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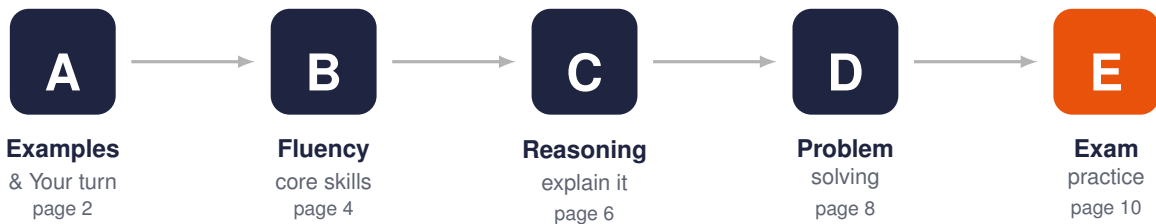
GCSE MATHEMATICS • RATIO & PROPORTION

# Sharing Ratio

## Worksheet

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • No calculator

Free Sharing Ratio worksheet for GCSE and iGCSE Maths, with full worked solutions



Tap a section to jump straight to it

**By the end of this worksheet you can:** simplify ratios, including units, and write them as  $1 : n$  • share in a ratio, and work back from one share or a difference • move between ratios and fractions • *Higher:* combine ratios, handle transfers, solve ratios of expressions and mix two mixtures.

### Which questions are for me?

**FOUNDATION** Everyone starts here. These skills appear on both tiers.

**HIGHER** The same skills where Higher papers use them: combining ratios, fixed totals, ratios of expressions and mixing. Grades 6 to 9.

Every section has both, clearly labelled. Questions get harder as you go, and every skill in Sections A to D is needed in Section E.

### Track your progress

| Section          | B  | C  | D  | E  |
|------------------|----|----|----|----|
| Foundation marks | 27 | 10 | 13 | 18 |
| Higher marks     | 16 | 15 | 17 | 15 |
| My score         |    |    |    |    |

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**A****Worked examples & Your turn**

Read each example carefully. Cover it up, then answer the question beside it using the same method.

**FOUNDATION***Everyone starts here***Worked example A1**

Write this ratio in its simplest form.

1 hour 20 minutes : 50 minutes

*Use the same units first.*

1 hour 20 minutes = 80 minutes

*Divide both parts by the HCF, 10.*

$80 : 50 = 8 : 5$

8 : 5

**Your turn A1**

Write this ratio in its simplest form.

750 g : 2 kg

**Worked example A2**

Ria, Sam and Tia share £90 in the ratio 2 : 3 : 4

Work out how much each person gets.

*Find the total number of parts, then one part.*

$2 + 3 + 4 = 9$  parts       $90 \div 9 = 10$

*Multiply each number in the ratio by 10, then check.*

$20 + 30 + 40 = 90$

£20, £30, £40

**Your turn A2**

Dan, Eve and Fin share £132 in the ratio 1 : 3 : 7

Work out how much more money Fin gets than Dan.

**Worked example A3**

Mortar is cement and sand in the ratio 1 : 3

Jo uses 12 kg of sand. How much mortar does she make?

*12 kg is the sand: 3 parts, not the total.*

$12 \div 3 = 4$ , so 1 part is 4 kg

*Mortar is 1 + 3 = 4 parts.  $4 \times 4 = 16$*

16 kg

**Your turn A3**

Squash and water are mixed in the ratio 2 : 9

Ella uses 450 ml of water. How much squash does she use?



**HIGHER***Higher strategies: these are new ways of thinking, not longer sums***Worked example A4: combining two ratios** $a : b = 2 : 3$  and  $b : c = 4 : 5$ . Find  $a : b : c$ .*Make  $b$  the same in both. LCM of 3 and 4 is 12.*

$$a : b = 8 : 12 \quad b : c = 12 : 15$$

$$a : b : c = 8 : 12 : 15$$

**Your turn A4** $x : y = 5 : 2$  and  $y : z = 3 : 4$ . Find  $x : y : z$  in its simplest form.**Worked example A5: the total stays fixed**Kim and Lee share marbles in the ratio  $5 : 3$ . Kim gives Lee 6 marbles and the ratio becomes  $1 : 1$ 

How many marbles did Kim have at the start?

*The total is fixed, so use 8 parts both times.*

$$5 : 3 \text{ becomes } 1 : 1 = 4 : 4$$

$$\text{Kim loses 1 part, so 1 part} = 6 \quad 5 \times 6 = 30$$

30 marbles

**Your turn A5**Amy and Ben have money in the ratio  $4 : 1$ . Amy gives Ben £30. The ratio is now  $3 : 2$ 

How much money did Amy have at the start?

**Worked example A6: ratio to equation**

Solve  $(2x + 3) : (x + 4) = 5 : 3$

*Equal fractions,  $\frac{2x+3}{x+4} = \frac{5}{3}$ , so multiply across.*

$$3(2x + 3) = 5(x + 4)$$

$$6x + 9 = 5x + 20, \text{ so } x = 11 \quad (25 : 15 = 5 : 3)$$

$$x = 11$$

**Your turn A6**

Solve  $(3x - 2) : (x + 6) = 4 : 3$

**Worked example A7: mixing two mixtures**Bottle A: 300 ml, cordial : water =  $1 : 5$ Bottle B: 400 ml, cordial : water =  $3 : 5$ 

Mix them. Find cordial : water in the mixture.

*Never add ratios. Find the amounts, then add.*

A:  $300 \div 6 = 50$  50 ml and 250 ml

B:  $400 \div 8 = 50$  150 ml and 250 ml

Total:  $200 : 500 = 2 : 5$

$$2 : 5$$

**Your turn A7**Tin A: 4 litres, red : white paint =  $3 : 1$ Tin B: 6 litres, red : white paint =  $1 : 2$ 

Mix them. Find red : white in the mixture, in its simplest form.



**B****Fluency**

Each question is a designed sequence. From one part to the next, ask yourself: what changed, and what did it do to the answer?

**FOUNDATION***Everyone starts here*

**B1** Write each ratio in its simplest form. If it cannot be simplified, say so.

(a)  $12 : 20$

(b)  $36 : 24$

(c)  $15 : 45 : 60$

(d)  $14 : 25$

[4 marks]

**B2** Write each ratio in its simplest form.

(a)  $2.5 : 4$

(b)  $0.6 : 1.5$

(c)  $\frac{1}{2} : \frac{3}{4}$

(d)  $40 \text{ cm} : 2 \text{ m}$

[4 marks]

**B3** Write each ratio in the form  $1 : n$

(a)  $4 : 12$

(b)  $5 : 8$

(c)  $8 : 2$

(d)  $20 \text{ mm} : 5 \text{ cm}$

[4 marks]

**B4** Share each amount in the ratio given.

(a) £40 in the ratio  $3 : 5$

(b) £40 in the ratio  $5 : 3$

(c) 40 kg in the ratio  $1 : 4 : 5$

(d) £50 in the ratio  $3 : 5$

[4 marks]

**B5** In a club, the ratio of boys to girls is  $3 : 5$

Work out the number of girls in the club when there are

(a) 64 members

(b) 18 boys

(c) 14 more girls than boys

[3 marks]



**FOUNDATION***continued: ratios, fractions and relationships***B6** A bag contains only coloured counters.

(a) red : blue = 2 : 7 What fraction of the counters are red?

(b) red : blue : green = 2 : 7 : 3 What fraction of the counters are red?

(c)  $\frac{3}{8}$  of the counters are red and the rest are blue. Write down the ratio red : blue.

(d) 40% of the counters are red and the rest are blue. Write the ratio red : blue in its simplest form.

**[4 marks]****B7** Write each relationship as a ratio in its simplest form.

(a) Ann has twice as much money as Ben.

Ann : Ben

(b) Ann has half as much money as Ben.

Ann : Ben

(c) Ann has 1.5 times as much money as Ben.

Ann : Ben

(d) Ann has 3 times as much as Ben. Cal has twice as much as Ben.

Ann : Ben : Cal

**[4 marks]****HIGHER***Higher tier only***B8** Write  $a : b : c$  in its simplest form.(a)  $a : b = 1 : 2$  $b : c = 2 : 5$ (b)  $a : b = 2 : 3$  $b : c = 6 : 7$ (c)  $a : b = 3 : 4$  $b : c = 10 : 3$ (d)  $a : b = 4 : 3$  $a : c = 6 : 5$ **[4 marks]****B9** Solve(a)  $x : 12 = 3 : 4$ (b)  $5 : x = 2 : 3$ (c)  $(x + 1) : (x - 1) = 3 : 2$ (d)  $(2x + 1) : (x + 5) = 5 : 4$ **[4 marks]****B10** Find the ratio  $x : y$  in its simplest form.(a)  $2x = 3y$ (b)  $4x = 10y$ (c)  $(x + y) : y = 7 : 3$ (d)  $(x + y) : (x - y) = 5 : 3$ **[4 marks]****B11**  $a : b = 3 : 5$ 

Write each ratio in its simplest form.

(a)  $(a + b) : b$ (b)  $a : (a + b)$ (c)  $(2a + b) : (a + b)$ (d)  $(b - a) : (a + b)$ **[4 marks]**

**C****Reasoning**

Show your working and explain your thinking. A correct answer without a reason does not score full marks.

**FOUNDATION**

Everyone starts here

- C1** Jack shares £60 between two people in the ratio 2 : 3

Here is his working.

$$60 \div 2 = 30 \quad 60 \div 3 = 20 \quad \text{So the shares are £30 and £20}$$

(a) Explain the mistake Jack has made.

(b) Work out the correct shares.

[2 marks]

- C2** The ratio of boys to girls in a class is 2 : 3

Lucy says, " $\frac{2}{3}$  of the class are boys."

Is Lucy correct? Give a reason for your answer.

[2 marks]

- C3** Mia has 50 sweets. She says, "I can share all of my sweets between Ali, Bea and Cal in the ratio 2 : 3 : 4 without cutting any sweets."

(a) Is Mia correct? Give a reason for your answer.

(b) Mia buys some more sweets so that she **can** share all of them in the ratio 2 : 3 : 4

What is the smallest number of extra sweets she needs?

[3 marks]

- C4** The length and the width of a rectangle are in the ratio 5 : 2

The perimeter of the rectangle is 56 cm.

Show that the area of the rectangle is  $160 \text{ cm}^2$

[3 marks]



**HIGHER**

Higher tier only

**C5**  $a$  and  $b$  are positive numbers with  $a : b = 3 : 4$

For each statement, write **true** or **false**. Give a reason for each answer.

- (i)  $3a = 4b$       (ii)  $4a = 3b$       (iii)  $b$  is 1 more than  $a$       (iv)  $a$  is  $\frac{3}{7}$  of  $a + b$

[4 marks]

**C6** Two whole numbers are in the ratio  $3 : 5$

Prove that the product of the two numbers is always 15 times a square number.

[3 marks]

**C7** Jo shares a sum of money between two people in the ratio  $3 : 5$

Kay shares a different sum of money between two people in the ratio  $2 : 7$

The larger share of Jo's money is equal to the larger share of Kay's money.

Show that Jo's sum of money : Kay's sum of money =  $56 : 45$

[3 marks]

**C8** The diagram shows a rectangle  $ABCD$  with  $AB = x$  cm and  $BC = 1$  cm, where  $1 < x < 2$

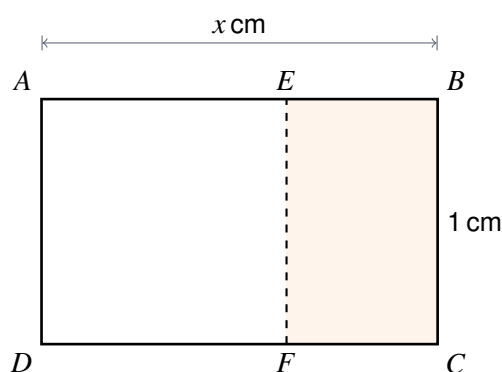


Diagram NOT accurately drawn

$AEFD$  is a square of side 1 cm. The rectangle  $EBCF$  that is left has the same ratio of longer side to shorter side as the rectangle  $ABCD$ .

(a) Show that  $x^2 - x - 1 = 0$

(b) Find the exact value of  $x$

[5 marks]



**D****Problem solving**

You decide the method. Read the whole question first, and show every step.

**FOUNDATION**

Everyone starts here

- D1** Gran shares some money between her three grandchildren in the ratio of their ages.  
The children are 7, 9 and 12 years old. The youngest child gets £42  
How much money does Gran share altogether? [3 marks]
- D2** In a car park there are only cars and vans. The ratio of cars to vans is 7 : 2  
There are 45 more cars than vans.  
How many vehicles are in the car park altogether? [3 marks]
- D3** A café makes smoothies by mixing strawberries, banana and yoghurt in the ratio 3 : 2 : 5 by mass.  
The café has 1.2 kg of strawberries, 1 kg of banana and 2.5 kg of yoghurt.  
What is the greatest mass of smoothie the café can make? Give your answer in kilograms. [4 marks]
- D4**  $A$ ,  $P$ ,  $Q$  and  $B$  are points on a straight line.

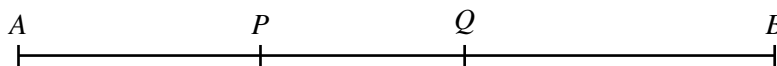


Diagram NOT accurately drawn

$$AB = 48 \text{ cm} \quad AP : PB = 1 : 2 \quad PQ : QB = 3 : 5$$

Work out the length of  $AQ$ .

[3 marks]



**HIGHER***Higher tier only*

- D5** The ratio of Maya's age to her mum's age is 1 : 4  
In 8 years' time, the ratio of Maya's age to her mum's age will be 1 : 3  
In how many years' time will the ratio of Maya's age to her mum's age be 1 : 2? [4 marks]
- D6** A bag contains only red, blue and green counters.  
The numbers of red, blue and green counters are in the ratio 4 : 5 :  $x$   
A counter is taken at random. The probability that it is green is  $\frac{1}{4}$   
There are 20 blue counters in the bag. Work out the number of green counters. [4 marks]
- D7** Alex gives  $\frac{1}{3}$  of his money to charity. He shares the rest between Bea and Cole in the ratio 3 : 5  
Cole gets £60 more than Bea.  
How much money did Alex have at the start? [4 marks]
- D8**  $ABCD$  is a square.  $P$  is the point on  $AB$  with  $AP : PB = 1 : 3$ .  $Q$  is the point on  $BC$  with  $BQ : QC = 1 : 1$

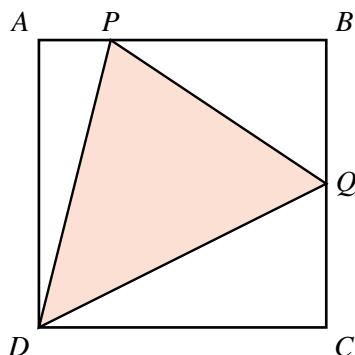


Diagram NOT accurately drawn

The area of triangle  $DPQ$  is  $63 \text{ cm}^2$   
Work out the area of the square  $ABCD$ .

[5 marks]



**Exam practice**

Exam-style questions. Write your answers in the spaces. Aim for about one minute per mark.

**FOUNDATION***Foundation and Higher crossover*

**E1** (a) Write  $42 : 56$  in its simplest form.

..... : .....

(1)

(b) Write  $1.2 \text{ kg} : 400 \text{ g}$  in its simplest form.

..... : .....

(2)

**(Total for Question E1 is 3 marks)**

**E2** Amir, Beth and Cara share £160 in the ratio  $3 : 4 : 9$   
Work out how much more money Cara gets than Amir.

£ .....

**(Total for Question E2 is 3 marks)**

**E3** A drink is made by mixing orange juice, lemonade and cranberry juice in the ratio  $5 : 3 : 2$   
Leo uses 450 ml of lemonade.

(a) Work out the total amount of drink Leo makes.

..... ml

(2)

(b) What fraction of the drink is cranberry juice?

.....

(1)

**(Total for Question E3 is 3 marks)**



- E4** A box contains only red pens, blue pens and green pens.  
red pens : blue pens = 2 : 3  
There are 3 times as many green pens as red pens.  
There are 44 pens in the box.  
Work out the number of blue pens in the box.

.....  
(Total for Question E4 is 3 marks)

- E5** The sizes of the angles of a triangle are in the ratio 2 : 3 : 7  
Show that one of the angles of the triangle is obtuse.

(Total for Question E5 is 3 marks)

- E6** Kit makes Sky paint by mixing blue paint and white paint in the ratio 3 : 5  
Lou makes Ocean paint by mixing blue paint and white paint in the ratio 2 : 3  
Which paint contains the greater proportion of blue paint?  
You **must** show your working.

.....  
(Total for Question E6 is 3 marks)



**HIGHER***Higher tier only*

**E7** In a car park, every car is red or silver or black.

red cars : silver cars = 3 : 4      silver cars : black cars = 6 : 5

What fraction of the cars are red?

.....  
(Total for Question E7 is 3 marks)

**E8** Rosa and Sam have some money in the ratio 7 : 3

Rosa gives Sam £40. The ratio of Rosa's money to Sam's money is now 3 : 2

How much money did Rosa have at the start?

£ .....

(Total for Question E8 is 4 marks)

**E9**  $a$  and  $b$  are positive numbers.       $(2a + 3b) : (4a - b) = 4 : 3$

Find the ratio  $a : b$ . Give your answer in its simplest form.

..... : .....

(Total for Question E9 is 3 marks)



- E10** Drink A is made from orange juice and water in the ratio 1 : 4  
Drink B is made from orange juice and water in the ratio 2 : 3  
Some of drink A and some of drink B are mixed to make 1000 ml of a new drink.  
In the new drink, the ratio of orange juice to water is 1 : 3  
How much of drink A is used?

..... ml

(Total for Question E10 is 5 marks)

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