Sismo Learning

11 PLUS || MATHS || LESSON NOTES

Ratio and Proportion

Comparing, sharing and scaling quantities, with worked examples, practice and a full answer key.

By the end of these notes you can

1. Write a ratio in the correct order, including ratios with three parts
2. Simplify ratios and find equivalent ratios, including different units
3. Move between ratios and fractions
4. Share an amount in a given ratio
5. Solve problems when one share or the difference is known
6. Use direct proportion for recipes, costs, exchange rates and best buys

Contents

1	Understanding ratio
2	Simplifying and equivalent ratios
3	Ratio and fractions
4	Sharing an amount in a given ratio
5	Using a known part or difference
6	Direct proportion
★	11 Plus exam style questions
✓	Answer key with worked solutions

Key vocabulary

Ratio	A comparison of two or more quantities, written with a colon, e.g. 3 : 2.
Part	One equal share of the whole when a ratio is used to split an amount.
Simplest form	A ratio whose parts have no common factor other than 1.
Equivalent ratios	Ratios that show the same comparison, e.g. 1 : 2 and 5 : 10.
Proportion	How one quantity changes as another changes; in direct proportion they scale together.
Unitary method	Finding the value of one item first, then multiplying.
Best buy	The option with the lowest cost for the same amount.

Before you start. Ratio builds directly on fractions. You will use HCF to simplify, equivalent fractions to scale, and fraction of an amount to share. If any of these feel shaky, revisit them first.

© Sismo Learning LTD

Concept 1 || Understanding ratio

KEY IDEAS

- A **ratio** compares the size of one quantity with another. We write it with a colon, for example 3 : 2, and read it as "3 to 2".
- **Order matters.** If there are 3 red and 2 blue counters, red : blue is 3 : 2 but blue : red is 2 : 3.
- A ratio can compare more than two things, for example squares : circles : triangles = 4 : 7 : 2.
- Sometimes one amount is hidden. Find it first by subtracting from the total, then write the ratio.

WATCH OUT Writing the numbers in the order they appear in the question instead of the order the question asks for.

Worked examples

Example 1.1

[1 mark]

A bag has 5 red counters and 3 blue counters. Write the ratio red : blue.

Step 1: Read the order asked for

The question asks for red first, then blue.

Step 2: Write the amounts in that order

red : blue = 5 : 3

ANSWER **5 : 3**

Example 1.2

[1 mark]

Using the same bag, write the ratio blue : red.

Step 1: Read the order asked for

Now blue comes first, then red.

Step 2: Write the amounts in that order

blue : red = 3 : 5

ANSWER **3 : 5**

© Sismo Learning LTD

Example 1.3

[2 marks]

A class of 24 pupils has 11 boys. Write the ratio boys : girls.

Step 1: Find the hidden amount

girls = 24 − 11 = 13

Step 2: Write the ratio in the order asked

boys : girls = 11 : 13

ANSWER **11 : 13**

Example 1.4

[1 mark]

A pattern has 4 squares, 7 circles and 2 triangles. Write the ratio squares : circles : triangles.

Step 1: Match each shape to its amount

squares = 4, circles = 7, triangles = 2

Step 2: Write all three in order

squares : circles : triangles = 4 : 7 : 2

ANSWER **4 : 7 : 2**

Example 1.5

[1 mark]

A recipe uses 1 cup of sugar for every 2 cups of flour. Write the ratio sugar : flour.

Step 1: Pick out the amounts

sugar = 1 cup, flour = 2 cups

Step 2: Write them in the order asked

sugar : flour = 1 : 2

ANSWER **1 : 2**

Example 1.6

[2 marks]

A fruit bowl holds 12 pieces of fruit: 3 apples, 5 bananas and the rest oranges. Write the ratio oranges : apples.

Step 1: Find the number of oranges

oranges = 12 − 3 − 5

oranges = 4

Step 2: Write the ratio in the order asked

oranges : apples = 4 : 3

ANSWER **4 : 3**

© Sismo Learning LTD

Your turn || Practice questions

Answers are in the Answer Key at the back.

1.1 A garden has 7 roses and 9 tulips. Write the ratio tulips : roses. **[1 mark]**

1.2 A team played 13 games. They won 8 and lost the rest. Write the ratio wins : losses. **[2 marks]**

1.3 A car park has 6 red cars, 11 silver cars and 2 black cars. Write the ratio black : red : silver. **[1 mark]**

1.4 Tom has 17 marbles. 9 are green and the rest are yellow. Write the ratio yellow : green. **[2 marks]**

1.5 A shelf holds 25 books: 5 maths books, 11 science books and the rest story books. Write the ratio story : maths. **[2 marks]**

© Sismo Learning LTD

Concept 2 || Simplifying and equivalent ratios

KEY IDEAS

- To **simplify** a ratio, divide every part by the same number. Dividing by the **highest common factor (HCF)** gets you to the simplest form in one go.
- A ratio is in its simplest form when the parts have no common factor other than 1.
- **Equivalent ratios** are made by multiplying or dividing every part by the same number, for example 2 : 3 = 4 : 6 = 10 : 15.
- If the quantities have **different units**, convert them to the same unit first, then simplify. The final ratio has no units.

WATCH OUT Simplifying 50 cm : 2 m as 50 : 2 = 25 : 1. Always make the units the same first.

Worked examples

Example 2.1

[1 mark]

Simplify 12 : 18.

Step 1: Find the HCF

Factors of 12: 1, 2, 3, 4, 6, 12

Factors of 18: 1, 2, 3, 6, 9, 18

HCF = 6

Step 2: Divide both parts by 6

12 ÷ 6 = 2

18 ÷ 6 = 3

ANSWER **2 : 3**

Example 2.2

[1 mark]

Simplify 45 : 30.

Step 1: Find the HCF

HCF of 45 and 30 = 15

Step 2: Divide both parts by 15

45 ÷ 15 = 3

30 ÷ 15 = 2

ANSWER **3 : 2**

© Sismo Learning LTD

Example 2.3

[2 marks]

Simplify 8 : 20 : 28.

Step 1: Find the HCF of all three

8, 20 and 28 are all in the 4 times table

HCF = 4

Step 2: Divide every part by 4

8 ÷ 4 = 2

20 ÷ 4 = 5

28 ÷ 4 = 7

ANSWER **2 : 5 : 7**

Example 2.4

[2 marks]

Write 50 cm : 2 m in its simplest form.

Step 1: Make the units the same

2 m = 2 × 100 = 200 cm

50 cm : 200 cm → 50 : 200

Step 2: Divide both parts by the HCF, 50

50 ÷ 50 = 1

200 ÷ 50 = 4

ANSWER **1 : 4**

Example 2.5

[2 marks]

Write 600 g : 1.5 kg in its simplest form.

Step 1: Make the units the same

1.5 kg = 1.5 × 1000 = 1500 g

600 g : 1500 g → 600 : 1500

Step 2: Divide both parts by the HCF, 300

600 ÷ 300 = 2

1500 ÷ 300 = 5

ANSWER **2 : 5**

© Sismo Learning LTD

Example 2.6

[1 mark]

Find the missing number: 3 : 4 = 15 : ?

Step 1: Find the multiplier

3 × 5 = 15, so the multiplier is 5

Step 2: Multiply the other part by the same number

4 × 5 = 20

ANSWER **? = 20**

Your turn || Practice questions

Answers are in the Answer Key at the back.

2.1 Simplify 16 : 24. **[1 mark]**

2.2 Simplify 35 : 63. **[1 mark]**

2.3 Simplify 18 : 27 : 45. **[2 marks]**

2.4 Write 45 minutes : 2 hours in its simplest form. **[2 marks]**

2.5 Find the missing number: 7 : 2 = ? : 18 **[1 mark]**

© Sismo Learning LTD

Concept 3 || Ratio and fractions

KEY IDEAS

- A ratio compares **part to part**. A fraction compares **part to whole**.
- For the ratio a : b, the whole is a + b parts. So the first quantity is $\frac{a}{a+b}$ of the total.
- Going the other way: if $\frac{2}{7}$ of a group are boys, then 2 parts are boys and 7 − 2 = 5 parts are girls, so boys : girls = 2 : 5.
- Always simplify the fraction at the end if you can.

WATCH OUT Thinking that red : blue = 3 : 5 means red is $\frac{3}{5}$ of the total. The total is 3 + 5 = 8 parts, so red is $\frac{3}{8}$.

Worked examples

Example 3.1

[2 marks]

The ratio red : blue counters is 3 : 5. What fraction of the counters are red?

Step 1: Find the total number of parts

3 + 5 = 8 parts

Step 2: Write red as a fraction of the total

red = $\frac{3}{8}$

ANSWER $\frac{3}{8}$

Example 3.2

[2 marks]

The ratio cats : dogs at a rescue centre is 4 : 7. What fraction of the animals are dogs?

Step 1: Find the total number of parts

4 + 7 = 11 parts

Step 2: Write dogs as a fraction of the total

dogs = $\frac{7}{11}$

ANSWER $\frac{7}{11}$

© Sismo Learning LTD

Example 3.3

[2 marks]

$\frac{2}{7}$ of the pupils walk to school and the rest come by car. Write the ratio walk : car.

Step 1: Read the fraction as parts

The whole is 7 parts. Walkers are 2 parts.

Step 2: Find the car parts

car = 7 − 2 = 5 parts

Step 3: Write the ratio

walk : car = 2 : 5

ANSWER **2 : 5**

Example 3.4

[2 marks]

The ratio boys : girls in a club is 6 : 9. What fraction of the club are boys? Give your answer in its simplest form.

Step 1: Find the total number of parts

6 + 9 = 15 parts

Step 2: Write boys as a fraction

boys = $\frac{6}{15}$

Step 3: Simplify by dividing by 3

$\frac{6}{15} = \frac{6 \div 3}{15 \div 3} = \frac{2}{5}$

ANSWER $\frac{2}{5}$

Example 3.5

[2 marks]

Paint is mixed red : yellow : white in the ratio 2 : 3 : 5. What fraction of the paint is white?

Step 1: Find the total number of parts

2 + 3 + 5 = 10 parts

Step 2: Write white as a fraction

white = $\frac{5}{10}$

Step 3: Simplify by dividing by 5

$\frac{5}{10} = \frac{1}{2}$

ANSWER $\frac{1}{2}$

© Sismo Learning LTD

Example 3.6

[2 marks]

$\frac{3}{8}$ of the sweets in a box are lemon and the rest are orange. Write the ratio orange : lemon.

Step 1: Read the fraction as parts

The whole is 8 parts. Lemon is 3 parts.

Step 2: Find the orange parts

orange = 8 − 3 = 5 parts

Step 3: Write the ratio in the order asked

orange : lemon = 5 : 3

ANSWER **5 : 3**

© Sismo Learning LTD

Your turn || Practice questions

Answers are in the Answer Key at the back.

3.1 The ratio squares : circles is 5 : 4. What fraction of the shapes are squares? **[2 marks]**

3.2 At a cinema the ratio adults : children is 3 : 7. What fraction of the audience are children? **[2 marks]**

3.3 $\frac{5}{12}$ of the marbles in a jar are blue and the rest are green. Write the ratio green : blue. **[2 marks]**

3.4 The ratio pens : pencils in a pot is 10 : 15. What fraction are pens? Give your answer in its simplest form. **[2 marks]**

3.5 A flag is coloured red : white : blue in the ratio 1 : 4 : 3. What fraction of the flag is white? Give your answer in its simplest form. **[2 marks]**

© Sismo Learning LTD

Concept 4 || Sharing an amount in a given ratio

KEY IDEAS

- **Step 1:** Add the parts of the ratio to find the total number of parts.
- **Step 2:** Divide the amount by the total number of parts to find the value of **one part**.
- **Step 3:** Multiply one part by each number in the ratio.
- **Check:** the shares must add back up to the starting amount. A **bar model** makes the parts easy to see.

WATCH OUT Dividing £40 in the ratio 3 : 5 by doing 40 ÷ 3 and 40 ÷ 5. You must divide by the total number of parts, 8.

Worked examples

Example 4.1

[3 marks]

Share £40 in the ratio 3 : 5.

Step 1: Find the total number of parts

3 + 5 = 8 parts

Step 2: Find the value of one part

£40 ÷ 8 = £5

Step 3: Multiply to find each share

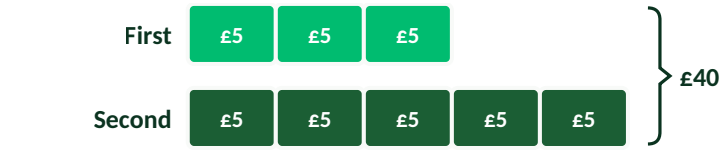
3 × £5 = £15

5 × £5 = £25

Step 4: Check

£15 + £25 = £40 ✓

BAR MODEL



ANSWER **£15 and £25**

Example 4.2

[3 marks]

Ali and Ben share 56 sweets in the ratio 2 : 5. How many sweets does each get?

Step 1: Find the total number of parts

2 + 5 = 7 parts

Step 2: Find the value of one part

56 ÷ 7 = 8

Step 3: Multiply to find each share

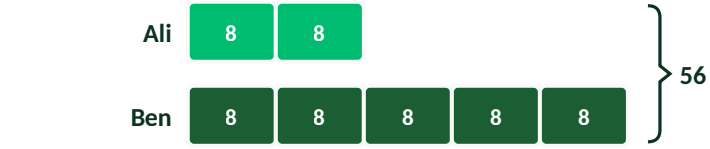
Ali: 2 × 8 = 16

Ben: 5 × 8 = 40

Step 4: Check

16 + 40 = 56 ✓

BAR MODEL



ANSWER Ali 16, Ben 40

Example 4.3

[3 marks]

Share £72 in the ratio 1 : 2 : 3.

Step 1: Find the total number of parts

1 + 2 + 3 = 6 parts

Step 2: Find the value of one part

£72 ÷ 6 = £12

Step 3: Multiply to find each share

1 × £12 = £12

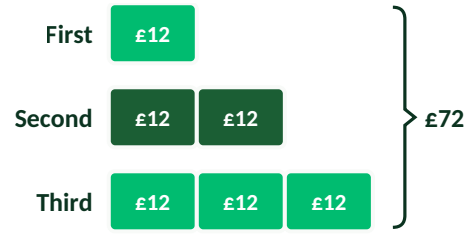
2 × £12 = £24

3 × £12 = £36

Step 4: Check

£12 + £24 + £36 = £72 ✓

BAR MODEL



ANSWER £12, £24 and £36

Example 4.4

[3 marks]

A ribbon 1.2 m long is cut into two pieces in the ratio 3 : 1. How long is the longer piece in centimetres?

Step 1: Change to centimetres

1.2 m = 1.2 × 100 = 120 cm

Step 2: Find the total number of parts

3 + 1 = 4 parts

Step 3: Find the value of one part

120 ÷ 4 = 30 cm

Step 4: Find the longer piece

The longer piece is 3 parts.

3 × 30 = 90 cm

ANSWER 90 cm

© Sismo Learning LTD

Example 4.5

[3 marks]

£90 is shared in the ratio 4 : 5. How much more does the second person get than the first?

Step 1: Find the total number of parts

4 + 5 = 9 parts

Step 2: Find the value of one part

£90 ÷ 9 = £10

Step 3: Find each share

4 × £10 = £40

5 × £10 = £50

Step 4: Find the difference

£50 − £40 = £10

Shortcut: the difference is 5 − 4 = 1 part = £10

ANSWER **£10 more**

Example 4.6

[3 marks]

Share £3.60 in the ratio 5 : 7.

Step 1: Change to pence

£3.60 = 360p

Step 2: Find the total number of parts

5 + 7 = 12 parts

Step 3: Find the value of one part

360 ÷ 12 = 30p

Step 4: Multiply to find each share

5 × 30p = 150p = £1.50

7 × 30p = 210p = £2.10

Step 5: Check

£1.50 + £2.10 = £3.60 ✓

ANSWER **£1.50 and £2.10**

© Sismo Learning LTD

Your turn || Practice questions

Answers are in the Answer Key at the back.

4.1 Share £60 in the ratio 1 : 4. **[3 marks]**

4.2 Share 84 stickers in the ratio 3 : 4. **[3 marks]**

4.3 Share £150 in the ratio 2 : 3 : 5. **[3 marks]**

4.4 2 kg of flour is split into two bags in the ratio 3 : 7. How many grams are in the larger bag? **[3 marks]**

4.5 £4.80 is shared in the ratio 5 : 3. How much more does the first person get? **[3 marks]**

© Sismo Learning LTD

Concept 5 || Using a known part or difference

KEY IDEAS

- Sometimes you are told **one share** instead of the total. Divide that share by its number of parts to find **one part**.
- Sometimes you are told the **difference** between two shares. Find how many parts the difference is, then divide to find one part.
- Once you know one part, you can find any share or the total by multiplying.
- Draw a bar model and label what you know. It shows straight away which parts the given number covers.

WATCH OUT Treating a given share as the total. If boys : girls = 3 : 4 and there are 12 boys, 12 is 3 parts, not 7 parts.

Worked examples

Example 5.1

[2 marks]

The ratio boys : girls in a choir is 3 : 4. There are 12 boys. How many girls are there?

Step 1: Match the known amount to its parts

Boys are 3 parts and there are 12 boys.

Step 2: Find the value of one part

$12 \div 3 = 4$

Step 3: Find the girls

Girls are 4 parts.

$4 \times 4 = 16$

BAR MODEL



ANSWER **16 girls**

Example 5.2

[3 marks]

Beads are red : green in the ratio 5 : 2. There are 35 red beads. How many beads are there altogether?

Step 1: Match the known amount to its parts

Red is 5 parts and there are 35 red beads.

Step 2: Find the value of one part

35 ÷ 5 = 7

Step 3: Find the total number of parts

5 + 2 = 7 parts

Step 4: Find the total

7 × 7 = 49

ANSWER 49 beads

Example 5.3

[3 marks]

Sam and Kim share some stickers in the ratio 2 : 7. Kim gets 35 more stickers than Sam. How many stickers does Sam get?

Step 1: Find how many parts the difference is

7 − 2 = 5 parts

Step 2: Find the value of one part

5 parts = 35

35 ÷ 5 = 7

Step 3: Find Sam's share

Sam is 2 parts.

2 × 7 = 14

BAR MODEL



Difference = 5 parts = 35

ANSWER 14 stickers

Example 5.4

[2 marks]

At a show the ratio adults : children is 2 : 9. There are 45 children. How many adults are there?

Step 1: Match the known amount to its parts

Children are 9 parts and there are 45 children.

Step 2: Find the value of one part

45 ÷ 9 = 5

Step 3: Find the adults

Adults are 2 parts.

2 × 5 = 10

ANSWER 10 adults

Example 5.5

[3 marks]

The ratio of Jo's age to her mum's age is 2 : 7. Her mum is 25 years older than Jo. How old is Jo?

Step 1: Find how many parts the difference is

7 − 2 = 5 parts

Step 2: Find the value of one part

5 parts = 25 years

25 ÷ 5 = 5 years

Step 3: Find Jo's age

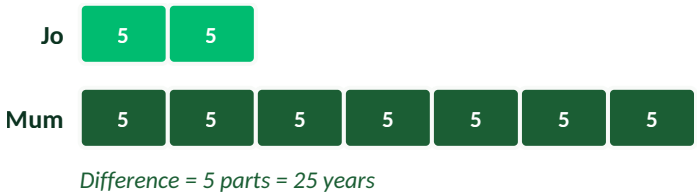
Jo is 2 parts.

2 × 5 = 10 years

Step 4: Check

Mum = 7 × 5 = 35 years, and 35 − 10 = 25 ✓

BAR MODEL



ANSWER Jo is 10 years old

Example 5.6

[3 marks]

A bag holds red, blue and green counters in the ratio 3 : 5 : 4. There are 20 blue counters. How many counters are there in total?

Step 1: Match the known amount to its parts

Blue is 5 parts and there are 20 blue counters.

Step 2: Find the value of one part

$20 \div 5 = 4$

Step 3: Find the total number of parts

$3 + 5 + 4 = 12$ parts

Step 4: Find the total

$12 \times 4 = 48$

ANSWER **48 counters**

© Sismo Learning LTD

Your turn || Practice questions

Answers are in the Answer Key at the back.

5.1 The ratio cats : dogs is 5 : 3. There are 15 dogs. How many cats are there? **[2 marks]**

5.2 Squash is mixed with water in the ratio 1 : 6. Ola uses 210 ml of water. How much squash does she need? **[2 marks]**

5.3 Ella and Finn share money in the ratio 4 : 9. Finn gets £30 more than Ella. How much does Ella get? **[3 marks]**

5.4 A fruit punch mixes orange, apple and mango juice in the ratio 2 : 3 : 6. It contains 480 ml of mango juice. How much punch is there altogether? **[3 marks]**

5.5 In a school the ratio boys : girls is 7 : 5. There are 14 more boys than girls. How many pupils are there altogether? **[3 marks]**

© Sismo Learning LTD

Concept 6 || Direct proportion

KEY IDEAS

- Two quantities are in **direct proportion** if they increase at the same rate: double one and the other doubles, halve one and the other halves.
- The **unitary method**: first find the value for **one** item, then multiply to find the value for the number you want.
- To compare **best buy**, work out the price of one item (or of the same amount, such as 100 ml) for each option. The lower price per unit is better value.
- Recipes, costs, exchange rates and speeds are all common 11 Plus proportion contexts.

WATCH OUT Adding instead of scaling. A recipe for 4 that is changed to serve 6 does not need "2 more grams" of everything; each amount is multiplied by the same number.

Worked examples

Example 6.1

[2 marks]

5 pens cost £3.50. How much do 8 pens cost?

Step 1: Find the cost of one pen

£3.50 = 350p

350 ÷ 5 = 70p

Step 2: Multiply by 8

8 × 70p = 560p = £5.60

ANSWER **£5.60**

Example 6.2

[2 marks]

A recipe for 4 people uses 300 g of flour. How much flour is needed for 6 people?

Step 1: Find the amount for one person

300 ÷ 4 = 75 g

Step 2: Multiply by 6

6 × 75 = 450 g

ANSWER **450 g**

© Sismo Learning LTD

Example 6.3

[3 marks]

A recipe for 12 biscuits uses 150 g butter, 200 g sugar and 2 eggs. How much of each is needed for 18 biscuits?

Step 1: Find the scale factor

$\frac{18}{12} = \frac{3}{2}$, so multiply every amount by 1.5

Step 2: Scale each ingredient

butter: 150 × 1.5 = 225 g

sugar: 200 × 1.5 = 300 g

eggs: 2 × 1.5 = 3

ANSWER 225 g butter, 300 g sugar, 3 eggs

Example 6.4

[2 marks]

A car uses 6 litres of fuel to travel 54 miles. How far can it travel on 10 litres?

Step 1: Find the distance for one litre

54 ÷ 6 = 9 miles

Step 2: Multiply by 10

10 × 9 = 90 miles

ANSWER 90 miles

Example 6.5

[3 marks]

Pack A has 6 rolls for £2.40. Pack B has 10 rolls for £3.80. Which pack is better value?

Step 1: Find the cost of one roll in Pack A

£2.40 = 240p

240 ÷ 6 = 40p per roll

Step 2: Find the cost of one roll in Pack B

£3.80 = 380p

380 ÷ 10 = 38p per roll

Step 3: Compare

38p is less than 40p, so Pack B is cheaper per roll.

ANSWER Pack B is better value

© Sismo Learning LTD

Example 6.6

[2 marks]

The exchange rate is £1 = €1.20. Mia has €54. How many pounds is this worth?

Step 1: Decide whether to multiply or divide

Each £1 gives €1.20, so to go from euros to pounds we divide by 1.20.

Step 2: Divide

54 ÷ 1.20 = 540 ÷ 12 = 45

ANSWER **£45**

Your turn || Practice questions

Answers are in the Answer Key at the back.

6.1 3 notebooks cost £4.50. How much do 7 notebooks cost? **[2 marks]**

6.2 A recipe for 6 people uses 450 g of pasta. How much pasta is needed for 4 people? **[2 marks]**

6.3 A printer prints 12 pages in 3 minutes. How many pages does it print in 10 minutes? **[2 marks]**

6.4 A 500 ml bottle of juice costs £1.20. A 750 ml bottle costs £1.65. Which is better value? **[3 marks]**

6.5 The exchange rate is £1 = $1.25. How many pounds do you get for $70? **[2 marks]**

© Sismo Learning LTD

★ || 11 Plus exam style questions

MIXED PROBLEMS

- These questions combine the skills from all six concepts, the way 11 Plus papers do.
- Draw a bar model, label what you know, and find one part first.

M1 Amir and Bella share £96 in the ratio 5 : 7. Bella then gives a quarter of her share to Cal. How much does Cal get? **[4 marks]**

M2 There are 21 cars in a car park. The ratio red : blue is 3 : 4. Then 3 more red cars arrive. What is the new ratio red : blue in its simplest form? **[4 marks]**

M3 A bag of 40 sweets has strawberry and lime sweets in the ratio 3 : 5. How many strawberry sweets must be added so the ratio becomes 1 : 1? **[4 marks]**

M4 Pastry is made by mixing flour and butter in the ratio 5 : 2 by weight. Lily has 450 g of flour and 200 g of butter. What is the greatest amount of pastry she can make? **[5 marks]**

M5 Kemi is 3 times as old as her brother. In 6 years' time she will be twice as old as him. How old is Kemi now? **[5 marks]**

© Sismo Learning LTD

✓ || Answer Key

Answer Summary

Q	Question	Answer
P1.1	A garden has 7 roses and 9 tulips. Write the ratio tulips : roses.	**9 : 7**
P1.2	A team played 13 games. They won 8 and lost the rest. Write the ratio wins : losses.	**8 : 5**
P1.3	A car park has 6 red cars, 11 silver cars and 2 black cars. Write the ratio black : red : silver.	**2 : 6 : 11**
P1.4	Tom has 17 marbles. 9 are green and the rest are yellow. Write the ratio yellow : green.	**8 : 9**
P1.5	A shelf holds 25 books: 5 maths books, 11 science books and the rest story books. Write the ratio story : maths.	**9 : 5**
P2.1	Simplify 16 : 24.	**2 : 3**
P2.2	Simplify 35 : 63.	**5 : 9**
P2.3	Simplify 18 : 27 : 45.	**2 : 3 : 5**
P2.4	Write 45 minutes : 2 hours in its simplest form.	**3 : 8**
P2.5	Find the missing number: 7 : 2 = ? : 18	**? = 63**
P3.1	The ratio squares : circles is 5 : 4. What fraction of the shapes are squares?	$\frac{5}{9}$
P3.2	At a cinema the ratio adults : children is 3 : 7. What fraction of the audience are children?	$\frac{7}{10}$
P3.3	$\frac{5}{12}$ of the marbles in a jar are blue and the rest are green. Write the ratio green : blue.	**7 : 5**
P3.4	The ratio pens : pencils in a pot is 10 : 15. What fraction are pens? Give your answer in its simplest form.	$\frac{2}{5}$
P3.5	A flag is coloured red : white : blue in the ratio 1 : 4 : 3. What fraction of the flag is white? Give your answer in its simplest form.	$\frac{1}{2}$
P4.1	Share £60 in the ratio 1 : 4.	**£12 and £48**
P4.2	Share 84 stickers in the ratio 3 : 4.	**36 and 48**
P4.3	Share £150 in the ratio 2 : 3 : 5.	**£30, £45 and £75**
P4.4	2 kg of flour is split into two bags in the ratio 3 : 7. How many grams are in the larger bag?	**1400 g**
P4.5	£4.80 is shared in the ratio 5 : 3. How much more does the first person get?	**£1.20 more**
P5.1	The ratio cats : dogs is 5 : 3. There are 15 dogs. How many cats are there?	**25 cats**

© Sismo Learning LTD

Q	Question	Answer
P5.2	Squash is mixed with water in the ratio 1 : 6. Ola uses 210 ml of water. How much squash does she need?	**35 ml**
P5.3	Ella and Finn share money in the ratio 4 : 9. Finn gets £30 more than Ella. How much does Ella get?	**£24**
P5.4	A fruit punch mixes orange, apple and mango juice in the ratio 2 : 3 : 6. It contains 480 ml of mango juice. How much punch is there altogether?	**880 ml**
P5.5	In a school the ratio boys : girls is 7 : 5. There are 14 more boys than girls. How many pupils are there altogether?	**84 pupils**
P6.1	3 notebooks cost £4.50. How much do 7 notebooks cost?	**£10.50**
P6.2	A recipe for 6 people uses 450 g of pasta. How much pasta is needed for 4 people?	**300 g**
P6.3	A printer prints 12 pages in 3 minutes. How many pages does it print in 10 minutes?	**40 pages**
P6.4	A 500 ml bottle of juice costs £1.20. A 750 ml bottle costs £1.65. Which is better value?	**The 750 ml bottle**
P6.5	The exchange rate is £1 = $1.25. How many pounds do you get for $70?	**£56**
M1	Amir and Bella share £96 in the ratio 5 : 7. Bella then gives a quarter of her share to Cal. How much does Cal get?	**£14**
M2	There are 21 cars in a car park. The ratio red : blue is 3 : 4. Then 3 more red cars arrive. What is the new ratio red : blue in its simplest form?	**1 : 1**
M3	A bag of 40 sweets has strawberry and lime sweets in the ratio 3 : 5. How many strawberry sweets must be added so the ratio becomes 1 : 1?	**10 strawberry sweets**
M4	Pastry is made by mixing flour and butter in the ratio 5 : 2 by weight. Lily has 450 g of flour and 200 g of butter. What is the greatest amount of pastry she can make?	**630 g of pastry**
M5	Kemi is 3 times as old as her brother. In 6 years' time she will be twice as old as him. How old is Kemi now?	**Kemi is 18 years old**

© Sismo Learning LTD

Full worked solutions

Concept 1 || Understanding ratio

Question P1.1

[1 mark]

A garden has 7 roses and 9 tulips. Write the ratio tulips : roses.

Step 1: Read the order asked for

Tulips first, then roses.

Step 2: Write the ratio

tulips : roses = 9 : 7

ANSWER **9 : 7**

Question P1.2

[2 marks]

A team played 13 games. They won 8 and lost the rest. Write the ratio wins : losses.

Step 1: Find the number of losses

losses = 13 − 8 = 5

Step 2: Write the ratio

wins : losses = 8 : 5

ANSWER **8 : 5**

Question P1.3

[1 mark]

A car park has 6 red cars, 11 silver cars and 2 black cars. Write the ratio black : red : silver.

Step 1: Match each colour to its amount

black = 2, red = 6, silver = 11

Step 2: Write all three in the order asked

black : red : silver = 2 : 6 : 11

ANSWER **2 : 6 : 11**

© Sismo Learning LTD

Question P1.4

[2 marks]

Tom has 17 marbles. 9 are green and the rest are yellow. Write the ratio yellow : green.

Step 1: Find the number of yellow marbles

yellow = 17 − 9 = 8

Step 2: Write the ratio

yellow : green = 8 : 9

ANSWER **8 : 9**

Question P1.5

[2 marks]

A shelf holds 25 books: 5 maths books, 11 science books and the rest story books. Write the ratio story : maths.

Step 1: Find the number of story books

story = 25 − 5 − 11

story = 9

Step 2: Write the ratio

story : maths = 9 : 5

ANSWER **9 : 5**

Concept 2 || Simplifying and equivalent ratios

Question P2.1

[1 mark]

Simplify 16 : 24.

Step 1: Find the HCF

HCF of 16 and 24 = 8

Step 2: Divide both parts by 8

16 ÷ 8 = 2

24 ÷ 8 = 3

ANSWER **2 : 3**

© Sismo Learning LTD

Question P2.2

[1 mark]

Simplify 35 : 63.

Step 1: Find the HCF

35 = 5 × 7 and 63 = 9 × 7

HCF = 7

Step 2: Divide both parts by 7

35 ÷ 7 = 5

63 ÷ 7 = 9

ANSWER **5 : 9**

Question P2.3

[2 marks]

Simplify 18 : 27 : 45.

Step 1: Find the HCF of all three

18, 27 and 45 are all in the 9 times table

HCF = 9

Step 2: Divide every part by 9

18 ÷ 9 = 2

27 ÷ 9 = 3

45 ÷ 9 = 5

ANSWER **2 : 3 : 5**

Question P2.4

[2 marks]

Write 45 minutes : 2 hours in its simplest form.

Step 1: Make the units the same

2 hours = 2 × 60 = 120 minutes

45 : 120

Step 2: Divide both parts by the HCF, 15

45 ÷ 15 = 3

120 ÷ 15 = 8

ANSWER **3 : 8**

© Sismo Learning LTD

Question P2.5

[1 mark]

Find the missing number: 7 : 2 = ? : 18

Step 1: Find the multiplier

2 × 9 = 18, so the multiplier is 9

Step 2: Multiply the other part by 9

7 × 9 = 63

ANSWER **? = 63**

Concept 3 || Ratio and fractions

Question P3.1

[2 marks]

The ratio squares : circles is 5 : 4. What fraction of the shapes are squares?

Step 1: Find the total number of parts

5 + 4 = 9 parts

Step 2: Write squares as a fraction

squares = $\frac{5}{9}$

ANSWER $\frac{5}{9}$

Question P3.2

[2 marks]

At a cinema the ratio adults : children is 3 : 7. What fraction of the audience are children?

Step 1: Find the total number of parts

3 + 7 = 10 parts

Step 2: Write children as a fraction

children = $\frac{7}{10}$

ANSWER $\frac{7}{10}$

© Sismo Learning LTD

Question P3.3

[2 marks]

$\frac{5}{12}$ of the marbles in a jar are blue and the rest are green. Write the ratio green : blue.

Step 1: Read the fraction as parts

The whole is 12 parts. Blue is 5 parts.

Step 2: Find the green parts

green = 12 − 5 = 7 parts

Step 3: Write the ratio in the order asked

green : blue = 7 : 5

ANSWER **7 : 5**

Question P3.4

[2 marks]

The ratio pens : pencils in a pot is 10 : 15. What fraction are pens? Give your answer in its simplest form.

Step 1: Find the total number of parts

10 + 15 = 25 parts

Step 2: Write pens as a fraction

pens = $\frac{10}{25}$

Step 3: Simplify by dividing by 5

$\frac{10}{25} = \frac{10 \div 5}{25 \div 5} = \frac{2}{5}$

ANSWER $\frac{2}{5}$

Question P3.5

[2 marks]

A flag is coloured red : white : blue in the ratio 1 : 4 : 3. What fraction of the flag is white? Give your answer in its simplest form.

Step 1: Find the total number of parts

1 + 4 + 3 = 8 parts

Step 2: Write white as a fraction

white = $\frac{4}{8}$

Step 3: Simplify by dividing by 4

$\frac{4}{8} = \frac{1}{2}$

ANSWER $\frac{1}{2}$

© Sismo Learning LTD

Concept 4 || Sharing an amount in a given ratio

Question P4.1

[3 marks]

Share £60 in the ratio 1 : 4.

Step 1: Find the total number of parts

1 + 4 = 5 parts

Step 2: Find the value of one part

£60 ÷ 5 = £12

Step 3: Multiply to find each share

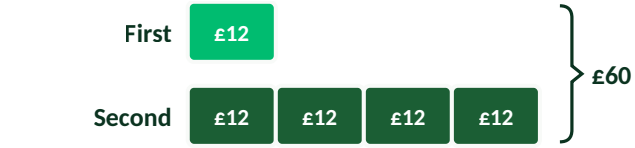
1 × £12 = £12

4 × £12 = £48

Step 4: Check

£12 + £48 = £60 ✓

BAR MODEL



ANSWER £12 and £48

Question P4.2

[3 marks]

Share 84 stickers in the ratio 3 : 4.

Step 1: Find the total number of parts

3 + 4 = 7 parts

Step 2: Find the value of one part

84 ÷ 7 = 12

Step 3: Multiply to find each share

3 × 12 = 36

4 × 12 = 48

Step 4: Check

36 + 48 = 84 ✓

ANSWER 36 and 48

Question P4.3

[3 marks]

Share £150 in the ratio 2 : 3 : 5.

Step 1: Find the total number of parts

2 + 3 + 5 = 10 parts

Step 2: Find the value of one part

£150 ÷ 10 = £15

Step 3: Multiply to find each share

2 × £15 = £30

3 × £15 = £45

5 × £15 = £75

Step 4: Check

£30 + £45 + £75 = £150 ✓

ANSWER **£30, £45 and £75**

Question P4.4

[3 marks]

2 kg of flour is split into two bags in the ratio 3 : 7. How many grams are in the larger bag?

Step 1: Change to grams

2 kg = 2 × 1000 = 2000 g

Step 2: Find the total number of parts

3 + 7 = 10 parts

Step 3: Find the value of one part

2000 ÷ 10 = 200 g

Step 4: Find the larger bag

The larger bag is 7 parts.

7 × 200 = 1400 g

ANSWER **1400 g**

© Sismo Learning LTD

Question P4.5

[3 marks]

£4.80 is shared in the ratio 5 : 3. How much more does the first person get?

Step 1: Change to pence

£4.80 = 480p

Step 2: Find the total number of parts

5 + 3 = 8 parts

Step 3: Find the value of one part

480 ÷ 8 = 60p

Step 4: Find the difference

The difference is 5 − 3 = 2 parts

2 × 60p = 120p = £1.20

ANSWER £1.20 more

Concept 5 || Using a known part or difference

Question P5.1

[2 marks]

The ratio cats : dogs is 5 : 3. There are 15 dogs. How many cats are there?

Step 1: Match the known amount to its parts

Dogs are 3 parts and there are 15 dogs.

Step 2: Find the value of one part

15 ÷ 3 = 5

Step 3: Find the cats

Cats are 5 parts.

5 × 5 = 25

ANSWER 25 cats

© Sismo Learning LTD

Question P5.2

[2 marks]

Squash is mixed with water in the ratio 1 : 6. Ola uses 210 ml of water. How much squash does she need?

Step 1: Match the known amount to its parts

Water is 6 parts and there is 210 ml of water.

Step 2: Find the value of one part

210 ÷ 6 = 35 ml

Step 3: Find the squash

Squash is 1 part.

1 × 35 = 35 ml

ANSWER 35 ml

Question P5.3

[3 marks]

Ella and Finn share money in the ratio 4 : 9. Finn gets £30 more than Ella. How much does Ella get?

Step 1: Find how many parts the difference is

9 − 4 = 5 parts

Step 2: Find the value of one part

5 parts = £30

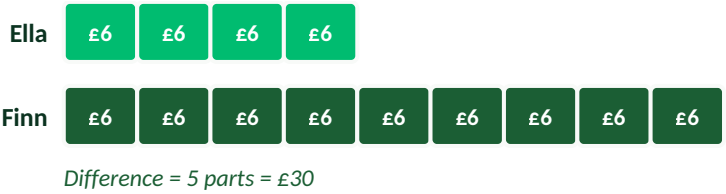
£30 ÷ 5 = £6

Step 3: Find Ella's share

Ella is 4 parts.

4 × £6 = £24

BAR MODEL



Difference = 5 parts = £30

ANSWER £24

Question P5.4

[3 marks]

A fruit punch mixes orange, apple and mango juice in the ratio 2 : 3 : 6. It contains 480 ml of mango juice. How much punch is there altogether?

Step 1: Match the known amount to its parts

Mango is 6 parts and there is 480 ml of mango.

Step 2: Find the value of one part

480 ÷ 6 = 80 ml

Step 3: Find the total number of parts

2 + 3 + 6 = 11 parts

Step 4: Find the total

11 × 80 = 880 ml

ANSWER **880 ml**

Question P5.5

[3 marks]

In a school the ratio boys : girls is 7 : 5. There are 14 more boys than girls. How many pupils are there altogether?

Step 1: Find how many parts the difference is

7 − 5 = 2 parts

Step 2: Find the value of one part

2 parts = 14

14 ÷ 2 = 7

Step 3: Find the total number of parts

7 + 5 = 12 parts

Step 4: Find the total

12 × 7 = 84

ANSWER **84 pupils**

© Sismo Learning LTD

Concept 6 || Direct proportion

Question P6.1

[2 marks]

3 notebooks cost £4.50. How much do 7 notebooks cost?

Step 1: Find the cost of one notebook

£4.50 ÷ 3 = £1.50

Step 2: Multiply by 7

7 × £1.50 = £10.50

ANSWER **£10.50**

Question P6.2

[2 marks]

A recipe for 6 people uses 450 g of pasta. How much pasta is needed for 4 people?

Step 1: Find the amount for one person

450 ÷ 6 = 75 g

Step 2: Multiply by 4

4 × 75 = 300 g

ANSWER **300 g**

Question P6.3

[2 marks]

A printer prints 12 pages in 3 minutes. How many pages does it print in 10 minutes?

Step 1: Find the pages for one minute

12 ÷ 3 = 4 pages

Step 2: Multiply by 10

10 × 4 = 40 pages

ANSWER **40 pages**

© Sismo Learning LTD

Question P6.4

[3 marks]

A 500 ml bottle of juice costs £1.20. A 750 ml bottle costs £1.65. Which is better value?

Step 1: Find the cost of 100 ml for the 500 ml bottle

500 ml is 5 lots of 100 ml

120p ÷ 5 = 24p per 100 ml

Step 2: Find the cost of 100 ml for the 750 ml bottle

750 ml is 7.5 lots of 100 ml

165p ÷ 7.5 = 22p per 100 ml

Step 3: Compare

22p is less than 24p, so the 750 ml bottle is cheaper per 100 ml.

ANSWER The 750 ml bottle

Question P6.5

[2 marks]

The exchange rate is £1 = $1.25. How many pounds do you get for $70?

Step 1: Decide whether to multiply or divide

Dollars to pounds means dividing by 1.25.

Step 2: Divide

70 ÷ 1.25 = 7000 ÷ 125 = 56

ANSWER £56

11 Plus exam style questions

Question M1

[4 marks]

Amir and Bella share £96 in the ratio 5 : 7. Bella then gives a quarter of her share to Cal. How much does Cal get?

Step 1: Find the total number of parts

5 + 7 = 12 parts

Step 2: Find the value of one part

£96 ÷ 12 = £8

Step 3: Find Bella's share

7 × £8 = £56

Step 4: Find a quarter of Bella's share

$\frac{1}{4}$ of £56 = £56 ÷ 4 = £14

ANSWER £14

© Sismo Learning LTD

Question M2

[4 marks]

There are 21 cars in a car park. The ratio red : blue is 3 : 4. Then 3 more red cars arrive. What is the new ratio red : blue in its simplest form?

Step 1: Find the value of one part

3 + 4 = 7 parts

21 ÷ 7 = 3

Step 2: Find the starting numbers

red = 3 × 3 = 9

blue = 4 × 3 = 12

Step 3: Add the new red cars

red = 9 + 3 = 12

Step 4: Write and simplify the new ratio

red : blue = 12 : 12 = 1 : 1

ANSWER **1 : 1**

Question M3

[4 marks]

A bag of 40 sweets has strawberry and lime sweets in the ratio 3 : 5. How many strawberry sweets must be added so the ratio becomes 1 : 1?

Step 1: Find the value of one part

3 + 5 = 8 parts

40 ÷ 8 = 5

Step 2: Find each flavour

strawberry = 3 × 5 = 15

lime = 5 × 5 = 25

Step 3: Make the amounts equal

A 1 : 1 ratio means equal amounts.

25 − 15 = 10

BAR MODEL



ANSWER **10 strawberry sweets**

Question M4

[5 marks]

Pastry is made by mixing flour and butter in the ratio 5 : 2 by weight. Lily has 450 g of flour and 200 g of butter. What is the greatest amount of pastry she can make?

Step 1: Test using all the flour

Flour is 5 parts: 450 ÷ 5 = 90 g per part

Butter needed = 2 × 90 = 180 g

180 g is less than 200 g, so this works.

Step 2: Test using all the butter

Butter is 2 parts: 200 ÷ 2 = 100 g per part

Flour needed = 5 × 100 = 500 g

500 g is more than 450 g, so this is not possible.

Step 3: Find the total pastry

The flour runs out first, so one part = 90 g.

Total = 7 parts = 7 × 90 = 630 g

ANSWER **630 g of pastry**

Question M5

[5 marks]

Kemi is 3 times as old as her brother. In 6 years' time she will be twice as old as him. How old is Kemi now?

Step 1: Write the ages now as parts

Kemi : brother = 3 : 1

The difference is 3 − 1 = 2 parts.

Step 2: Use the fact that the age difference never changes

In 6 years, Kemi : brother = 2 : 1, so the difference equals the brother's age then.

So the brother's age in 6 years = 2 parts.

Step 3: Find one part

Brother now = 1 part, brother in 6 years = 2 parts

So 6 years = 2 − 1 = 1 part

Step 4: Find Kemi's age

Kemi = 3 parts = 3 × 6 = 18

Step 5: Check

Now: 18 and 6. In 6 years: 24 and 12, and 24 = 2 × 12 ✓

ANSWER **Kemi is 18 years old**

© Sismo Learning LTD