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CAMBRIDGE Primary Mathematics

Teacher's Resource 5

Emma Low & Mary Wood

Second edition

Digital access

Cambridge Assessment International Education

Endorsed for teacher support

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Primary Mathematics

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Projects and their accompanying teacher guidance have been written by the NRICH Team. NRICH is an innovative collaboration between the Faculties of Mathematics and Education at the University of Cambridge, which focuses on problem solving and on creating opportunities for students to learn mathematics through exploration and discussion https://nrich.maths.org.

Test-style questions and sample answers have been written by the authors. In examinations, the way marks are awarded may be different. References to assessment and/or assessment preparation are the publisher's interpretation of the syllabus requirements and may not fully reflect the approach of Cambridge Assessment International Education.

Contents

Digital resources

The following items are available on Cambridge GO. For more information on how to access and use your digital resource, please see inside front cover.

You can download the following resources for each unit:

Introduction

Welcome to the new edition of our Cambridge Primary Mathematics series.

Since its launch, the series has been used by teachers and learners in over 100 countries for teaching the Cambridge Primary Mathematics curriculum framework.

This exciting new edition has been designed by talking to Primary Mathematics teachers all over the world. We have worked hard to understand your needs and challenges, and then carefully designed and tested the best ways of meeting them.

As a result of this research, we've made some important changes to the series. This Teacher's Resource has been carefully redesigned to make it easier for you to plan and teach the course and now includes pages from the Learner's Book.

The series still has extensive digital and online support, including Digital Classroom which lets you share books with your class and play videos and audio. This Teacher's Resource also offers additional materials available to download from Cambridge GO. (For more information on how to access and use your digital resource, please see inside front cover.)

The series uses the most successful teaching pedagogies like active learning and metacognition and this Teacher's Resource gives you full guidance on how to integrate them into your classroom.

Formative assessment opportunities help you to get to know your learners better, with clear learning intentions and success criteria as well as an array of assessment techniques, including advice on self and peer assessment.

Clear, consistent differentiation ensures that all learners are able to progress in the course with tiered activities, differentiated worksheets and advice about supporting learners' different needs.

All our resources are written for teachers and learners who use English as a second or additional language. They help learners build core English skills with vocabulary and grammar support, as well as additional language worksheets.

We hope you enjoy using this course.

Eddie Rippeth

Head of Primary and Lower Secondary Publishing, Cambridge University Press

About the authors

Emma Low

Emma graduated from University of London with a BA(Ed) in Education with Mathematics and Computer Studies and holds a MEd in Mathematics Education from the University of Cambridge. Within her Masters degree she studied a variety of international education systems and strategies which she uses in her teaching and writing.

Emma was a primary school teacher and Mathematics and ICT Leader, then became a Mathematics Consultant for the Local Authority, supporting schools through professional development and authoring publications. Emma has also taught secondary mathematics at an Outstanding comprehensive school.

Since 2010 Emma has been a freelance consultant and writer. She provides engaging and inspiring professional development, and supports effective and creative planning, teaching and assessment. Emma has written professional development materials as an associate of the National Centre for Excellence in the Teaching of Mathematics (NCETM). She has authored many mathematics text books, teachers' guides, mathematical games and activity books.

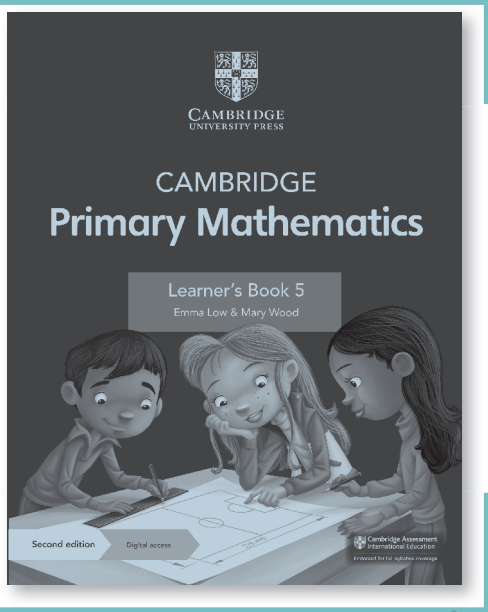
Mary Wood

Mary enjoys travelling and finding mathematics around her, from tile patterns on the roofs of churches and other buildings to the 'fat policeman' in Budapest, Hungary. His belt has the number 235 on it and 2, 3, 5 are the first three prime numbers.

Mary has a wealth of mathematical experience from an education career spanning over forty years. Following many years of classroom teaching, she has worked in educational consultancy and continuing professional development in the United Kingdom and overseas. Mary is an experienced examiner, which has allowed her to better understand the needs of teachers and students working in varied contexts. She enjoys writing and editing primary mathematics books.

How to use this series

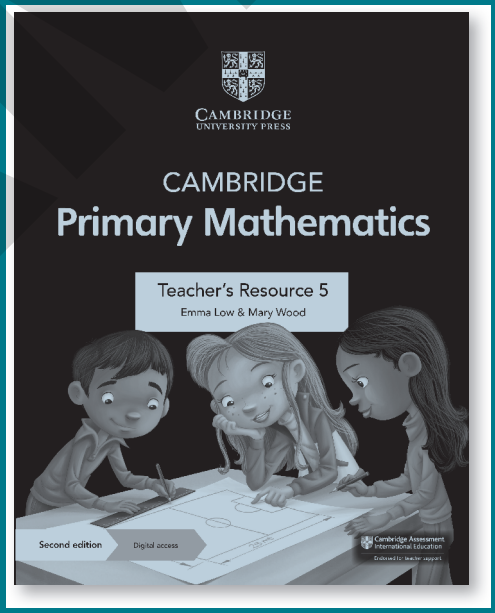
All of the components in the series are designed to work together.

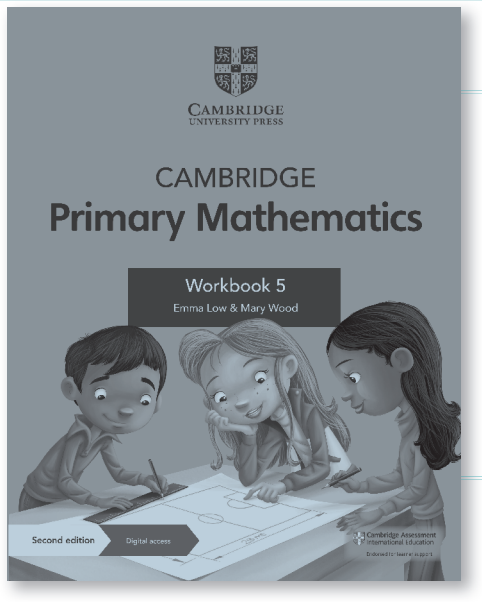


The Learner's Book is designed for learners to use in class with guidance from the teacher. It offers complete coverage of the curriculum framework. A variety of investigations, activities, questions and images motivate learners and help them to develop the necessary mathematical skills. Each unit contains opportunities for formative assessment, differentiation and reflection so you can support your learners' needs and help them progress.

The Teacher's Resource is the foundation of this series and you'll find everything you need to deliver the course in here, including suggestions for differentiation, formative assessment and language support, teaching ideas, answers, tests and extra worksheets. Each Teacher's Resource includes:

- a print book with detailed teaching notes for each topic
- Digital Access with all the material from the book in digital form plus editable planning documents, extra guidance, downloadable worksheets and more.





The skills-focused write-in Workbook provides further practice of all the topics in the Learner's Book and is ideal for use in class or as homework. A three-tier, scaffolded approach to skills development promotes visible progress and enables independent learning, ensuring that every learner is supported.

Teachers can assign learners questions from one or more tiers for each exercise, or learners can progress through each of the tiers in the exercise.

Digital Classroom includes digital versions of the Learner's Book and Workbook, complete with pop-up answers, designed for teachers to use at the front of class. Easily share the books with the whole class on your whiteboard, zoom in, highlight and annotate text, and get your learners talking with videos, images and interactive activities.

DC access card cover

Games Book cover

The Games Book is a supplementary resource designed to encourage learners to apply their mathematical knowledge through games. It consolidates and reinforces learning appropriate to the stage.

A letter to parents, explaining the course, is available to download from Cambridge GO (as part of this Teacher's Resource).

How to use this Teacher's Resource

This Teacher's Resource contains both general guidance and teaching notes that help you to deliver the content in our Cambridge Primary Mathematics resources. Some of the material is provided as downloadable files, available on **Cambridge GO**. (For more information about how to access and use your digital resource, please see inside front cover.) See the Contents page for details of all the material available to you, both in this book and through Cambridge GO.

Teaching notes

This book provides **teaching notes** for each unit of the Learner's Book and Workbook. Each set of teaching notes contains the following features to help you deliver the unit.

The **Unit plan** summarises the topics covered in the unit, including the number of learning hours recommended for the topic, an outline of the learning content and the Cambridge resources that can be used to deliver the topic.

Topic	Approximate number of learning hours	Outline of learning content	Resources
1.1 Understanding place value	4 hours	Explain the value of a digit in a decimal (tenths and hundredths). Multiply and divide whole numbers by 1000.	Learner's Book Section 1.1 Workbook Section 1.1 Additional teaching ideas for Section 1.1 Resource sheet 1A
Cross-unit resources			
Diagnostic check and mark scheme **Digital Classroom:** Unit 1 multimedia enhancement **Digital Classroom:** Unit 1 activity Worksheet 1A			

The **Background knowledge** feature explains prior knowledge required to access the unit and gives suggestions for addressing any gaps in your learners' prior knowledge.

Learners' prior knowledge can be informally assessed through the **Getting started** feature in the Learner's Book. (See the Assessment for Learning downloadable file section for more information.)

BACKGROUND KNOWLEDGE

We are surrounded by numbers in our everyday life. Some of these are whole numbers and some are decimals. Having a display of pictures in the classroom can help learners to see how numbers affect their lives.

The **Teaching skills focus** feature covers a teaching skill and suggests how to implement it in the unit.

TEACHING SKILLS FOCUS

Self-assessment

You can create amazing lessons, but only your learners can do the learning. You will need to guide learners in how to approach their work and use feedback positively.

Reflecting the Learner's Book, each unit consists of multiple sections. A section covers a learning topic.

At the start of each section, the **Learning plan** table includes the learning objectives, learning intentions and success criteria that are covered in the section.

It is helpful to share learning intentions and success criteria with your learners at the start of a lesson so that they can begin to take responsibility for their own learning. This also helps develop metacognitive skills.

LEARNING PLAN

Framework codes	Learning objectives	Success criteria
5Np.01	• Understand and explain the value of each digit in decimals (tenths and hundredths).	• Learners explain the value of a digit in a decimal (tenths and hundredths).

The **Language support** feature contains suggestions for how to support learners with English as an additional language. The vocabulary terms and definitions from the Learner's Book are also collected here.

LANGUAGE SUPPORT

Column: arrangement of numbers or objects in a line, running up and down the page or surface

Digit: the numbers 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. The value of the digit is determined by its position in a 2-digit number.

There are often **common misconceptions** associated with particular learning topics. These are listed, along with suggestions for identifying evidence of the misconceptions in your class and suggestions for how to overcome them.

Misconception	How to identify	How to overcome
Learners may consider hundredths to be greater than tenths.	Through discussion and in written work.	Ensure that place value charts are used as visual prompts.

For each topic, there is a selection of **starter ideas**, **main teaching ideas** and **plenary ideas**. You can pick out individual ideas and mix and match them depending on the needs of your class. The activities include suggestions for how they can be differentiated or used for assessment. **Homework ideas** are also provided.

Starter idea

Getting started (20 minutes)

Resources: Unit 1 Getting started exercise in the Learner's Book.

Description: Give learners 10 minutes to answer the Getting started questions in their exercise books.

Main teaching idea

Place value (20–30 minutes)

Learning intention: Understand and explain the value of each digit in decimals (tenths and hundredths).

Resources: Resource sheet 1B.

The **Cross-curricular links** feature provides suggestions for linking to other areas of the Primary curriculum.

CROSS-CURRICULAR LINKS

Work on the history of measurement will include reference to the metric system. The metric system is an internationally recognised decimalised system of measurement.

Thinking and Working Mathematically skills are woven throughout the questions in the Learner's Book and Workbook. These questions, indicated by ✦, incorporate specific characteristics that encourage mathematical thinking.

The teaching notes for each unit identify all of these questions and their characteristics. The **Guidance on selected Thinking and Working Mathematically questions** section then looks at one of the questions in detail and provides more guidance about developing the skill that it supports

Additional teaching notes are provided for the six **NRICH projects** in the Learner's Book, to help you make the most of them.

Projects and their accompanying teacher guidance have been written by the NRICH Team. NRICH is an innovative collaboration between the Faculties of Mathematics and Education at the University of Cambridge, which focuses on problem solving and on creating opportunities for students to learn mathematics through exploration and discussion. **https://nrich.maths.org**.

› **Digital Classroom:** If you have access to Digital Classroom, these links will suggest when to use the various multimedia enhancements and interactive activities.

Guidance on selected Thinking and Working Mathematically questions

Learner's Book Exercise 1.1, question 9

Learners are given four statements, each with a missing number, and have to work out which is the odd one out. You may need to remind learners that they need to calculate and then compare the missing numbers in order to identify the odd one out.

PROJECT GUIDANCE: PROJECT 1 POSSIBLY ODD

Why do this project?

This task gives learners the opportunity to explore how multiplying by ten changes the value of each digit in a number with a decimal point. This activity develops the skill of **conjecturing** (**TWM.03**) by providing a context for learners to form different ideas about which numbers they should choose to put in which boxes, helping them consolidate their understanding of place value.

Digital resources to download

This Teacher's Resource includes a range of digital materials that you can download from Cambridge GO.

Helpful documents for planning include:

- **Letter for parents – Using the Cambridge Primary and Lower Secondary resources:** a template letter for parents, introducing the Cambridge Primary Mathematics resources.
- **Lesson plan template:** a Word document that you can use for planning your lessons. Examples of completed lesson plans are also provided.
- **Curriculum framework correlation:** a table showing how the Cambridge Primary Mathematics resources map to the Cambridge Primary Mathematics curriculum framework.
- **Scheme of work:** a suggested scheme of work that you can use to plan teaching throughout the year.

Each unit includes:

- **Additional teaching ideas:** additional starter, main and plenary activity ideas are provided for each section in the unit.
- **Differentiated worksheets:** these worksheets are provided in variations that cater for different abilities. Worksheets labelled 'A' are intended to support less confident learners, while worksheets labelled 'B' are designed to challenge more confident learners. Answer sheets are provided.
- **Language worksheets:** these worksheets provide language support and can be particularly helpful for learners with English as an additional language. Answer sheets are provided.
- **Resource sheets:** these include templates and any other materials that support activities described in the teaching notes.
- **End-of-unit tests:** these provide quick checks of the learner's understanding of the concepts covered in the unit. Answers are provided. Advice on using these tests formatively is given in the Assessment for Learning section of this Teacher's Resource.

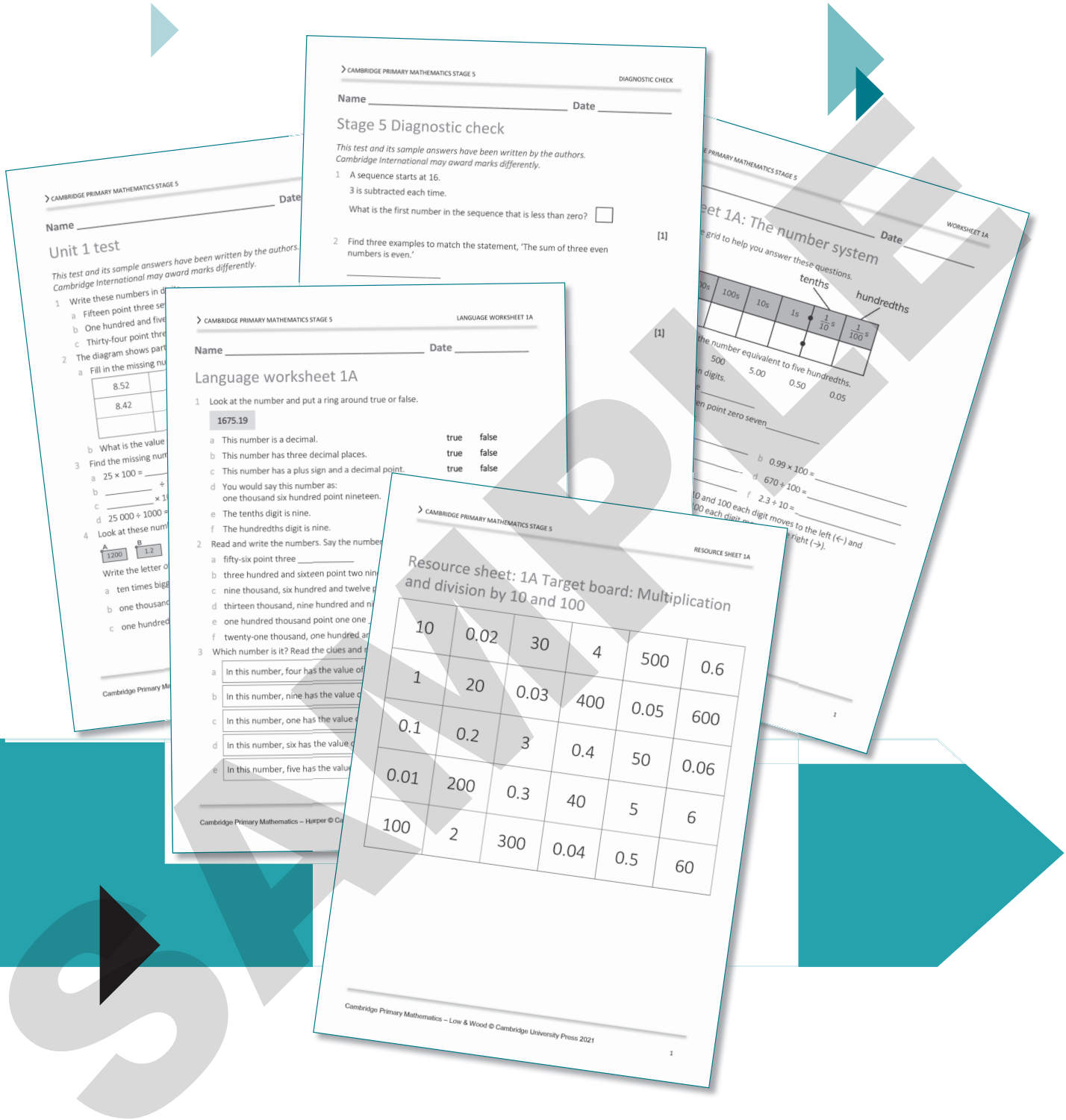
Additionally, the Teacher's Resource includes:

- **Diagnostic check and mark scheme:** a test to use at the beginning of the year to discover the level that learners are working at. The results of this test can inform your planning.
- **Mid-year test and mark scheme:** a test to use after learners have studied half the units in the Learner's Book. You can use this test to check whether there are areas that you need to go over again.
- **End-of-year test and mark scheme:** a test to use after learners have studied all units in the Learner's Book. You can use this test to check whether there are areas that you need to go over again, and to help inform your planning for the next year.
- **Answers to Learner's Book questions**
- **Answers to Workbook questions**
- **Glossary**

In addition, you can find more detailed information about teaching approaches.

Audio is available for download from Cambridge GO (as part of this Teacher's Resource and as part of the digital resources for the Learner's Book and Workbook).

Video is available through the Digital Classroom.



About the curriculum framework

The information in this section is based on the Cambridge Primary Mathematics curriculum framework from 2020. You should always refer to the appropriate curriculum framework document for the year of your learners' examination to confirm the details and for more information. Visit ***www.cambridgeinternational.orglprimary*** *to find out more.*

The Cambridge Primary Mathematics curriculum framework from 2020 has been designed to encourage the development of mathematical fluency and ensure a deep understanding of key mathematical concepts. There is an emphasis on key skills and strategies for solving mathematical problems and encouraging the communication of mathematical knowledge in written form and through discussion.

At the Primary level, it is divided into three major strands:

- Number
- Geometry and Measure
- Statistics and Probability.

Algebra is introduced as a further strand in the Cambridge Lower Secondary Mathematics curriculum framework.

Underpinning all of these strands is a set of Thinking and Working Mathematically characteristics that will encourage learners to interact with concepts and questions. These characteristics are present in questions, activities and projects in this series. For more information, see the *Introduction to Thinking and Working Mathematically* section in this resource, or find further information on the Cambridge Assessment International Education website.

A curriculum framework correlation document (mapping the Cambridge Primary Mathematics resources to the learning objectives) and scheme of work are available to download from Cambridge GO (as part of this Teacher's Resource).

About the assessment

Information concerning the assessment of the Cambridge Primary Mathematics curriculum framework is available on the Cambridge Assessment International Education website: **www.cambridgeassessment.org**

Introduction to Thinking and Working Mathematically

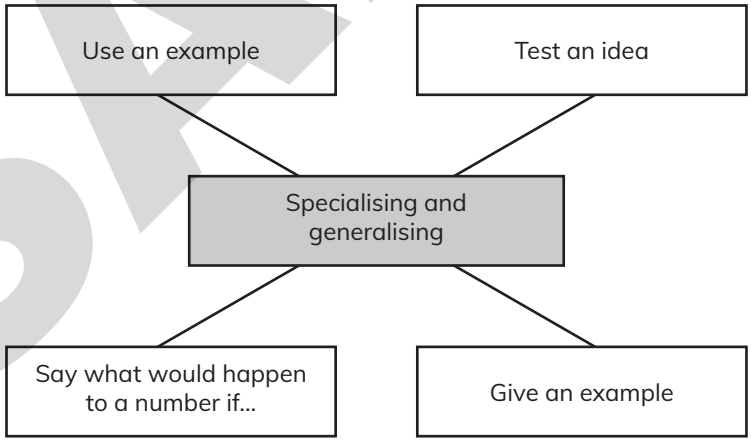
Thinking and working mathematically is an important part of the Cambridge Primary Mathematics course. The curriculum identifies four pairs of linked characteristics: specialising and generalising, conjecturing and convincing, characterising and classifying, and critiquing and improving.

There are many opportunities for learners to develop these skills throughout Stage 5. Throughout the exercises in the Learner's Book and the Workbook, we have added this icon alongside questions that can be used by you with your learners to develop the Thinking and Working Mathematically characteristics. There is a list of these questions and their intended characteristics in the teaching notes for each unit.

This section provides examples of questions that require learners to demonstrate the Thinking and Working Mathematically characteristics, along with sentence starters to help learners formulate their thoughts. Within the teaching notes for each unit, we have also selected one question from each exercise and provided further guidance on Thinking and Working Mathematically within the context of the question to help familiarise you with all of the characteristics.

There is a separate Thinking and Working Mathematically resource sheet for learners that you can download.

Specialising and generalising

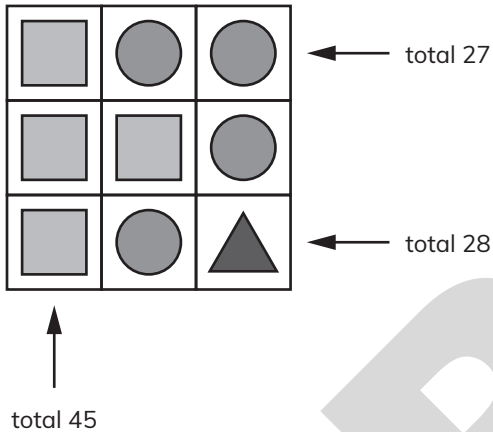


Specialising

Specialising involves choosing and testing an example to see if it satisfies or does not satisfy specific maths criteria. Learners look at specific examples and check to see if they do or do not satisfy specific criteria.

Example:

Each symbol stands for a number.



Find the value of each symbol.

Learners will show they are **specialising (TWM.01)** when they choose a value for each shape and check to see that it works, for example try $\square = 15$ then $15 \times 3 = 45$, which is the correct total for the first column. Learners complete the puzzle and check all the totals.

SENTENCE STARTERS

- I could try ….
- …. is the only one that …..
- …. is the only one that does not …..

Generalising

Generalising involves recognising a wider pattern by identifying many examples that satisfy the same maths criteria. Learners make connections between numbers, shapes and so on and use these to form rules or patterns.

Example:

Pierre starts counting at 88 and counts back in steps of 8.

88, 80, 72, 64, …

1 Will the number 1 be in the sequence?

2 How can you tell without counting back?

Learners will show they are **generalising (TWM.02)** when they notice properties of the sequence, for example all the numbers are multiples of 8. They use these properties to answer the questions:

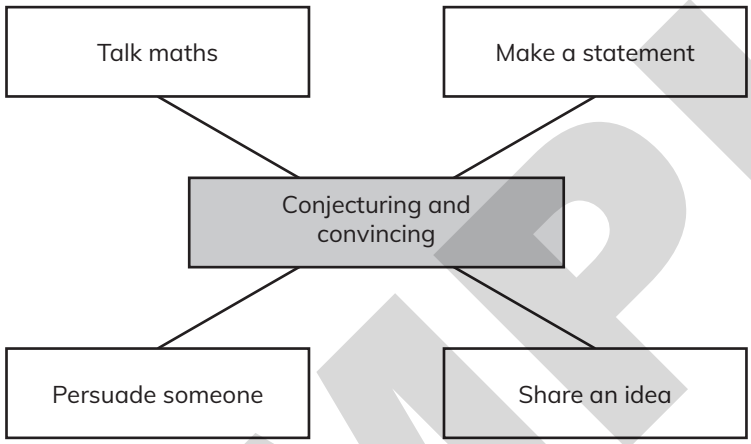
Answer:

1. No.
2. The numbers in the sequence are multiples of 8 so Pierre will count back to 8, then zero.

SENTENCE STARTERS

- I found the pattern... so...

Conjecturing and convincing



Conjecturing

Conjecturing involves forming questions or ideas about mathematical patterns. Learners say what they notice or why something happens or what they think about something.

Example:

> While multiplying 2-digit whole numbers by 2-digit whole numbers, Mia notices patterns of odd and even numbers. She makes a conjecture, 'The product of two consecutive numbers is always even.' She finds examples such as 17 × 18 = 306 to test her conjecture.

Learners will show they are **conjecturing (TWM.03)** when they form ideas about answers in this way.

SENTENCE STARTERS

- I think that ....
- I wonder if ....

Convincing

Convincing involves presenting evidence to justify or challenge mathematical ideas or solutions. Learners persuade people (a partner, group, class or an adult) that a conjecture is true.

Example:

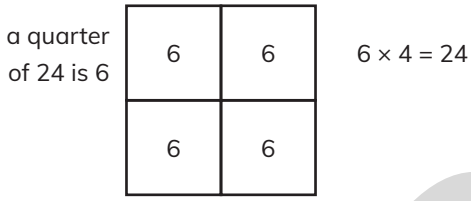
Ahmed says, 'I know that one quarter of a number is 6 so I can find the number by multiplying 6 by 4.'

Is Ahmed correct?

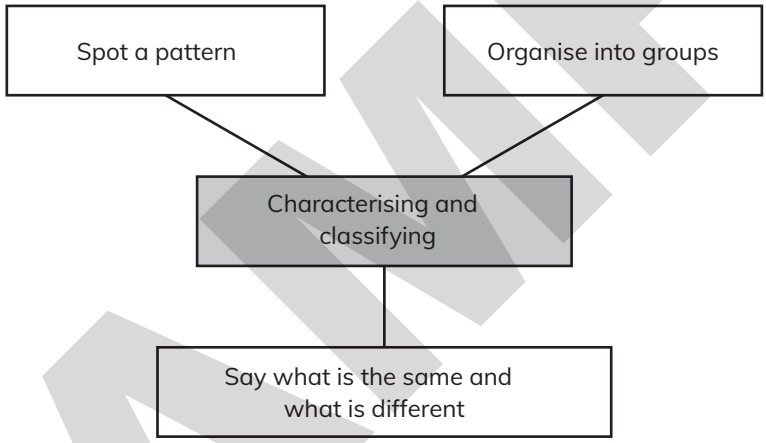
Explain your answer.

Learners will show they are **convincing (TWM.04)** when they use their knowledge and understanding of fractions to explain that the number is four quarters, which is 4 times bigger than one quarter. The number is 24 (since $6 \times 4 = 24$), so Ahmed is correct.

Learners could draw a diagram to help them justify their solution.



Characterising and classifying



Characterising

Characterising involves identifying and describing the properties of mathematical objects. Learners identify and describe the mathematical properties of a number or object.

Example:

Which of these numbers are prime numbers?

11, 21, 31, 41, 51, 61

How do you know they are prime numbers?

Learners will show they are **characterising (TWM.05)** when they identify and explain the properties of prime numbers as numbers that have just two factors, 1 and the number itself, and use this property to identify the prime numbers as 11, 31, 41 and 61. They could also explain that 21 and 51 have more than two factors so they can't be prime numbers.

Answer:

Factors of 21 are 1, 3, 7 and 21

Factors of 51 are 1, 3, 17 and 51

SENTENCE STARTERS

- This is similar to … so ….
- The properties of … include ….

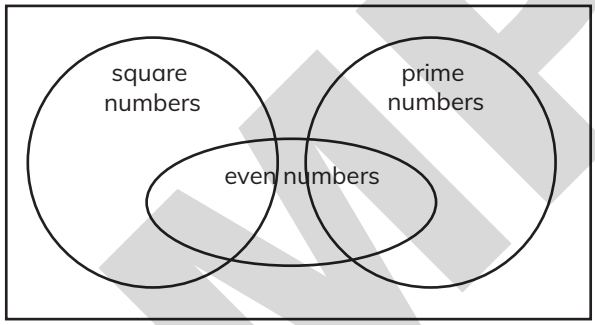
Classifying

Classifying involves organising mathematical objects into groups according to their properties. Learners organise objects or numbers into groups according their mathematical properties. They use Venn and Carroll diagrams.

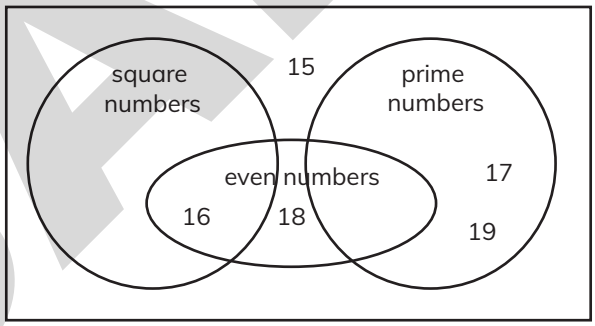
Example:

Write each number in the correct place on the diagram.

15 16 17 18 19



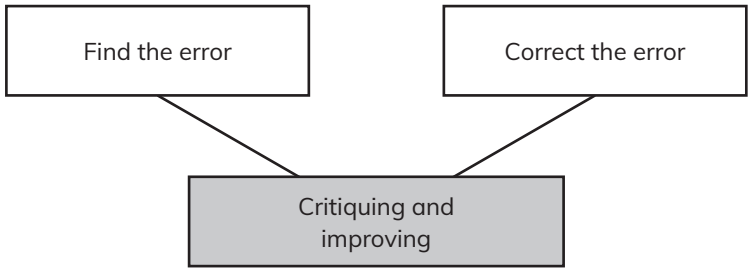
Learners show they are **classifying (TWM.06)** when they sort the numbers into groups according to their properties.



SENTENCE STARTERS

- … go together because ….
- I can organise the … into groups according to … .

Critiquing and improving



Critiquing

Critiquing involves comparing and evaluating mathematical ideas for solutions to identify advantages and disadvantages. Learners compare methods and ideas by identifying their advantages and disadvantages.

Example:

Fatima and Bibi calculate 120 + 221 + 480 using different strategies.

This is Fatima's method.	This is Bibi's method.
120 + 221 + 280	120 + 221 + 280
120 + 221 = 341	120 + 280 = 400
341 + 280 = 621	400 + 221 = 621
Answer 621	Answer 621

Which method do you prefer? Explain your answer.

Learners will show they are **critiquing (TWM.07)** when they compare the methods to identify the advantages and disadvantages of each method.

SENTENCE STARTERS

- the advantages of ... are and the disadvantages are ...

Improving

Improving involves refining mathematical ideas to develop a more effective approach or solution. Learners find a better solution.

Example:

Throughout the course learners are asked to reflect on their learning. Often, they are given prompts or questions to help them improve their answers, for example a question requiring an explanation:

'If you found it hard, try explaining your answers to your partner first and then work together to write down your thoughts.'

More general prompts include:

- Where did you start? Why?
- What calculations did you do?
- How did you check your solutions?
- How can you improve how you solve problems like this?

Learners are **improving (TWM.08)** when they respond to prompts or questions to help them revise their answer.

SENTENCE STARTERS

- The method would be better if …….
- I can improve the method by …….

Approaches to teaching and learning

The following are the key pedagogies underpinning our course content and how we understand and define them.

Active learning

Active learning is a teaching approach that places student learning at its centre. It focuses on how students learn, not just on what they learn. We, as teachers, need to encourage learners to 'think hard', rather than passively receive information. Active learning encourages learners to take responsibility for their learning and supports them in becoming independent and confident learners in school and beyond.

Assessment for Learning

Assessment for Learning (AfL) is a teaching approach that generates feedback which can be used to improve learners' performance. Learners become more involved in the learning process and, from this, gain confidence in what they are expected to learn and to what standard. We, as teachers, gain insights into a learner's level of understanding of a particular concept or topic, which helps to inform how we support their progression.

Differentiation

Differentiation is usually presented as a teaching approach where teachers think of learners as individuals and learning as a personalised process. Whilst precise definitions can vary, typically the core aim of differentiation is viewed as ensuring that all learners, no matter their ability, interest or context, make progress towards their learning intentions. Teachers therefore need to be responsive, and willing and able to adapt their teaching to meet the needs of their learners.

Language awareness

For many learners, English is an additional language. It might be their second or perhaps their third language. Depending on the school context, learners might be learning all or just some of their subjects through English.

For all learners, regardless of whether they are learning through their first language or an additional language, language is a vehicle for learning. It is through language that students access the learning intentions of the lesson and communicate their ideas. It is our responsibility, as teachers, to ensure that language doesn't present a barrier to learning.

Metacognition

Metacognition describes the processes involved when learners plan, monitor, evaluate and make changes to their own learning behaviours. These processes help learners to think about their own learning more explicitly and ensure that they are able to meet a learning goal that they have identified themselves or that we, as teachers, have set.

Skills for Life

How do we prepare learners to succeed in a fast-changing world? To collaborate with people from around the globe? To create innovation as technology increasingly takes over routine work? To use advanced thinking skills in the face of more complex challenges? To show resilience in the face of constant change? At Cambridge, we are responding to educators who have asked for a way to understand how all these different approaches to life skills and competencies relate to their teaching. We have grouped these skills into six main Areas of Competency that can be incorporated into teaching, and have examined the different stages of the learning journey and how these competencies vary across each stage.

These six key areas are:

- Creativity – finding new ways of doing things, and solutions to problems
- Collaboration – the ability to work well with others
- Communication – speaking and presenting confidently and participating effectively in meetings
- Critical thinking – evaluating what is heard or read, and linking ideas constructively
- Learning to learn – developing the skills to learn more effectively
- Social responsibilities – contributing to social groups, and being able to talk to and work with people from other cultures.

Cambridge learner and teacher attributes

This course helps develop the following Cambridge learner and teacher attributes.

Cambridge learners	Cambridge teachers
Confident in working with information and ideas – their own and those of others.	**Confident** in teaching their subject and engaging each student in learning.
Responsible for themselves, responsive to and respectful of others.	**Responsible** for themselves, responsive to and respectful of others.
Reflective as learners, developing their ability to learn.	**Reflective** as learners themselves, developing their practice.
Innovative and equipped for new and future challenges.	**Innovative** and equipped for new and future challenges.
Engaged intellectually and socially, ready to make a difference.	**Engaged** intellectually, professionally and socially, ready to make a difference.

Reproduced from Developing the Cambridge learner attributes *with permission from Cambridge Assessment International Education.*

More information about these approaches to teaching and learning is available to download from Cambridge GO (as part of this Teacher's Resource).

Setting up for success

Our aim is to support better learning in the classroom with resources that allow for increased learner autonomy while supporting teachers to facilitate student learning.

Through an active learning approach of enquiry-led tasks, open-ended questions and opportunities to externalise thinking in a variety of ways, learners will develop analysis, evaluation and problem-solving skills.

Some ideas to consider to encourage an active learning environment are as follows:

- Set up seating to make group work easy.
- Create classroom routines to help learners to transition between different types of activity efficiently, e.g. move from pair work to listening to the teacher to independent work.
- Source mini-whiteboards, which allow you to get feedback from all learners rapidly.
- Start a portfolio for each learner, keeping key pieces of work to show progress at parent–teacher days.
- Have a display area with learner work and vocab flashcards.

Planning for active learning

1. **Planning learning intentions and success criteria:** these are the most important features of the lesson. Teachers and learners need to know where they are going in order to plan a route to get there.
2. **Introducing the lesson:** include a 'hook' or starter to engage learners using imaginative strategies. This should be an activity where all learners are active from the start of the lesson.
3. **Managing activities:** during the lesson, try to: give clear instructions, with modelling and written support; coordinate logical and orderly transitions between activities; make sure that learning is active and all learners are engaged; create opportunities for discussion around key concepts.
4. **Assessment for Learning and differentiation:** use a wide range of Assessment for Learning techniques and adapt activities to a wide range of abilities. Address misconceptions at appropriate points and give meaningful oral and written feedback which learners can act on.
5. **Plenary and reflection:** at the end of each activity and at the end of each lesson, try to: ask learners to reflect on what they have learnt compared to the beginning of the lesson; build on and extend this learning.

To help planning using this approach, a blank Lesson plan template is available to download from Cambridge GO (as part of this Teacher's Resource). There are also examples of completed lesson plans.

We offer a range of Professional Development support to help you teach Cambridge Primary Mathematics with confidence and skill. For details, visit **cambridge.org/education**

Developing mental strategies

Learners begin to use mental methods in the early stages of learning mathematics, usually starting with counting objects and progressing to using number lines or squares to help them work out answers. Later they are taught to remember and recall number facts and develop the language necessary to talk about mathematics. As they progress, they learn more sophisticated mental methods. They may develop some methods intuitively, but some you will need to teach. It is important that you provide regular opportunities for learners to explain and discuss their methods so they share ideas with one another and acquire a range of mental strategies.

At some stage, it can be hard for learners to hold intermediate steps of a calculation in their head. At this point, encourage them to make notes or jottings. Not all learners will do a mental calculation in the same way, but some methods are more efficient and reliable than others. If you allow time for learners to discuss, explain and compare different methods you can guide them towards choosing and using efficient methods. Learners will see the need for methods that can be applied generally and this eventually leads towards using standard written methods.

You should start all mathematics lessons with a counting activity, tables or other mental activity. The session can be used to:

- practise and consolidate the rapid and accurate recall of number facts
- revise mental strategies for tackling number problems
- explain and demonstrate new mental strategies
- discuss different ways of solving problems
- reinforce the correct use of mathematical vocabulary.

Calculators can be used as a teaching aid to promote mental calculation and explore mathematical patterns. Learners will, with guidance from you, start to understand when it is appropriate to use a calculator.

This section provides details of activities and games to play with the whole class. They can be used within lessons to develop strategies for mental calculations involving addition, subtraction, multiplication and division as well as other curriculum content. Expect to spend about 10 minutes on each activity. Most of them can be used effectively as starters, main activities or plenaries.

LANGUAGE SUPPORT

There is a lot of vocabulary associated with the four basic mathematical operations. You may want to display these words in the classroom to help learners become familiar with them. You should ensure learners are using the correct vocabulary in discussions and encourage them to use a variety of terms, perhaps by asking questions such as 'How else could you say that?'

Addition		Subtraction	
add	total	subtract	difference
more	altogether	take away	count back
plus	count on	minus	decrease
sum	increase	leave	
Multiplication		**Division**	
lots of	multiply	share	halve
groups of	product	group	
times	double	divide	

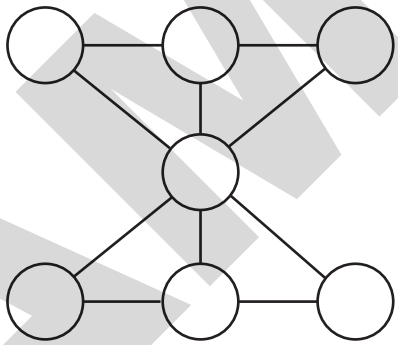
Teaching ideas

1 Number puzzles

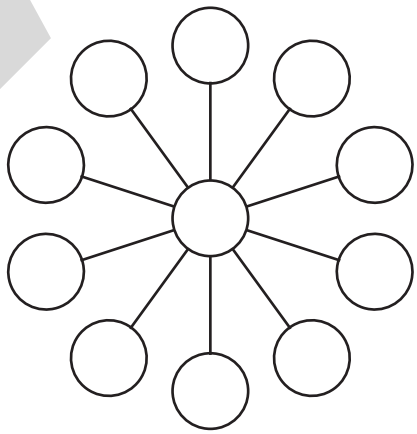
Resources: None.

Description: Write the puzzle on the board, give learners time to find a solution then discuss answers and ways of tackling the problem.

1 Can you put the numbers 1 to 7 in each circle so that the total of every line is 12?



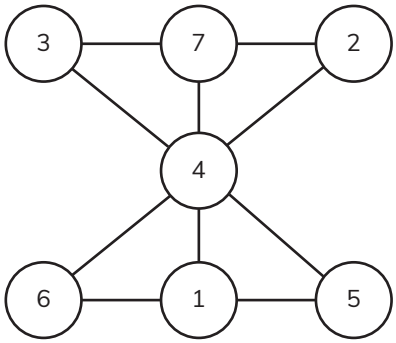
2 Can you put the numbers 1 to 11 in the circles so that every line has the same total?

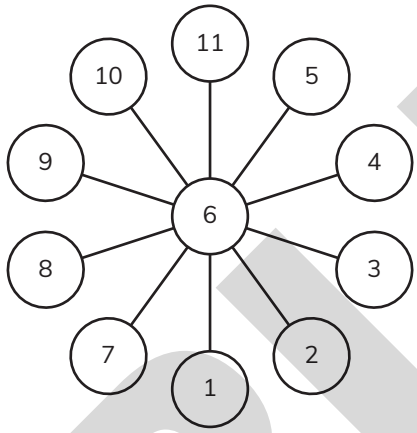


Questions to pose:

- Which number goes in the middle? How do you know?
- Can you find a different solution?

Answer:





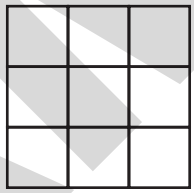
This activity is good for reminding learners of problem solving strategies.

2 Table practice – a game for 2 players

Resources: A dice or spinner.

Description: These instructions are given for the seven times table; you can adapt them for other tables.

Each player draws a 3 by 3 grid.



Player 1 rolls the dice, multiplies the score by 7 and records the answer in their grid. Player 2 then does the same thing. Continue until both players' grids are full.

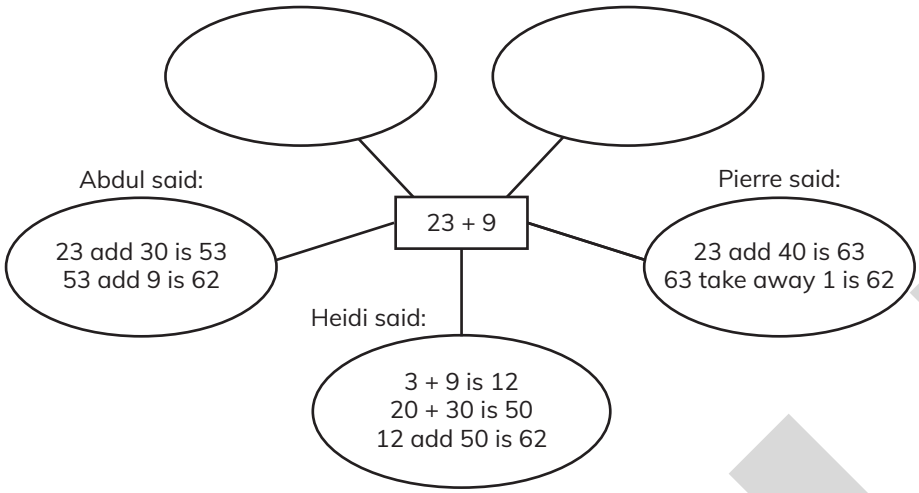
Players take turns to roll the dice again. Multiply the dice score by 7. If the answer is on either player's grid then they cross out that number. If the number appears more than once, only cross out one number.

The winner is the first player to have all their numbers crossed out.

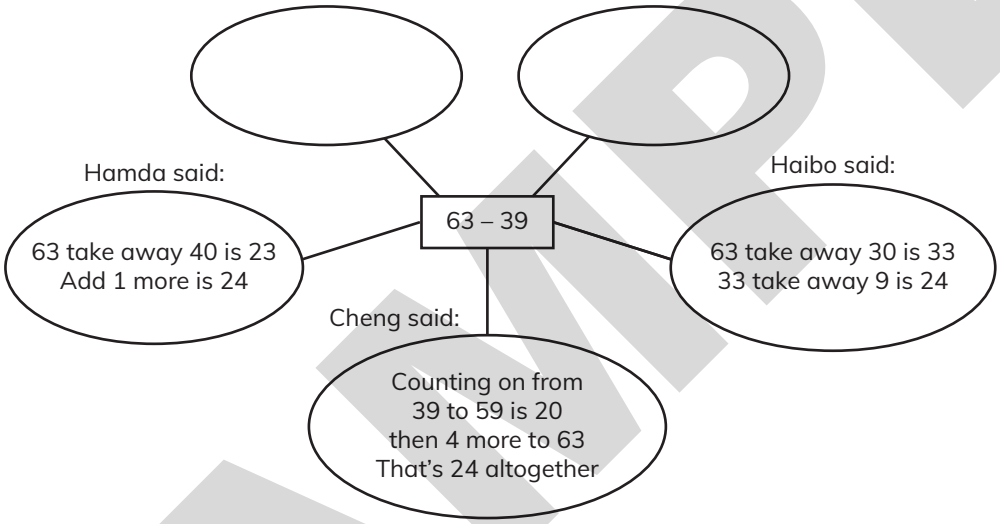
3 Mental methods for addition and subtraction

Resources: Display diagrams.

Description: Display the following diagram and say 'There are many ways of adding 23 and 39 mentally. Here are three of them. Does anyone have a different method?' Discuss alternative methods, then ask learners which method they prefer and why. Learners will be **critiquing (TWM.07)** when they compare the methods to identify advantages and disadvantages of each one.



Repeat with subtraction.



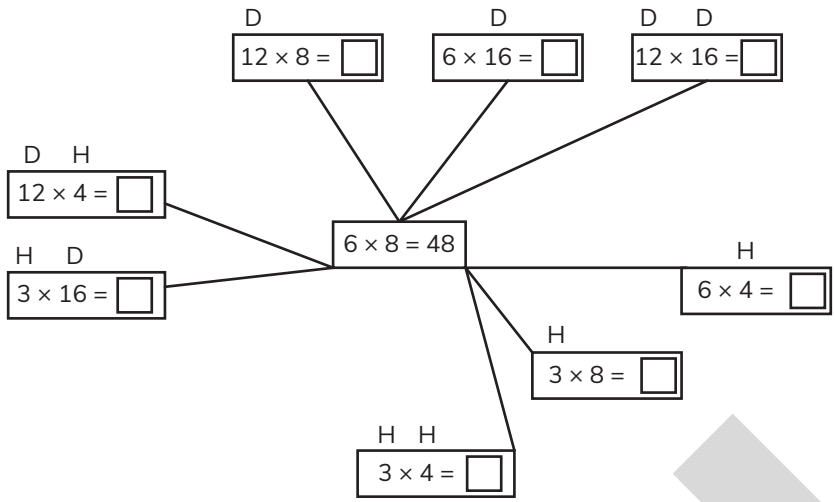
You could extend this activity to addition and subtraction of bigger numbers or numbers with the same number of decimal places.

4 Doubling and halving (1)

Resources: Display diagram.

Description: Start with a known fact, for example 6 × 8 = 48, and ask learners to use this fact to work out the other facts on the diagram. (On the diagram, D represents double and H halve. You may wish to add these later as you take feedback.)

Allow a few minutes for learners to find solutions, then take feedback.



Summarise the feedback, by listing the strategies.

Using doubling and halving

- Doubling one number and halving the other in a known fact leaves the answer unchanged, for example:
  - 6 × 8 = 3 × 16 = 48
  - 6 × 8 = 12 × 4 = 48
- Use halving starting from a known fact, for example if you know that 6 × 8 = 48 then halving one of the numbers gives:
  - 6 × 4 = 24
  - 3 × 8 = 24
- Use doubling starting from a known fact, for example if you know that 6 × 8 = 48 then doubling one of the numbers gives:
  - 6 × 16 = 96
  - 12 × 8 = 96

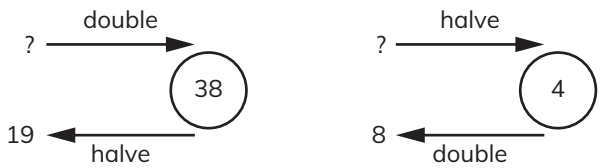
Explain that it is possible to continue doubling to include larger numbers and halving to include fractions and decimals.

5 Doubling and halving (2)

Resources: None.

Description: Remind learners that doubling and halving are **inverse operations** by using 'Think of a number activities'. For example:

- I'm thinking of a number. When I double it my answer is 38. What is my number?
- I'm thinking of a number. When I halve it my answer is 4. What number am I thinking of?



6 Multiplication and division using factors

Resources: None.

Description: Ask learners to jot down the answers to these calculations:

$3 \times 6 = \square$ $30 \times 6 = \square$ $300 \times 6 = \square$ $3 \times 60 = \square$ $3 \times 600 = \square$

Ask, 'How did you work out your answers?'

Say that 3 and 10 are **factors** of 30, so we have used factors to help us multiply.

30 × 6 split 30 into 10 × 3

10 × 3 × 6

10 × 18

= 180

Ask learners to use factors to help them multiply 35 × 8 and divide 96 by 6. Take feedback and summarise strategies:

Using factors

- Split one number into a factor pair to make multiplication easier, for example:

35 × 8 split 35 into 7 × 5

7 × 5 × 8

7 × 40

= 280

- Split one number into a factor pair to make division easier, for example:

96 ÷ 6 split 6 into 2 × 3

96 ÷ 2 ÷ 3 96 ÷ 2 = 48 then 48 ÷ 3

= 16

Remind learners that this method is based on the **Associative law** (see Unit 17).

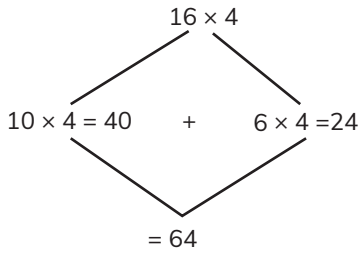
7 Multiplication and division using decomposition

Resources: None.

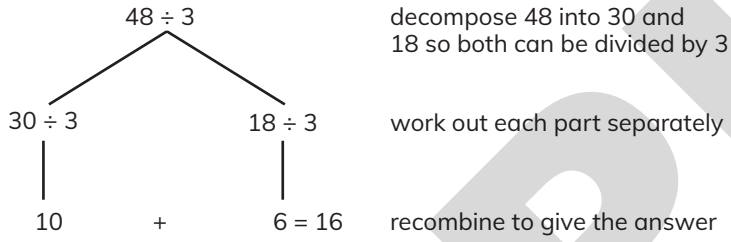
Description: Ask learners to look at these calculations and then explain the methods to their partner. Take feedback and summarise strategies.

Using decomposition

- Decompose a number to make a simpler multiplication, for example:



- Decompose a number to make a simpler division, for example:



Ask learners to do these calculations:

96 × 7 132 ÷ 6

Answer: 672, 22

Remind learners that this method is based on the **Distributive law** (see Unit 17).

8 Think of a number

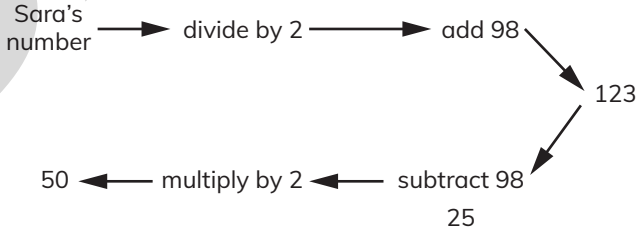
Resources: None.

Description: Present 'Think of a number' questions involving multiplication and division, for example:

Sara thinks of a number. She divides her number by 2 and adds 98 to the result. Her answer is 123. What is Sara's number?

Answer: 50

A method of recording:



Assessment ideas: This activity enables you to assess learners' understanding of multiplication and division as **inverse operations.**

9 Games using multiples and factors

Resources: Two 1–6 dice in different colours (or use spinners or digit cards).

Description:

Game 1: Multiples

Players draw a grid.

	7	2	4	Score ↓
3				
8				
5				
→ Score				

Total

Roll both dice to make a 2-digit number. Tell players to place the number in one of the nine boxes on their grid, aiming for it to be a multiple of both numbers on the axes. Repeat until all the boxes are filled.

Players score 1 point each time their number is a multiple of the number in the row or column heading.

Example:

	7	2	4	Score ↓
3	21	16	12	2
8	24	14	51	1
5	35	53	55	2
→ Score	2	2	1	10

Total

Game 2: Factors

Adapt game 1 so that players are aiming to find factors of given numbers using a 1–6 dice to give a 1-digit number and an adapted grid, for example:

	20	36	9	Score ↓
24				
18				
10				
→ Score				

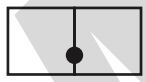
Total

Try asking players to choose their own numbers to place on the axes. After the game is completed discuss which were good/bad numbers to choose and why.

10 Game: compare and order decimals

Resources: A 0–9 dice or spinner or a set of digit cards.

Description: Players draw a grid:



Ask players to make a number between 1.5 and 8.5; 2.3 and 6; 0.3 and 5 and so on. Discuss how answers can be written as a number sentence, for example 3.8 is between 1.5 and 8.5 and can be written as $1.5 < 3.8 < 8.5$.

11 Multiplying a decimal by a whole number

Resources: None.

Description: Ask learners to look at this calculation and then explain the method to their partner.

0.8×7

$8 \div 10$ $\quad$ $\times 7$

$= 8 \times 7 \div 10$

$= 56 \div 10$

$= 5.6$

Answer:

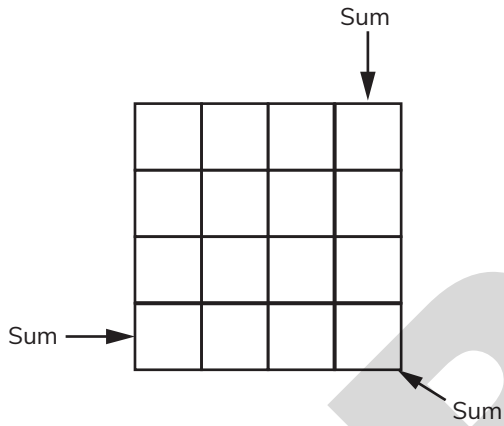
- Write 0.8 as $8 \div 10$.
- Change the order of multiplying/dividing (Associative law).
- Multiply 8 by 7 and divide the answer by 10.

Explain that we can use this method to multiply any number with 1 decimal place by a whole number.

12 Addition of fractions

Resources: A spinner labelled $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{1}{8}$, $\frac{3}{8}$ and $\frac{5}{8}$.

Description: Each player draws a grid:



Use the spinner to generate a fraction. Tell players to place the fraction in one of the nine boxes on the grid. Repeat eight more times. When all the boxes are filled, tell players to find the sum of the three rows, three columns and the diagonal. Any of the sums that appear only once must be crossed out. Add the remaining sums to give the total score.

Plenary ideas

1 The answer is … What is the question? (5–10 minutes)

Resources: None.

Description: Write a number on the board, for example 144, and ask learners to write down three questions that would give an answer of 144. Collect ideas and discuss the methods used to give the answer.

› **Assessment ideas:** Listening to learners' responses will give you information about how well learners chose an appropriate strategy.

2 True or false? (10 minutes)

Resources: None.

Description: As learners are working on mental calculation activities, look out for errors that they make. Use these as a basis for writing number sentences on the board and also include some statements that are correct. Learners must decide whether each statement is true or false and explain their decision.

Example: 2.5 + 3.9 = 5.14 is false because:

- The answer should have 1 decimal place, not 2.
- An estimate (by rounding each decimal number to the nearest whole number) would give 3 + 4 = 7 which is much bigger than 5.14.

› **Assessment ideas:** Listening to learners' responses will give you information about how well they are making connections, for example to work on estimation.

3 What else do you know? (10–15 minutes)

Resources: None.

Description: Write a multiplication fact such as 1.2 × 10 = 12 on the board. Ask learners to construct a diagram to show other facts that can be found. Start them off by giving a set of related facts, for example:

$$\boxed{1.2 \times 10 = 12} \longrightarrow \boxed{1.2 \times 5 = 6} \longrightarrow \boxed{0.6 \times 5 = 3}$$

Explain that they can continue this 'branch' or start a new 'branch'.

Allow five minutes for learners to work on their diagrams, then work as a class to build a diagram using as many different mental methods as possible.

› **Assessment ideas:** Watching learners as they work and listening to their suggestions will give you information about their progress.

4 Using known facts to find new facts (10–15 minutes)

Resources: None.

Description: Write this question on the board:

Here are some number facts.

1 × 17 = 17

2 × 17 = 34

4 × 17 = 68

8 × 17 = 136

Use these facts to work out 13 × 17.

Show your method.

Answer:
Show how to add the products for 1 × 17, 4 × 17 and 8 × 17

1 × 17 = 17
4 × 17 = 68
8 × 17 = 136
13 × 17 = 221

› **Assessment ideas:** Watching learners as they work and listening to their suggestions will give you information about their progress.

1 The number system

Unit plan

Topic	Approximate number of learning hours	Outline of learning content	Resources
1.1 Understanding place value	4	Explain the value of a digit in a decimal (tenths and hundredths). Multiply and divide whole numbers by 1000. Multiply and divide decimals by 10 and 100. Compose, decompose and regroup numbers, including decimals (tenths and hundredths).	Learner's Book Section 1.1 Workbook Section 1.1 Additional teaching ideas for Section 1.1 Resource sheet 1A Resource sheet 1B Resource sheet 1C Resource sheet 1D
1.2 Rounding decimal numbers	3	Round numbers with 1 decimal place to the nearest whole number.	Learner's Book Section 1.2 Workbook Section 1.2 Additional teaching ideas for Section 1.2 Resource sheet 1E Resource sheet 1F
Cross-unit resources			
Diagnostic check and mark scheme **Digital Classroom:** Unit 1 slideshow **Digital Classroom:** Unit 1 activity Worksheet 1A Worksheet 1B Language worksheet 1A Language worksheet 1B Learner's Book Check your progress Unit 1 test and answers			

Thinking and Working Mathematically questions in Unit 1

Questions	TWM characteristics covered
Learner's Book	
Exercise 1.1 question 8	Critiquing
Exercise 1.1 question 9	Classifying
Exercise 1.1 Think like a mathematician	Specialising
Exercise 1.2 question 5	Convincing
Exercise 1.2 question 6	Specialising
Check your progress question 8	Specialising
Workbook	
Exercise 1.1 question 11	Specialising
Exercise 1.1 question 13	Specialising
Exercise 1.1 question 17	Critiquing
Exercise 1.2 question 2	Generalising
Exercise 1.2 question 4	Generalising
Exercise 1.2 question 10	Generalising
Exercise 1.2 question 11	Classifying

BACKGROUND KNOWLEDGE

We are surrounded by numbers in our everyday life. Some of these are whole numbers and some are decimals. Having a display of pictures in the classroom can help learners to see how numbers affect their lives.

In earlier stages, learners used place value charts to help them understand place value. In Stage 4, learners worked with whole numbers, reading and writing them correctly. Learners understood and explained how the value of each digit was determined by its position in a number.

CONTINUED

They learned how to decompose and regroup numbers as a basis for adding and subtracting numbers in columns. They used their knowledge of place value to multiply and divide whole numbers by 10 and 100. They rounded whole numbers to the nearest 10, 100, 1000, 10 000 and 100 000.

In this unit, learners build on these experiences as the range of numbers is increased to include decimals.

Digital Classroom: Use the Unit 1 slideshow to demonstrate examples of the number system in everyday life. The i button will explain how to use the slideshow.

Supporting learners with the Getting started exercise

To support learners with work on the number system, provide regular counting and other number activities during lesson starters and ensure that there are visual representations such as place value charts and number lines in the classroom.

Check prior learning by reviewing learner's work using the Getting started exercise in the Learner's Book. Use question 1 to make sure that learners can read, write and say numbers correctly.

If necessary, give learners a reference grid to keep inside their book **(see figure 1 below)**.

A good understanding of place value underpins all calculation work. One of the main ideas in place value is that the value of a digit depends on its position in the number; this is addressed in question 2. Try asking learners a question relating to real life to support this thinking: 'Think about what the digit 7 is worth in $7 and $70. You have $67. Do you have enough money to buy a bike costing $70?'

Learners should be able to compose, decompose and regroup numbers, as in questions 3 and 4. Support those who struggle by using a place value chart **(see figure 2 below)**.

Questions 5 and 6 focus on multiplication and division by 10 and 100. Demonstrate on a place value grid how moving a digit one place to the left represents multiplication by 10 and moving two places to the left represents multiplication by 100. Division can be represented as movements to the right.

Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
100 000s	10 000s	1000s	100s	10s	1s

Figure 1: place value reference grid

100 000	200 000	300 000	400 000	500 000	600 000	700 000	800 000	900 000
10 000	20 000	30 000	40 000	50 000	60 000	70 000	80 000	90 000
1000	2000	3000	4000	5000	6000	7000	8000	9000
100	200	300	400	500	600	700	800	900
10	20	30	40	50	60	70	80	90
1	2	3	4	5	6	7	8	9

Figure 2: eight hundred and five thousand, four hundred and sixty nine

805 469 = 800 000 + 5000 + 400 + 60 + 9

TEACHING SKILLS FOCUS

Self-assessment

You can create amazing lessons, but only your learners can do the learning. You will need to guide learners in how to approach their work and use feedback positively. You will need to encourage them to be reflective about the quality of their thinking and the work they produce by asking questions about their learning:

- What do I know?
- What do I need to know?
- How can I improve this?
- What made sense and what didn't?
- What did I do well and what can I improve?

There are many features in the Learner's Book that encourage self-assessment, so try to help learners understand how to get the best out of the book.

At the beginning of every unit, learners are asked to complete a short exercise called 'Getting started'. This informs them of some of the facts, skills and strategies needed for the unit. When you give the answers, encourage them to assess their knowledge and work out if they need to revisit anything. If any learners are having difficulties, you will find helpful guidance in the Background knowledge section of these notes.

At the beginning of each section in the unit, learners are presented with a list of 'We are going to…' statements so they can check what they will be learning and see how they are doing as they work through the section. At the end of each section there are 'I can …' statements, so they can check that they are on target and seek help if this is not the case.

As part of each exercise there are prompts to check work and reflect on their progress. Ensure that these prompts are taken seriously. They include, for example:

- Look back over your answers. Did you use the worked example to help you? Did you find any question particularly hard? Why?
- Think about the questions you have just answered. If you were asked similar questions, what would you do differently?

Reflect on how your learners respond to self-assessment. Have you noticed any improvement over time? How might you help them get better?

Mental mathematics guidance

When learners are multiplying and dividing by 10 and 100, you can practise using 'people maths'. Learners hold a digit card and sit on chairs labelled with 1000s, 100s, 10s, 1s, $\frac{1}{10}$s and $\frac{1}{100}$s. They then move one, two or three places to the left or right to show multiplication or division by 10, 100 or 1000 (don't allow division that results in anything smaller than hundredths).

As you discuss methods and answers with learners you will revise and consolidate their place value vocabulary.

You can give purpose to work on rounding by linking it to work on calculation. Learners should use rounding to help them estimate before they calculate so they can check that their calculated answer is correct. Learners have not yet learned how to add decimals, so provide a calculator for the addition/subtraction at this stage.

At a convenient time during a lesson on rounding ask questions such as "Which of these is the best approximation for \$5.08 + \$3.97? How do you know?"

5 + 3 dollars	6 + 4 dollars	5 + 4 dollars
5 + 9.7 dollars	5.1 + 3 dollars	

Acknowledge different, reasoned answers. In this case rounding each number to the nearest whole number (5 + 4) would give an approximation of 9.

1.1 Understanding place value

LEARNING PLAN

Framework codes	Learning objectives	Success criteria
5Np.01	• Understand and explain the value of each digit in decimals (tenths and hundredths).	• Learners explain the value of a digit in a decimal (tenths and hundredths).
5Np.02	• Use knowledge of place value to multiply and divide numbers by 10, 100 and 1000.	• Learners multiply and divide whole numbers by 1000.
5Np.03	• Use knowledge of place value to multiply and divide decimals by 10 and 100.	• Learners multiply and divide decimals by 10 and 100.
5Np.04	• Compose, decompose and regroup numbers including decimals (tenths and hundredths).	• Learners compose, decompose and regroup numbers.

LANGUAGE SUPPORT

The vocabulary related to decimals will be new for learners, so practise using it wherever possible. Insist that decimals are read correctly and learners understand their values, for example:

- 6.4 (read as six point four) means 6 ones and 4 tenths
- 6.40 (read as six point four zero) means 6 ones and 4 tenths and 0 hundredths
- 6.04 (read as six point zero four) means 6 ones and 0 tenths and 4 hundredths.

Sometimes there are differences in the vocabulary used internationally. Some key words have alternative versions, for example:

Used in this book	Alternative
ones	units
decompose	partition or write in expanded form
regroup	recombine

Compose: put together, for example, 600 + 30 + 2 is 632

Decimal: a number written in decimal notation, for example 34.5

Decimal place: the position of a digit to the right of the decimal point in a decimal number. The number 45.67 has two decimal places

Decimal point: the decimal point separates whole numbers from decimal places. You read 57.08 as 'fifty-seven point zero eight'.

10s	1s	$\frac{1}{10}$s	$\frac{1}{100}$s
5	7	0	8

Decompose: break down a number into parts, for example 456 is 400 + 50 + 6

Hundredth: one part in one hundred equal parts; as a decimal it is written as 0.01

CONTINUED

Place value: the value of a digit determined by its position. For example, in 830 the 3 has a value of 3 tens (30)

100s	10s	1s
8	3	0

Regroup: to change the way a number is written. For example, 456 = 400 + 50 + 6, but you can change this to 400 + 40 + 10 + 6

Tenth: one part in ten equal parts. As a decimal it is written as 0.1

Common misconceptions

Misconception	How to identify	How to overcome
Learners may consider hundredths to be greater than tenths.	Through discussion and in written work.	Ensure that place value charts are used as visual prompts.
Learners may misunderstand the concept that multiplying or dividing by 10, 100 or 1000 moves the digits of a number 1, 2 or 3 places to the left or the right.	Through discussion and in written work.	Make sure learners understand that when a digit is moved to the left its value increases (ones become tens and so on) and when it is moved to the right its value decreases. When working with whole numbers, do not condone the use of a 'rule' involving 'add a zero' as this causes difficulties when working with decimal numbers and fractions. Calculators are a useful teaching resource to demonstrate patterns when multiplying and dividing by 10 and 100, as shown in the Multiplying and dividing whole numbers by 10, 100 and 1000 main teaching idea (in the Additional teaching ideas for this section).

Starter idea

Getting started (20 minutes)

Resources: Unit 1 Getting started exercise in the Learner's Book.

Description: Give learners 10 minutes to answer the Getting started questions in their exercise books. After 10 minutes, ask learners to swap their books with a partner and check their partner's answers as you discuss the questions as a class. After the class have marked their work, walk round and check if there are any questions that learners struggled with. You may want to recap particular concepts as a class. Refer to the Background knowledge section at the start of this unit for suggestions of how to address gaps in learners' prior knowledge.

Main teaching idea

Place value (20–30 minutes)

Learning intention: Understand and explain the value of each digit in decimals (tenths and hundredths).

Resources: Resource sheet 1B.

Description: Show a place-value chart. Tell the learners that it is like the one they used in Stage 4 but it has been extended to include decimal numbers.

100	200	300	400	500	600	700	800	900
10	20	30	40	50	60	70	80	90
1	2	3	4	5	6	7	8	9
0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

Ask learners to describe the grid.

Answer: 100 to 900 going across. Divide by 10 each time you move down a row

Point to 0.4 and ask:

- How do you say this number?
- What is ten times this number?

Answer: zero point four, four

Point to 0.04 and ask "How do you say this number?"

Answer: zero point zero four

Repeat for other decimals, emphasising the language.

Show a partly labelled place value grid and ask "What are the titles of the columns marked with a question mark?"

Answer: tenths, hundredths

100s	10s	1s	?	?

Place numbers (up to 2 d.p.) on the grid and ask learners to say the numbers. Then reverse the process: say numbers (up to 2 d.p.) and ask learners to place the numbers on the grid.

Shade cells in the displayed chart to make numbers with 2 decimal places, for example shade 6, 0.5 and 0.01 to make 6.51.

100s	10s	1s	$\frac{1}{10}$s	$\frac{1}{100}$s
		6	5	1

Ask:

- How do you say this number?

Answer: 6.51 is six point five one

- How do you **decompose** this number?

Answer: 6 + 0.5 + 0.01

- Can you **regroup** this number in a different way?

Answer: 5 + 1.5 + 0.01, other answers are possible

- How do you say the number equivalent to 6 ones + 5 tenths + 1 hundredth? Remind learners that when they combine numbers in this way, they are **composing** a number.

Answer: 6.51

Repeat for other numbers and also ask questions about specific place values:

- What is the value of the digit 4 in the number 6.48?

Answer: 4 tenths or $\frac{4}{10}$

- What is the value of the digit 6 in the number 4.06?

Answer: 6 hundredths or $\frac{6}{100}$

Ask learners to work in pairs on the activity in Resource sheet 1B. Make sure they say the numbers as instructed.

Now ask learners to complete questions 1 to 4 of Exercise 1.1 in the Learner's Book.

Differentiation ideas: Support less confident learners by pairing them with a more confident learner who is willing to help them. Ask more confident learners to make sets of three cards offering different ways of decomposing and regrouping decimals, for example:

5.39	5 + 0.3 + 0.09	4 + 1.3 + 0.09

Plenary idea

Target board (10 minutes)

Resources: Copy of target board.

Description: Display the target board:

3.06	2.13	5	3.45	5.18
3.34	3.24	3.3	2.5	4
3	3.1	1.69	3.29	4.79
4.09	3.5	4.9	2	1.8

Ask questions related to it, for example:

- Which number is the result of dividing 409 by 100?

Answer: 4.09

- What is 18 divided by 10

Answer: 1.8

Insist that learners say the decimals correctly (e.g. 3.06 is 'three point zero six').

More teaching ideas are available to download from Cambridge GO (as part of this Teacher's Resource).

Guidance on selected Thinking and Working Mathematically questions

Learner's Book Exercise 1.1, question 9

Learners are given four statements, each with a missing number, and have to work out which is the odd one out. You may need to remind learners that they need to calculate and then compare the missing numbers in order to identify the odd one out.

Learners will show they are **classifying (TWM.06)** when they calculate the missing numbers and notice that three of them are the same, leaving the fourth as the odd one out.

CROSS-CURRICULAR LINKS

Work on the history of measurement will include reference to the metric system. The metric system is an internationally recognised decimalised system of measurement, for example lengths can be measured in millimetres (mm) and centimetres (cm). There are 10 mm in a cm so 1.4 cm = 14 mm.

Learners will use metric measurements in science, for example when working on evaporation they may measure air temperatures in Celsius and the depth of water in a pond in millimetres or centimetres, and understand that 10 mm = 1 cm.

Homework ideas

1. Learners design a poster that shows how to multiply and divide by 10, 100 and 1000. They can illustrate it with examples, including drawings, pictures or photographs. For example:
   - 1 metre is 100 times as long as 1 centimetre
   - 1 cent is 100 times smaller than 1 dollar.
2. Learners write questions and answers based on the target board used in the Target board plenary idea.

1.2 Rounding decimal numbers

LEARNING PLAN

Framework codes	Learning objectives	Success criteria
5Np.05	• Round numbers with one decimal place to the nearest whole number.	• Learners can round a number with one decimal place to the nearest whole number.

LANGUAGE SUPPORT

Learners may find the word 'round' and phrases such as 'round to the nearest…' confusing if they mix up the mathematical and everyday meanings of the word 'round'. Emphasise to learners that in mathematical contexts the word has a particular meaning.

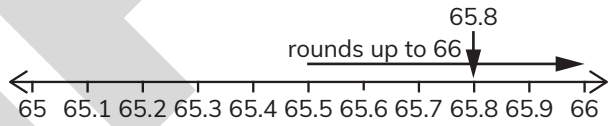
It may be helpful to discuss other ways that 'round' is used in an everyday context, for example:

- something that is circular, for example 'It is a round table'
- to encircle something, for example 'she wrapped a blanket round her friend' or 'the moon goes round the Earth'

Nearest: closest to

Round: change a number to a simpler value when an accurate answer is not needed

Round to the nearest…: you can round a number to the nearest whole number. For example: 65.8 rounded to the nearest whole number is 66



65.8 is closer to 66 than to 65

Common misconceptions

Misconception	How to identify	How to overcome
Learners may misunderstand the convention that 0.5 rounds up to the next whole number.	During discussion and in written work.	Remind learners that the same conventions used with whole numbers apply to rounding decimal numbers.
Learners may misunderstand that the 'nearest whole number' may be different to the whole number part of the original number, for example 10.6 rounds to 11 to the nearest whole number.	During discussion and in written work. Make sure that learners do not just delete decimal places to leave a whole number.	Demonstrate using a number line and encourage learners to use number lines.

Starter idea

Round to the nearest hundred (10 minutes)

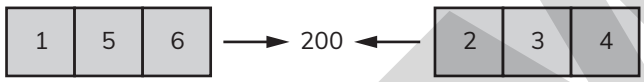
Resources: 0–9 dice or spinner.

Each learner draws a record sheet:

100	200	300	400	500	600	700	800	900	1000

Description: Roll the dice three times to produce 3 digits. Each learner makes a 3-digit number, rounds it to the nearest hundred and writes their 3-digit number above the corresponding multiple of 100. The winner is the first learner to write one number above each of the multiples.

Discuss the strategies used by learners to place the digits. Confident learners will consider which multiples of 100 they need before making their 3-digit numbers. They may realise that 1000 can be made only by rounding up, and 100 can be made only by rounding down unless you allow 0 to be used as a hundreds digit. All other multiples can be made by rounding up or down, for example:



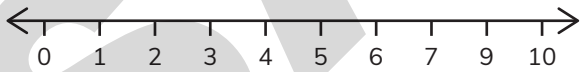
Main teaching ideas

Rounding a decimal to the nearest whole number (20 minutes)

Learning intention: Rounding a decimal with 1 decimal place to the nearest whole number.

Resources: 1–6 dice or spinner.

Description: Show a number line.



Ask learners to place numbers such as 4.5 or 9.8 on the number line.

What is 4.4 rounded to the nearest whole number?

Answer: 4

What is 9.8 rounded to the nearest whole number?

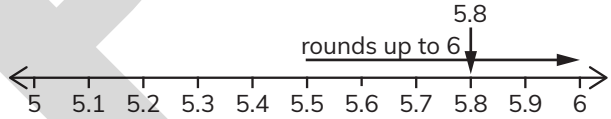
Answer: 10

Remind learners that in Stage 4, they learnt conventions for rounding whole numbers. We apply the same conventions when we round decimals, for example:

To round to the **nearest whole number** look at the tenths digit:

- if it is less than 5 round down
- if it is 5 or more round up.

Example: Round 5.8 to the nearest whole number.



Round these numbers to the nearest whole number.

67.9 4.5 3.2

Answer: 67.9, 4.5, 3.2

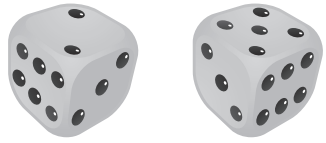
Round these measures to the nearest whole number.

6.7 cm 9.8 m 5.1 km

Answer: 7 cm, 9.8 m, 5.1 km

Dice game (a game for 2 players)

Ask learners to take turns to roll two dice and make a number with 1 decimal place. They should then round this number to the nearest whole number.



You could use
2.5 which rounds to 3
or
5.2 which rounds to 5.

Learners record their answers. The first player to round to each of the numbers 1–7 is the winner.

This game leads nicely into the Think like a mathematician section in the Learner's Book.

Ask learners to complete questions 1 to 3 of Exercise 1.2 in the Learner's Book.

› **Differentiation ideas:** You may need to help some learners to get started with the investigation. They have already made numbers with 1 decimal place when they played the game. Now they are instructed to find all the possible numbers, so they should focus on writing down the numbers in a systematic way.

A number line is provided in question 1. They could draw their own number lines for questions 2 and 3.

You can challenge more confident learners to work in pairs to produce a puzzle or game that involves rounding for the rest of the class to use.

Plenary idea

Feedback to the class (10 minutes)

Resources: None.

Description: See the Using decimals to solve problems main teaching idea (in the Additional teaching ideas for this section). You should warn learners that they are expected to present their findings to give them time to prepare.

› **Assessment ideas:** Ask learners to give feedback on the presentation, giving as many good points as they can and just one suggestion for improvement. Learners will show they are **critiquing (TWM.07)** when they explain their points for improvement.

More teaching ideas are available to download from Cambridge GO (as part of this Teacher's Resource).

Guidance on selected Thinking and Working Mathematically questions

Learner's Book Exercise 1.2, question 6

Learners must find two numbers, each with 1 decimal place, that round to 231 to the nearest whole number and that sum to 462.

Learners will first need to work out all the numbers with 1 decimal place that round to 231. They will then show they are **specialising (TWM.01)** when they choose pairs of these numbers and add them to see if the total is 462 (i.e. they fit the given criteria). Allow learners to use calculators as they have not yet been taught to add decimal numbers.

CROSS-CURRICULAR LINKS

In geography population statistics are often rounded to make them easier to understand. For example, when the population of Tokyo in 2015 is quoted as 9.273 million, the number 9 273 000 has been rounded to the nearest thousand.

Homework ideas

1. Resource sheet 1F
2. Ask learners to find an itemised bill from a shop. Write each amount in dollars and cents and then round them to the nearest whole number of dollars.

Assessment ideas

- Suggest to learners that they check the three Look what I can do! sections and discuss these with their partner, reflecting on their progress throughout the unit and what they can do to improve their performance.
- As a class, complete the **Digital Classroom** Unit 1 activity before learners work on the Check your progress section of the Learner's Book. (The i button will explain how to use the activity.) Deal with any issues that arise and consider using the differentiated worksheets to give learners confidence before they work on the Unit 1 test.

PROJECT GUIDANCE: PROJECT 1 DECIMAL DICE

Why do this project?

This task gives learners the opportunity to explore how multiplying by ten changes the value of each digit in a number with a decimal point. This activity develops the skill of **conjecturing** (**TWM.03**) by providing a context for learners to form different ideas about which numbers they should choose to put in which boxes, helping them consolidate their understanding of place value. This project relates to learning objectives 5Np.01 (Understand and explain the value of each digit in decimals (tenths and hundredths)) and 5Np.03 (Use knowledge of place value to multiply and divide decimals by 10 and 100).

Possible approach

In this activity, all games can be played with either a 1–6 or 0–9 dice. As a whole class, discuss the rules of the original game and play it a few times with all of the learners working against the teacher. When each learner chooses a box for a number, encourage them to explain why they made that choice. Provide some time for learners to play this game in pairs, then bring the class back together and introduce the second game. Make sure that all learners understand the rules of this new game, recapping how to multiply by ten if needed. Do learners think that the new rules will make the game very different? Why or why not?

Allow more time for learners to play the second game in pairs, thinking carefully about where to put each number. You might like to warn learners that you will be asking them to explain their tactics at the end of the lesson. After learners have played this a few times, introduce the new rule where each person can choose to either keep their number or give it to their partner.

In the plenary, encourage learners to explain the strategies that they were using. Which numbers were they hoping to roll? Why?

Key questions

Why have you chosen to put that number in that box?

Why are some boxes more significant than others?

How has the game changed?

What can you say about how the value of each digit has changed when the number was multiplied by ten?

In the final version, are you more likely to win if you go first or second? Why?

Possible support

Some learners might find it easier to start with fewer boxes, or to begin by playing the game without decimals.

Possible extension

Encourage learners to make up a similar game of their own. What could they multiply their number by at the end? What could the target be?