

Autumn
Scheme of learning
Year 8

#MathsEveryoneCan

White Rose
MATHS

The **White Rose Maths** schemes of learning

Why small steps?

We know that if too many concepts are covered at once, it can lead to cognitive overload, so we believe it is better to follow a small steps approach to the curriculum. As a result, each block of content in our schemes of learning is broken down into small manageable steps.

It is not the intention that each small step should last a lesson – some will be a short step within a lesson; some will take longer than a lesson. We encourage teachers to spend the appropriate amount of time on each step for their group, and to teach some steps alongside each other if necessary.



Teaching for mastery

Our research-based schemes of learning are designed to support a mastery approach to teaching and learning and are consistent with the aims and objectives of the National Curriculum.

Putting number first

Our schemes have number at their heart. A significant amount of time is spent reinforcing number in order to build competency and ensure students can confidently access the rest of the curriculum.

Depth before breadth

Our easy-to-follow schemes support teachers to stay within the required key stage so that students acquire depth of knowledge in each topic. Opportunities to revisit previously learnt skills are built into later blocks.

Working together

Students can progress through the schemes as a whole group, encouraging those of all abilities to support each other in their learning.

Fluency, reasoning and problem solving

Our schemes develop all three key areas of the National Curriculum, giving students the knowledge and skills they need to become confident mathematicians.

The White Rose Maths schemes of learning

Concrete – Pictorial – Abstract (CPA)

Research shows that all students, when introduced to a new concept, should have the opportunity to build competency by following the CPA approach. This features throughout our schemes of learning.

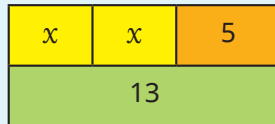
Concrete

Students should have the opportunity to work with physical objects/concrete resources, in order to bring the maths to life and to build understanding of what they are doing.



Pictorial

Alongside concrete resources, students should work with pictorial representations, making links to the concrete. Visualising a problem in this way can help students to reason and to solve problems.



Abstract

With the support of both the concrete and pictorial representations, students can develop their understanding of abstract methods.

$$2x + 5 = 13$$

Key Stage 3 and 4 symbols

The following symbols are used to indicate:



concrete resources might be useful to help answer the question



a bar model might be useful to help answer the question



drawing a picture might help students to answer the question



students talk about and compare their answers and reasoning



a question that should really make students think. The question may be structured differently or require a different approach from others and/or tease out common misconceptions.



the step has an explicit link to science, helping students to make cross-curricular connections.

Teacher guidance

Every block in our schemes of learning is broken down into manageable small steps, with comprehensive teacher guidance for each one. Here are the features included in each step.

Notes and guidance provide an overview of the content of the step, and ideas for teaching, along with advice on progression and where a topic fits within the curriculum.

Misconceptions and common errors are highlighted, as well as areas that may require additional support.

Year 8 | Autumn term | Block 1 – Ratio | Step 1

Understand ratio

White Rose MATHS

Notes and guidance

In this small step, students explore how ratio is used to represent multiplicative relationships between two or more values, and they are introduced to the colon in the context of a ratio.

Highlight that a ratio is a comparison of two or more parts of a whole. Begin by using sentences, for example "For every 2 squares, there are 3 circles", before writing this as a formal ratio. Emphasise the importance of the order of the terms within ratio notation. For example, if the ratio of red counters to yellow counters is 3 : 4, the ratio of yellow counters to red counters is 4 : 3. Bar models are a useful representation to emphasise the equal parts of a ratio.

As their confidence develops, students can work with ratios that compare three or more quantities, for example 3 : 4 : 1

Misconceptions and common errors

- Students may use additive rather than multiplicative relationships to make comparisons, for example "There are two more blue counters than red counters."
- Students may confuse the order of a ratio, for example writing 2:5 rather than 5:2

Mathematical talk

- What is the purpose of ratio?
- Why is the order important in ratio notation?
- What does a colon mean in the context of ratio?
- What ratios are represented?
- How are 2 : 1 and 1 : 2 different?
- What does 1 : 1 mean?
- Can a ratio compare more than two quantities? Explain how you know.
- How is a ratio different from a fraction?
- For every _____, there are _____
This can be written as _____ : _____
- In the ratio _____ : _____, the first number represents _____ and the second number represents _____

National Curriculum links

- Use ratio notation, including reduction to simplest form
- Understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction

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Mathematical talk provides key questions, discussion points and possible sentence stems that can be used to develop students' mathematical vocabulary and reasoning skills, digging deeper into the content.

National Curriculum links to indicate the objective(s) being addressed by the step.

Teacher guidance

Teaching approaches


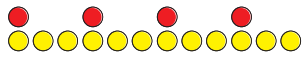
offer practical strategies for classroom use, including effective representations, modelled examples and key questions or activities designed to promote reasoning and problem solving.

Year 8 | Autumn term | Block 1 – Ratio | Step 1

Understand ratio

White Rose MATHS

Teaching approaches

- Show some cubes and counters.

Ask students questions to develop understanding of ratio.
 - How many counters are there for every 3 cubes?
 - How many cubes are there for every 5 counters?
 - What is the ratio of cubes to counters?
 - What is the ratio of counters to cubes?Repeat for other ratios.
- Give students 4 red counters and 12 yellow counters.

Ask what ratios they can see.
Show that the counters can be split into groups of 1 red counter and 3 yellow counters and demonstrate how the ratios 1:3, 2:6, 3:9 and 4:12 are equivalent.

Key vocabulary

ratio comparison of two or more values

proportion relationship between two or more quantities in which the ratio of one quantity to another is the same

equal parts parts of a whole with the same value

bar model visual representation used to show a mathematical relationship

Links and next steps

- Students will need to understand the meaning of ratio for a variety of topics, such as interpreting genetic crosses.
- Support curriculum – Year 8 Autumn Block 1 – Step 1 – Understand ratio
- Students will later understand π as the ratio between diameter and circumference.
- Challenge students to write ratios in different contexts, for example the ratio of the three angles in a triangle.

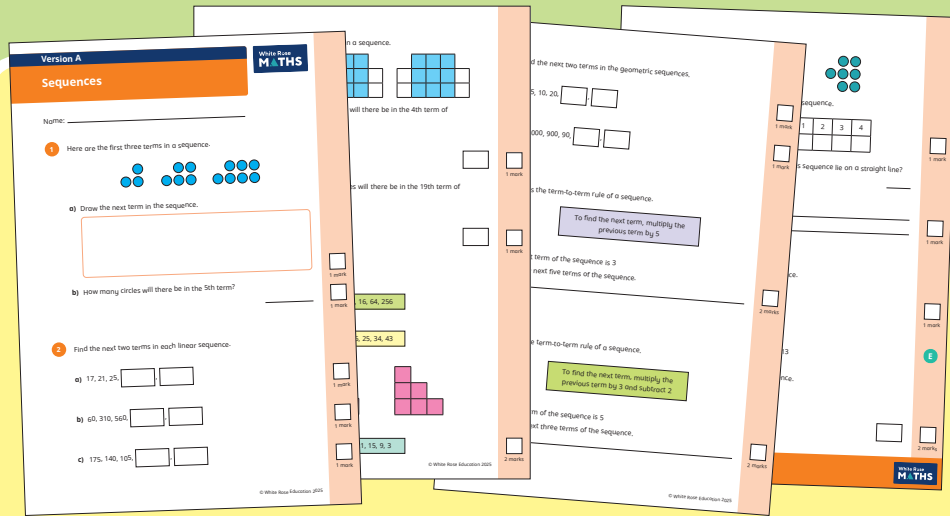
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Key vocabulary

emphasises the importance of mathematical language and offers clear, age-appropriate definitions to support understanding

Links and next steps highlight connections to science (where appropriate) as well as alignment with the Support curriculum and shows how this step builds towards future learning. It may also include a challenge to deepen understanding, while remaining within the scope of the small step.

Free supporting materials



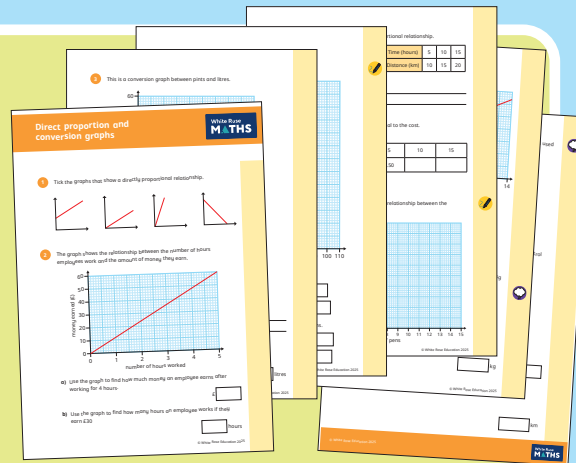
End-of-block assessments are provided for teachers to see how well students are progressing with the material in the curriculum. These have a total of 20 marks, assessing students' understanding of all of the steps within a block. These can be used flexibly – in the classroom, as homework, with/without a calculator, immediately after a block or later in the year – to suit teachers' and students' needs. Answers are provided.

End-of-term assessments are also provided for teachers to assess how well material is being learnt and retained in the medium and long term. There will be a calculator and non-calculator paper provided for the end of each term for each Years 7, 8 and 9. All papers will have a total of 40 marks available. We suggest 45 minutes for a paper, so that they can be done within a typical lesson. Mark schemes are provided.

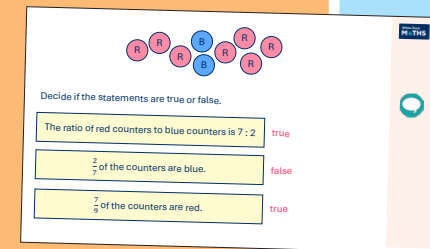
Premium supporting materials

Worksheets to accompany every small step, providing relevant practice questions for each topic that will reinforce learning at every stage.

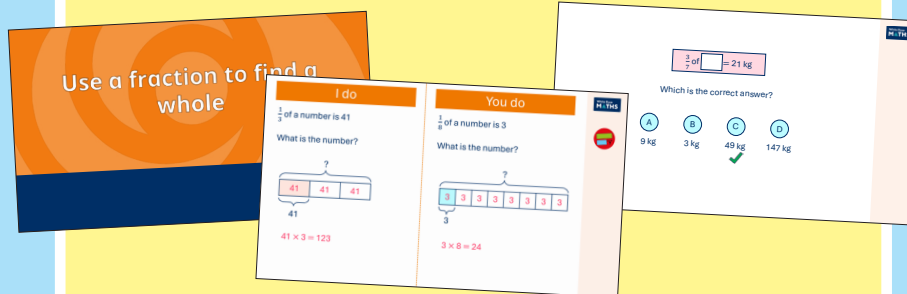
Answers to all the worksheet questions are provided.



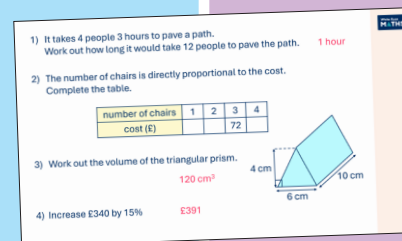
A true or false question for every small step in the scheme of learning. These can be used to support new learning or as another tool for revisiting knowledge at a later date.



Teaching slides for every small step, providing worked examples, multiple choice questions and open-ended questions. These are fully animated and editable, so can be adapted to the needs of any class.



Flashback 4 starter activities to improve retention. Q1 is from the last lesson; Q2 is from last week; Q3 is from 2 to 3 weeks ago; Q4 is from last term/year.



Yearly overview

The yearly overview provides suggested timings for each block of learning, which can be adapted to suit different term dates or other requirements.

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	Ratio, proportion and rates of change Ratio		Ratio, proportion and rates of change Proportion and scale		Algebra Algebraic manipulation		Algebra Coordinates and graphs			Number Multiply and divide fractions		Geometry and measures Symmetry and reflection
Spring	Geometry and measures Area, volume and density		Algebra Equations and inequalities		Number Percentages			Algebra Indices		Number Standard form	Statistics Interpret and represent data	
Summer	Geometry and measures Angles in parallel lines and polygons			Probability Tables and probability			Geometry and measures Circles		Statistics Graphs and charts		Algebra Sequences	consolidation

Autumn Block 1

Ratio

Small steps

Step 1

Understand ratio

Step 2

Ratio problems (whole given)

Step 3

Ratio problems (part given)

Step 4

Ratio problems (difference given)

Step 5

Simplify ratios

Step 6

Express ratios in the form $1:n$ and $n:1$ **E**

Step 7

Compare ratios and fractions

Step 8

Solve problems with ratio

E denotes an **extend step**, providing opportunities for deeper exploration of the content.

Understand ratio

Notes and guidance

In this small step, students explore how ratio is used to represent multiplicative relationships between two or more values, and they are introduced to the colon in the context of a ratio.

Highlight that a ratio is a comparison of two or more parts of a whole. Begin by using sentences, for example “For every 2 squares, there are 3 circles”, before writing this as a formal ratio. Emphasise the importance of the order of the terms within ratio notation. For example, if the ratio of red counters to yellow counters is 3 : 4, the ratio of yellow counters to red counters is 4 : 3. Bar models are a useful representation to emphasise the equal parts of a ratio.

As their confidence develops, students can work with ratios that compare three or more quantities, for example 3 : 4 : 1

Misconceptions and common errors

- Students may use additive rather than multiplicative relationships to make comparisons, for example “There are two more blue counters than red counters.”
- Students may confuse the order of a ratio, for example writing 2 : 5 rather than 5 : 2

Mathematical talk

- What is the purpose of ratio?
- Why is the order important in ratio notation?
- What does a colon mean in the context of ratio?
- What ratios are represented?
- How are 2 : 1 and 1 : 2 different?
- What does 1 : 1 mean?
- Can a ratio compare more than two quantities? Explain how you know.
- How is a ratio different from a fraction?
- For every _____, there are _____
This can be written as _____ : _____
- In the ratio _____ : _____, the first number represents _____ and the second number represents _____

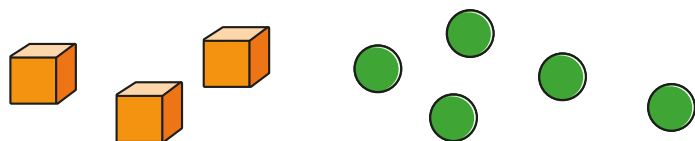
National Curriculum links

- Use ratio notation, including reduction to simplest form
- Understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction

Understand ratio

Teaching approaches

- Show some cubes and counters.

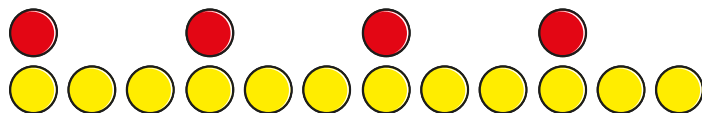


Ask students questions to develop understanding of ratio.

- How many counters are there for every 3 cubes?
- How many cubes are there for every 5 counters?
- What is the ratio of cubes to counters?
- What is the ratio of counters to cubes?

Repeat for other ratios.

- Give students 4 red counters and 12 yellow counters.




Ask what ratios they can see.

Show that the counters can be split into groups of 1 red counter and 3 yellow counters and demonstrate how the ratios 1 : 3, 2 : 6, 3 : 9 and 4 : 12 are equivalent.

Key vocabulary

ratio	comparison of two or more values
proportion	relationship between two or more quantities in which the ratio of one quantity to another is the same
equal parts	parts of a whole with the same value
bar model	visual representation used to show a mathematical relationship

Links and next steps

-  Students will need to understand the meaning of ratio for a variety of topics, such as interpreting genetic crosses.
- Support curriculum – Year 8 Autumn Block 1 – Step 1 – Understand ratio
- Students will later understand π as the ratio between diameter and circumference.
- Challenge students to write ratios in different contexts, for example the ratio of the three angles in a triangle.

Ratio problems (whole given)

Notes and guidance

In this small step, students divide an amount into a given ratio.

Bar models are useful to represent what is known/unknown and to support students in understanding the calculations required. A comparison bar model is more useful than a single bar model, particularly for later steps where a difference is given. Ensure that students understand the terms “part” and “whole” and establish that they need to work out the total number of parts before dividing. Discuss adding the separate amounts at the end to check that they are equal to the original total. Provide students with opportunities to explore a range of problems, as well as ratios that compare three or more quantities.

Misconceptions and common errors

- Students may always expect integer answers when dividing in a ratio.
- Students may have difficulties setting up a comparison bar model or may not draw the bar model in proportion.
- Students may only divide the total by the number of parts and forget additional steps. For example, when sharing £20 in the ratio 2 : 3, they may work out $£20 \div 5 (= £4)$, but forget to work out $£4 \times 2$ and $£4 \times 3$

Mathematical talk

- How many parts are there in total?
- How do you know who receives the most/least?
- What is the same and what is different about the ratios 3 : 2 and 2 : 3?
- What can you work out from the bar model?
- What is important to consider when drawing a bar model?
- Do the sizes of the bars/parts matter? Explain your answer.
- Why is it impossible to share 10 counters in the ratio 1 : 3?
- Is it possible to share £10 in the ratio 1 : 3? How do you know?
- Explain why sharing in the ratio 1 : 2 is the same as sharing in the ratio 2 : 4

National Curriculum links

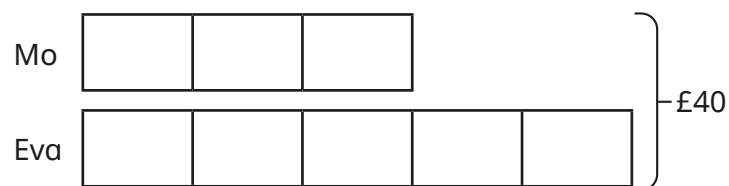
- Use ratio notation, including reduction to simplest form
- Understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction
- Divide a given quantity into two parts in a given part : part or part : whole ratio; express the division of a quantity into two parts as a ratio

Ratio problems (whole given)

Teaching approaches

- Tell students that Mo and Eva share £40 in the ratio 3 : 5

Draw a bar model to represent the information.



Ask students questions about the bar model.

- Who receives more money? How do you know?
- How many parts are there in total?
- How can you work out what each part is worth? Where can you put this on the bar model?
- How much money does Mo/Eva receive?
- How can you check this is correct?
- How much more money does Eva have than Mo?

Repeat for other values and contexts, encouraging the use of a bar model for each question.

Key vocabulary

ratio	comparison of two or more values
proportion	relationship between two or more quantities in which the ratio of one quantity to another is the same
equal parts	parts of a whole with the same value
whole	total or complete amount
parts	quantities being compared in a ratio, for example the ratio 3 : 2 has 5 parts
bar model	visual representation used to show a mathematical relationship

Links and next steps

- Support curriculum – Year 8 Autumn Block 1 – Step 4 – Ratio problems (whole given)
- Challenge students to explore problems that require unit conversion, for example sharing 1.8 litres in the ratio 7 : 4 : 5, and giving the answer in millilitres.

Ratio problems (part given)

Notes and guidance

In this small step, students build on the previous step to find other values when one of the parts is known.

Comparison bar models are again a useful representation to highlight the known/unknown information, and the calculations needed when compared to the previous step. It may be useful to draw comparisons between problems where a whole is given and where a part is given and the key differences between their respective bar models, paying particular attention to where given information is labelled.

As with the previous step, provide a variety of questions, such as working out the total when a part is given or working out the difference between each part of the ratio. Where appropriate, students can work with ratios that compare three or more quantities.

Misconceptions and common errors

- Students may always add the parts of a ratio together and divide the given amount by this total, regardless of whether they are given the whole, a part or a difference.
- Students may have difficulties setting up a comparison bar model to represent the ratio in proportion. Inaccurate bar models could result in incorrect calculations.

Mathematical talk

- What is important to consider when drawing a bar model?
- Do the sizes of the bars matter? Why?
- How many parts are there in total?
- Where should the information be labelled on the bar model?
- What other information can you work out from the bar model?
- What calculation should you do first?
- How can you check that the answer is correct?
- _____ parts are worth _____, so 1 part is worth _____

National Curriculum links

- Use ratio notation, including reduction to simplest form
- Understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction
- Divide a given quantity into two parts in a given part : part or part : whole ratio; express the division of a quantity into two parts as a ratio

Ratio problems (part given)

Teaching approaches

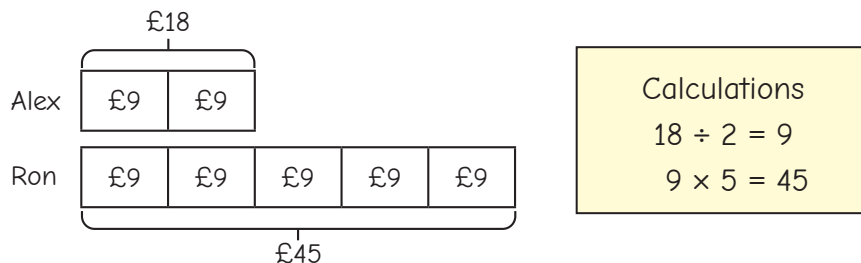
- Show students two bar models.



Ask questions to develop understanding.

- What is the same? What is different?
 - How can you calculate the value of one part of each bar model?
- Tell students that Alex and Ron are sharing some money in the ratio 2:5 and that Alex gets £18

Draw a bar model to represent the problem, then model how to find the unknown values.



Key vocabulary

ratio	comparison of two or more values
proportion	relationship between two or more quantities in which the ratio of one quantity to another is the same
equal parts	parts of a whole with the same value
whole	total or complete amount
parts	quantities being compared in a ratio, for example the ratio 3:2 has 5 parts
bar model	visual representation used to show a mathematical relationship

Links and next steps

- Support curriculum – Year 8 Autumn Block 1 – Step 5 – Ratio problems (part given)
- Understanding calculations with ratio is fundamental to understanding proportional change and scale factors.
- Challenge students to work with ratios in an algebraic context. For example, if the numbers a and b are in the ratio 3:4 and $a = 18$, work out the value of $3a - 2b$.

Ratio problems (difference given)

Notes and guidance

In this small step, students solve problems involving a difference between two or more quantities of a ratio.

Again, comparison bar models are useful representations. Encourage students to pay careful attention to where given information should be labelled on the bar models. Discuss the importance of drawing relatively accurate bar models, as those that are not proportional can lead to incorrect calculations.

Drawing attention to similarities and differences between problems where a part, whole or difference is given will be useful to develop students' understanding. Further opportunities to consolidate the many types of "sharing in a ratio" problems are provided later in the block.

Misconceptions and common errors

- Students may always add the parts of a ratio together and divide the given amount by this total, regardless of whether they are given the whole, a part or a difference.
- Students may draw or label bar models incorrectly, resulting in incorrect calculations.

Mathematical talk

- Where should the difference be labelled on the bar model?
- How many parts of the ratio does the difference represent?
- What calculation should you do first?
- What other information can you work out from the bar model?
- What is important to consider when drawing a bar model?
- Explain why the sizes of the bars/parts matter in a bar model.
- How can you check that the answer is correct?
- How is solving a ratio problem where the difference is given different from solving one where the total is given?
- Why is it important to recognise that the difference in a ratio refers to the difference in actual values rather than the difference in ratio parts?

National Curriculum links

- Use ratio notation, including reduction to simplest form
- Understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction

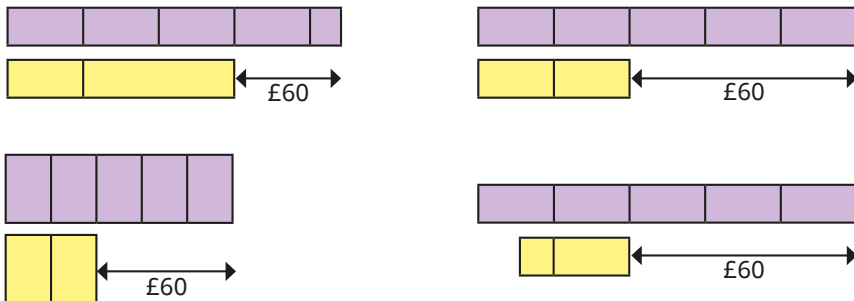
Ratio problems (difference given)

Teaching approaches

- Ask students questions about two ratio problems.

A	B
<p>Jo and Kim share some money in the ratio 2 : 3 Kim receives £12 How much does Jo receive?</p>	<p>Jo and Kim share some money in the ratio 2 : 3 Kim receives £12 more than Jo. How much does Jo receive?</p>

- What will be the same/different about the bar models for the problems?
 - How can you work out the value of 1 part for problem A/B?
- Show students some bar models and ask which one(s) are the best for representing a ratio problem, and why.



Key vocabulary

difference	positive result of subtracting two values
ratio	comparison of two or more values
proportion	relationship between two or more quantities in which the ratio of one quantity to another is the same
equal parts	parts of a whole with the same value
whole	total or complete amount
parts	quantities being compared in a ratio, for example the ratio 3 : 2 has 5 parts
bar model	visual representation used to show a mathematical relationship

Links and next steps

- Support curriculum – Year 9 Spring Block 4 – Step 3 – Ratio problems (whole, part or difference given)
- Students will later relate the language of ratios and the associated calculations to the arithmetic of fractions and to linear functions.
- Students could explore ratio problems involving other areas of mathematics, for example ratios comparing three or more quantities in the context of perimeter of shapes.

Simplify ratios

Notes and guidance

In this small step, students simplify ratios to their smallest integer terms.

Students may be familiar with the concept of simplifying by finding common factors from simplifying fractions in Year 7. Ensure that they understand that a ratio can be simplified if all the values in a ratio share a common factor. Encourage them to identify the highest common factor, although comparing other strategies is also useful to encourage flexible thinking.

Concrete resources such as cubes and counters can be used to support understanding. It may also be useful to look at the answers to questions in previous steps and simplify these to see how the original ratio is obtained.

Misconceptions and common errors

- Students may think that a ratio can only be simplified by repeatedly dividing by 2, for example not appreciating that $6:33$ cannot be simplified in this way.
- Students may choose a factor other than the highest common factor of the values in the ratio, resulting in an equivalent but not fully simplified ratio.
- Students may look only at the numbers and not the units and incorrectly simplify, for example $£2:50p$ to $1:25$

Mathematical talk

- Why are factors useful when simplifying a ratio?
- What is a common factor?
- Is dividing both values of a ratio by the highest common factor the only way to simplify a ratio? Explain how you know.
- Can a simplified ratio contain numbers that are not integers? Explain how you know.
- What does it mean to simplify a ratio? Why is it useful?
- How is simplifying a ratio similar to simplifying a fraction?
- Can you simplify a ratio that compares more than two values? Explain how you know.
- _____ : _____ is equivalent to _____ : _____
- The highest common factor of _____ and _____ is _____

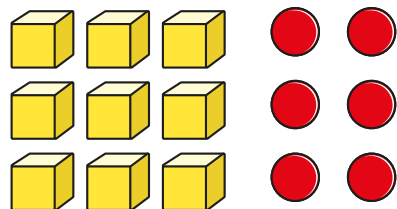
National Curriculum links

- Use ratio notation, including reduction to simplest form
- Understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction

Simplify ratios

Teaching approaches

- Show students some cubes and counters.

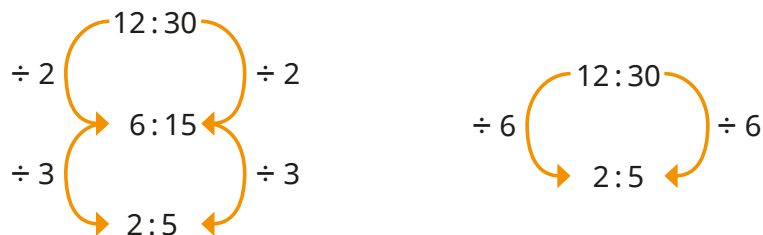


Ask students to write the different ratios they can see.

Circle groups to identify the ratios 9:6, 6:4 and 3:2 and explain that these are equivalent.

Ask which ratio is written in the simplest form and discuss how we know this.

- Model different methods to simplify a ratio using factors.



Discuss what is the same and what is different, encouraging key vocabulary such as “factor” and “highest common factor”.

Key vocabulary

simplify	write a ratio in a simpler equivalent integer form
simplest form	when the highest common factor of the values in a ratio is 1
equivalent	two ratios are equivalent if they simplify to the same ratio
factor	integer or term that divides exactly into another integer or term
common factor	integer or term that is a factor of two or more numbers or expressions
highest common factor	common factor of two or more integers or terms that has the greatest value or power

Links and next steps

- Support curriculum – Year 8 Autumn Block 1 – Step 3 – Simplify ratios
- Students will later combine a set of ratios.
- Encourage students to link ratios and percentages through simplifying, for example exploring why 80% can be equivalent to 4:1

E Express ratios in the form $1:n$ and $n:1$

Notes and guidance

In this small step, students extend the simplification techniques from the previous step to express a unit ratio.

Students need to understand that when a ratio is written in the form $1:n$, the first quantity of the ratio has a value of 1 and the second quantity of the ratio (n) can be any value, including non-integer values, and vice versa for ratios written in the form $n:1$. Discuss how it can be easier to compare ratios in this format, especially when dealing with proportional change.

Misconceptions and common errors

- Students may not write ratios in the form asked for, for example writing a ratio in the form $n:1$ rather than $1:n$.
- Students may ignore the fact that division is not commutative. For example, they may express $2:8$ as $4:1$, rather than $0.25:1$, calculating $8 \div 2$ rather than $2 \div 8$
- Students may think that a ratio must always be expressed using integers, leading them to assume that n cannot be a decimal or fraction.

Mathematical talk

- What should you divide both quantities in the ratio by?
- If a ratio is simplified to the form $1:n$, will n always be an integer? How do you know?
- What is the difference between a ratio in the form $1:n$ and a ratio in the form $n:1$?
- Why is a ratio written in the form $1:n$ useful?
- Which would be larger, a $1:200$ scale model or a $1:300$ scale model?
- How is a ratio in the form $1:n$ different from other ways of writing a ratio?
- What does the value of n tell you about the relationship between the two quantities?
- For every _____, there are _____

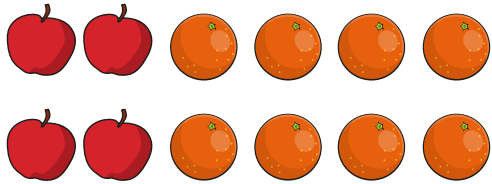
National Curriculum links

- Use ratio notation, including reduction to simplest form
- Understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction

E Express ratios in the form $1:n$ and $n:1$

Teaching approaches

- Show students an image.



Ask questions to develop understanding of unit ratio.

- How many oranges are there for every 4/2 apples?
- How many oranges are there for every apple?
- What is the ratio of apples to oranges in the form $1:n$?
- What is the value of n ?

Repeat with other ratios and model expressing ratios as unit ratios in an abstract form. Include those where n is not an integer, for example expressing $6:5$ as $1.2:1$

- Show students some ratios and ask them to identify whether they are written in the form $1:n$, $n:1$ or neither.

1:4

1:3.5

5.8:1

7:2

1.2:1

0.6:6

8:2

5000000:1

1:0.0001

Key vocabulary

- simplify** write a ratio in a simpler equivalent integer form
- equivalent** two ratios are equivalent if they simplify to the same ratio
- unit ratio** ratio written in the form $n:1$ or $1:n$

Links and next steps

- Students will express quantities as a unit ratio, for example expressing the surface area of an animal compared to its volume and then using this to determine the relationship between surface area and volume.
- Students will later apply their understanding of unit ratios to proportional change, for example maps and scale factors.
- Challenge students to work with unit ratios in an algebraic context, for example writing $\frac{a}{b}:1$ in the form $1:n$.

Compare ratios and fractions

Notes and guidance

In this small step, students explore how the parts in a ratio compare to each value in the ratio as a fraction of the whole.

Using representations such as cubes and counters can be useful to highlight that a ratio compares one part of the whole to another part, whereas a fraction compares a part to the whole. Single bar models are easier than comparison bar models for comparing fractions and ratios. Encourage students to focus on how many parts there are in total before thinking about fractions. Provide them with opportunities to write both ratios as fractions and fractions as ratios.

This step provides an opportunity to reinforce previous learning on making 1 whole from a given fraction or fractions.

Misconceptions and common errors

- Students may rewrite the digits in a given ratio as a fraction, for example thinking that $2:3$ represents $\frac{2}{3}$ of the whole.
- Students may write the digits in a given fraction as a ratio, for example writing $\frac{3}{7}$ as the ratio $3:7$
- Students may try to use a comparison bar model when comparing ratios and fractions, instead of a single bar model.

Mathematical talk

- How are ratios the same as fractions?
- How are ratios different from fractions?
- What is the sum of the parts in the ratio?
- What does the numerator of a fraction represent?
- What does the denominator of a fraction represent?
- What is the connection between the sum of the parts of a ratio and its corresponding fraction?
- How does $2:7$ represent $\frac{2}{9}$ and $\frac{7}{9}$ of a whole?
- The ratio has _____ parts in total.
- The denominator is _____, so the sum of the parts of the ratio is _____

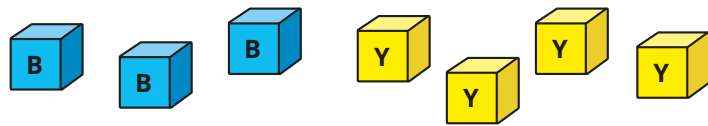
National Curriculum links

- Use ratio notation, including reduction to simplest form
- Understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction

Compare ratios and fractions

Teaching approaches

- Show students some coloured cubes.



Ask questions about the cubes.

- What is the ratio of yellow cubes to blue cubes/blue cubes to yellow cubes?
 - Why is the fraction of cubes that are blue not $\frac{3}{4}$?
 - What fraction of the cubes are blue/yellow?
- Model using a single bar model to work out the ratio given a fraction, and vice versa.

For example, tell students that $\frac{3}{8}$ of a drink is made from orange cordial and the rest is made from water.



Discuss what the denominator/numerator of the fraction represents.

Ask students to write the ratio of orange cordial to water, highlighting why it is not 3 : 8

Key vocabulary

fraction	number with a numerator and a denominator that represents a proportion
numerator	top number in a fraction that indicates the number of equal parts out of a whole
denominator	bottom number in a fraction that indicates the number of equal parts a whole has been divided into

Links and next steps

- Students link ratios and fractions when determining the proportion of offspring that will have a specific characteristic such as eye colour.
- Support curriculum – Year 8 Autumn Block 1 – Step 2 – Link ratio and fractions
- Encourage students to link dividing in a ratio problems with fractions of amounts. For example, ask them to explain why when sharing an amount in the ratio 3 : 5, they can find $\frac{3}{8}$ and $\frac{5}{8}$ of the amount.

Solve problems with ratio

Notes and guidance

In this small step, students solve ratio problems in context, giving them the opportunity to consolidate and reinforce their understanding of ratio covered in the previous steps.

Pay particular attention to problems involving sharing in a ratio. If using bar models, ensure that students label given information correctly to avoid potential errors. Comparing bar models for similar problems can be useful to remind students of the different strategies needed when sharing in a ratio.

Also give students questions involving simplifying ratios, writing ratios in the forms $1:n$ and $n:1$, as well as working fluently with ratios and fractions.

This step can be used to focus in on any areas of particular difficulty or to explore ratios in other topics such as geometry or algebra.

Misconceptions and common errors

- When sharing in a ratio, students may incorrectly assume that the given value represents the total.
- Students may struggle to interpret information for multi-step problems if there is no scaffolding.

Mathematical talk

- What does _____ represent in the question?
- Where should _____ be labelled on the bar model?
- How many parts of the bar model does _____ represent?
- What do you know? What can you find out?
- How can a bar model help you to solve the problem?
- What is the first step in solving the problem?
- Is there more than one way to solve the problem?
- Why is it important to understand whether a value represents the whole, a part or the difference when solving problems with ratio?
- How can you check your answer?

National Curriculum links

- Use ratio notation, including reduction to simplest form
- Understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction
- Divide a given quantity into two parts in a given part : part or part : whole ratio; express the division of a quantity into two parts as a ratio

Solve problems with ratio

Teaching approaches

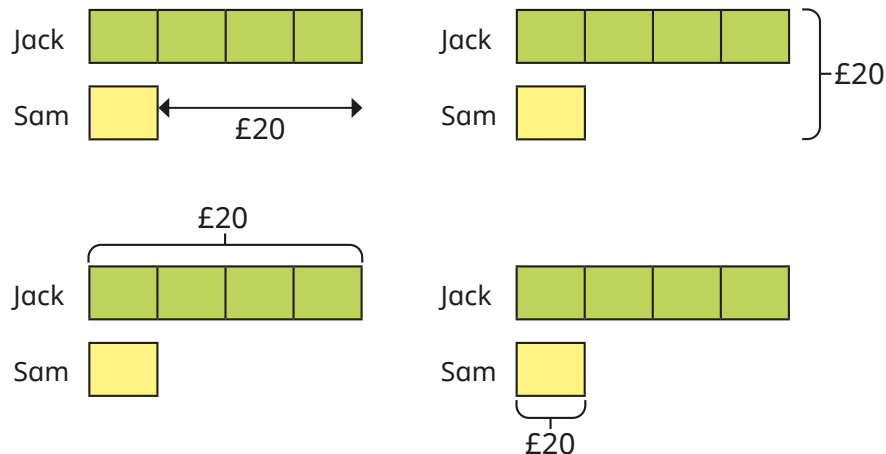
- Show students two similar problems and ask them to discuss what is the same and what is different.

The ratio of red to blue counters is 2 : 5
There are 70 red counters.
How many counters are there in total?

The ratio of red to blue counters is 2 : 5
There are 70 blue counters.
How many counters are there in total?

Model how to answer each problem using bar models.

- Show students some bar models and ask them to write a suitable question for each model.



Key vocabulary

- ratio** comparison of two or more values
- fraction** number with a numerator and a denominator that represents a proportion
- bar model** visual representation used to show a mathematical relationship
- equal parts** parts of a whole with the same value

Links and next steps

- Students will problem solve with ratio when exploring chemical formulae such as H_2O (a molecule of water).
- Students will later explore ratio in area and volume problems.
- Challenge students to link ratio and graphs, exploring the ratio of $x : y$ values for graphs that pass through the origin and graphs that do not pass through the origin.