate} \times \text{time}, \qquad \text{time} = \frac{\text{amount}}{\text{rate}}.$$

- **Pay:** \$13.40 per hour for 7.5 hours earns $13.40 \times 7.5 = \$100.50$.
- **Exchange rates:** if 1 euro $= \$1.09$, then 250 euros $= 250 \times 1.09 = \$272.50$, and $\$500 = 500 \div 1.09 = 458.72$ euros. Going **from** the currency with the 1 in front, multiply; going **to** it, divide. Check your answer makes sense: there are fewer euros than dollars.

- **Flow rate:** a tank of 423 litres filled at 18 litres per minute takes $423 \div 18 = 23.5$ minutes, which is 23 minutes 30 seconds.
- **Fuel consumption:** a car using 36 litres for 480 km uses $\frac{36}{480} \times 100 = 7.5$ litres per 100 km.
- **Pressure:** with pressure $=$ force $\div$ area (given in the question), 840 N on 0.4 m² gives $840 \div 0.4 = 2100$ N/m².
- **Density:** with density $=$ mass $\div$ volume (given), 632 g of metal with volume 80 cm³ has density $632 \div 80 = 7.9$ g/cm³.
- **Population density:** people per km². 3.3 million people in 2200 km² gives $3\,300\,000 \div 2200 = 1500$ people per km².

The units of a rate tell you how it was worked out: g/cm³ means grams **divided by** cm³.

Speed, distance and time

Speed is the rate of travelling distance:

$$\text{speed} = \frac{\text{distance}}{\text{time}}, \qquad \text{distance} = \text{speed} \times \text{time}, \qquad \text{time} = \frac{\text{distance}}{\text{speed}}.$$

Times must be decimals of an hour for km/h. There are 60 minutes in an hour, not 100: 2 hours 24 minutes is $2 + \frac{24}{60} = 2.4$ hours, **not** 2.24. So 174 km in 2 hours 24 minutes is $174 \div 2.4 = 72.5$ km/h.

Going back the other way, 3.35 hours is 3 hours and $0.35 \times 60 = 21$ minutes.

Changing units of speed. 1 km $= 1000$ m and 1 hour $= 3600$ s, so

$$1\ \text{m/s} = \frac{3600}{1000}\ \text{km/h} = 3.6\ \text{km/h}.$$

m/s to km/h: multiply by 3.6 (13.5 m/s $= 48.6$ km/h). km/h to m/s: divide by 3.6 (72 km/h $= 20$ m/s).

Average speed for a journey in stages is the **total distance divided by the total time**, never the mean of the speeds. 30 km at 60 km/h takes 0.5 h; 50 km at 40 km/h takes 1.25 h. The average speed is $\frac{80}{1.75} = 45.714\ldots = 45.7$ km/h, not $\frac{60+40}{2} = 50$.

Key facts and formulas

None of these is in the List of formulas printed on the exam paper. The formulas for density, pressure and population density are given in the question when you need them; speed $=$ distance $\div$ time is not.

Formula	Status
Simplify a ratio: divide every part by the HCF; clear decimals and fractions first	Learn it
Form $1 : n$: divide every part by the first part	Learn it
Sharing in $a : b$: one part $= \frac{\text{total}}{a+b}$, shares $a\times$ part and $b\times$ part	Learn it

Formula	Status
One part $=\dfrac{\text{difference}}{b-a}$ when the difference between the shares is known	Learn it
Fraction for the first share in $a:b$ is $\dfrac{a}{a+b}$	Learn it
Unitary method: find the amount for one, then multiply	Learn it
Rate $=\dfrac{\text{amount}}{\text{time}}$, amount $=$ rate $\times$ time	Learn it
Speed $=\dfrac{\text{distance}}{\text{time}}$, distance $=$ speed $\times$ time, time $=\dfrac{\text{distance}}{\text{speed}}$	Learn it
Average speed $=\dfrac{\text{total distance}}{\text{total time}}$	Learn it
1 m/s $=3.6$ km/h	Learn it
Density $=\dfrac{\text{mass}}{\text{volume}}$, pressure $=\dfrac{\text{force}}{\text{area}}$, population density $=\dfrac{\text{population}}{\text{area}}$	Given in the question

How to do it

In the questions we have tagged for this topic (111 questions from Papers 1–4, 2021–2025, two of them printed on two papers), the types came up this often. 34 of the 111 questions mix two or three types, so the counts add up to more than 111.

Question type	Questions
Sharing in a ratio	47
Rates: money, exchange, flow, fuel, density	35
Speed, distance and time	28
Writing and simplifying ratios, $1:n$ and map scales	25
Proportion: recipes, scaling and best value	12

1. Sharing in a ratio (47 questions)

1. **Add the parts** of the ratio (or subtract them, if you are given a difference; or take just one person's parts, if you are given their share).
2. **Divide** the amount you know by that number of parts to get **one part**.
3. **Multiply** one part by each person's number of parts.
4. **Check** that the shares add up to the total, and answer exactly what was asked (one share, both shares, or the total).

For example, 264 kg shared in the ratio $7:5$: one part $=264\div12=22$, so the shares are 154 kg and 110 kg.

Variations you will meet:

- **Three-part ratios**, such as "divide $\$X$ in the ratio $a : b : c$": add all three parts.
- **One share given**: in $3 : 4 : 9$ the middle share is 52. One part $= 52 \div 4 = 13$, total $= 16 \times 13 = 208$.
- **The difference given** ("receives $\$d$ more than"): divide by the **difference** of the parts, not the sum (see the bar model).
- **"Show that the total is ..."** or **"show that Alain receives ..."**: write every step, starting from the given values; don't start from the answer.
- **A percentage or fraction of the total**: in $9 : 16$, the first share is $\frac{9}{25} = 36\%$ of the total.
- **Angles in a ratio**: the angles of a quadrilateral in the ratio $2 : 3 : 4 : 6$ share 360°, so one part is 24° and the angles are 48°, 72°, 96° and 144°. A triangle shares 180°.
- **Two linked ratios**: make the shared quantity the same in both, then combine (see Example 2).
- **A ratio with a letter**, such as $(c + 3) : (c - 1)$: write the ratio as equal fractions and solve.
- **A later change**: when some items are added or taken away, write new expressions for each share, then form an equation.

2. Rates: money, exchange, flow, fuel, density (35 questions)

1. **Write the rate as "per one"** and note its units: \$ per hour, litres per minute, g/cm³.
2. **Decide which form you need**: rate = amount ÷ time, amount = rate × time, or time = amount ÷ rate.
3. **Make the units match** before you calculate: kg to g, hours to minutes, litres to ml.
4. **Calculate**, then check the size of the answer is sensible.

For example, if 1 pound $= \$1.27$: 340 pounds $= 340 \times 1.27 = \$431.80$, and $\$190.50 = 190.50 \div 1.27 = 150$ pounds.

Variations you will meet:

- **Exchange rates**: multiply or divide by the rate, and compare two prices by changing both into **one** currency first. Keep the full calculator value until the end, then round money to the cent.
- **Density with a volume**: find the volume first (a cuboid 3 cm by 5 cm by 8 cm is 120 cm³), then mass = density × volume $= 120 \times 11.3 = 1356$ g.
- **Changing the units of a rate**: 99 kg per hour is $99\,000$ g in 3600 s, so $99\,000 \div 3600 = 27.5$ g per second.
- **Flow rates and filling tanks**: time = volume ÷ rate. Remember 1 litre $= 1000$ cm³ $= 1000$ ml, and give the time in minutes and seconds if asked.
- **Fuel consumption**: litres per 100 km = litres ÷ km $\times 100$; for a journey in two parts, use the total fuel and the total distance.
- **Pay, charges and work rates**: "a fixed charge plus \$ per hour" means take off the fixed charge first; "7 items every 15 minutes" means find how many 15-minute blocks fit in the time.
- **Conversion graphs** (money or units): read across from one axis to the line and down to the other.

3. Speed, distance and time (28 questions)

1. **Write the time as a decimal of an hour** (minutes $\div 60$) for km/h, or in seconds for m/s.
2. **Use the right form**: speed $= \frac{d}{t}$, distance $= s \times t$ or time $= \frac{d}{s}$.
3. **Change units** if the answer needs them: $\times 3.6$ for m/s to km/h, $\div 3.6$ for km/h to m/s.
4. **Give a time in hours and minutes** by multiplying the decimal part of the hours by 60.

For example, 8.8 km at 16 km/h takes $8.8 \div 16 = 0.55$ h $= 0.55 \times 60 = 33$ minutes.

Variations you will meet:

- **Converting speed units**: km/h to m/s, m/s to km/h, or m/min to km/h (350 m/min $= 350 \times 60 \div 1000 = 21$ km/h). "Show that" versions (is a speed below a limit?) need both speeds in the same unit and a sentence.
- **Average speed over several stages**: total distance $\div$ total time, including any stops.
- **Times from a timetable or clock**: find the time taken first, then use it; and after finding a time, add it on to a start time to give an arrival time.
- **A train passing through a station, tunnel or bridge**: the front must travel the length of the platform **plus** the length of the train. A 130 m train crossing a 320 m bridge at 54 km/h ($= 15$ m/s) takes $(130 + 320) \div 15 = 30$ s.
- **Two people travelling towards each other**: the gap closes at the **sum** of their speeds. Towns 66 km apart, speeds 14 km/h and 19 km/h: they meet after $66 \div 33 = 2$ hours. If one sets off earlier, first work out how far that person has gone before the other starts.
- **Speed with letters**, such as a time in seconds in terms of the lengths and a speed in km/h: use the same steps with letters, dividing the km/h speed by 3.6.

4. Writing and simplifying ratios, $1 : n$ and map scales (25 questions)

1. **Put every part in the same unit**, and clear any decimals or fractions.
2. **Divide every part by the HCF** (or keep dividing by common factors until none is left).
3. **For** $1 : n$, divide every part by the first part; n can be a decimal.

For example, 3.5 kg : 750 g $= 3500 : 750 = 14 : 3$.

Variations you will meet:

- **A ratio from data** in a table or chart: write the numbers in the order asked, then simplify. $84 : 126 : 210$ has HCF 42, so it is $2 : 3 : 5$.
- **Map scales in the form** $1 : n$: change both lengths to cm. "4 cm represents 1 km" is $4 : 100\,000 = 1 : 25\,000$.
- **Using a map scale**: real length $=$ map length $\times n$. At $1 : 25\,000$, 7.4 cm on the map is $185\,000$ cm $= 1.85$ km.
- **Finding the ratio from a total and a difference**: two amounts total 44 and one is 12 more than the other, so they are 28 and 16, and the ratio is $7 : 4$.

- **Is a scale suitable?** Work out how big the drawing would be at that scale and say whether it would fit on the paper.
- **Angles or costs from another question part** written as a ratio: simplify fully.

5. Proportion: recipes, scaling and best value (12 questions)

1. **Find the amount for one** (one person, one cake, one gram), or find the multiplier directly ($\frac{\text{new}}{\text{old}}$).
2. **Multiply** by the number you want.
3. **Round sensibly**: whole bags or tins round **up** (you need enough), whole people or cakes you can make round **down**.

For example, a recipe uses 300 ml of stock for 4 people. For 14 people: $300 \div 4 = 75$ ml each, so $75 \times 14 = 1050$ ml.

Variations you will meet:

- **"Is there enough?"**: work out what is needed and compare it with what there is, then say yes or no with the numbers. With 500 ml of that stock you can serve $500 \div 75 = 6.67$, so only 6 people.
- **The greatest number you can make** from several ingredients: work out how many each ingredient allows; the **smallest** of these is the answer.
- **Best value**: find the cost of the same amount for every size (or the amount per cent), compare, and name the best one. 750 ml for $\$2.94$ is 39.2 cents per 100 ml and 1.2 litres for $\$4.56$ is 38 cents per 100 ml, so the 1.2 litre bottle is better value.
- **Inverse proportion**: more workers, less time. Multiply to find the total work, then divide.

Worked examples

The bold codes show where marks are earned, as in Cambridge mark schemes. The number is how many marks.

- **M1** method mark: for a correct method, even if the numbers slip.
- **A1** accuracy mark: for a correct answer; it needs the M mark before it.
- **B1** mark for a correct result on its own, with no method needed.

Example 1

(a) Write the ratio 1.8 kg : 750 g in its simplest form. **[2]**

(b) Divide $\$660$ in the ratio $4 : 7 : 9$. **[2]**

(c) Write the ratio $12 : 27$ in the form $1 : n$. **[1]**

(a) Same units: $1800 : 750$. **M1**

The HCF of 1800 and 750 is 150, so $12 : 5$. **A1**

(b) One part $= \dfrac{660}{4+7+9} = \dfrac{660}{20} = 33$. **M1**

$\$132$, $\$231$, $\$297$ **A1** (check: $132 + 231 + 297 = 660$)

(c) Divide both parts by 12: $27 \div 12 = 2.25$, so $1 : 2.25$. **B1**

Example 2

(a) Priya and Tom share some money in the ratio Priya : Tom $= 5 : 12$. Tom receives $\$91$ more than Priya. Calculate the total amount of money they share. **[2]**

(b) In an animal shelter, dogs : cats $= 4 : 3$ and cats : rabbits $= 5 : 2$. There are 246 animals in the shelter, all dogs, cats or rabbits. Find the number of rabbits. **[3]**

(a) The difference is $12 - 5 = 7$ parts, so one part $= 91 \div 7 = 13$. **M1**

Total $= 17 \times 13 = \$221$ **A1**

(b) Cats are in both ratios. The LCM of 3 and 5 is 15: dogs : cats $= 20 : 15$ and cats : rabbits $= 15 : 6$.

dogs : cats : rabbits $= 20 : 15 : 6$ **B1**

One part $= \dfrac{246}{20+15+6} = \dfrac{246}{41} = 6$ **M1**

Rabbits $= 6 \times 6 = 36$ **A1**

Example 3

A cyclist rides 27 km in 1 hour 48 minutes.

(a) Calculate her average speed in kilometres per hour. **[2]**

(b) Change your answer to part (a) into metres per second. **[2]**

(c) She then rides a further 13 km at 20 km/h. Calculate her average speed for the whole ride. **[3]**

(a) 1 hour 48 minutes $= 1 + \frac{48}{60} = 1.8$ hours. **M1** for $27 \div 1.8$

15 km/h **A1**

(b) $\dfrac{15 \times 1000}{3600}$ **M1**

$= 4.166\ldots = 4.17$ m/s **A1**

(c) Time for the second part $= 13 \div 20 = 0.65$ h (39 minutes). **M1**

Total distance $= 27 + 13 = 40$ km; total time $= 1.8 + 0.65 = 2.45$ h. **M1**

Average speed $= 40 \div 2.45 = 16.326\ldots = 16.3$ km/h **A1**

(Not the mean of 15 and 20.)

Example 4

(a) In country A, a 2 kg bag of rice costs $\$5.70$. In country B, a 5 kg bag of the same rice costs 1180 rupees. The exchange rate is $\$1 = 86.5$ rupees. In which country is the rice better value? Show all your working. **[3]**

(b) A car uses 5.9 litres of fuel per 100 km. Fuel costs $\$1.62$ per litre. Calculate the cost of the fuel for a journey of 430 km. **[3]**

(a) Country A: $5.70 \div 2 = \$2.85$ per kg. **B1**

Country B: $1180 \div 86.5 = \$13.64$ for 5 kg $(13.641\ldots)$, so $13.641\ldots \div 5 = \$2.728\ldots$ per kg. **M1**

$2.73 < 2.85$, so the rice is better value in **country B**. **A1**

(Comparing in rupees also works: B is 236 rupees per kg, A is $2.85 \times 86.5 = 246.53$ rupees per kg.)

(b) Fuel used $= \dfrac{430}{100} \times 5.9 = 25.37$ litres. **M1**

Cost $= 25.37 \times 1.62$ **M1**

$= 41.0994 = \$41.10$ **A1**

Common mistakes

- **Giving one part, or the wrong share.** Examiners regularly see the value of one part, or the other person's share, as the final answer. Reread what the question asks for: one share, both shares or the total.
- **Dividing by the sum when you are given a difference.** In the ratio $2 : 7$, if one person gets 35 more than the other, 35 is 5 parts, not 9.
- **Not simplifying fully.** Answers like $30 : 25 : 10$ or a ratio that still has decimals lose the mark. Check that no number divides every part, and that every part is a whole number.
- **Mixing units in a ratio.** 2 kg : 500 g is not $2 : 500$; it is $2000 : 500 = 4 : 1$.
- **Adding the ingredients of a recipe together** and using the total. Scale each ingredient on its own with the same multiplier.
- **Multiplying instead of dividing by an exchange rate** (or the other way round). Ask which currency should give the bigger number, and check your answer against it.
- **Rounding too early.** Examiners see converted prices rounded before the difference is found, which gives a wrong difference. Keep the full calculator value until the last step.
- **Writing minutes as a decimal directly.** 3 hours 45 minutes is 3.75 hours, not 3.45. Examiners report candidates dividing a distance by 13.45 for 13 hours 45 minutes.
- **Wrong factor when converting speeds**: using 100 instead of 1000 m in a km, or 60 instead of 3600 s in an hour. Use $\times 3.6$ and $\div 3.6$, and check that m/s is the smaller number.

- **Averaging the speeds.** The average speed for a whole journey is total distance ÷ total time.
- **Forgetting the length of the train** when it passes through a station or over a bridge, or dividing the speed by the time.
- **Best value: choosing the wrong item after correct working**, or comparing values rounded so much that they look equal. Say which is cheaper **per unit** and name it.
- **Rounding a count the wrong way.** "How many bags does he need" rounds up; "how many can she make" rounds down.

How to get the marks

- **Sharing questions**: the method mark is for dividing by the correct total (or difference) of parts and multiplying by a part. Write the division down, e.g. $\frac{660}{20}$, even if you then do it in your head.
- **Give both shares in the order asked** when there are two answer lines. Swapped answers usually lose marks.
- **"Simplest form"** means whole numbers with no common factor; "cao" (correct answer only) means a partly simplified ratio scores nothing. The form $1 : n$ allows a decimal n.
- **"Show that"**: start from the question's numbers and reach the given value, showing every step (for example $36 \div 4 = 9$, then $9 \times 15 = 135$ for a ratio $5 : 4 : 6$ with 36 in the middle share). Working backwards from the given answer is not accepted.
- **Best value and "is there enough?"**: the mark needs a comparison of like quantities **and** a clear conclusion, such as "No, 42 g is needed but there is only 40 g".
- **Units**: give the units the question asks for (km/h, m/s, grams per second, litres per 100 km); a correct number in the wrong unit loses the final mark.
- **Accuracy**: give exact answers in full, otherwise 3 significant figures; money to the nearest cent; times in hours and minutes or minutes and seconds if asked.
- **Keep full values** in your calculator between steps, especially with exchange rates.

Quick check

1. Write the ratio 35 cm : 1.4 m in the form $1 : n$.
2. A bag has 96 marbles, coloured red, green and white in the ratio $5 : 4 : 3$. How many green marbles are there?
3. A recipe for 8 muffins uses 180 g of flour. How much flour is needed for 18 muffins?
4. (a) Change 64.8 km/h into m/s. (b) A train 185 m long travels at 64.8 km/h. How long does it take to pass completely through a tunnel 715 m long?
5. A metal block has a mass of 2.73 kg and a volume of 390 cm³. Using density $=$ mass ÷ volume, find its density in g/cm³.

Answers

1. $35 : 140$; divide by 35: $1 : 4$.
2. One part $= 96 \div (5 + 4 + 3) = 8$, so green $= 4 \times 8 = 32$.
3. $180 \div 8 = 22.5$ g per muffin, so $22.5 \times 18 = 405$ g.
4. (a) $64.8 \div 3.6 = 18$ m/s. (b) The distance is $185 + 715 = 900$ m, so the time is $900 \div 18 = 50$ seconds.
5. 2.73 kg $= 2730$ g, so density $= 2730 \div 390 = 7$ g/cm³.

Past questions to try

- **0580/42/M/J/25 Q3**: two masses in the ratio $4 : 7$ with a known difference; find both.
- **0580/31/M/J/25 Q14**: scale up the flour for a number of cakes, then find how many whole bags to buy.
- **0580/22/F/M/24 Q14**: the time for a whole train to cross a bridge, with the speed in km/h and the lengths in metres.
- **0580/31/M/J/25 Q25**: the mass of a cuboid of gold from its dimensions and density.