Student Name

Mathematics Stage 4

RATIOS AND RATES

Book 2 Solve problems involving ratios

Version: 260207

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CONTENTS

OVERVIEW

SYLLABUS CONTENT

MA4-RAT-C-01 solves problems involving ratios and rates, and analyses distance–time graphs

Solve problems involving ratios

- Apply the unitary method to solve ratio problems
- Divide a quantity in a given ratio
- Solve real-life problems involving ratios

SUMMARY

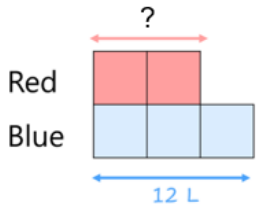
Solve Problems involving Ratios

Unitary Method

1. Identify the number of parts the given quantity represents.
2. Divide to find the value of 1 part.
3. Multiply to find the number of parts required by the question.

Given the value of a part, find the value of another part

Purple paint is made by mixing red and blue paint in the ratio 2:3.
How much red paint do you need to mix with 12 L of blue paint?



3 parts = 12 L

÷ 3 ÷ 3

1 part = 4 L

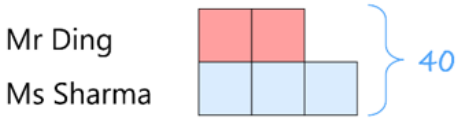
× 2 × 2

2 parts = 8 L

You will need 8 L of blue paint.

Dividing in a ratio

Mr Ding and Ms Sharma divide $40 in the ratio 2:3.
How much does each person get?



5 parts = $40

÷ 5 ÷ 5

1 part = $8

× 2 × 2

2 parts = $16

3 parts = $24

Mr Ding gets $16 and Ms Sharma $24.

REVIEW OF PRIOR KNOWLEDGE

1 $\frac{1}{3}$ of a bag of counters are red and the rest are blue.

a Write the ratio of red counters to blue counters.

b Write the ratio of blue counters to red counters.

2 The ratio of apples to oranges in a bowl of fruit is 4:3

What fraction of the fruit are:

a Apples

b Oranges

3 3 metres of cable costs $5.40

a Find the cost of 1 metre of cable.

b Find the cost of 30 metres of cable.

4 Use the unitary method to work out these problems:

a $\frac{2}{5}$ of a number is 200.

Find $\frac{3}{5}$ of the number.

b $\frac{3}{10}$ of a number is 36.

Find $\frac{7}{10}$ of the number.

c $\frac{3}{4}$ of a number is 60.

Find the number.

d Brian drinks $\frac{5}{8}$ of the water from his drink bottle and there is 300 mL left. How much water was in the drink bottle to begin with?

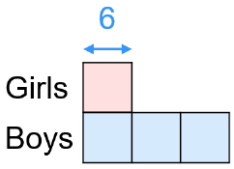
SOLVING PROBLEMS USING EQUIVALENT RATIOS

- If a problem gives a ratio $1:n$, we can solve it using equivalent ratios.
  1. Set up a ratio table with the two quantities.
  2. Use equivalent ratios to find the unknown quantity.

Example Solve ratio problems using equivalent ratios.

The ratio of girls to boys in a class is 1:3.

If there are 6 girls in a class, how many boys are there?



1. Ratio table.

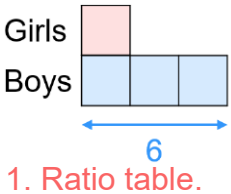
Girls	:	Boys
1	:	3
6	:	

2. Find unknown.

	Girls	:	Boys	
× 6	1	:	3	× 6
	6	:	18	

There are 18 boys.

If there are 6 boys in a class, how many girls are there?



1. Ratio table.

Girls	:	Boys
1	:	3
	:	6

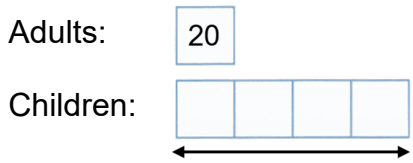
2. Find unknown.

	Girls	:	Boys	
× 2	1	:	3	× 2
	2	:	6	

There are 2 girls.

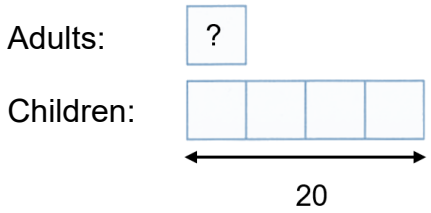
The ratio of adults to children in a nursery is 1 : 4.

a If there are 20 adults, how many children are there?



Adult	:	Child
1	:	4
20	:	

b If there are 20 children, how many adults are there?



Adult	:	Child
	:	
	:	

1 Orange drink is made by mixing cordial and water in the ratio 1:7.

a If you have 50 mL of cordial, how much water do you need?

Cordial: 

Water: 

Cordial	:	Water
1	:	7
50	:	

50 mL

b If you have 560 mL of water, how much cordial do you need?

Cordial: 

Water: 

Cordial	:	Water
	:	
	:	

80 mL

2 A child-care centre requires an adult to child ratio of 1 : 4.

a Find the number of children that can be cared for by 2 adults.

8

b Find the number of adults that are required to care for 12 children.

3

c Find the number of children that can be cared for by 10 adults.

40

d Find the number of adults that are required to care for 52 children.

13

3 A drink is made by mixing water and cordial in the ratio 5:1.

a How much water do you need for 60 mL of cordial?

300 mL

b How much cordial do you need for 200 mL of water?

40 mL

c What fraction of the drink is water?

$\frac{5}{6}$

4 The ratio of the width to length of a rectangle is 1: 4.

a If the width is 15 cm, how long is the rectangle?

60 cm

b If the length is 20 cm, how wide is the rectangle?

5 cm

c If the width is 12 cm, what is the perimeter?

120 cm

d What fraction of the perimeter is one width of the rectangle?

$\frac{1}{10}$

5 Rice and water are to be combined in a ratio of 2 : 3.

a Find the amount of water to combine with 12 cups of rice.

18 cups

b Find the amount of rice to combine with 12 cups of water.

8 cups

6 In a nut mixture the ratio of peanuts to walnuts to cashews is 2 : 3 : 1.

a If the number of peanuts is 20, find the number of walnuts and cashews.

30 walnuts 10 cashews

b If the number of walnuts is 6, find the number of peanuts and cashews.

4 peanuts 2 cashews

c If the number of cashews is 8, find the number of peanuts and cashews.

16 peanuts 24 walnuts

FINDING LENGTHS IN SCALE DRAWINGS

- A **scale drawing** is a **similar figure** of a real-life object.
  The **original** is the real-life object, and the **image** is the drawing.
- Examples include maps, house plans, and scientific diagrams.
- Scales for scale drawings are written in **simplified ratio notation: $1 : n$**
- A scale of 1:500 means every 1 unit on the drawing is 500 units in real life.

Scales in Scale Drawings
image : original

1. Set up a ratio table ***image : original***
   a. The first row should be the given scale.
   b. The second row should be the given length and the length you want to find.
2. Find the unknown side by multiplying or dividing.

Example Calculate original length.

A map has a scale of $1:500$.
What is the real-life distance that 28 mm on the map would represent?

1.

Image	:	Original
1	:	500
28	:	

2.

Image	:	Original
1	:	500
28	:	14 000

×500

The real-life distance is 14 000 mm, or 14 m.

Why do we set up our ratio boxes as image : original?

The scale factor is given as ..... : .....

How did we know 28 is the image length?

The question says 28 mm on a ..... meaning it is the image.

How do we know that it is 14 000 *millimetres?*

The unit given was 28 .....

a A map has a scale of $1:1000$.
What is the real-life distance that 37 mm on the map would represent?

Image	:	Original
	:	
	:	

37 000 mm or 37 m

b A city map has a scale of 1:10,000.
If the distance between two landmarks on the map is 3 cm, what is the real-life distance between the landmarks?

Image	:	Original
	:	
	:	

30 000 cm or 300 m

Example Calculate image length.

A map has a scale of $1:500$. What length on the map would represent 85 m in real life?

1.

Image	:	Original
1	:	500
	:	85

2.

Image	:	Original
1	:	500
0.17 ÷500	:	85

The map distance is 0.17 m, or 17 cm.

How did we know to divide by 500 to find x?

Image to original, we multiply,

so, from …… to ……., we divide.

How do we know that it was 0.17 ***metres***?

The unit given was 85 ……

a A diagram has a scale of 1:200.
What length on the diagram represents 450 metres in real life?
Answer in metres.

Image	:	**Original**
	:	
	:	

2.25 m

b A map has a scale of $1:10\,000$.
What length on the map would represent 23 km in real life?
Answer in metres.

Image	:	**Original**
	:	
	:	

2.3 m

1 A map has a scale of 1:50 000.

a How many centimetres in real life does 1 cm on the map equal?

50 000 cm

b Therefore, how many metres does 1 cm represent?

500 m

c What is the scale factor, as a fraction?

$\frac{1}{50000}$

2 A map scale is given as 1 cm = 100 m. Write this as a simplified ratio.

1: 10 000

3

a A map has a scale of 1:100.
How many metres on the map does 300 m in real life equal?

Image : **Original**
:
:

3 m

b Your science teacher tells you to draw a scale drawing of a tree with scale 1:150. If the tree is 45 m high, how high should it be in your drawing?

Image : **Original**
:
:

0.3 m or 30 cm

c A map scale is 1:200 000.
Chatswood to Redfern is 4 cm on the map. How far is it in real life?

8 km

d Blackbottle and Toowoola are 17 cm apart on a map with a scale of 1:50 000. How many km apart are the towns in real life?

8.5 km

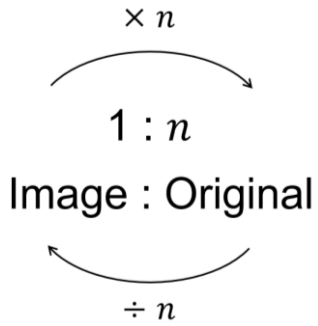
e The town of Gilgandra is 66 km north of Dubbo. On a map with a scale of 1 : 100 000, what is the scaled distance between the 2 towns?

66 cm

f Lord Howe Island is 2.8 km wide.
How long would its scaled width be on a map with a scale of 1 : 50 000?

5.6 cm

A shortcut you can use **only** if scale factor is given in the form $\mathbf{1}:\boldsymbol{n}$



4 Find the **actual distance** for the given scaled distances.
Give your answer in an appropriate unit.

a	1: 5	**i**	44 m $44\text{ m} \times 5 = \ldots\ldots\ldots\ldots$ 220 m	**ii**	310 cm 1550 cm
b	1: 10 000	**i**	2 cm 200 m	**ii**	4 mm 40 m
c	1: 20 000	**i**	80 cm 16 km	**ii**	18.5 mm 370 m
d	1: 400	**i**	16 mm 6.4 m	**ii**	0.03 m 12 m
e	1: 0.5	**i**	12 cm 6 cm	**ii**	3.2 mm 1.6 mm
f	100: 1	**i**	3 cm 0.03 cm	**ii**	11.5 km 115 m

5 Find the **scaled length** for the give actual lengths.

a	1: 10	**i**	40 m $40\text{ m} \div 10 = \ldots\ldots\ldots\ldots$ 4 m	**ii**	310 cm 31 cm
b	1: 200	**i**	200 m 1 m	**ii**	4 km 20 m
c	1: 500	**i**	10 000 m 20 m	**ii**	75 cm 0.15 cm
d	1: 10 000	**i**	1350 m 0.135 m	**ii**	45 km 4.5 m
e	1: 0.1	**i**	23 m 230 m	**ii**	6.15 m 61.5 m
f	100: 1	**i**	7.5 cm 750 cm	**ii**	8.2 m 820 m

6 A map scale is a ratio of **scaled distance : real-life distance**.
A map of a park was drawn using the scale ratio of 1 : 500.

a 1 mm on the map represents …… mm in real life.

500

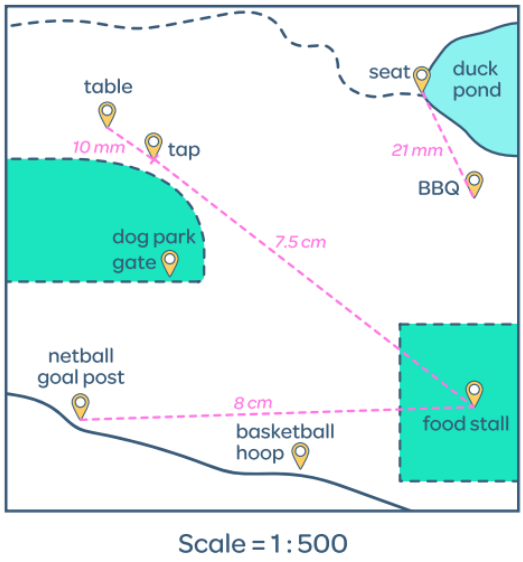
b 1 cm on the map represents …… cm in real life.

500

c Calculate the real-life distance between the table and the tap:

Scaled	:	Real Life
1	:	500
10	:	

5000 cm



Scale = 1 : 500

d Convert your answer to metres: …… m

50 m

e Calculate the distance between the seat and the BBQ in metres.

10.5 m

f Calculate the real-life distance between the netball goal post and the food stall in metres.

40 m

g In real life, the distance between the dog park and the food stall is 35 000 mm.
How far would it be on the map?

7 cm

7 A model city has a scale ratio of 1 : 1000.

a Find the real-life height of a skyscraper that has a scaled height of 8 cm.

Scaled	:	Real Life
	:	
	:	

80 m

b Find the scaled length of a train platform that is 45 m long in real life.

Scaled	:	Real Life
	:	
	:	

4.5 cm

8 A scientist draws a bacteria using the scale 100:1.
If the drawing is 7 cm long, how long is the bacteria in real life?

Scaled	:	**Real Life**
100	:	1
	:	

0.07 cm

9 A map is drawn with a scale of 1:125 000.

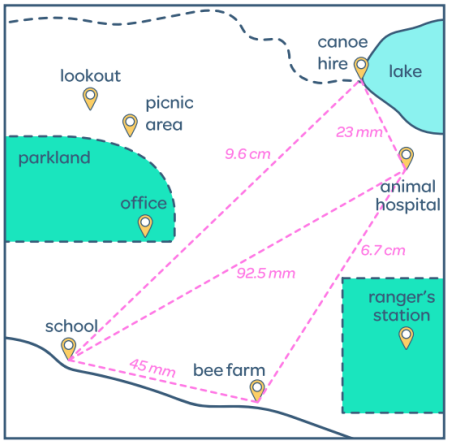
a 1 mm on the map represents:

…… mm in real life.

…… cm in real life.

…… m in real life.

…… km in real life.



125 000

12 500

125

0.125

b A teacher is planning a class excursion from the school to the bee farm.
What is the real-life distance between the two locations?

5.625 km

c Between the office and the ranger station the real-life distance is 7 km.
How far apart would they be on the map?

56 mm

10 A map maker wants to make a map of an area that is 8 km by 8 km.
She decides to use a scale of 1:100. Explain why this map scale is not appropriate.

A 1:100 scale would make the 8 km × 8 km map 80 meters × 80 meters, which is impractically large for any practical use

11 A scientist shows a photomicrograph image of a 10 cm long cell.
He says the cell is magnified by a scale of 1:100 000 through his microscope.
Explain what is wrong with the scientist's ratio.

The scientist's ratio is backwards - a magnification should be written as 100,000:1, not 1:100,000, since the image is larger than the actual cell.

12 An engineer designs a mobile phone SIM card using a diagram with a scale of 100:1.
If the scaled drawing is 80 cm long, what is its actual length in millimetres?

8 mm

13 Your science teacher asks you to draw a scale diagram of a bacteria cell with a scale of 500:1
If the microscope says the bacteria is 0.01 mm in length, how long should the bacteria in your diagram be?

5 mm

14 2012 HSC Standard 2 Band 5

A map has a scale of 1 : 500 000.

Two mountain peaks are 2 cm apart on the map.
What is the actual distance between the two mountain peaks, in kilometres?

10 km

Two cities are 75 km apart. How far apart are the two cities on the map, in centimetres?

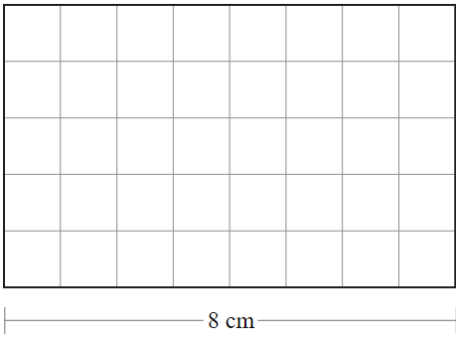
15 cm

15 2021 HSC Standard 2 Band 5

A rectangular sportsground has been drawn to scale on a 1-cm grid as shown.
The scale used is 1: 3000

Kerry took 12 minutes to walk around the perimeter of this sportsground.

What was Kerry's average speed in kilometres per hour?



3.9 km/h

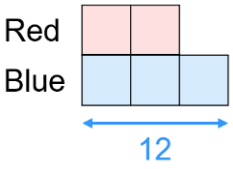
SOLVING PROBLEMS USING THE UNITARY METHOD

- If a problem gives a ratio $m:n$, one part's value, and asks for the value of the other, we can solve it using the **unitary method**.
  1. Identify the number of parts the given quantity represents.
  2. Divide to find 1 part's value.
  3. Multiply to find the required number of parts.

Example Solve ratio problems using the unitary method.

Purple paint is made by mixing red and blue paint in the ratio 2:3.
How much red paint do you need to mix with 12 L of blue paint?

Bar Model



Unitary Method

$3 \text{ parts} = 12 \text{ L}$
$\div 3 \quad \div 3$
$1 \text{ part} = 4 \text{ L}$
$\times 2 \quad \times 2$
$2 \text{ parts} = 8 \text{ L}$

You will need 8 L of red paint.

How did we know 12 L represents 3 parts?

There are 12 L of ..... paint.

In the ratio, ... is 3 parts.

How do we find the value of 1 part?

We know the value of 3 parts, so we divide by ..... to find 1 part.

How do we know how many parts we need to find?

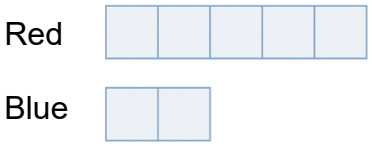
The question asks for how much ..... paint. In the ratio, ... paint represents ..... parts.

a The ratio of girls to boys in a class is 3:5.
If there are 9 girls, how many boys are there?

..... Parts = 9
1 Part = ...
..... Parts = ...

15 boys

b Purple paint is made by mixing red and blue paint in the ratio 5:2.
If you use 10L of blue paint, how many litres of red paint is needed?



..... Parts = 10
1 Part = ...
..... Parts = ...

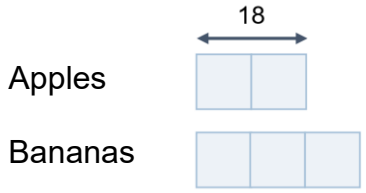
25 L red paint

Key ideas

1. The unitary method involves ..... to find the value of 1 ....., then ..... to find the value you want.

1

a The ratio of apples to bananas is 2:3.
If there are 18 apples, how many bananas are there?



…… parts = 18

1 part = ……

…… parts = ……

27

b The ratio of boys to girls in a class is 3:5.
If there are 20 girls, how many boys are in the class?

…… parts = 20

1 part = ……

…… parts = ……

12

2 A drink is made by mixing water and cordial in the ratio 5:2.

a How much cordial do you need for 200 mL of water?

…… parts = 200

…… = ……

…… = ……

80 mL

b How much water do you need for 60 mL of cordial?

…… parts = 60

…… = ……

…… = ……

150 mL

c How much drink, in total, can you make with 120 mL of cordial?

…… parts = 120

…… = ……

…… = ……

420 mL

3 To make pink paint, white and red paint need to be mixed in the ratio 3:4.
How much white paint is needed to mix with 10 L of red paint?

7.5 L

4 In a recipe, for every 3 cups of milk, 4 cups of water are used.
Chloe has 6 cups of water. How much milk will she need?

4.5 cups

5 At a cake sale, you sold cupcakes and cookies in the ratio 5:4.

a If you sold 15 cupcakes, work out the number of cookies sold.

12

b If you sold 15 *more* cupcakes than cookies, work out the number of cookies sold.

60

6 In a rectangle, the ratio of the width to the length is 5 : 12. The length is 48 cm.

a Find the width of the rectangle.

b Find the perimeter of the rectangle.

width: 20 cm, perimeter: 136 cm

7 Terry, Ash and Felicity share a prize in the ratio 11 : 8 : 6. Ash received $720.

a How much did Terry receive?

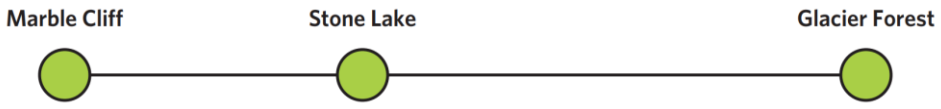
b How much more money did Ash receive compared to Felicity?

c How much was the total prize money?

Terry: $990, Ash received $180 more than Felicity, total: $2250

8 The ratio of the distance between Marble Cliff and Stone Lake to the distance between Stone Lake and Glacier Forest is 3 : 4

The distance between Marble Cliff and Stone Lake is 21 km.
Find the distance between Marble Cliff and Glacier Forest.



49 km

9 Paula is making a wooden box. She knows that for every $\frac{3}{5}$ m of pine she needs 70 cm of oak.

a She states that the ratio of pine to oak is $\frac{3}{5} : 70$. Explain why she is incorrect.

the units are different.

b Write the correct simplified ratio of pine to oak.

6:7

c How many metres of pine would she need if she wants to use 14 m of oak?

12 m

10 $\frac{3}{7}$ of a company workforce are male.

a What is the ratio of female to male in the workforce?

4:3

b 160 females work for the company. How many people work for the company altogether?

280

11 In an office, the ratio of men to women is 3 : 4.
12 men, which is 20% of the number of men in the office, wear glasses.

a How many men work in the office?

60 men

b How many women work in the office?

80 women

c 15% of the women wear glasses.
Work out the total percentage of employees who wear glasses.

17.14%

12 Faith makes orange paint by mixing red and yellow paint.
She mixes 12 litres of red paint with 15 litres of yellow paint to get the right shade of orange.
Faith wants to make more of the same shade of orange paint.
She uses another 8 litres of yellow paint. How many more litres of red paint she needs to use?

6.4 L

13 Jessie is making fuel for her leaf blower by mixing petrol with oil.

a Her current container has 4.1 litres of fuel mixed in a ratio of 40:1 (petrol : oil).
How much petrol and how much oil are in this mixture?

4 L : 0.1 L

b Jessie's leaf blower manual states the correct mixing ratio should be 25:1 (petrol : oil).
If she wants to correct his mixture and already has 4 litres of petrol, how much oil should be in the mixture in total?

0.16 L

c How much extra oil does Jessie need to add to her current mixture to achieve the correct ratio?

0.06 L or 60 mL

14 Lily is making a drink by mixing water and cordial. She starts by making 5.4 L of drink using a ratio of 35:1. However, the instructions say she should use the ratio of 20:1. How much more cordial should she add to her current mixture so that the ratio is correct?

112.5 mL

SOLVING RATIO PROBLEMS USING EQUIVALENT FRACTIONS

FOUNDATION

1 When two ratios are equivalent, we can express this using fractions.

E.g., $1:2 = 4:8 \rightarrow \frac{1}{2} = \frac{4}{8}$

a Represent $x:y = 5:1$ using fractions.

$\frac{x}{y} = \frac{5}{1}$

b Represent $x:y = 3:4$ using fractions.

$\frac{x}{y} = \frac{3}{4}$

c Represent $2:3 = x:y$ using fractions.

$\frac{2}{3} = \frac{x}{y}$

2 Find the value of x in these equivalent ratios.

a $\frac{x}{15} = \frac{6}{5}$

18

b $\frac{x}{4} = \frac{9}{12}$

3

c $\frac{x}{7} = \frac{1}{4}$

1.75

d $x:6 = 18:90$

1.2

e $15:48 = x:16$

5

f $12:15 = x:75$

60

3 When working with equivalent ratios, always set up the fraction so that x is in the numerator.

a $20 : 16 = 2 : x$

$\frac{x}{2} = \frac{16}{20}$

1.6

b $6:27 = 42:x$

189

c $12:15 = 8:x$

10

d $16:14 = 4:x$

3.5

e $8:x = 25:22$

7.04

f $x:9 = 4:x$

6

4 Solve these ratio problems using the algebraic fractions method.

1. Set up ratio table.
2. Use the rows in the table to set up an equation, always have x in the numerator.

a The ratio of tin to lead in a type of metal is 8 : 5. How much tin is needed for 35g of lead?

Tin	:	Lead
8	:	5
x	:	35

$$\frac{x}{35} = \frac{8}{5}$$

56 g

b The ratio of tin to lead in a type of metal is 8 : 5. How much lead is needed for 70g of tin?

Tin	:	Lead
	:	
	:	

$$\frac{x}{70} = \text{—}$$

43.75 g

c The length and width of a rectangle are in the ratio of 9 : 4. Find the length of the rectangle when the width is 5.2 cm.

	:	
	:	
	:	

11.7 cm

d The length and width of a rectangle are in the ratio of 9 : 4. Find the width of the rectangle when the length is 128.7 cm.

	:	
	:	
	:	

57.2 cm

e The ratio of a boy's height to his father's is 3 : 5. If the boy's height is 1.23 m, how tall is his father?

2.05 m

f The ratio of Carla's weight to Tracey's weight is 7 : 9. If Tracey weighs 82.8 kg, how much does Carla weigh?

64.4 kg

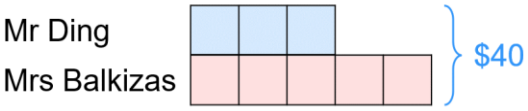
DIVIDING IN A RATIO

- In a **part:part ratio**, add the parts to find the **total**.
- **Dividing in a ratio** means finding part values from a total.
- Use the **unitary method** to solve these problems.

Example Divide a quantity in a given ratio and calculate the value of a part.

Mr Ding and Mrs Balkizas divide $40 in the ratio 3:5, how much does each person get?

Bar Model



Unitary Method

$8 \text{ parts} = \$40$

$\div 8 \quad \div 8$

$1 \text{ part} = \$5$

$\times 3 \quad \times 3$

$3 \text{ parts} = \$15$

$5 \text{ parts} = \$24$

Mr Ding gets $15 and Mrs Balkizas $25.

How do we know the total number of parts?

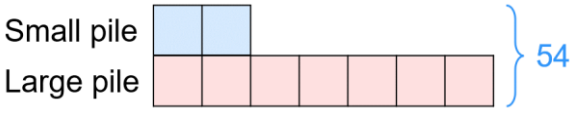
The ratio is 3:5, the total parts is …… + ……

How do we find the value of 1 part?

We know the value of 8 parts is 40,

so we divide 40 by …… to find 1 part.

a 54 sweets are shared in two piles in the ratio 2:7. How much is each pile?



…… parts = 54

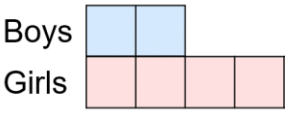
1 part = ……

…… parts = ……

…… parts = ……

12 small pile : 42 large pile

b The ratio of boys to girls is 2:5. If there are 546 students, how many boys are there and how many girls are there?



…… parts = 549

1 part = ……

…… parts = ……

…… parts = ……

156 boys : 390 girls

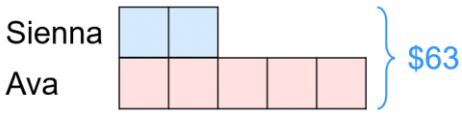
Key ideas

1. When you are given a total and asked to find the value of the parts, this is called …… in a ratio.
2. We can use the …… method to divide in a ratio.

Example Divide a quantity in a given ratio and calculate the difference.

Sienna and Ava share $63 in the ratio 2 : 5. *How much more* does Ava get than Sienna?

Bar Model



Unitary Method

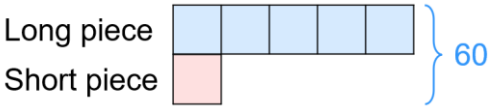
$$7 \text{ parts} = \$63$$
$$\div 7 \quad \div 7$$
$$1 \text{ part} = \$9$$
$$\times 3 \quad \times 3$$
$$3 \text{ parts} = \$27$$

The difference is $48

How did we know how many parts to find?

The questions asks how much ..... Ava gets compared to Sienna, so it is the difference of the parts ..... − ..... = 3

a A 60 cm piece of timber needs to be cut in the ratio 5 : 1.
What is the difference between the lengths of the two pieces?



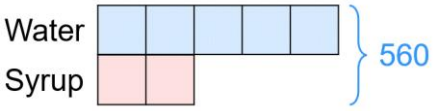
..... parts = ...

1 part = ...

..... parts = ...

40 cm difference

b A cordial drink needs 5 parts water to 2 parts syrup.
How much more water is needed than syrup if making a drink that is 560 mL total?



..... parts = ...

1 part = ...

..... parts = ...

240 mL difference

1 Determine the total number of parts in each ratio.

a $7 : 5 =$ ☐ parts — 12

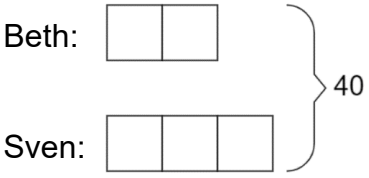
b $10 : 1 =$ ☐ parts — 11

c $12 : 13 =$ ☐ parts — 25

d $5 : 9 : 4 =$ ☐ parts — 18

2

a Beth and Sven divide 40 sweets in the ratio 2:3.
How many sweets does Beth receive?



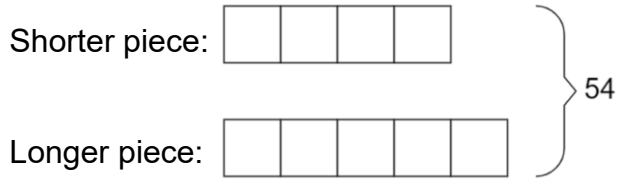
…… parts = 40

1 part =

…… parts =

16

b A 54 m long piece of timber is cut in the ratio 4:5.
Find the length of the shorter piece.



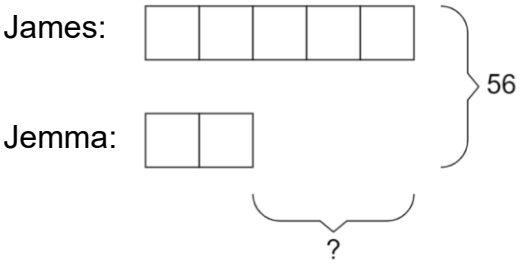
…… parts =

1 part =

…… parts =

24 m

c James and Jemma scored goals in their netball game in the ratio 5:2.
If they scored 56 goals total, how many more goals did James score compared to Jemma?



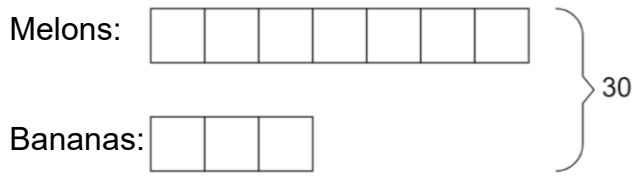
…… parts = 56

…… = ……

…… = ……

24

d Ben buys melons and bananas in the ratio 7:3.
If he buys 30 pieces of fruit in total, how many more melons did he buy?



…… parts = ……

…… = ……

…… = ……

12

3

a Pink paint is made by mixing red and white paint in the ratio 1:2.
How much of each colour is there if you need to make 51 L of paint?

Red: □

White: □□

..... parts = ...

1 part = ...

..... parts = ...

Red: 17 L, White: 34 L

b David, Jimmy, and Rex are paid to do some gardening.
They are to be paid in the ratio 2:3:4.
If they are paid $72 in total, how much should each person receive?

David: □□

Jimmy: □□□

Rex: □□□□

..... parts = ...

1 part = ...

..... parts = ...

..... parts = ...

..... parts = ...

David: $16, Jimmy: $24, Rex: $32

4 Match the diagram to the situation.

a Seb and Flo share some money. Seb gets $120. iii

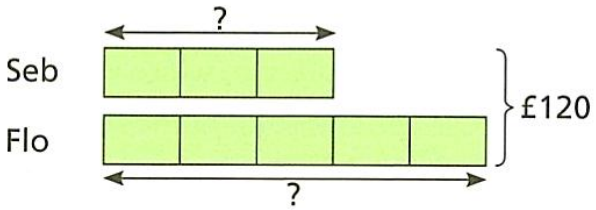
b Seb and Flo share $120. i

c Seb and Flo share some money. Flo gets $120. ii

d Seb and Flo share some money. Flo gets $120 more than Seb. iv

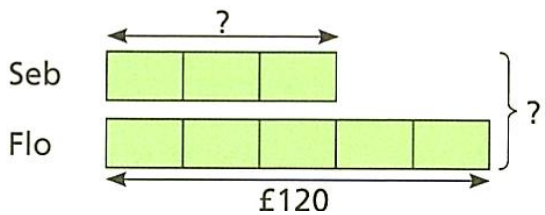
e For each diagram, find the amount represented by the question mark.

i



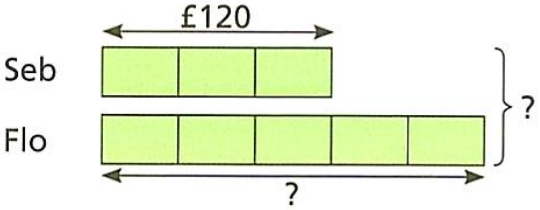
45, 75

ii



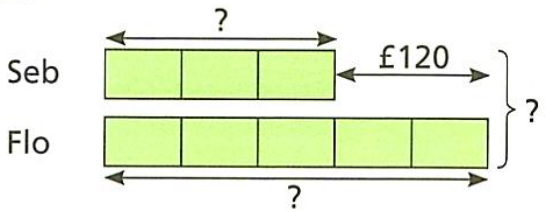
72, 84

iii



200, 320

iv



180, 480, 300

5 Solve these ratio problems without using a bar model.

a The required staff to student ratio for an excursion is 2:15. If 340 people attended the excursion, how many teachers were there?

..... parts = ...

1 part = ...

..... parts = ...

40 teachers

b The ratio of commercials to actual show time for a particular TV channel is 2:3. How many minutes of actual show were there in 1 hour?

..... parts = ...

1 part = ...

..... parts = ...

36 minutes

c Walter and William have a height ratio of 7:8. If their combined height is 285 cm, how tall is Walter?

..... parts = ...

1 part = ...

..... parts = ...

133 cm

d Trudy and Bella make 80 biscuits. If Trudy makes 3 biscuits in the time that Bella makes 2 biscuits, how many biscuits does Trudy make?

..... parts = ...

1 part = ...

..... parts = ...

48 biscuits

6 Fertiliser is made up of three nutrients nitrogen, potassium and phosphorus in the ratio 4:5:3. How much of each nutrient is present in a 1.5 kg bag?

N: 500g, K: 625g, P: 375g

7 Three friends, Cam, Holly and Seb, share a prize of $750 in the ratio 3:4:8. How much more money does Seb receive than Cam?

$250

8 All the angles in a triangle must add up to $180°$. The angles of a triangle are in the ratio 2 : 5 : 1. Calculate the sizes of the angles.

45°, 112.5°, 22.5°

9 The angles in a triangle are in the ratio 1:2:3. Show that this must be a right-angled triangle.

The angles are 30°, 60°, 90°, so it is a right-angled triangle.

10 The perimeter of a rectangle is 50 cm. The dimensions of the rectangle are in the ratio 4:1. Work out the area of the rectangle.

100 cm^2

11 ABC is a straight line 20 cm long.

BC is three times as long as AB. Work out the length of AB.

5 cm

12 **HSC Standard 2 Sample Question Band 5**

A farmer sells 216 sheep at a livestock auction.

Three buyers purchased all the sheep in the ratio 7:3:2.

How many sheep did the buyer of the highest number of sheep purchase?

126 sheep

13 Olivia says that to share an amount in the ratio 5 : 3,
you can simply multiply the total by $\frac{5}{8}$ and $\frac{3}{8}$ instead of using the unitary method.

a Show that she is correct by using both methods to share \$120

Unitary method	Fraction method
…… parts = ……	$\frac{5}{8} \times \$120 =$
1 part = ……	
…… parts = ……	$\frac{3}{8} \times \$120 =$
…… parts = ……	

b Use Olivia's method to share \$6919 in the ratio 50:137.

1850 : 5069

14 Amy and Ben have been given \$60 to share between them.
How much will they each receive if they divide it in the ratio given? Use the fraction method.

a 4 : 1

Amy: $\frac{4}{5} \times \$60 =$

Ben: $\frac{1}{5} \times \$60 =$

\$48 : \$12

b 1 : 2

\$20 : \$40

c 3 : 1

\$45 : \$15

d 3 : 2

\$36 : \$24

e 1 : 5

\$10 : \$50

f 7 : 3

\$42 : \$18

g 1 : 9

\$6 : \$54

h 2: 5 : 8

\$8 : \$20 : \$32

i 1: 4 : 3

\$7.50 : \$30 : \$22.50

MIXED APPLICATIONS

FOUNDATION

1 Solve these ratio questions.

a Kate and Jack share 24 sweets in the ratio 1 : 3
How many sweets does Kate get?

6

b Kate and Jack share 24 sweets in the ratio 3 : 1
How many sweets does Kate get?

18

c Kate and Jack share 24 sweets in the ratio 6 : 2
How many sweets does Kate get?

18

d Kate and Jack share 12 sweets in the ratio 3 : 1
How many sweets does Kate get?

9

e Kate and Jack share some sweets in the ratio 3 : 1
Jack gets 12. How many does Kate get?

36

f Kate and Jack share some sweets in the ratio 3 : 1
Kate gets 12. How many does Jack get?

4

g Kate and Jack share some sweets in the ratio 3 : 1
Kate gets 12 more than Jack. How many does Jack get?

6

h Kate and Jack share some sweets in the ratio 4 : 1
Kate gets 12 more than Jack. How many does Jack get?

4

i Kate and Jack share some sweets in the ratio 4 : 1
Kate gets 15 more than Jack. How many does Jack get?

5

j Kate and Jack share some sweets in the ratio 4 : 1
Jack gets 15. How many sweets do they have altogether?

75

k Kate and Jack share some sweets in the ratio 4 : 1
What fraction of the sweets does Jack have?

$\frac{1}{5}$

2 Marta and Faith share some sweets in the ratio 3:2.

a If there are 30 sweets altogether, how many do they each get?

Marta: 18, Faith: 12

b If Marta gets 30 sweets, how many sweets were there altogether?

50

c If Faith gets 30 sweets, how many sweets does Marta get?

45

d If Marta gets 30 more sweets than Faith, how many sweets were there altogether?

150 sweets

3 Ann, Beatrice, and Collie are sharing money in the ratio 2 : 3 : 7.

a What fraction of the money does Beatrice get?

$\frac{1}{4}$

b If the total amount of money shared is \$240, how much does Collie get?

\$140

c If Beatrice gets \$90, how much does Ann get?

\$60

d If Collie gets \$20 more than Beatrice, how much does Ann get?

\$10

4 Chocolate is made of cocoa and sugar.
In milk chocolate, 20% of the mass is cocoa and 55% is sugar.

a What is the mass of cocoa in a chocolate bar weighing 250 g?

50 g

b A bar of milk chocolate contains 50 g of cocoa. How many grams of sugar does it have?

137.5 g

c What fraction of the bar is neither cocoa nor sugar?

$\frac{1}{4}$

d What is the ratio of sugar to cocoa in a bar of chocolate, in simplest form?

11:4

5 The lengths of the sides of a triangle are in the ratio 3:4:5.
Find the length of each side of the triangle if:

a the perimeter is 192 cm

48 cm, 64 cm, 80 cm

b the shortest side is 9 cm

9 cm, 12 cm, 15 cm

c the longest side is 9 cm

5.4 cm, 7.2 cm, 9 cm

d the difference between the longest and shortest sides is 18 cm.

27 cm, 36 cm, 45 cm

6 Complete the table.

	Ratio Jenny : Ben			Amount to Share	Jenny's Amount	Ben's Amount	Jenny gets more/less	Jenny's amount as fraction of the whole.
a	3	:	2	$30	$18	$12	$6 more	$\frac{3}{5}$
b	3	:	2	$40	$24	$16	$8 more	$\frac{3}{5}$
c	3	:	4	$56	$24	$32	$8 less	$\frac{3}{7}$
d	1	:	4	$40	$8	$32	$24 less	$\frac{1}{5}$
e	3	:	4	$35	$15	$20	$5 less	$\frac{3}{7}$
f	3	:	8	$33	$9	$24	$15 less	$\frac{3}{11}$
g	8	:	8	$33	$16.50	$16.50	Same	$\frac{1}{2}$
h	8	:	4	$24	$16	$8	$8 more	$\frac{2}{3}$
i	2	:	5	$28	$8	$20	$12 less	$\frac{2}{7}$
j	9	:	7	$28	$15.75	$12.25	$3.50 more	$\frac{9}{16}$

7 I eat $\frac{2}{9}$ of a chocolate bar. My friend eats $\frac{3}{7}$ of the bar.

a Who ate more chocolate?

The friend

b What fraction did we eat altogether?

$\frac{41}{63}$

c What percentage of the bar did I eat?

$22.\dot{2}\%$

d Write the ratio of how much I ate to how much my friend ate in simplest form.

14:27

8

a Alfie and Becky share counters in the ratio 5:3. Becky receives 12. How many does Alfie receive?

20

b Alfie and Becky share 32 counters in the ratio 5:3. How many does Alfie get?

20

c Alfie and Becky share counters in the ratio 5:3. Alfie gets 10 more than Becky. How many does each person have?

Alfie: 25, Becky: 15

d Alfie and Becky share counters in the ratio 3:5. Becky receives 20 more than Alfie. How many are shared in total?

80

9 A chocolate bar weighing 120g has these ingredients:

Cocoa: 28g

Sugar: 58g

Hazelnut Paste: 1.2g

The rest is milk powder.

a What fraction of the bar is sugar?

$\frac{29}{60}$

b What is the ratio of hazelnut paste to cocoa?

3:70

c How many grams of milk powder is in the 120g bar?

32.8 g

d In a 30g bar, how much of each ingredient will there be?

Cocoa: 7g, Sugar: 14.5 g, Hazelnut: 0.3 g, Milk powder: 8.2 g

10 NAPLAN A+

It is known that one of the angles in a triangle is 120°.

Calculate the size of the other 2 angles if they are in the ratio $2:3$.

24° and 36°

11 HSC Standard 2 Sample Question Band 4

A scalene triangle has angles in the ratio 9 : 2 : 4.

In degrees, what is the size of its largest angle?

108°

12 HSC Standard 2 Sample Question Band 4

There are 48 people in a meeting room.

The ratio of females to males in the room is 13 to 11.

How many females need to leave the room so that the ratio of females to males in the room is 1 to 1?

4 females

13 2023 HSC Standard 2 Band 4

A bag contains 150 jellybeans. Some of them are red and the rest are blue.

The ratio of red to blue jellybeans is 2:3.

Sophie eats 10 of each colour.

What is the new ratio of red to blue jellybeans?

5 : 8

14 2022 HSC Standard 2 Band 5

A full container has 4.8 L of a mixture of cordial and water in the ratio 1:3.

After removing 1.2 L of the mixture, more water is added to refill the container.

What is the ratio of cordial to water in the final mixture?

3 : 13

15 Sam, Eddie and Maria invested \$1500, \$5000 and \$9500 respectively when they started a new business. The total annual profit of \$480 000 was shared in the same ratio as their investment. How much did each person receive?

\$45 000, \$150 000, \$285 000

16 For this question, study the worked example before and answer the questions.

Three quantities are in the ratio $p:q:r$

p is 20% of q and the ratio of $q:r = 10:3$

Work out the ratio of $p:q:r$

Worked Solution	Explanation
$p:q:r$ $p:10:3$	Explain what happened between these two lines. *They …… q:r = 10:3 into the ratio p:q:r*
$p = 0.2q$ $= 0.2(10)$ $= 2$	Explain how we know $p = 0.2q$ *p is ……% of q*
$\therefore p:q:r = 2:10:3$	Explain how we determined that $p = 2$ *Since we know q = …… from the previous ratio and p = ……q, we can substitute to find the value of* p

17 $m:n = 3:8$. r is 25% of n. Find the ratio $m:r$.

3 : 2

18 Bobbie and Emily share some money in the ratio 2:5. Bobbie gives 20% of her share to Sven. Sven receives \$24. Work out the original amount of money that was shared.

\$420

19 The algebraic fraction method is much more powerful than the unitary method when it comes to determining changes in the ratio. Read the worked example:

The ratio of boys to girls in a theatre is 3:2.

55 girls arrive and the ratio becomes 2:5.

Work out how many boys there are in this theatre.

Worked Solution	Explanation
Old ratio: Boys : Girls 3 : 2 $3x$: $2x$ New Ratio: Boys : Girls $3x$: $2x + 55$ 2 : 5 $\frac{3x}{2x+55} = \frac{2}{5}$ $3x = \frac{2}{5}(2x + 55)$ $15x = 2(2x + 55)$ $15x = 4x + 110$ $11x = 110$ $x = 10$ ∴ There are 30 boys.	$3x$ represents the actual number of boys in the theatre, and $2x$ represents the actual number of girls. The actual number represents multiples of parts in a ratio because we need to scale up both parts equally to get real values while maintaining the same ratio. Explain why the new number of girls is $2x + 55$ *…… girls joined the original $2x$ girls.* Explain where this equation came from. *We set the new ratio of boys:girls equal to …… : ……* Annotate each step of the equation with the operation done to both sides. Explain why the number of boys is $3x$, not x. *The original ratio showed …… parts for boys.*

20 A bowl contains apples and oranges in the ratio 1:3.
Ed adds 4 more apples to the bowl.
The ratio of apples to oranges is now 1:2. Work out the number of oranges in the bowl.

24 oranges

21 The ratio of blue counters to orange counters in a bag is 1:4.
Five more blue counters are added to the bag.
The ratio of blue counters to orange counters is now 1:3.
Work out the total number of counters in the bag at the start.

75 counters

22 Tim and Luke have money in the ratio 5:2.
Tim gives $10 to Luke and the ratio becomes 2:1.
Work out the original amount of money that Luke had.

$60

23 The ratio of the number of marbles in box A to the number of marbles in box B is 7:3.
Jackson removes 3 marbles from box A and places them into box B. The ratio is now 5:3.
How many marbles were in each box originally?

28 in box A, 12 in box B

24 The ratio of Rob's age to Ed's age is 4:5.
In 4 years, the ratio of their ages will be 5:6.
Work out how old Rob and Ed are now.

Rob 16 years, Ed 20 years

25 Bottle A has 1 L of cordial drink with a cordial to water ratio of 3 :7.

Bottle B has 1 L of cordial drink with a cordial to water ratio of 1:4.

The drink from both bottles is combined to form a 2 L drink.

What is the new cordial to water ratio?

1 : 3

26 Adam, Bertie, and Cameron are sharing $240. Work out how much each person receives.

a Bertie receives $60. The ratio of Adam's to Cameron's shares are 4:5.

A: $80, C: $100

b Adam receives $\frac{1}{3}$ of the money. The ratio of Bertie to Cameron's shares are 1 : 3.

B: $40, C: $120

c Cameron receives 20% more money than Adam. The ratio of Adam to Bertie is 5:1.

A: $100, B: $20, C: $120

d The ratio of Adam to Bertie's shares are 1: 3. The ratio of Bertie to Cameron's shares are 1:2.

A: $24, B: $72, C: $144

27 w is 20% of x. y is $\frac{2}{5}$ of x. Find the ratio $w:x:y$

1: 5 : 2

28 The ratio of students to staff in a school trip is 25:3.
Note: each part is unrelated.

a What are the possible total number of staff and students on the trip?

Any multiple of 28.

b There are 12 members of staff. Some students then cancel. The ratio is now 15:2. How many students cancelled?

10

c At the last minute, 15 extra students and 15 extra staff join. The new ratio is 40:7. How many students and staff were there to begin with?

225 students, 27 staff

d The ratio of male to female students is 8:7 and the ratio of male to female staff is 4:5. What fraction of the total are male?

$\frac{11}{21}$

CHECK YOUR UNDERSTANDING

Solving ratio problems

1 The ratio of girls to boys in a class is 5 : 3.
If there are 30 girls, how many boys are there?

a 28 **b** 18 **c** 50 **d** 9

2 A recipe for biscuits uses butter to sugar in the ratio 7 : 4.
How much sugar is needed for 154 g of butter?

a 88 g **b** 56 g **c** 98 g **d** 269.5 g

3 On a farm, the ratio of cows to sheep is 3 : 7.
There are 210 cows on the farm. How many sheep are there?

a 147 **b** 490 **c** 90 **d** 63

4 A shade of green paint is made by mixing blue to yellow in the ratio 3 : 7
If 518 mL of yellow paint is used, how much blue is needed?

a 155.4 mL **b** 207.2 mL **c** 222 mL **d** 296 mL

5 Sherry and Terry share sweets in the ratio 2 : 3.
Sherry has 30 fewer sweets than Terry.
How many sweets doe they have altogether?

a 120 **b** 30 **c** 60 **d** 150

6 Adam and Matt share money in the ratio 4 : 9.
Adam gets $468.
What is the total amount shared?

a $144 **b** $1053 **c** $1521 **d** $676

Dividing in a ratio

1 70 litres of light blue paint is made by mixing blue and white paint in the ratio 5 : 2.
How much white paint is used?

a 35 L **b** 50 L **c** 20 L **d** 28 L

2 In a class of 30, the ratio of girls to boys is 2 : 3.
How many boys are there?

a 10 **b** 3 **c** 15 **d** 18

3 Share $80 in the ratio 1 : 4

a 5 : 20 **b** 15 : 65 **c** 16 : 64 **d** 64 : 16

4 Share $42 in the ratio 2 : 5

a 2 : 40 **b** 21: 8.4 **c** 6: 36 **d** 12: 30

5 Peter and Jane have some money in the ratio 1 : 3.
Jane has $12 more than Peter.
How much money does Peter have?

a 10 **b** 3 **c** 15 **d** 18

6 The ratio of adults to children at a party was 6 : 7.
There were 28 children.
How many adults were there?

a 24 **b** 28 **c** 52 **d** 104