Exercise walk-through

3.1
Ratio and proportion (R1–R5)

AQA · GCSE · Mathematics

Scale, similarity and rates of change

- **Scale drawings.** A map **scale** of $1 : 25\,000$ means 1 cm on the map is 25 000 cm in real life.
- A 4 cm line on the map is $4 \times 25\,000 = 100\,000$ cm, which is 1 km.
- **Length, area and volume.** If two shapes are similar with a length **scale** factor of k, the **area scale factor** is k^2 and the volume scale factor is k^3.
- A square with sides 3 times as long has 9 times the area.

Growth and decay

- **Simple interest** pays the same amount every year. **Compound interest** pays interest on the interest too, so the amount is multiplied by the same number every year:
- where P is the starting amount, r the percentage rate and n the number of years.
- For decay, such as a car losing value, use $1 - \frac{r}{100}$.
- **Worked example 13.** 1000 yuan is saved at 10% a year for 4 years.

$$A = P\left(1 + \frac{r}{100}\right)^n$$

Sources for this lesson

- AQA, *GCSE Mathematics (8300) specification*, subject content section 3.3 (Ratio, proportion and rates of change).
- NASA, *Mars Climate Orbiter Mishap Investigation Board Phase I Report* (10 November 1999).
- AQA, *GCSE Mathematics* Higher Paper 2 (June 2024), the reverse-percentage and house-price questions, adapted.

Exercises 2.1·2.3

2.1 Simplify 45 : 60 [1]



2.2 Share £350 in the ratio 2 : 5 [3]



2.3 Express 7 as a fraction of 28 [1]



Exercises 2.1·2.3

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2.1 3 : 4.

2.2 Share £350 in the ratio 2 : 5 [3]



2.2 £100 and £250.

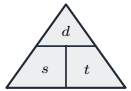
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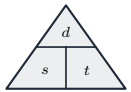
2.3 $\frac{7}{28} = \frac{1}{4}$.

Exercise 2.4

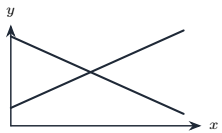
2.4 A 234 km journey takes 2 h 36 min. Find the average speed in km/h. [3]



2.5 A block of mass 96 g has volume 12 cm^3. Find its density. [2]

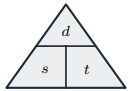


2.6 A 2.5 kg bag costs £6.00 and a 400 g bag costs £1.10. Which is better value? Show working. [3]

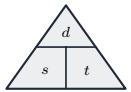


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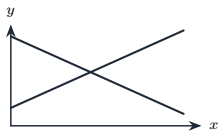
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2.4 2 h 36 min $= 2.6$ h; $234 \div 2.6 = 90$ km/h.

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Full solution on next slide

Full solution 2.4

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2.5 $96 \div 12 = 8$ g/cm^3.

2.6 2.5 kg bag: $6.00 \div 2.5 = £2.40$/kg; 400 g bag: $1.10 \div 0.4 = £2.75$/kg – the 2.5 kg bag is better value.

Exercise 3.1

3.1 *(Original.)* An alloy is copper and zinc in the ratio $7:3$. A block weighs 950 g. (a) Find the mass of copper. (b) A second block has 273 g of zinc: find its total mass. [4]



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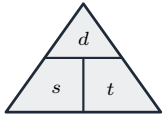
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3.1 (a) $\frac{7}{10} \times 950 = 665$ g. (b) Zinc is $\frac{3}{10}$ of total: total $= 273 \div \frac{3}{10} = 910$ g.

Exercise 3.2

3.2 *(Original, Higher algebraic density.)* A solid has volume $V = 2x^3$ and mass $m = 5x^2$. Find an expression for its density in terms of x. [3]

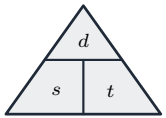


3.3 *(Original.)* Water and juice are mixed $4:1$ to make 15 litres. A different batch uses 12 litres of water. How much juice does it need, and how much drink does it make? [3]



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3.2 density $= \dfrac{5x^2}{2x^3} = \dfrac{5}{2x}$.

3.3 Water makes 4 parts = 12 litres, so 1 part = 3 litres: juice = 3 litres, total drink = 15 litres.

Local review guidance: unit prices or parts-per-total stated; exact amounts with units; best-buy verdicts quote the compared rates. This is authored classroom guidance.