

# Mastering Mathematics

FOR 11–14 YEARS

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Series editor: Linda Mason

BOOK  
**1**

**Sample  
chapter**



IN COLLABORATION WITH  
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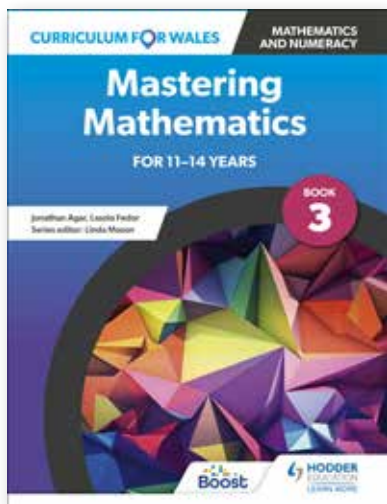
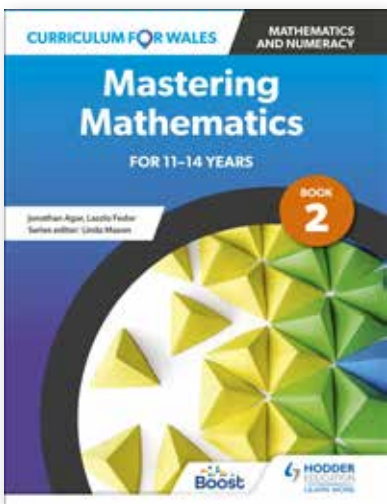
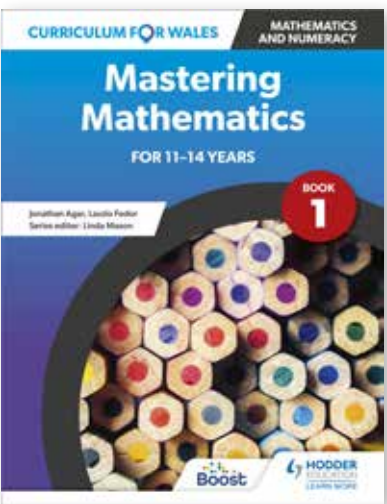
# Mastering Mathematics for 11-14 years

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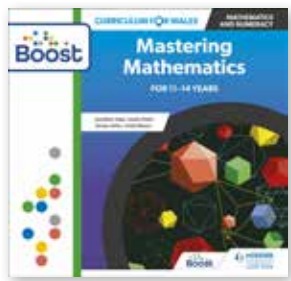
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### In collaboration with University of Wales Press

We have worked in collaboration with University of Wales Press on our Curriculum for Wales resources. They have reviewed content to make sure it is tailored to the new curriculum and explores Welsh culture and heritage in an authentic way. Find out more about UWP and their resources in Welsh and English languages: visit [www.uwp.co.uk](http://www.uwp.co.uk) / [www.gwasgprifysgolcymru.org](http://www.gwasgprifysgolcymru.org)

The Curriculum for Wales has been developed in Wales, by practitioners for practitioners, bringing together educational expertise and wider research and evidence. Our resources are designed to reflect the Welsh context and to help develop your identity as a citizen of Wales and the world.

We would also like to thank the teachers from schools across Wales who helped to plan and review this title. Our authors have a wealth of experience teaching, examining and working in education in Wales:

- Laszlo Fedor - Principal Examiner for GCSE Mathematics (Higher Tier) WJEC (Welsh Examining Board)
- Jonathan Agar – Assistant Headteacher, Bishop Hedley High School, Merthyr Tydfil; Principle Examiner – GCSE Mathematics Unit 2 Foundation
- Series Editor Linda Mason is an experienced teacher and examiner of WJEC 11-14 and GCSE Mathematics, and works as a challenge adviser to WJEC.



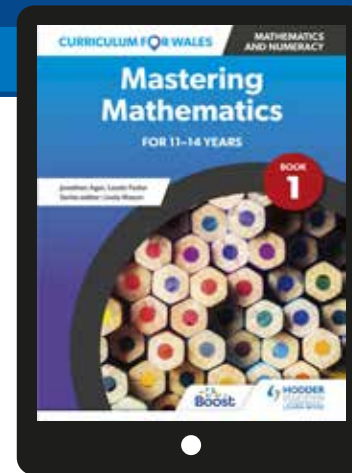
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- 139 worksheets with a total of 1834 questions
- 417 presentations
- 139 'Auto-marked Quizzes'
- 139 'Useful weblinks' documents
- Automatic reporting tools to easily track students' progress

A **Core** subscription includes a teacher eBook for planning and front-of-class teaching, with the option to add copies of the Boost eBook for students. A **Premium** subscription includes unlimited Boost eBooks for students.



✓ We're here to help you make the most of your Boost subscription with free training, online help videos and a dedicated support team.

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# See what's inside our three books

## Contents

### Book 1

- Probability
- Working with shapes
- Coordinates and transformations

#### Consolidation 1

- Types of number
- Calculations
- Using letter symbols
- Sequences

#### Consolidation 2

- Fractions
- Place value and rounding

#### Consolidation 3

- Averages and range
- Displaying data

#### Consolidation 4

- Working with decimals
- Percentages
- Ratio and proportion

#### Consolidation 5

- Measurements
- Area and perimeter
- Angles

#### Consolidation 6

### Book 2

- Sequences
- Graphs

#### Consolidation 1

- Angles
- Constructions
- Calculations

#### Consolidation 2

- Negative numbers
- Fractions
- Expressions and formulas

#### Consolidation 3

- Equations
- Working with 2D shapes

#### Consolidation 4

- Properties of 3D shapes
- Percentages
- Multiplicative reasoning

#### Consolidation 5

- Working with data
- Circles
- Pythagoras' theorem

#### Consolidation 6

### Book 3

- Powers and indices
- Fractions
- Accuracy

#### Consolidation 1

- Percentages
- Using measures

#### Consolidation 2

- Using ratio and proportion and percentage
- Equations, expressions, formulas and inequalities

#### Consolidation 3

- Graphs
- Real-life graphs
- Transformations

#### Consolidation 4

- Prisms and cylinders
- Trigonometry
- Real-life finance

#### Consolidation 5

- Working with data
- Probability

#### Consolidation 6

# CURRICULUM FOR WALES

## Explore our full range of resources for 11–14 years

Discover our full range of brand-new resources designed to support secondary schools in the design and teaching of the new Curriculum for Wales. Including books and digital teacher materials, these resources will support learning for ages 11–14 and help teachers and students navigate the new curriculum with confidence.

Our resources are designed to be used flexibly by teachers as they create and deliver their new curriculum to confidently address the four purposes and the ‘what matters’ statements in each Area of Learning and Experience. Support students to progress through their learning with inspiring ideas and engaging content that reflects the Welsh context, helping them to develop a sense of *cynefin* and identity as a citizen of Wales and the wider world.

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#### Health and Well-being




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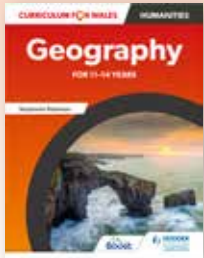
### Humanities

#### History



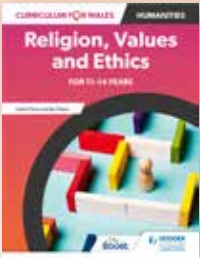
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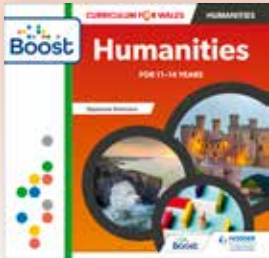
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*A free editable curriculum builder for English will also be available – email [welshcurriculum@hodder.co.uk](mailto:welshcurriculum@hodder.co.uk) for more information.*

### Find out more

Find out more about our resources to support the new Curriculum for Wales: Visit [www.hoddereducation.co.uk/wales-new-curriculum](http://www.hoddereducation.co.uk/wales-new-curriculum) or email [welshcurriculum@hodder.co.uk](mailto:welshcurriculum@hodder.co.uk).

# How to use this book

## How to get the most from this book

Hodder Education's mathematics resources support the learning and experience of mathematics for years 7–9 and comprise:

- three books to support the Wales National Curriculum for ages 11–14
- Boost online content.

Our Book 1 material is split into 17 chapters, and each chapter comprises two, three or four units. In total there are 49 units in the book. The material across all three books, and the editable course planner, is designed to be used whenever the teacher feels it is appropriate for the class; for example, some content in Book 2 or even Book 3 may be suitable for some teaching in year 7. Similarly, our scheme of work is designed to be flexible.

The book contains indication of five proficiencies: **conceptual understanding**, **communication using symbols**, **fluency**, **logical reasoning** and **strategic competence**.

As these five proficiencies are intertwined, an individual proficiency is not developed in isolation. Consequently, in general, many of the proficiencies could be highlighted in activities, examples and exercises throughout the book.

As an aid, the best fit or a principle proficiency is flagged as guidance only, to raise awareness of a particular proficiency for the learner. We have chosen to highlight good examples of conceptual understanding and communication using symbols as relevant alongside various mathematical explanations, activities and worked examples. And fluency, logical reasoning and strategic competence are highlighted in relation to individual questions in our exercises, reviews and consolidation sections. All of these indicators are intended as guidance to aid the learner in understanding their own proficiency development.

Fluency

Logical reasoning

Strategic competence

Conceptual understanding

Communication using symbols

In summary, the five proficiencies capture a learner's developing understanding of the multi-faceted nature of their learning.

- **Conceptual understanding** allows learners to develop their ability to connect ideas through increasing depth of knowledge. The understanding of the way in which concepts are connected aids learner development.
- Through progression in **communication using symbols**, learners develop understanding of conventions and of abstract representation.
- With experience, learners will develop **fluency** in remembering facts, relationships and techniques.
- Learners develop **logical reasoning**, including justification and proof, in understanding the relationship between concepts.
- In developing **strategic competence**, learners show independence in applying ideas within a problem and recognise mathematical structure.

All exercise questions that relate to finance are indicated with this symbol.



Each chapter includes:

- *Coming up* – a list of learning objectives that will be tackled in the chapter
- a *Starter* problem – either an activity or a puzzle – to engage the students with a new topic and designed to be used before the first lesson, or at the start of the first lesson in that topic

### Mystery numbers

Each symbol on these cards represents a different mystery number.

Each symbol represents an integer (whole number).



Solve these clues to find the mystery numbers.

#### Clues

<ul style="list-style-type: none"><li>★ is even</li><li>★ is a multiple of 7</li><li>★ has a digit sum of 6</li><li>★ has two digits</li></ul>	<ul style="list-style-type: none"><li>◆ is prime</li><li>◆ has two digits</li><li>◆ is one more than a square number</li><li>◆ has a digit sum of 10</li></ul>	When you add 7 to the answer is 23 ◆
<ul style="list-style-type: none"><li>● is even</li><li>● has two digits</li><li>● is a square number</li><li>● has digits that sum to make another square number</li></ul>	<ul style="list-style-type: none"><li>■ has two digits</li><li>■ is a square number</li><li>■ is a cube number</li></ul>	● is a multiple of 6 When you: <ul style="list-style-type: none"><li>• double ● the answer is more than 30</li><li>• subtract 10 from ● the answer is less than 10</li></ul>

Choose your own mystery number.

Make up some clues and give them to a friend to solve.



- activities, investigations and whole-class discussion points
- a *Review exercise* at the end of the chapter; this encompasses all of the units covered in the chapter.

Each of the **individual units** within the chapter includes:

- a *Skill checker* – simple diagnostic questions to test basic understanding in preparation for the unit

### Skill checker

Match together the calculations which have the same answers.

$60 - 6 \times 3$	$5 + 42$	$18 - 32$	$16 - 2 \times 3$	$7 \times 8 + 50 \div 2$
$1 + 4 \times 2$	$7 \times 9 \div 3$	$7 \times (2 + 4)$	$2 \times 3 + 4$	$9 \times (4 + 5)$

- a clear and detailed explanation of the topic
- plenty of worked examples with solutions
- a focus on fluency, with a carefully structured approach that takes into account cognitive load theory
- helpful hints and guidance on misconceptions and pitfalls to watch out for
- *Now try these* exercise questions:
  - ▶ Develop conceptual understanding and communication using symbols.
  - ▶ Are split up into three bands of increasing demand: Band 1 questions are for those students who are working towards age-related expectations, Band 2 are for those at age-related expectations, and Band 3 are for those working beyond age-related expectations. Most students will engage with Band 2 questions and either Band 1 or Band 3, depending on which is most appropriate.
  - ▶ Are carefully calibrated to enable the learner to understand each question and answer before moving on.

- ▶ Give the opportunity to apply skills, including working systematically, modelling, breaking problems down into stages, visualising, working backwards, and trial and improvement. Note that the bold terms above comprise the three key strategies for the Wales curriculum.
- ▶ Non-calculator questions are indicated.
- a list of key words (highlighted in the text). These are fully explained in a glossary at the back of the book.

There are six sets of consolidation questions throughout the book, each of which appears after a sequence of two or three chapters. These are designed to cover approximately a half term's work.

The book encourages learners to use physical equipment (manipulatives) and representations as well as visual and abstract representations, for example the use of cards, bar model diagrams and physical number lines to aid the development of understanding.

Opportunities to link with Science and Technology, Humanities, Expressive Arts, Health and Well-being, Languages, Literacy and Communication teaching and learning are included in the *Cross-curricular activities* panels. Scattered throughout the books are examples that we hope will encourage exploration of historical Welsh mathematicians and contexts.

All answers are provided online at:

**[www.hoddereducation.co.uk/MasteringMathematicsWales](http://www.hoddereducation.co.uk/MasteringMathematicsWales)** and are freely accessible. You can also find an editable content planner here, with lesson suggestions and time built in for consolidation, assessment and application lessons. A suggestion for how content in these resources can be mapped to the Wales curriculum's What Matters statements and Progression Steps has been included in an editable format, to enable schools to create their own structure, as well as a full set of links to other areas of the curriculum across all subjects.



# Fractions

## Coming up...

- ▶ Arranging fractions in order
- ▶ Using the number line for ordering fractions
- ▶ Using the symbols =, ≠, <, >, ≤, ≥
- ▶ Using addition and subtraction applied to proper fractions
- ▶ Multiplying and dividing integers and proper fractions
- ▶ Calculating fractions of amounts
- ▶ Using a calculator to calculate results accurately and then interpreting them appropriately
- ▶ Expressing one quantity as a fraction of another, where the fraction is less than 1

Summaries of each section provided, showcasing the key learning points covered in each chapter

## Make some fractions

Here are some number cards.

1

2

3

4

5

6

7

8

9

### Challenge 1

Use the number cards to make as many fractions as you can that are worth the same as  $\frac{1}{2}$ .  
You can only use each card once.  
You can only use two cards for each fraction.  
In how many ways can you do this?

1

2

### Challenge 2

Use the number cards to make as many fractions as you can that are worth the same as  $\frac{1}{2}$ .  
You can only use each card once.  
You can only use three cards for each fraction.  
In how many ways can you do this?

6

1

2

### Challenge 3

Use the number cards to make as many fractions as you can that are worth the same as  $\frac{1}{2}$ .  
You can only use each card once.  
You can use as many cards as you like for each fraction.  
In how many ways can you do this?  
Can you find a way that uses all the cards?

2

7

5

4

Build confidence with engaging starter activities and challenges to introduce each chapter and concept

## 8.1 Equivalent fractions

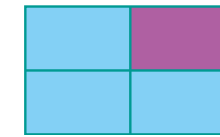
### Skill checker

① What fraction of each of these flags is blue?

a



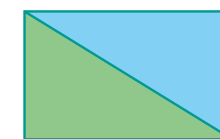
b



c



d



Ease the Support learning progress with skill-checker activities at the start of each topic

② Match each diagram to one of the fractions below.

a



b



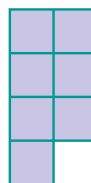
c



d



e



f



$\frac{7}{8}$

$\frac{1}{4}$

$\frac{3}{4}$

$\frac{5}{8}$

1

$\frac{1}{2}$

③ Write down all of the factors of each number.

a 6

b 15

c 30

d 18

④ Which of these numbers are multiples of 3?

16

26

36

43

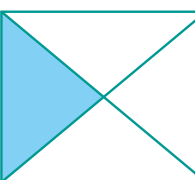
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64

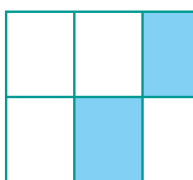
### Activity

Look at these diagrams.

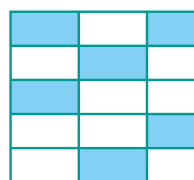
a



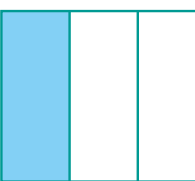
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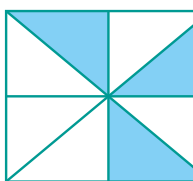
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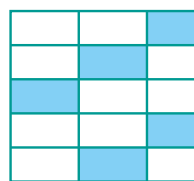
d



e



f



- ① Discuss which ones have one third shaded and write them down.
- ② Write down the fraction that is shaded for each drawing.
- ③ Write down the fractions that represent  $\frac{1}{3}$ .

### Note

See Chapter 4 for a reminder of factors and multiples.

Notes throughout to highlight where to find useful or relevant information

Activities throughout help develop pupils' conceptual understanding

Conceptual understanding

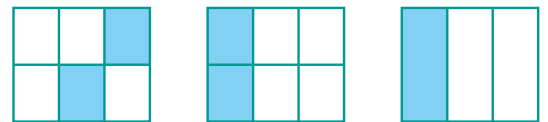
You have seen that  $\frac{1}{3}$ ,  $\frac{2}{6}$  and  $\frac{5}{15}$  all represent one third.

They have different **numerators** and different **denominators** but they are worth the same.

They all represent one out of three equal parts.

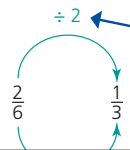
Look at the fractions and the diagrams that represent one third. You can use them to write down other fractions that represent one third, such as  $\frac{3}{9}$ ,  $\frac{4}{12}$  and  $\frac{10}{30}$ .

$\frac{1}{3}$ ,  $\frac{2}{6}$ ,  $\frac{3}{9}$ ,  $\frac{4}{12}$ ,  $\frac{5}{15}$  and  $\frac{10}{30}$  are **equivalent** fractions. They look different but are worth the same amount.



Two rectangles shaded out of six is worth the same as one rectangle shaded out of three.

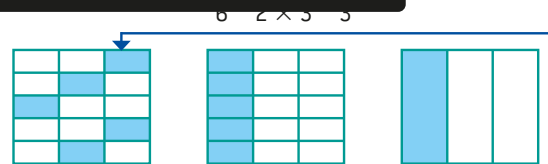
You can divide the numerator and denominator by 2 as 2 is a factor of 2 and of 6.



**Remember**

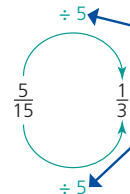
The numerator is the top number and the denominator is the bottom number.

Call outs with key things to remember to support pupils' progress



Five rectangles shaded out of 15 is worth the same as one rectangle shaded out of three.

You can divide the numerator and denominator by 5 as 5 is a factor of 5 and of 15.



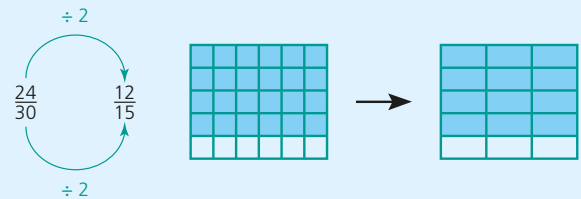
Fractions are usually written in their simplest form, so you write all of the fractions equivalent to one third as  $\frac{1}{3}$ . Writing fractions in their simplest form is called **cancelling** or **simplifying**.

**Worked example**

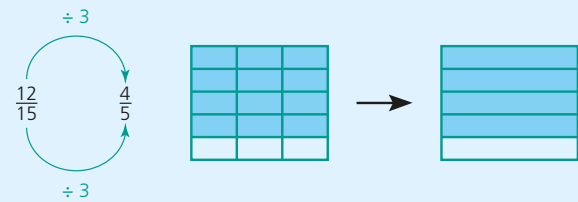
Simplify  $\frac{24}{30}$ .

**Solution**

2 is a factor of both 24 and 30, so you can divide both the numerator and the denominator by 2.



3 is a factor of both 12 and 15, so divide 12 and 15 by 3.



**Note**

You could do this in one step by dividing both the numerator and the denominator by 6.

$\frac{4}{5}$  is in its simplest form. 4 and 5 don't have a common factor so you can't simplify this further.

**Activity**

Show that  $\frac{2}{3} < \frac{3}{4}$  in as many different ways as you can.

Lots of activities inbetween engaging and accessible explanations

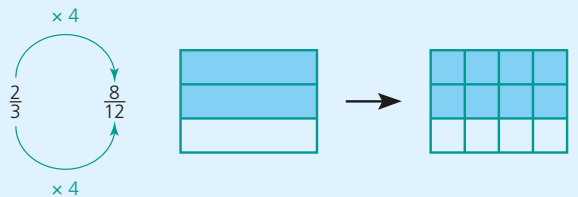
Sometimes you need to rewrite a fraction by multiplying both the numerator (top) and the denominator (bottom) by the same number. This is useful when comparing or combining fractions.

**Worked example**

Show that  $\frac{2}{3} < \frac{3}{4}$ .

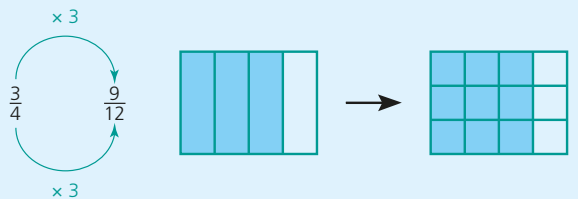
**Solution**

You can write both fractions as twelfths because both denominators (3 and 4) are factors of 12.



The multiplier of 4 turns thirds into twelfths.

You can write this as  $\frac{2}{3} = \frac{4 \times 2}{4 \times 3} = \frac{8}{12}$ .



The multiplier of 3 turns quarters into twelfths.

You can write this as  $\frac{3}{4} = \frac{3 \times 3}{3 \times 4} = \frac{9}{12}$ .

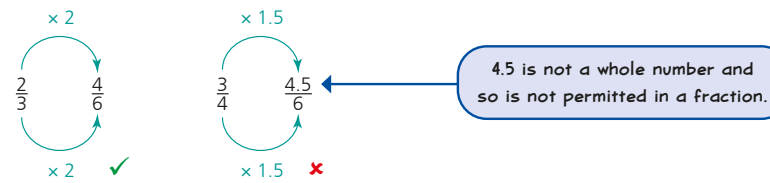
and  $\frac{8}{12} < \frac{9}{12}$ , so  $\frac{2}{3} < \frac{3}{4}$ .

**Remember**

< means 'less than'.

> means 'greater than'.

Fractions must be written using whole numbers.



### Worked example

Harri ran  $\frac{3}{10}$  of a mile and Catrin ran  $\frac{4}{15}$  of a mile. Who ran further?

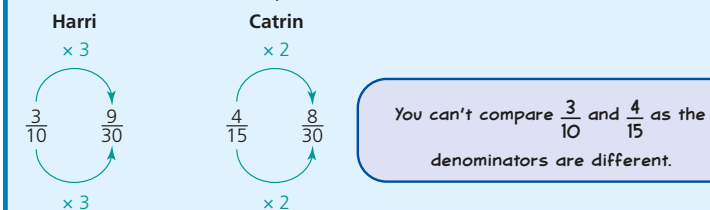
#### Solution

Rewrite the fractions so that they both have the same denominator.

The denominator must be a multiple of 10 and of 15.

$10 \times 15 = 150$  so you could write both denominators as 150 but it is easier to use the lowest denominator possible.

The lowest common multiple of both 10 and 15 is 30.



$$\frac{9}{30} > \frac{8}{30} \text{ so } \frac{3}{10} > \frac{4}{15}$$

Harri ran further than Catrin.

#### Note

30 is called the 'lowest common denominator'.

Equivalent fractions can be used when you write one number as a fraction of another.

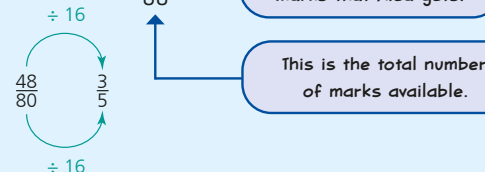
### Worked example

Aled gets 48 marks out of 80 in his maths test.

What fraction of the marks does Aled get?

#### Solution

Write this as  $\frac{48}{80}$ .



This shows that  $\frac{48}{80} = \frac{3}{5}$ .  
Therefore, the fraction of the marks that Aled gets is  $\frac{3}{5}$ .

#### Note

For a reminder of lowest common multiples, see Chapter 4.

#### Hint

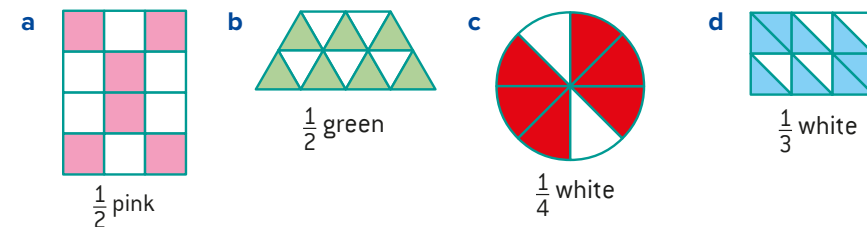
You could have simplified in two or more steps.

Hints help to guide pupils on how to approach each question

## 8.1 Now try these

### Band 1 questions

1 Which of these badges are coloured correctly?



$\frac{1}{2}$  pink

$\frac{1}{2}$  green

$\frac{1}{4}$  white

$\frac{1}{3}$  white

Secure and deepen understanding by working through banded questions that get progressively more difficult

2 A packet of coloured sweets is emptied.



Target key skills using the fluency, logical reasoning and strategic competence markers

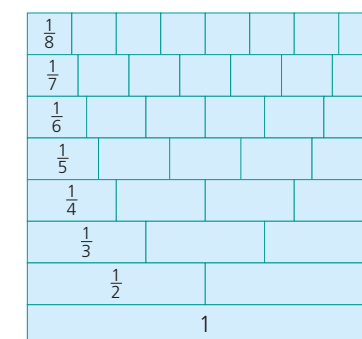
a Copy and complete the table.

Colour	Red	Blue	Brown	Yellow	Pink	Green
Number						

b What fraction of the packet is:

- i blue
- ii brown
- iii green
- iv red or green
- v blue or yellow
- vi not red?

3 Use this diagram to write the fractions below it in order, with the smallest first.



$\frac{2}{5}$   $\frac{1}{2}$   $\frac{1}{8}$   $\frac{3}{7}$   $\frac{5}{6}$   $\frac{2}{3}$   $\frac{3}{4}$

4 Place the symbol < or > between each pair of fractions to make true statements.

- a  $\frac{3}{11}$   $\frac{2}{11}$
- b  $\frac{5}{12}$   $\frac{1}{12}$
- c  $\frac{1}{2}$   $\frac{1}{4}$
- d  $\frac{1}{3}$   $\frac{1}{2}$



Strategic competence

- 5 Match the fractions in the first box to the fractions of equal value in the second box.

$\frac{4}{8}$	$\frac{2}{6}$	$\frac{6}{8}$	$\frac{3}{12}$	$\frac{2}{10}$	$\frac{1}{5}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{3}{4}$
---------------	---------------	---------------	----------------	----------------	---------------	---------------	---------------	---------------	---------------

- 6 Which of these fractions are equivalent to one third ( $\frac{1}{3}$ )?

$\frac{2}{6}$	$\frac{15}{25}$	$\frac{6}{18}$	$\frac{14}{20}$	$\frac{8}{10}$	$\frac{8}{24}$	$\frac{10}{30}$	$\frac{10}{20}$	$\frac{12}{16}$	$\frac{16}{20}$	$\frac{7}{21}$	$\frac{24}{30}$	$\frac{17}{51}$	$\frac{24}{28}$	$\frac{16}{48}$
---------------	-----------------	----------------	-----------------	----------------	----------------	-----------------	-----------------	-----------------	-----------------	----------------	-----------------	-----------------	-----------------	-----------------

Fluency

- 7 Copy and complete.

a  $\frac{1}{10} = \frac{\square}{20}$

b  $\frac{2}{5} = \frac{\square}{20}$

c  $\frac{1}{4} = \frac{\square}{20}$

d  $\frac{3}{5} = \frac{\square}{20}$

e  $\frac{3}{4} = \frac{\square}{20}$

f  $\frac{3}{10} = \frac{\square}{20}$

Band 2 questions

- 8 Copy and complete.

a  $\frac{1}{2} = \frac{3}{\square} = \frac{\square}{14}$

b  $\frac{1}{3} = \frac{\square}{9} = \frac{5}{\square}$

c  $\frac{1}{4} = \frac{\square}{8} = \frac{6}{\square}$

d  $\frac{2}{3} = \frac{4}{\square} = \frac{\square}{12}$

e  $\frac{3}{4} = \frac{\square}{16} = \frac{24}{\square}$

f  $\frac{2}{5} = \frac{8}{\square} = \frac{\square}{15}$

- 9 a Write  $\frac{5}{6}$  and  $\frac{3}{4}$  as equivalent fractions with a denominator of 12.  
b Which fraction is bigger,  $\frac{5}{6}$  or  $\frac{3}{4}$ ?

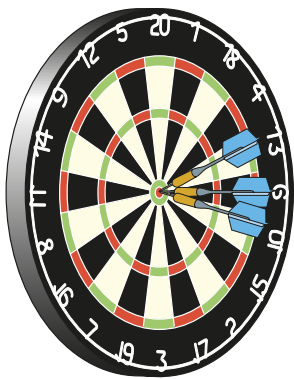
Strategic competence

- 10 The table shows the points scored by the football teams in the Premier League in one year.

Manchester United	83	Hull	49
Arsenal	78	Crystal Palace	49
Newcastle	69	Stoke	48
Chelsea	67	Fulham	48
Liverpool	64	Swansea	47
Norwich	60	Aston Villa	45
Everton	59	Cardiff	44
Southampton	52	West Ham	42
Manchester City	51	West Bromwich	26
Tottenham	50	Sunderland	19

What fraction of the teams scored more than 60 points?

- 11 A dartboard is a circle divided into 20 sectors numbered 1 to 20.
- a i What fraction of the sectors are even numbers?  
ii What fraction are odd numbers?
- b What fraction of the sectors are multiples of 5?
- c i What fraction of the sectors are prime numbers?  
ii What fraction of the sectors are not prime numbers?
- d Add the numbers on the black sectors and the numbers on the white sectors.  
What fraction of the total is the total of the black sectors?



Logical reasoning

- 12 Which of these fractions are equivalent to  $\frac{9}{15}$ ?

$\frac{18}{30}$	$\frac{12}{18}$	$\frac{21}{35}$	$\frac{6}{12}$	$\frac{6}{10}$	$\frac{15}{25}$
-----------------	-----------------	-----------------	----------------	----------------	-----------------

Strategic competence

- 13 a Sahid wants to rewrite all of these fractions so that they have the same denominator. What is the lowest denominator he can use?

$\frac{2}{5}$	$\frac{3}{10}$	$\frac{1}{2}$	$\frac{7}{25}$
---------------	----------------	---------------	----------------

- b Now write the fractions in order of size, starting with the smallest.

- 14 For each option below, write the first amount as a fraction of the second amount. Simplify your answer.

- a 24, 48      b £10, £100      c 24 kg, 80 kg  
d 15 km, 35 km      e 96 cm, 144 cm

- 15 For each pair of fractions, replace 'and' with =, < or > to make true statements.

- a  $\frac{1}{2}$  and  $\frac{1}{3}$       b  $\frac{1}{3}$  and  $\frac{5}{12}$       c  $\frac{2}{9}$  and  $\frac{5}{18}$       d  $\frac{2}{5}$  and  $\frac{12}{30}$   
e  $\frac{1}{4}$  and  $\frac{3}{10}$       f  $\frac{4}{5}$  and  $\frac{5}{6}$       g  $\frac{5}{8}$  and  $\frac{2}{3}$       h  $\frac{3}{4}$  and  $\frac{5}{7}$

Logical reasoning

- 16 For each fraction:

- a write the fraction in its simplest form  
b show how you can reach the simplest form in one step.

- i  $\frac{6}{8}$       ii  $\frac{4}{16}$       iii  $\frac{9}{12}$       iv  $\frac{12}{18}$       v  $\frac{10}{30}$       vi  $\frac{18}{24}$

Fluency

- 17 Lucy, Michelle and Ali share £36. Lucy gets £18. Michelle gets £12. Ali gets £6.  
What fraction of £36 does each person get?  
Write each fraction in its simplest form.

Band 3 questions

Strategic competence

- 18 Find a fraction that lies between each of the following pairs of fractions.

- a  $\frac{1}{2}$  and  $\frac{3}{4}$       b  $\frac{1}{2}$  and  $\frac{1}{4}$       c  $\frac{1}{2}$  and  $\frac{1}{3}$       d  $\frac{1}{2}$  and  $\frac{2}{3}$       e  $\frac{1}{4}$  and  $\frac{2}{5}$       f  $\frac{3}{8}$  and  $\frac{3}{4}$

- 19 Anya gets £12 pocket money. This is how she spends it.



- a What fraction does she spend on magazines?  
b Anya saves any money she has left. What fraction of her pocket money does she save?

Develop a greater depth of knowledge and understanding with more challenging 'Band 3' questions

Review questions  
at the end of each  
chapter can help to  
reinforce learning,  
or be used in class  
or set as homework

Review exercise: averages and range

Band 1 questions

Fluency

- 1 Find the range of lengths in each of these data sets.
- a 4 m, 6 m, 7 m, 11 m, 16 m, 23 m
  - b 12 cm, 6 cm, 19 cm, 35 cm, 11 cm
  - c 5.7 km, 9.2 km, 3.7 km, 5.3 km, 6.1 km, 8.3 km
- 2 Find the mode of each of these data sets.
- a 2, 3, 4, 4, 5, 7, 8
  - b 12, -19, 25, 12, 9, -6, 8
  - c -6, 2, 3, -3, 3, -6, -6, 2, -3
- 3 Find the median temperature for each of these data sets.
- a 8 °C, 11 °C, 13 °C, 19 °C, 28 °C
  - b 17 °C, -11 °C, 6 °C, -1 °C, -18 °C
  - c 4 °F, 18 °F, 13 °F, 7 °F
- 4 Find the mean price of each of these data sets.
- a £5, £3.40, £2.64, £7.68, £1.98
  - b 72p, 34p, 8p, 17p, 19p, 48p
  - c €2.57, €2.78, €2.64, €5.13
- 5 Six friends each buy a new dress for a party. Here are the costs of the dresses.
- |     |      |     |     |     |      |
|-----|------|-----|-----|-----|------|
| £16 | £136 | £35 | £16 | £55 | £100 |
|-----|------|-----|-----|-----|------|
- a Work out the mode and the median values.
  - b What is the difference between the most expensive dress and the least expensive dress?
- 6 These are the masses of 15 parcels.
- |        |       |        |        |        |
|--------|-------|--------|--------|--------|
| 1.2 kg | 40 g  | 250 g  | 2.1 kg | 3.5 kg |
| 0.7 kg | 430 g | 1.1 kg | 300 g  | 0.2 kg |
| 0.1 kg | 350 g | 250 g  | 0.5 kg | 370 g  |
- a What is the mode of the data?
  - b What is the range?
  - c What is the median?
  - d A post office worker says, 'Most parcels are over 0.5 kg'. Is that true for these parcels?



Logical reasoning

- 7 Three friends play a board game. The table shows their scores each time they rolled the dice.
- |       |                              |
|-------|------------------------------|
| Isaac | 1, 3, 5, 6, 2, 4, 5, 2, 4, 4 |
| Ellis | 2, 3, 3, 4, 6, 1, 1, 5, 2, 3 |
| Max   | 4, 5, 5, 6, 6, 1, 1, 2, 3, 4 |
- a For each player, find:
    - i the mode
    - ii the median
    - iii the range.
  - b Do the differences in your answers in part a tell you anything about the three players?

Strategic competence

- 8 A data set has five numbers. One of them is missing.
- |    |    |    |    |                      |
|----|----|----|----|----------------------|
| 23 | 46 | 45 | 29 | <input type="text"/> |
|----|----|----|----|----------------------|
- The list has a mode of 45.
- a What is the missing number?
  - b Find the median of the complete data set.
  - c Find the range of the complete data set.

Band 2 questions

Logical reasoning

- 9 Mr Davies and Mrs Evans want to compare how long it takes them to get to work. They write down their journey times each day in minutes.

Monday (Dydd Llun)	Tuesday (Dydd Mawrth)	Wednesday (Dydd Mercher)	Thursday (Dydd Iau)	Friday (Dydd Gwener)	Saturday (Dydd Sadwrn)	Sunday (Dydd Sul)
34	36	35	31	35	21	18
32	34	31	34	30	-	-

- a Find the median time for:
    - i Mr Davies
    - ii Mrs Evans.
  - b Calculate the mean time for:
    - i Mr Davies
    - ii Mrs Evans.
  - c Find the range for:
    - i Mr Davies
    - ii Mrs Evans.
  - d Compare the range for Mr Davies and Mrs Evans. Why do you think the range differs?
  - e Who has the shorter average journey time? State which average you have used and explain why.
- 10 The number of cars passing each hour in Ceri's vehicle survey is shown in the table.

Time	1st hour	2nd hour	3rd hour	4th hour	5th hour	6th hour
Cars	75	63	204	66	90	86

- a Find the mean number of cars passing per hour.
  - b What is the range for the number of cars passing each hour?
  - c The third hour is excluded from the data. How does this affect the range?
  - d Why do you think the number of cars passing in the third hour is much higher than in the other hours?
- 11 Here are the five best javelin throws for three athletes.

Athlete	Length of throw (metres)
Ben Jason	61, 82, 73, 59, 81
Chris White	72, 70, 69, 64, 75
Mel Cox	63, 59, 58, 65, 69

- a Find the mean, median, mode and range for each athlete.
- b Chris White is chosen to represent the team. Explain why.

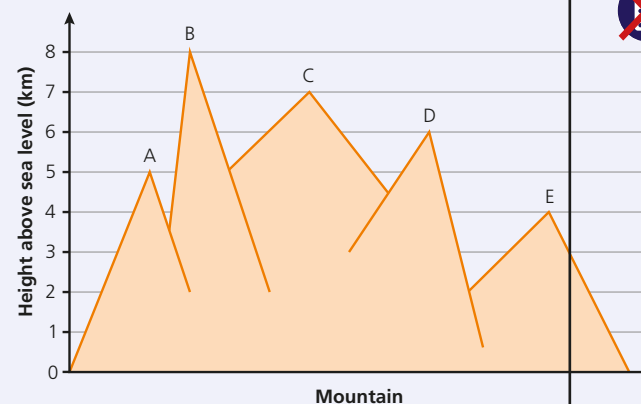


## Consolidation 5: Chapters 12–14

### Band 1 questions

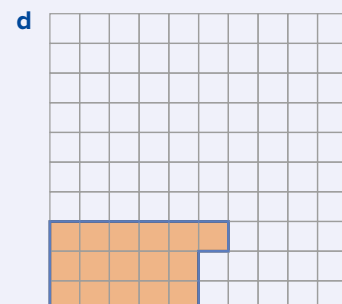
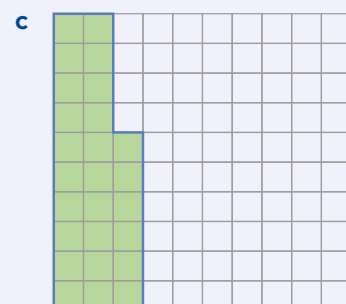
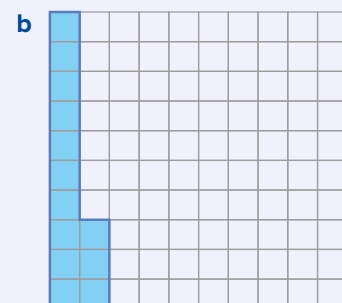
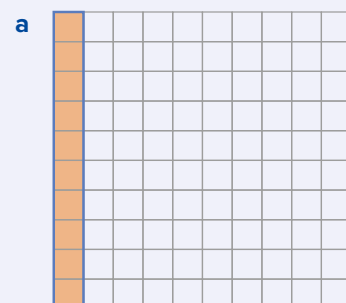
Logical reasoning

- 1 Look at the picture of a mountain range.
- a What is the ratio of the heights of:
- Mountain A to Mountain B
  - Mountain B to Mountain D
  - Mountain E to Mountain D?
- b The heights of which two mountains are in the ratio 2 : 1?  
Give all your answers in simplified form.



Fluency

- 2 Look at these diagrams.



- Express each shaded part as a percentage of the whole square.
- Write each of your answers a decimal.
- Write each of your answers as a fraction, simplifying your answers.

Track progress and check understanding with further banded questions across chapters

Fluency

- 3 Look at the number 430.726.  
The digit 7 is in the tenths column. It has a value of seven tenths or 0.7.

- a Write down the value of each of these digits:
- 4
  - 3
  - 2
  - 6
- b Work out:
- $430.726 \times 0.01$
  - $430.726 \div 0.1$

Strategic competence

- 4 For lunch, Gwilym goes to the café near to his office.  
He buys a packet of sandwiches for £3.49, a carton of orange juice for £1.29 and a packet of crisps for 69p.
- How much did Gwilym spend on his lunch?
  - Gwilym paid with a £10 note. How much change did he get?

Logical reasoning

- 5 Anna thinks that 0.381 is larger than 0.42.  
Is she correct? Explain your answer.

Fluency

- 6 Copy and complete these calculations.
- $2 \times 0.9 - 0.4 =$
  - $1.8 \times 3 - 2 =$
  - $5 - 3 \times 0.8 =$
  - $7 - 0.6 \times 5 =$
  - $0.9 \div 3 + 3.1 =$

Logical reasoning

- 7 At Ysgol Harlech, 24 out of 80 students in Year 8 wear glasses.
- What percentage do not wear glasses?
  - Convert this to a fraction and to a decimal.

### Band 2 questions

Fluency

- 8 By first converting all of these quantities to percentages, put them in order of size.

0.795     $\frac{4}{5}$      $\frac{3}{4}$     72%    0.81

Strategic competence

- 9 For the school play Mrs Williams, the drama teacher, buys some equipment for the stage. She gets:
- ten light bulbs costing £0.87 each
  - ten costumes costing £19.95 each
  - one tin of paint for the set at £13.45.
- Find how much Mrs Williams spends in total.

Fluency

- 10 There are 126 houses in Spencer Street.  
The houses are a mixture of bungalows, two-storey houses and three-storey houses, in the ratio 2 : 3 : 4.  
Find the number of each type of house in the street.
- 11 Copy and complete the following:
- $$12 \div 3 = 4 \qquad 12 \div 0.3 = \quad \quad \quad 1.2 \div 0.3 = \quad \quad \quad 0.12 \div 0.3 = \quad \quad \quad$$



# Glossary

Glossary pages in each book which provides definitions of key terms

**Acute** An acute angle lies between  $0^\circ$  and  $90^\circ$ .

**Addition (add)** Addition or adding is finding the total of two or more amounts. For example,  $3 + 4 = 7$ .

**Angle** An angle is a measure of turning. Angles are measured in degrees. For example, a full turn is  $360^\circ$ .

**Area** The area of a shape is the amount of surface that it covers. Area is measured in square units such as  $\text{mm}^2$ ,  $\text{cm}^2$ ,  $\text{m}^2$  and  $\text{km}^2$ .

**Arithmetic sequence** An arithmetic sequence is a sequence where the difference between consecutive terms is a constant. For example, 7, 11, 15, 19, ...

**Average** An average is a measure of the typical value in a data set. Common averages are the mean, the mode and the median.

**Axes** Axes is the plural of axis. An axis is a fixed reference line for the measurement of coordinates. The x-axis is horizontal and the y-axis is vertical.

**Bar chart** A bar chart is a chart that uses rectangular bars to display data. The height of each bar represents the frequency.

**Base** The base of a shape is the line or surface on which it appears to be standing.

**Biased** Data is biased if some outcomes occur more or less than would be expected. For example, a dice is biased if the number 6 hardly ever comes up.

**BIDMAS** BIDMAS is a way of remembering the order in which you carry out the different operations in a calculation: Brackets, Indices, Division, Multiplication, Addition and Subtraction.

**Brackets** Brackets are a way of grouping numbers or algebraic terms together. For example,  $(3 + 5) \div 2$  means the same as  $8 \div 2$ .

**Cancel** To cancel a fraction is to simplify it by dividing the numerator and denominator by a common factor.

**Capacity** The capacity of a 3-D shape is the volume it can hold. It is measured in cubic units such as  $\text{mm}^3$  and  $\text{cm}^3$ , or for liquids litre (l) and millilitre (ml).

**Centilitre** 1 centilitre (1 cl) is one hundredth of a litre.

**Centimetre** 1 centimetre (1 cm) is one hundredth of a metre.

**Centre of rotation** The centre of rotation is the 'pivot' point about which an object is rotated.

**Certain** If an event is certain, its probability is 1. For example, it is certain that the Sun will rise tomorrow.

**Chance** The chance of something happening is how likely it is to happen. Words can be used – it is unlikely that Sam will get up before midday. Or numbers can be used – the probability of Sam getting up before midday is about 0.09.

**Circle** A circle is a shape made up of all the points that are a specific distance from the centre.

**Circumference** The circumference is the perimeter of a circle.

**Common denominator** The common denominator of two or more fractions is a common multiple of all of the denominators. It is used when adding or subtracting fractions.

**Common factor** A common factor of two or more numbers is a number that divides exactly into all the numbers. You simplify fractions by cancelling by a common factor.

**Commutative** An operation is commutative if the order in which you do it doesn't matter. Addition and multiplication are commutative operations.

**Congruent** Congruent shapes are exactly the same shape and size – they are identical.

**Coordinates** Coordinates are a way of showing position on a pair of axes or graph. For example, the point (3, -5) is 3 to the right and 5 down.

**Cube (number)** To find the cube of a number you multiply the number by itself twice. For example, the cube of 5.6 ( $5.6^3$ ) is  $5.6 \times 5.6 \times 5.6$  or 175.616.

**Cube (shape)** A cube is a 3-D shape with six identical square faces.

**Cube root** The cube root of a number is the number that, when multiplied by itself twice, gives the original number. The inverse of cubing is cube rooting. For example, the cube root of 27 is 3 (as  $3 \times 3 \times 3 = 27$ ). The symbol  $\sqrt[3]{\phantom{x}}$  is used for the cube root of a number, so  $\sqrt[3]{27} = 3$ .

**Decimal** A decimal is a number written using a decimal point. For example, 82.17. The digits after the decimal point represent a value less than one.

**Decimal place** The number of decimal places in a decimal is the number of digits after the decimal point. For example, 3.2 is written to one decimal place and 5.678 is written to three decimal places.

**Decimal point** The decimal point is the dot in a decimal number. The digits before the decimal point represent whole numbers; the digits after the decimal point represent fractions. For example, the number 4.37 means four units plus three tenths plus seven hundredths.

**Denominator** The denominator is the bottom integer of a fraction. It tells you how many equal parts the whole is divided into. For example,  $\frac{3}{8}$  has a denominator of 8, so the 'whole' has been divided into eight equal parts.

**Diameter** A diameter is a line that passes through the centre of a circle and joins two points on the circumference.

**Difference** The difference between two numbers is the result of subtracting the smaller from the larger. For example, the difference between 15 and 6 is  $15 - 6 = 9$ .

**Digit** A digit is one of the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8 or 9. Digits are used to write numbers.

# Answers

Answer pages provided in each book for activities and questions

## ► 1 Probability

### A dicey problem

B is the best starting position.

### 1.1 Skill checker

- A: 0.5; B: 0.25; C: 0.75; D: 0.1; E: 0.9; F: 0.2; G: 0.6
  - i, ii A:  $0.5 = \frac{1}{2} = 50\%$ ; B:  $0.25 = \frac{1}{4} = 25\%$ ; C:  $0.75 = \frac{3}{4} = 75\%$ ; D:  $0.1 = \frac{1}{10} = 10\%$ ; E:  $0.9 = \frac{9}{10} = 90\%$ ; F:  $0.2 = \frac{1}{5} = 20\%$ ; G:  $0.6 = \frac{3}{5} = 60\%$

- Students' own work

### Discussion activity

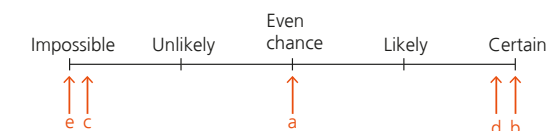
Many possible answers, for example:

- It is impossible for the Sun to rise in the west tomorrow.
- It is certain that a cat will catch a mouse somewhere tomorrow.
- It is unlikely that a person will live to be 110 years old.
- It is likely that it will rain sometime next week.
- There is an even chance that a new baby will be a girl.

### 1.1 Now try these

- Likely = will probably happen  
Impossible = will never happen  
Unlikely = will probably not happen  
Certain = will definitely happen  
Even chance = has an equal chance of happening or not happening
- Even chance
  - Unlikely or impossible
  - Certain
  - Unlikely
  - Unlikely or impossible
  - Likely
  - Likely

3



- Likely
  - Very likely
- They are both close to 0, with Bryn twice the probability of Anwen.
  - Yes, he is correct, but as Anwen has almost a zero probability of winning so does Bryn, as twice almost zero is also almost zero!
- 4 sections must be green and 4 must be red.
  - 5 or 6 sections must be green.
  - 1 section must be red.
- Weather is not a random event and tomorrow's weather is dependent on today's weather.
  - The UK tends to be wetter in the winter, so it is more likely to rain on 18 December compared with 18 June.
- It depends on the strength of the opposition, how Rhys feels and how he has recovered from the previous race.  
So no, it is not likely to be an even chance.
- Very unlikely
  - Likely
  - Unlikely
  - Certain
  - Likely
- a, b, c Students' own work

### 1.2 Skill checker

- Highly unlikely
    - Even chance
    - Impossible
    - Unlikely
    - Highly likely
  - Students' own answers



## Help pupils become confident and capable mathematicians with accessible explanations and engaging activities.

This book gradually builds on prior knowledge to deepen understanding, offering clear explanations, worked examples, exercise questions and a range of other activities that teachers can choose from to build their lessons and teaching plans.

Designed to be used flexibly, these materials cover the four 'what matters' statements and follow the five principles of progression from the Curriculum for Wales.

- Develop pupils' conceptual understanding and communication with symbols throughout, using plenty of worked examples and banded questions
- Target fluency, logical reasoning and strategic competence by using the markers included in each exercise question
- Improve outcomes by selecting from banded questions most suited to enable progression
- Ease the transition between progression steps with skill-checker activities at the start of each topic and review questions after each chapter
- Link topics to other Areas of Learning and Experience (AoLE), such as Science and Technology, with cross-curricular activities and discussion points

## What next?

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