

Ratio Problems - Higher

Solutions

For AQA GCSE Mathematics (8300) • Higher tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (1 mark)

$$p:q = 3:5$$

p is what percentage of *q*?

Circle your answer.

Options: 37.5%, 40%, 60%, 75%

$p:q = 3:5$ means *p* is 3 parts when *q* is 5 parts.

So *p* is $\frac{3}{5}$ of *q*.

$$\frac{3}{5} = 0.6 = 60\%$$

Check with numbers: if $q = 100$ then $p = 60$ ✓

Answer: 60%

Tip: 37.5% is $\frac{3}{8}$, which is *p* as a percentage of $p + q$, not of *q*. Read carefully what you are comparing with.

2 (2 marks)

Divide 84 in the ratio 5:7

$$\text{Total parts: } 5 + 7 = 12$$

$$1 \text{ part} = 84 \div 12 = 7$$

$$5 \times 7 = 35$$

$$7 \times 7 = 49$$

Check: $35 + 49 = 84$ ✓

Answer: 35 and 49

Marks: 1 mark for $84 \div 12$. 1 mark for 35 and 49.

3 (2 marks)

$a:b = 3:4$ and $b:c = 6:5$

Work out $a:c$ in its simplest form.

b is in both ratios, so make the b numbers the same.

The LCM of 4 and 6 is 12.

$a:b = 3:4 = 9:12$ (multiply by 3)

$b:c = 6:5 = 12:10$ (multiply by 2)

So $a:b:c = 9:12:10$

$a:c = 9:10$

Answer: 9 : 10

Tip: Do not just join the ratios together or add the two b numbers. Make the b numbers equal first.

Marks: 1 mark for making the b numbers equal, e.g. $9:12$ and $12:10$. 1 mark for $9 : 10$.

4 (3 marks)

A fruit punch is made from orange juice, mango juice and lemonade only.

$\frac{3}{10}$ of the punch is lemonade.

The ratio of orange juice to mango juice is 2:5

What fraction of the punch is orange juice?

The juice (orange and mango) is $1 - \frac{3}{10} = \frac{7}{10}$ of the punch.

Orange : mango = 2:5, so orange is $\frac{2}{7}$ of the juice.

Orange = $\frac{2}{7} \times \frac{7}{10}$

$$= \frac{14}{70} = \frac{1}{5}$$

Answer: $\frac{1}{5}$

Tip: $\frac{2}{5}$ is wrong: the ratio 2:5 has $2 + 5 = 7$ parts, so orange is $\frac{2}{7}$ of the juice, not $\frac{2}{5}$.

Marks: 1 mark for $\frac{7}{10}$. 1 mark for $\frac{2}{7} \times \frac{7}{10}$ (or using a total, e.g. 70 parts). 1 mark for $\frac{1}{5}$.

5 (3 marks)

In a car park, the ratio of electric cars to petrol cars is 3:8

There are 45 more petrol cars than electric cars.

$\frac{1}{3}$ of the petrol cars are silver.

How many silver petrol cars are there?

There are $8 - 3 = 5$ more parts of petrol cars than electric cars.

These 5 parts are 45 cars.

1 part = $45 \div 5 = 9$ cars

Petrol cars = $8 \times 9 = 72$

Silver petrol cars = $\frac{1}{3} \times 72 = 24$

Answer: 24

Tip: The 45 is the **difference**, so it matches $8 - 3 = 5$ parts. Do not divide 45 by 11 or by 8.

Marks: 1 mark for $45 \div 5$. 1 mark for 72 petrol cars. 1 mark for 24.

6 (2 marks)

A garden is covered by grass, flower beds and vegetable beds only.

35% of the garden is grass.

40% of the garden is flower beds.

Write the ratio grass : flower beds : vegetable beds in its simplest form.

Vegetable beds = $100\% - 35\% - 40\% = 25\%$

Ratio = 35:40:25

Divide each number by 5: 7:8:5

Answer: 7 : 8 : 5

Tip: Check that your ratio is fully simplified: 7, 8 and 5 have no common factor other than 1.

Marks: 1 mark for 25% or 35:40:25. 1 mark for 7:8:5.

7 (3 marks)

Ciaran has three times as much money as Hana.

Ciaran gives Hana £24

They now have the same amount of money.

How much money did Ciaran have at the start?

Ciaran : Hana = 3:1, so let Hana have £ x and Ciaran have £ $3x$.

After the gift: Ciaran has $3x - 24$ and Hana has $x + 24$.

These are equal: $3x - 24 = x + 24$

$2x = 48$, so $x = 24$

Ciaran had $3 \times 24 = £72$

Check: $72 - 24 = 48$ and $24 + 24 = 48$ ✓

Answer: £72

Tip: When Ciaran gives £24, his amount goes down by 24 **and** Hana's goes up by 24. The gap between them closes by £48, not £24.

Marks: 1 mark for $3x - 24$ and $x + 24$ (or a correct trial). 1 mark for $x = 24$. 1 mark for £72.

8 (4 marks)

Nia, Olu and Pip share some money in the ratio 2:3:5

Pip gets £84 more than Nia.

Nia saves $\frac{1}{4}$ of her share.

Olu saves $\frac{1}{3}$ of his share.

How much money do Nia and Olu save altogether?

Pip has $5 - 2 = 3$ more parts than Nia.

These 3 parts are £84, so 1 part = $84 \div 3 = £28$

Nia gets $2 \times 28 = £56$ and Olu gets $3 \times 28 = £84$

Nia saves $\frac{1}{4} \times 56 = £14$

Olu saves $\frac{1}{3} \times 84 = £28$

Altogether: $14 + 28 = £42$

Answer: £42

Marks: 1 mark for $84 \div 3$. 1 mark for Nia's or Olu's share (£56 or £84). 1 mark for £14 or £28 saved. 1 mark for £42.

9 (3 marks)

Concrete is made from cement, sand and gravel in the ratio 1:2:4 by mass.

Jo has 20 kg of cement, 50 kg of sand and 100 kg of gravel.

What is the greatest mass of concrete she can make?

Find which ingredient runs out first.

20 kg of cement needs $2 \times 20 = 40$ kg of sand and $4 \times 20 = 80$ kg of gravel.

She has 50 kg of sand and 100 kg of gravel, so this works.

(50 kg of sand would need 25 kg of cement, but she only has 20 kg.)

So the cement runs out first.

Greatest mass = $20 + 40 + 80 = 140$ kg

Answer: 140 kg

Tip: You cannot use all 170 kg, because the amounts are not in the ratio 1:2:4. Find the ingredient that runs out first.

Marks: 1 mark for using the ratio with one of the amounts, e.g. 40 kg of sand. 1 mark for showing the cement runs out first. 1 mark for 140.

10 (4 marks)

The ratio of boys to girls in a club is 5:3

6 boys leave and 6 girls join.

The ratio of boys to girls is now 1:1

How many people are in the club?

Let the number of boys be $5x$ and the number of girls be $3x$.

Afterwards: boys = $5x - 6$ and girls = $3x + 6$

The ratio is now 1:1, so these are equal:

$$5x - 6 = 3x + 6$$

$$2x = 12$$

$$x = 6$$

$$\text{Boys} = 5 \times 6 = 30 \text{ and girls} = 3 \times 6 = 18$$

$$\text{Total} = 30 + 18 = 48 \text{ (6 leave and 6 join, so the total stays 48)}$$

$$\text{Check: } 24:24 = 1:1 \quad \checkmark$$

Answer: 48

Marks: 1 mark for $5x - 6$ or $3x + 6$. 1 mark for $5x - 6 = 3x + 6$. 1 mark for $x = 6$. 1 mark for 48.

11 (2 marks)

Bag *A*: red : blue = 1:3. Bag *B*: red : blue = 3:1. All the counters go into bag *C*. Jo says red : blue in bag *C* will be 1:1. Always, sometimes or never true?

Try bags with the same number of counters, e.g. 4 in each:

A: 1 red, 3 blue. *B*: 3 red, 1 blue. *C*: 4 red, 4 blue, which is 1:1. So it can be true.

Try bags with different numbers, e.g. 8 in *A* and 4 in *B*:

A: 2 red, 6 blue. *B*: 3 red, 1 blue. *C*: 5 red, 7 blue, which is 5:7, not 1:1.

So Jo is only right when the two bags hold the same number of counters.

Answer: Sometimes true (e.g. 4 and 4 counters give $4:4 = 1:1$, but 8 and 4 counters give $5:7$)

Tip: You cannot just add ratios. $1:3$ and $3:1$ only combine to $1:1$ if both bags contain the same number of counters.

Marks: 1 mark for a correct example (either case). 1 mark for Sometimes true with both cases shown.
