

# Ratio Problems - Higher

## Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Higher tier

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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.

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**1** (2 marks)

In a car park there are only cars, vans and motorbikes.

$\frac{3}{5}$  of the vehicles are cars.

The number of vans is two times the number of motorbikes.

Write down the ratio of the number of cars to the number of vans to the number of motorbikes.

Vans and motorbikes make up  $1 - \frac{3}{5} = \frac{2}{5}$  of the vehicles.

Write the fractions with denominator 15: cars =  $\frac{3}{5} = \frac{9}{15}$ , vans and motorbikes =  $\frac{6}{15}$

Vans : motorbikes = 2:1, so vans =  $\frac{4}{15}$  and motorbikes =  $\frac{2}{15}$

cars : vans : motorbikes = 9:4:2

**Answer:** 9 : 4 : 2

**Tip:** Check your ratio:  $9 + 4 + 2 = 15$  parts, and cars are  $\frac{9}{15} = \frac{3}{5}$  of them ✓. 3:2:1 is wrong because it makes cars only half of the vehicles.

*Marks:* 1 mark for splitting  $\frac{2}{5}$  in the ratio 2:1 (e.g.  $\frac{4}{15}$  and  $\frac{2}{15}$ ). 1 mark for 9 : 4 : 2.

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**2** (3 marks)

A florist has only roses, tulips and lilies.

The numbers of roses, tulips and lilies are in the ratio 6:5:2

There are 12 more tulips than lilies.

Work out the number of roses.

Tulips have  $5 - 2 = 3$  more parts than lilies.

3 parts = 12 flowers

1 part =  $12 \div 3 = 4$  flowers

Roses =  $6 \times 4 = 24$

**Answer:** 24

**Tip:** The 12 matches the **difference** between tulips and lilies,  $5 - 2 = 3$  parts. Do not divide 12 by  $6 + 5 + 2 = 13$ .

*Marks:* 1 mark for  $5 - 2 = 3$  parts. 1 mark for  $12 \div 3 = 4$ . 1 mark for 24.

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**3** (3 marks)

There are only red, blue and green counters in a bag.

red : blue = 3:2 and blue : green = 4:5

There are 45 counters in the bag.

How many green counters are there?

Blue is in both ratios, so make the blue numbers the same.

red : blue = 3:2 = 6:4 (multiply by 2)

blue : green = 4:5

So red : blue : green = 6:4:5

Total parts:  $6 + 4 + 5 = 15$

1 part =  $45 \div 15 = 3$

Green =  $5 \times 3 = 15$

**Answer:** 15

**Tip:** Do not add the two blue numbers or write 3:2:4:5. Change 3:2 to 6:4 so that blue is 4 in both ratios.

*Marks:* 1 mark for 6:4:5. 1 mark for  $45 \div 15$ . 1 mark for 15.

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**4** (3 marks)

Some sweets are shared between Kim and Lee in the ratio 3:5

Lee gives  $\frac{1}{5}$  of his sweets to Kim.

What is the new ratio of Kim's sweets to Lee's sweets?

Choose numbers that fit the ratio: Kim has 3 sweets and Lee has 5.

Lee gives  $\frac{1}{5}$  of 5 = 1 sweet to Kim.

Kim now has  $3 + 1 = 4$

Lee now has  $5 - 1 = 4$

Kim : Lee = 4:4 = 1:1

**Answer:** 1 : 1

**Tip:** Choosing numbers that fit the ratio (such as 3 and 5, or 30 and 50) makes this kind of question much easier.

*Marks:* 1 mark for  $\frac{1}{5}$  of Lee's share. 1 mark for Kim's and Lee's new amounts. 1 mark for 1 : 1.

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**5** (4 marks)

Ruth and Sanjay grow tomato plants.

The ratio of the number of Ruth's plants to the number of Sanjay's plants is 4:7

Sanjay gives Ruth 15 of his plants.

The ratio of the number of Ruth's plants to the number of Sanjay's plants is now 3:4

How many plants do Ruth and Sanjay have altogether?

You must show all your working.

Let Ruth have  $4x$  plants and Sanjay have  $7x$  plants.

Afterwards: Ruth has  $4x + 15$  and Sanjay has  $7x - 15$ .

$$\frac{4x + 15}{7x - 15} = \frac{3}{4}$$

$$4(4x + 15) = 3(7x - 15)$$

$$16x + 60 = 21x - 45$$

$$105 = 5x, \text{ so } x = 21$$

$$\text{Total} = 4x + 7x = 11x = 11 \times 21 = 231$$

Check: Ruth  $84 + 15 = 99$ , Sanjay  $147 - 15 = 132$ , and  $99:132 = 3:4$  ✓

**Answer:** 231

**Tip:** The total number of plants does not change, but you do not know it yet. Use  $4x$  and  $7x$  and form an equation from the new ratio.

*Marks:* 1 mark for  $4x + 15$  and  $7x - 15$ . 1 mark for  $4(4x + 15) = 3(7x - 15)$ . 1 mark for  $x = 21$ . 1 mark for 231.

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**6** (4 marks)

Kit, Lou and Max share some marbles in the ratio 7:4:3

Kit then gives 10 of his marbles to Max.

Kit and Max now have the same number of marbles.

Work out the total number of marbles.

Let Kit have  $7x$ , Lou  $4x$  and Max  $3x$  marbles.

Afterwards: Kit has  $7x - 10$  and Max has  $3x + 10$ .

These are equal:  $7x - 10 = 3x + 10$

$4x = 20$ , so  $x = 5$

Total =  $7x + 4x + 3x = 14x = 14 \times 5 = 70$

Check: Kit  $35 - 10 = 25$ , Max  $15 + 10 = 25$  ✓

**Answer:** 70

**Tip:** Giving 10 marbles closes the gap by 20, because Kit loses 10 **and** Max gains 10. So the difference of  $7 - 3 = 4$  parts is 20 marbles.

*Marks:* 1 mark for  $7x - 10$  and  $3x + 10$ . 1 mark for  $7x - 10 = 3x + 10$ . 1 mark for  $x = 5$ . 1 mark for 70.

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**7** (4 marks)

The ratio of the number of adults to the number of children at a party is 4:7  
After 8 more adults arrive, the ratio is 4:5  
How many children are at the party?

Let the number of adults be  $4x$  and the number of children be  $7x$ .

8 more adults arrive: adults =  $4x + 8$ . The number of children stays  $7x$ .

$$\frac{4x + 8}{7x} = \frac{4}{5}$$

Cross-multiply:  $5(4x + 8) = 4 \times 7x$

$$20x + 40 = 28x$$

$$40 = 8x$$

$$x = 5$$

$$\text{Children} = 7 \times 5 = 35$$

Check: adults = 28, and  $28:35 = 4:5$  ✓

**Answer:** 35

Marks: 1 mark for  $4x + 8$ . 1 mark for a correct equation. 1 mark for  $x = 5$ . 1 mark for 35.

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**8** (4 marks)

The ratio of Ann's weekly savings to Bo's weekly savings is 7:4  
Both Ann and Bo increase their weekly savings by £6  
The ratio of Ann's weekly savings to Bo's weekly savings is now 5:3  
Work out Ann's and Bo's weekly savings before the increase.

Let Ann's savings be  $7k$  and Bo's be  $4k$ .

After the increase: Ann =  $7k + 6$  and Bo =  $4k + 6$

$$\frac{7k + 6}{4k + 6} = \frac{5}{3}$$

Cross-multiply:  $3(7k + 6) = 5(4k + 6)$

$$21k + 18 = 20k + 30$$

$$k = 12$$

$$\text{Ann} = 7 \times 12 = \text{£}84$$

$$\text{Bo} = 4 \times 12 = \text{£}48$$

$$\text{Check: } 90:54 = 5:3 \quad \checkmark$$

**Answer:** Ann £84, Bo £48

*Marks:* 1 mark for  $7k + 6$  and  $4k + 6$ . 1 mark for a correct equation. 1 mark for  $k = 12$ . 1 mark for both amounts.

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**9** (3 marks)

$$\frac{a + 3b}{a - b} = 5$$

Find the ratio  $a:b$

Multiply both sides by  $(a - b)$ :

$$a + 3b = 5(a - b)$$

$$a + 3b = 5a - 5b$$

Collect like terms:  $8b = 4a$

Divide by 4:  $a = 2b$

So  $a$  is twice  $b$ , which means  $a:b = 2:1$

**Answer:** 2 : 1

**Tip:**  $a = 2b$  gives  $a:b = 2:1$ , not 1:2. Check with numbers:  $a = 2$ ,  $b = 1$  gives  $\frac{2+3}{2-1} = 5 \quad \checkmark$

*Marks:* 1 mark for  $a + 3b = 5(a - b)$ . 1 mark for  $8b = 4a$  or  $a = 2b$ . 1 mark for 2 : 1.

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