



eClassroom

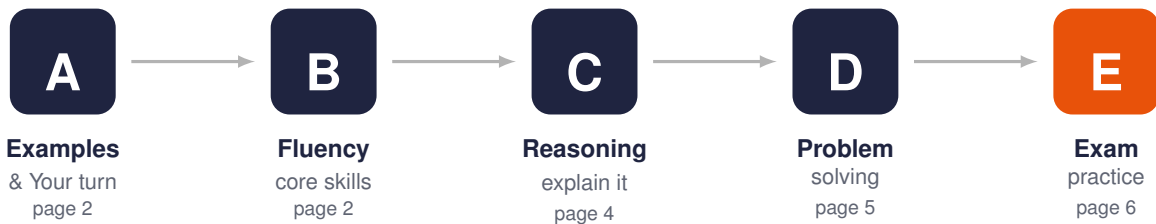
GCSE MATHEMATICS • RATIO & PROPORTION

Compound Measures

Worked Solutions

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • Calculator allowed

Full worked solutions for the free Compound Measures worksheet, GCSE and iGCSE Maths



Tap a section to jump straight to it

Full worked solutions for every question on the Compound Measures worksheet, in the same order and with the same question numbers.

How to mark your work. Tick each step you got right, not just the final answer. In the exam, method marks are given for correct working even when the final answer is wrong. If you lost marks, find the *first* line where your working is different from ours. That is the thing to fix.

In Section E: **M** = method mark, **P** = process mark, **A** = accuracy mark, **B** = independent mark, **C** = communication mark.

Question sheet

Ratio revision engine

Free courses

More worksheets



Join students already acing their exams.

Book your FREE lesson at www.eclassroom.org.uk

A**Your turn answers**

Compare each line of your working with the solution.

FOUNDATION

A1 $50 \text{ minutes} = \frac{50}{60} \text{ hours}$ $10 \div \frac{50}{60} = 10 \times \frac{60}{50} = \boxed{12 \text{ km/h}}$

A2 $\text{volume} = \text{mass} \div \text{density}$ $810 \div 2.7 = \boxed{300 \text{ cm}^3}$

A3 $\text{force} = \text{pressure} \times \text{area}$ $150 \times 0.6 = \boxed{90 \text{ N}}$

HIGHER

A4 $\text{Time} = 6 \div 4 + 6 \div 12 = 1.5 + 0.5 = 2 \text{ hours}$ $12 \div 2 = \boxed{6 \text{ km/h}}$ (not 8, the mean of the speeds)

A5 Volumes: $400 \div 0.8 = 500 \text{ cm}^3$ and $300 \div 1.2 = 250 \text{ cm}^3$ $700 \div 750 = 0.933\ldots$ $\boxed{0.93 \text{ g/cm}^3}$

A6 In 30 minutes the bike goes 6 km. The car closes the gap at $42 - 12 = 30 \text{ km/h}$.
 $6 \div 30 = 0.2 \text{ hours} = \boxed{12} \text{ minutes}$

A7 Least pressure on the largest face: $0.4 \times 0.5 = 0.2 \text{ m}^2$ $200 \div 0.2 = \boxed{1000 \text{ N/m}^2}$

B**Fluency solutions**One mark for each correct part. The notes in *italics* explain why each sequence was chosen.**FOUNDATION**

B1 (a) $\boxed{50 \text{ km/h}}$ (b) $\boxed{225 \text{ km}}$ (c) $\boxed{4.5 \text{ hours}}$ (d) $24 \text{ minutes} = 0.4 \text{ hours}$, $50 \times 0.4 = \boxed{20 \text{ km}}$
(a) to (c) use the same three numbers in three ways. In (d) change minutes to hours first.

B2 (a) $\boxed{2.5 \text{ hours}}$ (b) $\boxed{1.75 \text{ hours}}$ (c) $0.4 \times 60 = \boxed{24 \text{ minutes}}$ (d) $0.15 \times 60 = 9$ $\boxed{3 \text{ hours } 9 \text{ minutes}}$
3.15 hours is not 3 hours 15 minutes.



B3 (a) $600 \div 250 = 2.4 \text{ g/cm}^3$ (b) $2.4 \times 40 = 96 \text{ g}$ (c) $30 \div 2.4 = 12.5 \text{ cm}^3$ (d) $1 \text{ m}^3 = 1\,000\,000 \text{ cm}^3$,
so 7800 kg

B4 (a) 80 N/m^2 (b) 800 N/m^2 (c) $80 \times 1.5 = 120 \text{ N}$ (d) $20 \div 80 = 0.25 \text{ m}^2$
A smaller area gives a bigger pressure for the same force.

B5 (a) $75.60 \div 7 = \text{£}10.80$ (b) $420 \div 35 = 12 \text{ km}$ (c) $45 \div 3 = 15 \text{ minutes}$

B6 (a) 30 km/h (b) 30 minutes (c) $20 \div 0.5 = 40 \text{ km/h}$ (d) $50 \div 1 = 50 \text{ km/h}$
The steeper the line, the faster the speed. A flat line means no movement.

HIGHER

B7 (a) $80 \div 3 = 26.66\dots$ 26.7 km/h (b) $60 \div 2 = 30 \text{ km/h}$ (c) $60 \div 1.5 = 40 \text{ km/h}$
(d) e.g. 120 km each way: $240 \div 5 = 48 \text{ km/h}$
Only (b), with equal times, gives the mean of the two speeds. Stops count in the total time.

B8 (a) $600 \div 200 = 3 \text{ g/cm}^3$ (b) $200 \div 75 = 2.666\dots$ 2.67 g/cm^3 (c) $500 \div 140 = 3.571\dots$ 3.57 g/cm^3
(d) Mass = $1.9 \times 100 = 190 \text{ g}$, and the first liquid has mass $1.5 \times 60 = 90 \text{ g}$, so B has 100 g in 40 cm^3 :
 2.5 g/cm^3
Equal volumes give the mean density. Equal masses do not.

B9 (a) $72 \times 1000 \div 3600 = 20 \text{ m/s}$ (b) $15 \times 3.6 = 54 \text{ km/h}$ (c) 2700 kg/m^3 (d) $1 \text{ m}^2 = 10\,000 \text{ cm}^2$:
 $50\,000 \text{ N/m}^2$

B10 (a) $120 \div 80 = 1.5 \text{ hours}$ (b) $12 \div 20 = 0.6 \text{ hours} = 36 \text{ minutes}$ (c) $200 \div 8 = 25 \text{ s}$ (d) $80 \div 2 = 40 \text{ s}$
Moving towards each other, add the speeds. Catching up, subtract them.



C

Reasoning solutions

Your wording can be different. Check that your reason makes the same point.

FOUNDATION

C1 (a) 1 hour 30 minutes is 1.5 hours, not 1.30 hours. (b) $120 \div 1.5 = 80 \text{ km/h}$

C2 Wood: $1\,000\,000 \times 0.6 = 600\,000 \text{ g} = 600 \text{ kg}$ Water: $500\,000 \times 1 = 500\,000 \text{ g} = 500 \text{ kg}$ **the wood**

C3 (a) $600 \div 0.03 = 20\,000 \text{ N/m}^2$
 (b) The force is the same but the area halves, so the pressure doubles, to $40\,000 \text{ N/m}^2$

C4 Volume = $25 \times 8 \times 5 = 1000 \text{ cm}^3$ Mass = $1000 \times 19.3 = 19\,300 \text{ g} = 19.3 \text{ kg}$, more than 19 kg

HIGHER

C5 $25 \text{ m/s} = 25 \times 3600 \text{ m per hour} = 90\,000 \text{ m per hour} = 90 \text{ km/h}$, which is faster than 85 km/h

C6 Take 120 g of each. Volumes: $120 \div 0.8 = 150$ and $120 \div 1.2 = 100$ $240 \div 250 = 0.96 \text{ g/cm}^3$, not 1.0
With equal masses there is more of the less dense liquid by volume, so the density is below 1.0

C7 Side s : weight $\propto s^3$, area $= s^2$, so pressure $\propto \frac{s^3}{s^2} = s$

Doubling s : weight $\times 8$ and area $\times 4$, so the pressure is multiplied by 2 **as required**

C8 (a) Distance d each way. Time = $\frac{d}{u} + \frac{d}{v} = \frac{d(u+v)}{uv}$ Average = $\frac{2d}{d(u+v)/(uv)} = \frac{2uv}{u+v}$ **as required**

$$(b) \frac{u+v}{2} - \frac{2uv}{u+v} = \frac{(u+v)^2 - 4uv}{2(u+v)} = \frac{(u-v)^2}{2(u+v)}$$

When $u \neq v$ the numerator is positive and so is the denominator, so the average speed is less than $\frac{u+v}{2}$

proved



D**Problem solving solutions**

There is often more than one correct method. Any complete, correct method scores full marks.

FOUNDATION

D1 09 47 to 11 32 is 1 hour 45 minutes = 1.75 hours $147 \div 1.75 = \boxed{84 \text{ km/h}}$

D2 Volume = $25 \times 10 \times 1.6 = 400 \text{ m}^3 = 400\,000$ litres $400\,000 \div 20 = \boxed{20\,000}$ seconds
 $20\,000 \div 3600 = 5.55\dots$ hours, about 5 hours 33 minutes **Yes**, it is full within 6 hours

D3 Volume = $4^3 = 64 \text{ cm}^3$ Mass = $64 \times 10.5 = 672 \text{ g}$ Value = $672 \times 0.65 = \boxed{\text{£}436.80}$

D4 Weekday: $30 \times 11.40 = \text{£}342$ Weekend rate = $11.40 \times 1.5 = \text{£}17.10$, and $6 \times 17.10 = \text{£}102.60$
 Total = **£444.60**

HIGHER

D5 Fast train: $515 \div 2.5 = 206 \text{ km/h}$ Normal train: $206 \times 0.6 = 123.6 \text{ km/h}$
 Time = $515 \div 123.6 = 4.166\dots$ hours = 4 hours 10 minutes Extra time = **1** hour **40** minutes

D6 Volume = $\pi \times 0.5^2 \times 2 = 0.5\pi \text{ m}^3$ Mass = $2400 \times 0.5\pi = 1200\pi \text{ kg}$ Weight = $12\,000\pi \text{ N}$
 Area = $\pi \times 0.5^2 = 0.25\pi \text{ m}^2$ Pressure = $\frac{12\,000\pi}{0.25\pi} = \boxed{48\,000 \text{ N/m}^2}$
 π and the radius cancel: the pressure is $2400 \times 2 \times 10$, whatever the radius.

D7 $0.5 \text{ m/s} = 50 \text{ cm/s}$. Each second, a length of 50 cm of water flows out: $12 \times 50 = 600 \text{ cm}^3$
 Each minute: $600 \times 60 = 36\,000 \text{ cm}^3 = \boxed{36}$ litres

D8 Let the volume of copper be $c \text{ cm}^3$. Then zinc is $(100 - c) \text{ cm}^3$
 $8.9c + 7.1(100 - c) = 800$ $1.8c + 710 = 800$ $c = 50$
 Mass of copper = $8.9 \times 50 = \boxed{445 \text{ g}}$ Check: zinc = $7.1 \times 50 = 355 \text{ g}$, and $445 + 355 = 800$



E**Exam practice solutions**

Marks are shown on the right of each line.

FOUNDATION*Foundation and Higher crossover*

- E1** 2 hours 15 minutes = 2.25 hours B1
 $216 \div 2.25$ M1
96 km/h A1
-
- E2** Volume = $5 \times 3 \times 10 = 150 \text{ cm}^3$ and mass = 1350 g B1
 $1350 \div 150$ M1
9 g/cm³ A1
-
- E3** (a) $450 \div 1.5$ M1
300 N/m² A1
(b) The pressure doubles (to 600 N/m²) B1
-
- E4** Times: $18 \div 12 = 1.5$ hours and $10 \div 20 = 0.5$ hours P1
Total time = 2 hours P1
 $28 \div 2$ M1
14 km/h A1
-
- E5** (a) **30** minutes (11 30 to 12 00) B1
(b) 60 km in 1 hour (12 00 to 13 00) M1
60 km/h A1
-
- E6** $1.8 \text{ m}^3 = 1800$ litres B1
 $1800 \div 2.5 = 720$ seconds M1
12 minutes A1

HIGHER

- E7** Volumes: $579 \div 19.3 = 30 \text{ cm}^3$ and $210 \div 10.5 = 20 \text{ cm}^3$ P1
 $(579 + 210) \div (30 + 20) = 789 \div 50$ P1
15.78 g/cm³ A1



- E8** Face areas: $0.8 \times 0.2 = 0.16$, $0.8 \times 0.5 = 0.4$, $0.2 \times 0.5 = 0.1 \text{ m}^2$ P1
Greatest: $480 \div 0.1 = 4800$ Least: $480 \div 0.4 = 1200$ P1
 $4800 - 1200$ P1
3600 N/m^2 A1
-
- E9** By 09 30, Ali has driven 30 km, so they are 140 km apart P1
They close the gap at $60 + 80 = 140 \text{ km/h}$, so they meet 1 hour later P1
10 30 A1
-
- E10** (a) $\frac{12}{v} + \frac{12}{v+12} = \frac{8}{3}$ M1
 $\times 3v(v+12)$: $36(v+12) + 36v = 8v(v+12)$ M1
 $72v + 432 = 8v^2 + 96v$, so $8v^2 + 24v - 432 = 0$ and $v^2 + 3v - 54 = 0$ A1 **as required**
(b) $(v+9)(v-6) = 0$, and $v > 0$, so $v = 6$ M1
 $24 \div \frac{8}{3} = \text{9}$ km/h A1
-

