

Exercise walk-through

3.1

Ratio and proportion (R1–R5)

AQA · GCSE · Mathematics

1. Unit 3.3 at a glance

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Foundation rows R1-R16 in three tiers. Higher-only additions: compound units (density, pressure) in numerical AND algebraic contexts, percentages above 100 percent and original-value problems, the k - k squared- k cubed similarity ladder, constructed proportion equations, instantaneous rate as a tangent gradient, and general iterative processes beyond compound interest.

Must-know: multipliers $(1 \pm r/100)$ with original value dividing the final; density = m/V and pressure = F/A ; direct $y = kx^n$, inverse $y = k/x^n$; growth $A = P(1 \pm r/100)^n$; lengths k : areas k^2 : volumes k^3 .

2. Units, ratio and sharing

Units, ratio and sharing

Change freely between standard units; compound units divide: speed = distance/time, density = mass/volume, pressure = force/area - algebraic at Higher: $V = 2x^3$ and $m = 5x^2$ give density $5/(2x)$.

Ratio reduces to simplest form ($45 : 60 = 3 : 4$); share by parts/total (350 pounds in $2 : 5$ gives 100 and 250); express one quantity as a fraction of another; best-buy problems compare unit prices.

Check yourself

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Unit and compound-unit conversions incl. density and pressure (algebraic at Higher); ratio notation, sharing and best-buy contexts; percentage multipliers incl. original value and simple interest.

Direct and inverse proportion graphically and algebraically with constructed equations; the $k : k^2 : k^3$ ladder; gradients as average (chord) and instantaneous (tangent) rates; compound growth and decay with iterative processes.

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

2.1 Simplify $45 : 60$ [1]

2.1 $3 : 4$.

2.2 Share £350 in the ratio $2 : 5$ [3]

2.2 £100 and £250.

2.3 Express 7 as a fraction of 28 [1]

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

Exercises 2.4·2.6

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]

Exercises 2.4·2.6

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

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

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

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

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]

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

Exercises 3.1·3.3

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]

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]

Exercises 3.1·3.3

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]

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.

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]

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

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]

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.