Oxford International Primary

6

Maths

Teacher's Guide

Second edition

OXFORD

Oxford International Primary

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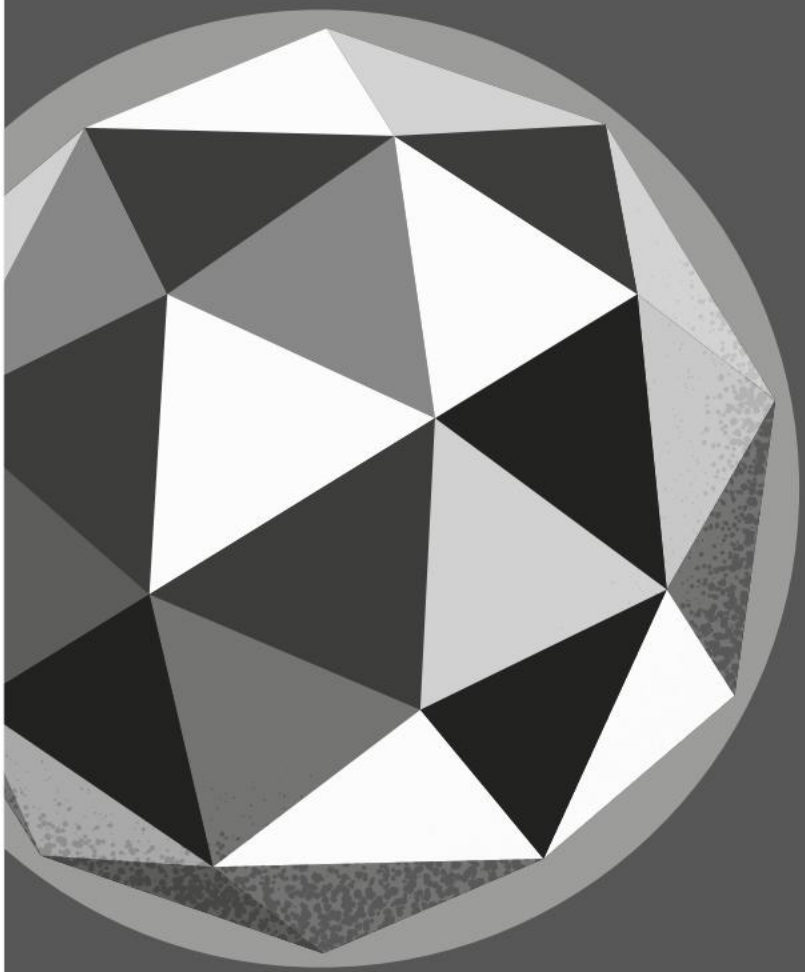
Teacher's Guide



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Introduction

The joy of learning maths

We are living in an ever-changing world, where the way we work, live, learn, communicate and relate to one another is constantly shifting. In this climate, we need to instill in our learners the skills to equip them for every eventuality so they are able to overcome challenges, adapt to change and have the best chance of success. To do this, we need to evolve beyond traditional teaching approaches and foster an environment where students can start to build lifelong learning skills for success. Students need to learn how to learn, how to problem solve, be agile and work flexibly. Going hand-in-hand with this is the development of self-awareness and mindfulness through the promotion of wellbeing to ensure that students learn the socio-emotional skills to succeed.

With *Oxford International Primary Math*s, students develop lifelong learning skills as well as mathematical skills. The course promotes the development of real-world skills including financial literacy. The activities in the Student Books and Practice Books offer numerous opportunities to think creatively and develop interpersonal skills. Fundamentally, *Oxford International Primary Math*s promotes students' self-development as critical thinking and motivation are at the heart of the problem-solving approach in the course.

This series is based on the English National Curriculum Programme of Study for Primary Maths. The *Oxford International Primary Maths* books for each stage meet all the learning objectives from the curriculum. Each lesson includes the learning objectives and a summary of the key teaching points. A full mapping grid identifying the unit and lesson where each objective can be found is available online at www.oxfordowl.co.uk

Oxford International Primary Maths: A problem-solving approach

In this second edition of *Oxford International Primary Maths*, there is a strong focus on using a problem-solving approach. While mathematical facts are important, it is unlikely that simply giving students the information they need will result in them understanding the mathematics and being able to apply their learning in new problem-solving situations. This is often described as a move from 'surface learning' to 'deep learning'.

Many people remember mathematics lessons as places where the teacher stood at the front of the class writing on the board. Students wrote down the information, maybe worked through a couple of examples with the teacher and then proceeded to complete a series of exercises to practise the skill that they had been taught. This can be described as a *didactic* approach and it relies on the idea that direct instruction is the appropriate strategy to adopt. The authors of this series would argue that *heuristic* strategies encourage students to explore the mathematics for themselves supported by the teacher. 'Heuristic' derives from the Greek word meaning to discover, and in mathematics learning, heuristic strategies are ones where students engage in exploration and discovery to solve a problem. Heuristic strategies include making a visual representation of a problem, making a calculated guess or estimate, simplifying a problem or following a known method. This results in a deeper understanding.

When faced with any problem in mathematics, there are recognised stages to go through in order to solve the problem, and these have been developed and agreed by many researchers. One version that summaries the problem-solving process comes from Georg Polya.

1. Understand the problem.

2. Devise a plan.

3. Carry out the plan.

4. Check the reasoning.

In following these stages, students use a number of skills that support problem solving, such as using trial and improvement, working systematically, pattern spotting, visualising, conjecturing and generalising.

Embedding a mastery approach

In recent years, the term 'mastery' has been used in conjunction with mathematics learning. It has been drawn from teaching approaches in countries where mathematics performance is deemed to be very high. The essence of mastery is to produce students who have deep conceptual understanding and procedural fluency through learning in a collaborative and problem-solving context. Mastery learning incorporates use of manipulatives, exposure to different methods of solving a problem, dialogue and explanation.

Following a Concrete Pictorial Abstract (CPA) approach

One of the more successful approaches to learning was provided by Jerome Bruner in his model of enactive, iconic and symbolic modes. This has been developed in recent years to form the CPA approach. CPA stands for concrete, pictorial and abstract, each of which aligns with Bruner's modes. The concrete phase involves students making use of physical manipulatives to help understand the learning, before moving to record the learning in pictorial form as individuals. As the learning develops, students will begin to recognise how to record their learning in a more general and abstract way. The CPA approach is not necessarily sequential, and students might move between the different modes as they work through a problem.

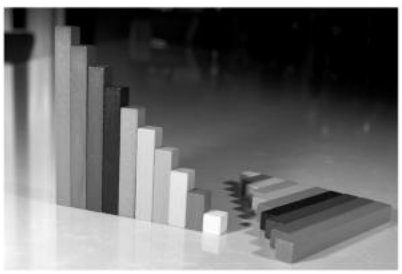
Oxford International Primary Maths and the use of manipulatives

Throughout the series, students are encouraged to use manipulatives, or concrete objects, to model addition, subtraction, multiplication and division. These manipulatives include:

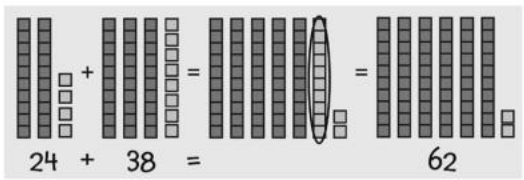
- base-ten equipment (ones-cubes, tens-rods, hundreds-flats and thousands-cubes)

- place-value counters

- number rods.



Such manipulatives are used to explain to students how the written methods 'work', for example by modelling exchanging 10 ones-cubes for 1 tens-rod in an addition.



Differentiation

There are several ways that you can differentiate learning in the classroom. These include differentiation by:

- task
- outcome
- support
- grouping.

It has been traditional in some schools to offer up to three different levels of tasks for each lesson. This is differentiation by task. It is important that all students are exploring the same area of mathematics as they can collaborate and discuss their mathematics in a way that is not possible if students are engaged on different activities. This approach has been extensively researched and published by Jo Boaler of Stanford University, California. For example, she has outlined projects that gave students in different schools either a differentiated approach in lessons, or lessons where everyone worked on the same task (Boaler, J., 2005. *The Elephant in the Classroom.* Souvenir Press). Where all abilities worked on the same task, every student made and sustained 'better than expected' progress, and performed better on statutory tests and exams. The Education Endowment Foundation teacher's toolkit suggests that collaborative learning can result in a five-month acceleration in students' learning. (See https://educationendowmentfoundation.org.uk/resources/teaching-learning-toolkit.)

The expectation in this series is that all students will be offered the same starting point. The activities are carefully designed to be accessible to all students in your class and the teacher's notes for the activity offer differentiated outcomes for students. It is also important that you offer differentiated support to different students. You will mainly do this through the sort of questioning that you engage in and support you offer. You will ask challenging questions and supporting questions to help all students access the task. For example, when engaging in a simple counting activity with some students you might model the action of counting by placing a finger on each object as you count and emphasise the last number you say to model that the last number you say gives the number of objects in the set. You might ask other students engaged in the same activity to compare two sets, or to find one more or one less than the set they are counting.

Grouping students to promote a growth mindset

When engaging in learning mathematics, it is expected that you will use a variety of student groupings. This may be a change for some teachers who have previously grouped students by prior attainment in their classroom. Research has shown that grouping students 'by ability', which usually means grouping students using test results, can have a negative impact on their future attainment. It is more effective to use a range of ways of grouping students. You will decide on the most appropriate way of grouping depending on the activity. You are also given advice in the teacher's notes.
It is important that the teacher is active in deciding which form of grouping is appropriate. It is also important that students learn how to operate in a range of different groups and with a range of different students so that they get used to working in a variety of ways and with different people.

The three main ways of grouping students are based on:

- friendship
- ability/prior experience
- mixed attainment.

Friendship groups are most appropriate for activities in which the students have been given some element of choice. Perhaps they are carrying out some research for a data handling project or exploring data on animals to develop their understanding of measurement. This grouping is the default if teachers do not actively group students.

Ability groups, or groups based on students' prior experience, may be helpful if the lesson requires a very specific prior knowledge. You can group together the students you know have this knowledge and they can then work with minimal guidance from you, which allows you to focus on groups who need additional support.

Mixed-attainment groups are encouraged for the majority of the activities. This form of grouping is also favoured by those following a mastery approach. Working in collaborative, all-attainment groups also supports students' wellbeing and promotes a growth mindset, as described in research by Carol Dweck. She found that students who were grouped by ability tended to stay in those groupings throughout their school life, and regard themselves as having a fixed ability that could not be changed. This has dire consequences for students in middle or lower sets. When placed in mixed-ability groups, all students can develop a growth mindset which enables them to believe they can learn and improve, whatever their starting point (Dweck, C., 2007. 'The Perils and Promise of Praise'. *Educational Leadership.* October 2007, 65(2), 34–39). A growth mindset is promoted when students do not feel that their future success is predicated on prior achievement. This kind of grouping is particularly helpful for students new to English. Mixed-attainment groups allow students who are less confident in English to hear more-confident peers using mathematical vocabulary. Research has shown that mixed-attainment groups benefit both high attainers, who become more secure in their mathematics knowledge through explaining their thinking to peers, and those less secure in their mathematical knowledge as peer teaching has been shown to be effective.

Whatever form of grouping you choose, it is helpful to assign roles to individuals in the group. Some teachers use 'role cards' to remind members of the group of the role they should play. Here are some examples of roles.

- Leader: You should make sure everyone has a chance to speak and focus the discussion around the task.
- Time keeper: You should encourage the group to stay on task. Announce when the time is half way through and when time is nearly up.
- Recorder: You should write down group members' ideas or draw a collective graphic. You will write on the board during the presentation.
- Presenter: You will present the group's findings to the whole class at the end of the session.
- Resource organiser: You will make sure that group members have all the resources they need during the task.

Assessment

Assessment is the process of establishing how individual students are progressing and what they have achieved, or a means of measuring their learning. Assessment is usually carried out in two main ways – assessment of learning and assessment for learning.

Assessment of learning is sometimes called summative assessment, and takes place at the end of a lesson, a unit, a term or even a year. It measures what students know at that point as a summary of their learning to that point. In *Oxford International Primary Maths*, summative assessment opportunities are provided in the Review lesson at the end of each unit in the Student Book, while half-termly summative assessment opportunities are provided through printable resources, available online.

Assessment for learning is an approach brought to prominence by Paul Black and Dylan Wiliam and is based on the notion that students have a full, clear sense of what they are learning, where they have reached in their learning and what they need to do to improve further. It is carried out during lessons and gives teachers continuous data on each student's learning, as well as allowing students to track their own learning, which provides greater motivation. (Black, P., Harrison, C., Lee, C., Marshall, B., and Wiliam, D. 2004. 'Inside the Black Box: Assessment for Learning in the Classroom'. *Phi Delta Kappan.* (86)1, 8–21.)

It is suggested that there are five key strategies for assessment for learning. These are outlined below with suggestions of how you can do this in your classroom.

1 Being clear about learning objectives and success criteria with the students.

Each activity has at least one learning objective. At the beginning of a lesson, share the activity's learning objective with students. This should be more than simply stating the objective. You should make sure that students understand the objective and how you will measure success. For example, you might say: *I know that you can all count 10 objects* and all count to 10 as a class. Then you point to 20 on a number line and ask: *Does anyone know what this number is?* If a student knows it is 20 praise them, if no-one knows, tell them it is 20 and say: *By the end of the lesson I will be able to listen to you count to 20.*

2 Planning student discussions that give you evidence of their learning.

Every activity plan in the Teacher's Guide offers the opportunity for small-group or whole-class discussion. There are also examples of probing questions that you can ask to assess students' current understanding. For example, if a group has been counting two sets of objects you can ask: *Were there more or less in the second group? How do you know?*

3 Giving students feedback that helps them move forward.

This allows students to know whether or not they are meeting the success criteria and what they can do next to move their learning on. Developing the example above, if a group has been comparing two sets and understands the concept of 'more' and 'less' you could ask them to make sets that are one more and one less, or even two more and two less.

4 Activating students to act as instructional resources for each other.

Collaborative group work in mixed-attainment groups, as described by Jo Boaler in her research (see under Differentiation earlier), gives students the opportunity to operate both as learners and teachers, with peer learning being highly effective. Not only is understanding of the mathematics enhanced, but students can support each other in assessing their progress.

5 Activating students as owners of their own learning.

The key point here is to listen carefully to the students and adapt your questioning to support individual development and to follow individual interests.

Questioning is key

The most skilled mathematics teachers can ask open questions to elicit students' current understandings. Skilful open questioning also allows students to articulate their current understanding carefully and though this process either consolidate their understanding or come to realise where they have made a mistake. The list below offers a series of open questions that can be used whatever mathematics you are teaching.

- *How are these the same/different?*
- *About how many/how long/many more … do you think there will be?*
- *What would happen if …?*
- *How else could you have done that?*
- *Why did you …?*
- *How did you …?*
- *How do you know that is correct?*

If you want students to check their solutions and consolidate their learning it is helpful to ask them to explain how they reached their solution to a friend. Similarly, to support students in reflecting on their learning you might ask the following.

- *What mathematics did you use to solve the problem?*
- *What new mathematics did you learn?*
- *What key words did you use?*
- *What was the most challenging part of the activity?*
- *What did you do when you got stuck?*
- *What other questions could you ask?*
- *Did this remind you of any other areas of mathematics?*

In *Oxford International Primary Maths*, there is an opportunity to ask these reflective questions, and for students to reflect on their learning, at the end of each unit in the Review lesson of the Practice Book.

Word problems

Word problems are useful as an assessment of children's understanding of the correct mathematics to use in any given situation. In *Oxford International Primary Maths* word problems are included throughout the units and on every Student Book Review page as part of the end-of-unit assessment. Many teachers find teaching word problems a challenge. This area is particularly challenging for students with a limited English vocabulary as word problems are tightly bound to linguistic ability. We have to decode and understand what the problem is asking us to do before we can begin to apply our mathematical knowledge. Some teachers have found the following acronym helpful when working with students on solving word problems.

R: Read the problem carefully.

U: Understand what the problem is asking you to do.

C: Choose the mathematics or arithmetical operations that you need to use to solve the problem.

S: Solve the problem.

A: Answer the problem.

C: Check that the answer is accurate and reasonable.

It is often helpful for students to underline key facts and write down the operations they are going to use before they solve the problem. For example:

> Tony rode his bicycle 7 miles to school with his friend. On his way home he took a short cut which was only 5 miles. How far did he cycle altogether?
>
> *This will be an addition calculation.*

It is a useful activity for students to annotate word problems and write down the operation(s) they will use without carrying out the calculation as this focuses on the skill of understanding the problem and choosing the operations appropriately.

Another activity that helps students to become skilled at solving word problems is asking them to write their own word problems based on a picture or a set of objects. Here is an example.

- How many black cubes are there? (3)
- Two friends took three cubes each. How many were left? (2)
- If I take out the black cubes, how many are left? (5)
- If I share the cubes equally between two people, how many do they each get? (4)

Wellbeing and *Oxford International Primary Maths*

It is thought that students learn more and feel more connected to their learning when they are active in their lessons. *Oxford International Primary Maths* has active learning at its heart. Most lessons start with a whole-class session that usually includes a range of physical or active

activites. You will see this signified by a 'star-jump' icon in the Teacher's Guide.

Many adults and children have felt anxious about their learning of mathematics at some stage. This anxiety is reduced by working collaboratively in all-attainment groups. There is also a reflective session at the end of each lesson and the formative assessment activity in the Practice Book asks students to reflect on their learning across the unit.

Wellbeing is also supported by effective questioning to support and stretch students and by planning group work carefully. These areas have already been discussed above.

Language support

The challenges

Ministries of Education at both local and national level are increasingly adopting the policy of English Medium Instruction (EMI), for either one or two subjects or across the whole curriculum. The rationale for doing so varies according to the local context, but improving the levels of achievement in English is an important factor.

In international schools an additional reason is likely to be that students do not share a mother tongue with each other or perhaps the teacher. English is, therefore, chosen as the medium for instruction so that all students are in the same position and to provide the opportunity to develop proficiency in an international language.

This does not mean that the mathematics teacher is now being asked to replace the English teacher, or to have the same skills or knowledge of English (though in many primary schools one teacher may indeed teach both). What it does mean, however, is that mathematics teachers have to view their role differently: they have to become much more language aware. It is this recognition of the need to ensure that the delivery of the content is not negatively impacted by the use of the second language that informs the planning and methodology of EMI.

This raises significant challenges, including:

- the teacher's knowledge of English
- students' level of English (which may vary considerably in international schools)
- resources that provide appropriate language support
- assessment tools which ensure that it is the content and not the language that is being tested
- differentiation that acknowledges different levels of proficiency in both language and content.

Meeting the challenges positively

Perhaps lack of confidence in their own English proficiency is one of the most common concerns among teachers. However, while it is a factor, success in EMI is not necessarily linked to teachers' proficiency in English. Teachers who have English as their mother tongue may well lack the sensitivity to, or awareness of, the language that a non-native speaker has acquired through learning and studying the second language. Developing this awareness and demonstrating it in both materials and method is the key to effective EMI.

Classroom language/Teacher Talk

Often non-native-speaker teachers are more concerned about their ability to run and manage the whole class in English than they are about the teaching of the mathematics concepts, as the resources or textbook should help them with the latter. However, this use of English in the class is very important as it provides exposure to the second language, which plays a valuable role in language acquisition. It is also true that the Teacher Talk for purposes such as checking attendance and collecting homework does not have to be totally accurate or accessible to students. When teaching the mathematics concepts, however, it is essential that the Teacher Talk is comprehensible. Some basic strategies to ensure this include:

- simplify your language
- use short, simple sentences and project your voice
- paraphrase (say in a different way) as necessary
- use visuals, write or draw on the board, gestures and body language to clarify meaning
- repeat as necessary
- plan before the lesson
- prepare clear, simple instructions and check understanding.

Creating a language-rich environment

Primary teachers often excel at providing a colourful and engaging physical environment for students. In the EMI classroom, this becomes even more important. Posters, 'word walls', lists of key structures, students' work, English signs and notices all provide a backdrop that provides the opportunity for language exposure and language acquisition.

Planning

When planning, look carefully at each stage of the unit and identify the language demands. This means thinking about what language students will need to understand or produce, and deciding how best to scaffold the learning to ensure that language does not become an obstacle to understanding the concept. This involves providing language support and goes beyond the familiar strategy of identifying key vocabulary.

Support for listening and reading

Listening and reading are receptive skills, requiring understanding rather than production of language. If you are asking students to listen to or read texts in English, ask yourself the following questions when you are planning the unit.

- Do I need to teach any vocabulary before they listen/read?
- How can I prepare them for the content of the text so that they are not listening 'cold'?

- Can I provide visual support to help them understand the key content?
- How many times should I ask them to read/listen?
- What simple question can I set before they listen/read for the first time to focus their attention?
- How can I check more detailed understanding of the text? Can I use a graphic organiser (e.g. tables, charts and diagrams) or gap-fill task to reduce the language demands?
- Do I need to differentiate the task for those students who find reading/listening difficult?
- Could I make the tasks interactive (e.g. jigsaw reading, when students access different information before coming together then share information)?
- How am I going to check their answers and give feedback?

Support for speaking and writing

Speaking and writing are productive skills because students doing these need to produce language. They are different from the receptive skills of listening and reading where students receive language from other sources. These skills may require more input from the teacher.

When you plan to use a task that requires students to *produce* English (speak or write), you need to think about how to help them do this.

This means that you have to think in detail about what language the task requires (Language Demands, LD) and what strategies you will use to help them use English to perform the task (Language Support, LS).

You need to ask yourself the following questions.

- What *vocabulary* does the task require? (LD)
- Do I need to teach this before they start? How? (LS)
- What *phrases/sentences* will they need? Think about the language for learning mathematics (e.g. predicting and comparing). What structures do they need for these language functions? (LD)
- Will they be able to produce these sentences or should I provide some *scaffolding* [e.g. sentence starters/sentence frames/gapped sentences (see below)]? (LS)

  A square has ____ sides.

  A triangle has ____ sides.

  A quadrilateral has ____ sides.

  A pentagon has ____ sides.
- While I am *monitoring* this task is there any way I can provide further support for their use of English (especially for the less-confident students)? (LS)
- What language will students need to use at the *feedback* stage (e.g. when they present their task)? Do I need to scaffold this? (LD, LS)

Teaching vocabulary and structures

Vocabulary

Learning the key mathematics vocabulary is central to EMI and 'learning' means more than simply understanding the meaning. Knowing a word also involves being able to *pronounce* it accurately and *use* it appropriately. Below is a list of strategies that could be useful.

- Avoid writing the list of vocabulary on the board at the start of the unit and 'explaining' it. The vocabulary should be introduced as and when it arises. Word boxes are provided on each page of the Student Books and Practice Books with the key words for the lesson. This helps students associate the word or phrase with the concept and context.
- Before the lesson, check that you are confident with the pronunciation and spelling of the vocabulary that will be used. Write the vocabulary clearly on the board when you first introduce it in the lesson. If you think students may struggle to pronounce words, decide how best to model the pronunciation.
- Give students a chance to say a word once they have understood it. The most efficient way to do this is through repetition drilling.
- Use visuals whenever possible to reinforce students' understanding of the word.
- Ensure that students are recording the vocabulary systematically in their glossaries at the back of their Student Books, and, if possible, use a word wall that lists the vocabulary under unit or topic headings.
- Remember to use and revise the vocabulary.

Structures

In order for students to talk or write about their mathematics, they will need to go beyond vocabulary: they will also need to use those phrases and sentence frames that a particular task requires.

For example, they may need the following expressions in mathematics.

X is the same as Y.

The sides are the same length.

The next number in the sequence.

I predict that X will happen.

If X happens, then Y happens.

The next step is …

You need to build up banks of common mathematics phrases and encourage students to record them. This is an important part of identifying the language demands and providing the necessary support. You do not have to focus on grammar as the language can be taught as phrases rather than specific grammatical structures.

Using this Teacher's Guide

Every unit of the Teacher's Guide begins with useful background information that includes the following.

The Big idea: The main mathematical concept covered in the unit is outlined.

Look out for: This section focuses on tricky concepts that may need explaining prior to any learning taking place.

Common misconceptions: Common errors that students make, or misunderstandings that students have, are identified. This section offers advice on how to deal with these misconceptions.

Key vocabulary: This is a list of the key mathematical words used in the unit.

Coverage in lessons: The English National Curriculum objectives covered in the unit are listed.

Every lesson in the Student Book and Practice Book has corresponding lesson notes in the Teacher's Guide. These comprehensive lesson notes include the following.

A mini reproduction: This shows the relevant pages from the Student Book.

Global skills: These are the skills that aim to foster a classroom environment where students develop the skills for success. The skills are: *creative skills* where students are problem solving, investigating or exploring new maths content; *real-world skills* where students are taking part in research, or presenting and interpreting information, or if they are dealing with money and developing their financial literacy; *interpersonal skills* where students are practising their teamwork and communication, often through working in pairs or larger groups; and *self-development skills* where students have the opportunity to reflect on their learning and talk about what went well and what they are still uncertain about.

The key vocabulary and resources: Key vocabulary used in the lesson, and the concrete resources required for the activity, are listed.

Language support: This includes a range of strategies, including card sorts and card games, word walls, team games to define or explain words, use of similar words to explain meaning and exploration of the origins of words.

The key principles underpinning the language support are listed below.

Words should be introduced and explained carefully.

Words should be explained in context.

Repetition is vital.

Words should be linked to pictures or actions.

Students should develop their own glossaries.

The learning of mathematics vocabulary should be fun.

Language should not be a barrier to effective learning of mathematics.

Detailed lesson notes: Comprehensive lesson notes include an Introductory activity and Main activity. These notes refer to the Student Book and Practice Book, where relevant. The notes include probing questions for formative assessment, which are italicised. Icons are used to suggest the groupings that should be used at each point of the activity (whole class, small group, pairs, individual). A separate 'star-jump' icon indicates that the activities give students an opportunity for physical movement (standing up, jumping, moving around) rather than doing activities sitting down.

Differentiation: The Teacher's Guide offers strategies for you to *support* those students who may have difficulty accessing the task; to *consolidate* the learning for those students who need a little more practice; and to *extend* the learning for those who need more challenge.

The Teacher's Guide also offers differentiated outcomes. These outcomes are listed in the form of:

All students

Most students

Some students

Stretch zone: Each activity in the Student Book and the Practice Book has a Stretch zone question to support deeper learning. The Teacher's Guide provides additional notes on these activities.

Reflection time: Suggestions are made on how to bring the class back together to reflect on the learning and share ideas.

Answers: Answers to all the Student Book and Practice Book activities are provided.

Review pages: The Teacher's Guide has notes on the Review pages of the Student Book (summative assessment), with answers to the assessment questions, and the Practice Book (a formative, reflective review).

Digital resources: Where it is appropriate to use digital resources in a lesson, such as sharing the interactive Student eBook page on an interactive whiteboard (IWB), suggestions are embedded in the lesson plan.

Resources sheets: These photocopiable resources can be used with some of the main activities. They are referenced in the resources section of the lesson plan and are available on the Oxford Owl website (www.oxfordowl.co.uk).

Tour of a typical unit

Engage lesson

The 'Big question' provides a discussion stimulus about the key idea of the unit.

1 Numbers and counting

How do we use numbers?

In this unit you will:

- count, read and write numbers to 100
- count in twos, fives and tens
- know and make numbers using objects and pictures
- use words such as equal to, more than, less than (fewer), most, least
- read and write numbers from 1 to 20 in words.

Learning objectives are stated clearly at the beginning of every unit.

Engage

Which numbers can you see in the classroom?

Which numbers can you see on your way to school?

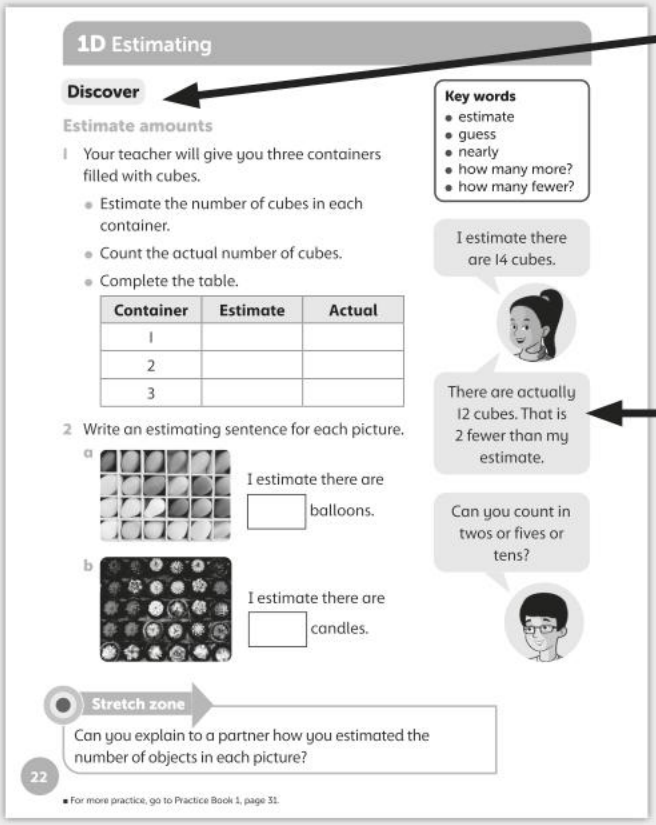
What is the biggest number you have ever seen?

Further questions allow students to develop communication skills.

6

The Engage spread is bright and colourful, with artwork or photos to spark interest in young students and provide discussion points.

Student Book Discover and Explore



Each Discover lesson introduces mathematics skills and concepts. These lessons often involve a practical activity or use of concrete resources.

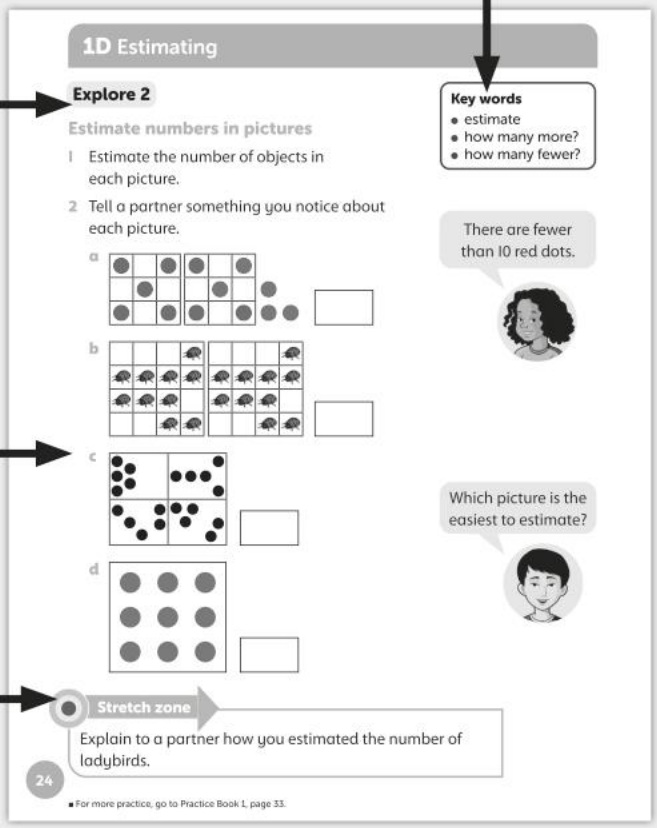
The speech bubbles provide useful hints, probing questions, or examples of how to complete a question. These help students who need a little extra support with the language or the mathematics.

The key words for the lesson are included on each page so they can be introduced in the context in which they are used.

Each Explore lesson allows students to practise the skills they learned in the Discover lesson. In these lessons, students are more likely to work independently or in pairs.

Step-by-step instructions guide students through the activities they will undertake.

Extension activities provide challenge for the most confident students.



Connect lesson

The Connect lesson makes links between the different areas of mathematics in the unit.

1 Numbers and counting

Connect

Make a number poster

Work as a group.

1 Collect some magazines. Talk about which magazines might have numbers in them. What do the numbers tell us?

Connect activities are often set in real-life contexts to make the link between mathematics and the real world.

2 Cut out pictures that have numbers.

3 Make a poster to display in class.

4 Talk in your group about the numbers you have found.

Stretch zone

Take photographs of numbers on the way home from school. What job are the numbers doing? Explain your ideas to a partner.

A further extension activity provides a challenge for the most confident students.

We use numbers to count or to say how many of something there are.

The 'Big idea' sums up what students have discovered in the unit. It answers the Big question on the Engage page.

What is the biggest number on your poster?

What is the smallest number on your poster?

Review lesson

Students' progress is assessed through the questions and tasks at the end of each unit. In Student Books 2 and 6, these questions reflect the style of the SATs (national Standard Assessment Tests).

1 Numbers and counting

Review

1 Draw the beads and write the numbers in the spaces.

Beads	Numbers	Words
	5	
		sixteen
		
		three
		
	12	
		nineteen
	1	
		four
	14	
		twenty

2 Samir has a bracelet with 19 beads. Lina's bracelet has one more bead than Samir's. How many beads are on Lina's bracelet? ☐

Celine's bracelet has 10 more beads than Lina's. How many beads are on Celine's bracelet? ☐

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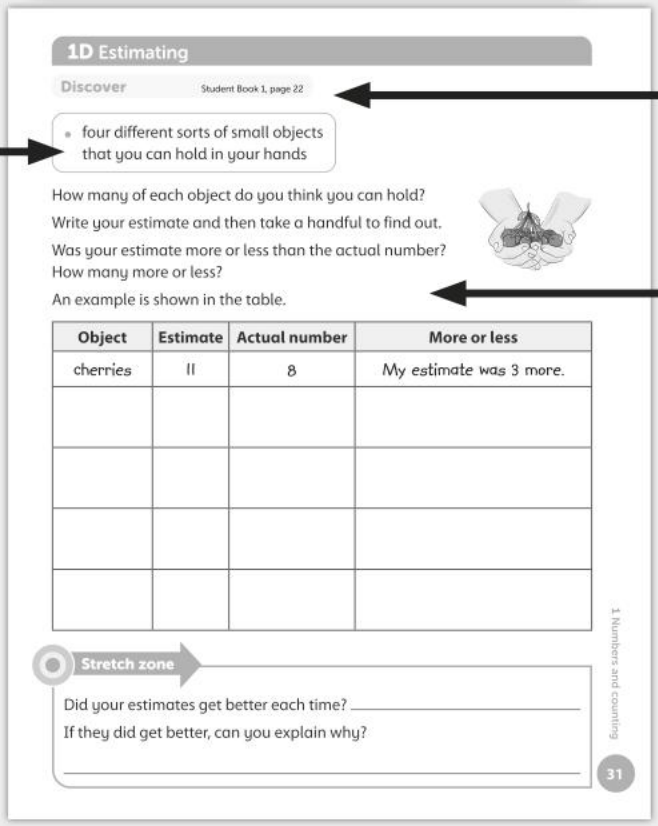
A word problem is always included on the Review page.

Practice Book Discover and Explore

Practice Book activities can be completed in the school lesson or as homework.

Most of the Discover and Explore lessons in the Student Book have a corresponding page in the Practice Book. These activities provide opportunities for students to consolidate and deepen their learning.



1D Estimating

Discover Student Book 1, page 22

- four different sorts of small objects that you can hold in your hands

How many of each object do you think you can hold?
Write your estimate and then take a handful to find out.
Was your estimate more or less than the actual number?
How many more or less?
An example is shown in the table.

Object	Estimate	Actual number	More or less
cherries	11	8	My estimate was 3 more.

Stretch zone

Did your estimates get better each time? _____
If they did get better, can you explain why?
_____

1 Numbers and counting

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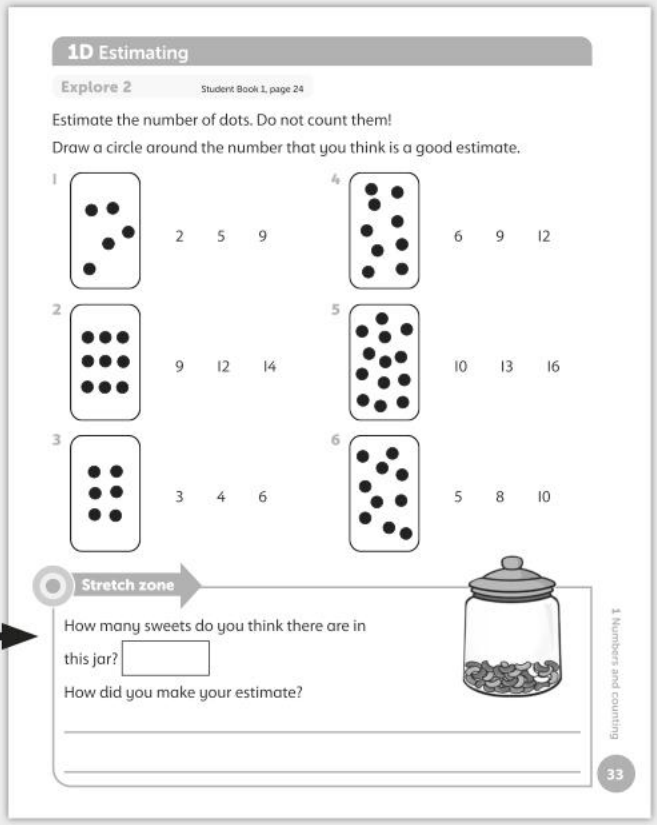
Step-by-step instructions guide students through the activities they will undertake.

If students require concrete resources, these are listed in a box at the top of the page. This is particularly useful if students are completing the activities at home.



1D Estimating

Explore 2 Student Book 1, page 24

Estimate the number of dots. Do not count them!
Draw a circle around the number that you think is a good estimate.

1 2 5 9

2 9 12 14

3 3 4 6

4 6 9 12

5 10 13 16

6 5 8 10

Stretch zone

How many sweets do you think there are in this jar? ☐
How did you make your estimate?
_____
_____

1 Numbers and counting

33

Extension activities provide challenge for the most confident students.

Practice Book Review

Each Review page in the Practice Book includes a reminder of all the topics learned in the unit.

1 Numbers and counting

Review

1 Draw a face next to each bubble to show how you feel about your learning.

counting objects

reading and writing numbers

counting in twos, fives and tens

estimating quantities

2 Tell a partner about one thing you did really well in this unit.

3 Draw or write about things you found easy, challenging or really hard.

Self-assessment activities help students to reflect on their learning.

What work did you feel confident doing?

What work was challenging?

Is there any work you might need some extra help with?

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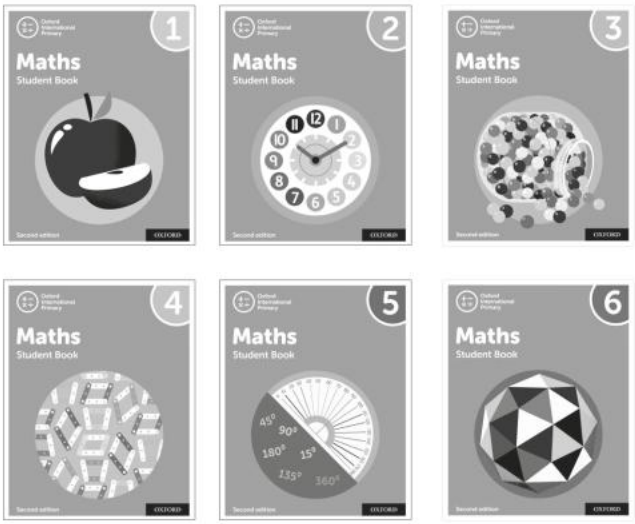
Component overview

The Student Books

The Student Books are write-in textbooks for students to read and use. There are six Student Books: one for each school year at primary school. The Student Books introduce learning through a mixture of practical, discussion and independent activities.

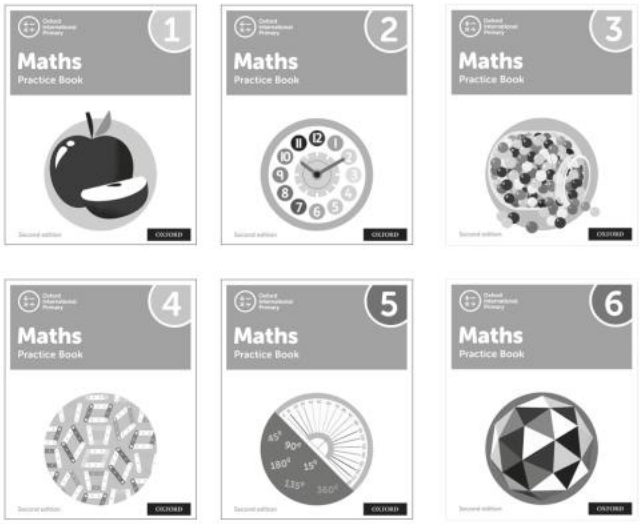
Student Book	Typical student age range
Student Book 1	Age 5–6
Student Book 2	Age 6–7
Student Book 3	Age 7–8
Student Book 4	Age 8–9
Student Book 5	Age 9–10
Student Book 6	Age 10–11



The Practice Books

The Practice Books are write-in workbooks for students to read and use. There are six Practice Books: one for each school year at primary school. The Practice Books provide deeper learning opportunities through a range of independent activities, which can be completed in school or at home.

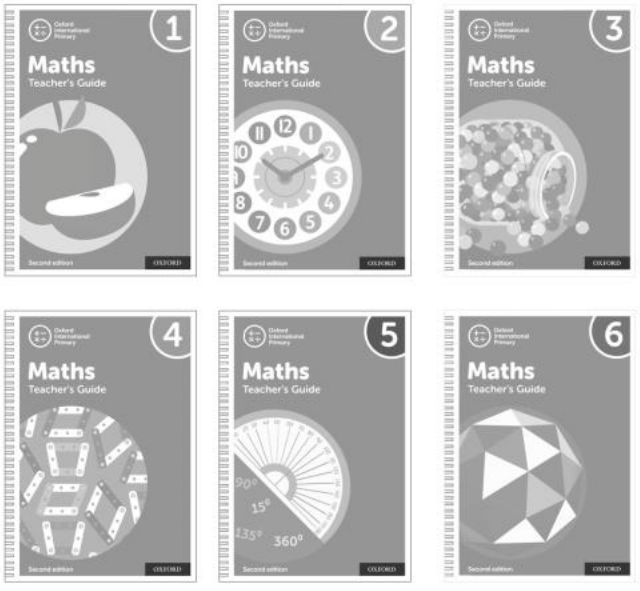
Practice Book	Typical student age range
Practice Book 1	Age 5–6
Practice Book 2	Age 6–7
Practice Book 3	Age 7–8
Practice Book 4	Age 8–9
Practice Book 5	Age 9–10
Practice Book 6	Age 10–11



The Teacher's Guides

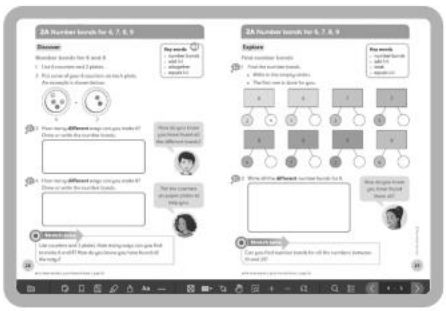
There are six Teacher's Guides: one for each school year at primary school. Each Teacher's Guide includes:

- an introduction with advice about delivering mathematics in primary schools using *Oxford International Primary Mathematics*
- a unit overview, giving advice on teaching each unit, including common misconceptions and how to deal with them
- a lesson plan for every lesson in the Student Book and corresponding pages in the Practice Book
- model answers to each question in the Student Book and Practice Book.



Digital resources

Interactive eBooks



For the teacher

Teachers can access the Student Books, Practice Books and Teacher's Guides online in eBook format, on the Oxford Owl website (www.oxfordowl.co.uk).

The enhanced eBooks show the course content on screen, making it easier for teachers to deliver engaging lessons.

For the students

Teachers can allocate an eBook version of the Student Books to students for use at home. The Student eBooks include interactive activities, worksheets and audio of all the key vocabulary,

Assessment resources

The downloadable assessment materials offer you additional opportunities to assess students' progress. The materials include:

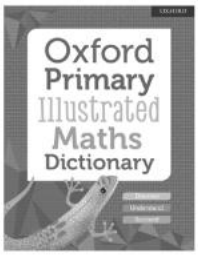
- end-of-unit summative assessment
- end-of-year summative assessment.

Every test comes with everything you need to assess and record progress including:

- answers
- mark schemes and guidance on assessment.

Oxford Primary Illustrated Maths Dictionary

The *Oxford Primary Illustrated Maths Dictionary* gives comprehensive coverage of the key maths terminology students use in the course. Entries are in alphabetical order, and each includes a clear and straightforward definition along with a fun and informative colour illustration or diagram to help explain the meaning. The dictionary is suitable for students with English as an Additional Language.



The curriculum

The Oxford International Curriculum offers a new approach to teaching and learning focused on wellbeing, which places joy at the heart of the curriculum and develops the global skills students need for their future academic, personal and career success.

Through six subjects – English, Maths, Science, Computing, Wellbeing and Global Skills Projects – the Oxford International Curriculum offers a coherent and holistic approach to ensure continuity and progression across every student's educational journey, equipping them with the skills to shape their own future. Through this approach, we can help your students discover the joy of learning and develop the global skills they need to thrive in a changing world.

1 Number and place value

Overview

Big idea

The two Big Ideas for this unit are place value for numbers up to a million, and negative numbers.

In the decimal number system, the value of a digit depends on its place, or position, in the number. It is important to know that each place has a value 10 times the value of the place to its right and that this extends indefinitely. Students practise ordering and rounding numbers in order to consolidate their understanding of place value in large numbers. They look at large numbers in contexts, knowing when numbers can be rounded or when they need to be exact.

Clear mental images of the number system help students to understand negative numbers. The use of number lines and empty number lines, as well as real-life examples such as thermometers, enables students to compare and calculate with negative numbers.

Look out for

- **Students who consider all the digits in a number when** rounding to the nearest 100 000. Give students lots of opportunities to round large numbers by looking at the digit immediately to the right of the value being rounded. For example, rounding 237 428 to the nearest 100 000 does not make use of the 7000 or the 8 ones; only the 30 000 is used to determine whether to round to 200 000 or 300 000.
- **Students who say that to multiply by powers of 10 you 'add zeros'.** This strategy gives the correct answer for the multiplication of integers (for example $257 \times 10 = 2570$). However, this strategy gives incorrect answers for the multiplication of decimals (for example, 24.31×100 does not equal 24.3100). The activities in this unit show students that, when multiplying or dividing by 10 or 100, the digits change position on the place-value grid.

Possible misconceptions

- **Students think that, for example, $^{-}9 > {}^{-}4$.** Use number lines to help students place negative numbers and see how larger digits mean a smaller number when negatives are used.
- **Students think that you cannot subtract a larger number from a smaller number**. For the 'counting on' and 'counting back' activities in this unit, students need to count back across zero. For example, students may think that $25 - 75$ 'doesn't work', not that $25 - 75 = {}^{-}50$. It is important to use a number line with negative numbers to support these activities.

Key vocabulary

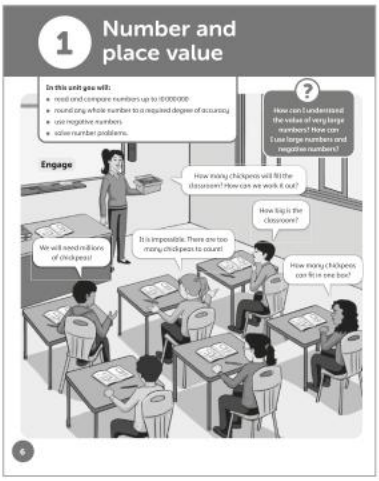
- ten thousand, hundred thousand, million
- 4-, 5-, 6-, 7-digit number
- number system
- > greater than, more than, larger than, bigger than
- < less than, fewer than, smaller than
- ≥ greater than or equal to
- ≤ less than or equal to
- power of 10, multiple of 10
- half-way between, estimate
- about the same as, is approximately equal to, just over, just under, round to the nearest
- negative number, positive number, place value, place-value grid, number pairs, known facts, derive
- temperature, below freezing

Coverage in lessons

Learning objective	E	1A	1B	1C	1D	1E	C	R
Read, write, order and compare numbers up to 10 000 000 and determine the value of each digit.	✓	✓	✓		✓	✓	✓	✓
Round any whole number to a required degree of accuracy.	✓		✓				✓	✓
Use negative numbers in context, and calculate intervals across zero.				✓	✓			✓
Solve number and practical problems that involve all of the above.	✓		✓	✓	✓	✓	✓	✓

1 Number and place value

Engage Student Book page 6



Big question

- How can I understand the value of very large numbers? How can I use large numbers and negative numbers?

Global skills

- **Creative skills:** investigating
- **Interpersonal skills:** teamwork
- **Self-development skills:** reflecting on learning

Key vocabulary

- ten thousand, hundred thousand, million

Resources

- metre rules and measuring tapes
- cuboid containers of various sizes
- dried chickpeas or similar
- calculators

Language support

Listen to how students say large numbers. Encourage them to say the number in full and not to say each digit separately. For example: 876 426 is 'eight hundred and seventy-six thousand, four hundred and twenty-six' not 'eight seven six four two six'. Model this in your discussions with students.

Introductory activity

*How long would it take you to count to one **million**?* Some students may assume that you can count each number in one second and so then calculate how long one million seconds is in days and hours. To challenge this assumption, ask, *How long does it take you to say a number like 876 426 aloud?* First, model how to say this number aloud: *eight hundred and seventy-six thousand, four hundred and twenty-six*. Agree that, for smaller numbers, one second per number or one second per two numbers might be a good estimate, but larger numbers, such as 876 426, may take more than one second to say. *Do you want to revise your estimate for how long it would take to count to 1 million?* Allow students time to discuss this in pairs and share their feedback.

Main activity

Look together at page 6 of the Student Book. Display on the IWB, if possible. The class should work in mixed-attainment groups of four to six students. *How many chickpeas would fill the classroom?* After their suggestions, ask, *How could you calculate this?* Give students time in their groups to decide how to solve this problem. You can simplify the problem by using a much smaller container and asking, *How many chickpeas would fill this container?* Then ask, *How many small containers would fill a 1-cubic metre container?* As a class, you can then calculate the size of the classroom in cubic metres to solve the problem.

Differentiation

Supporting: Encourage students to take an active role in the discussions and contribute to the group activity.

Consolidating: Ask students to support one another in deciding on appropriate calculations and to explain the strategies they are using.

Extending: Ask students to check the accuracy of their answers and to justify them.

Reflection time

Ask groups to share their solutions with the whole class. Each group should tell the presenting group two things that they like in the solution ('We like …') and one target for future problem-solving activities ('Next time, you could …').

You could set further 'large number' challenges for students to work on. Ask, for example, *How many times would the total number of students in this school fit into the National Stadium?* or *How long would it take to walk from your school to the capital city (or a capital city of a neighbouring country)?*

1A Place value

Discover Student Book page 7 • Practice Book page 15

Specific learning focus

- Know what each digit represents in whole numbers up to ten million.

Global skills

- **Creative skills:** exploring
- **Interpersonal skills:** communication

Key vocabulary

- hundred thousand, million, ten million

Resources

- large digit cards 0–9 and sets for each pair of students
- mini whiteboards and markers

Language support

Listen to each student speaking the numbers aloud. Ask, for example:

- *How many digits does this number have?*
- *What do you know about a 6-/7-digit number?*

Use the vocabulary of place value: ten thousand, hundred thousand, million, ten million and so on.

Introductory activity

Ask seven students to come to the front of the classroom. Ask each student to take a digit from the large digit cards you have prepared. Ask these students to make a line facing the rest of the class. They should make this line one student at a time. As each student joins the line, ask the rest of the class: *What number is this?* (or ask individual students).

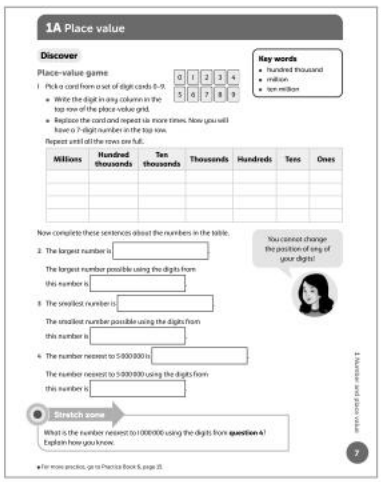
- One student with the number 7 – the class say 'seven'.
- Two students with the number 3 and the number 7 – the class say 'thirty-seven'.
- Three students with the numbers 5, 3 and 7 – the class say 'five hundred and thirty-seven'.
- Four students with the numbers 6, 5, 3 and 7 – the class say 'six thousand, five hundred and thirty-seven' and so on.

Repeat this as many times as you think is necessary.

Main activity

Give each pair a set of digit cards 0–9. Ask them to take turns choosing a digit and they both write it down to form a 7-digit number, for example 5 438 261. One student then points to a digit in the number and the other has to say the value of that digit. For example, the 3 has a value of 30 000. They can take turns until all digits have been chosen. Repeat with a new 7-digit number made from the digit cards.

Now ask students to work in pairs to complete the activities on page 7 of the Student Book. While students work, ask them to say the numbers aloud to you so that you can check their pronunciation. Ask questions to check students' understanding, for example, *How did you decide that this was the biggest possible number? Are you sure that you can't find a smaller number than that?*


1A Place value

Discover

Place-value game

Key words
- hundred thousand
- million
- ten million

Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones

Stretch zone

Differentiation

Supporting: Ask students to show you the largest and smallest numbers and explain their reasoning.

Consolidating: Ask students to justify their responses to the questions on Student Book page 7.

Extending: Challenge students to create 8-digit numbers and to order these numbers smallest to greatest and vice versa.

Stretch zone: What is the number nearest to 1 000 000 using the digits from question 4? Explain how you know.

Ask questions to check students' understanding of place value in this number. *Are you sure that you can't swap any of the digits to make the number closer to 1 000 000? Convince me.*

As an additional activity, you could give students some newspapers and magazines and ask them to find examples of large numbers and decimals. Then ask them to write the numbers in words.

Reflection time

Give out mini whiteboards and markers. Read out a series of 5-, 6- and 7-digit numbers and ask students to write the numbers on their whiteboards. Give students five seconds to write the numbers. Then say, *Show me your numbers*. This helps you to assess individual understanding. Include some numbers with zeros as placeholders, for example 'three hundred and two thousand, one hundred and seven' (302 107).

Practice Book: Students complete Practice Book page 15. They can do this directly after the Main activity, as homework, or as the focus of a separate mathematics session to help students consolidate their learning and build fluency.

Students write large numbers (all about the year 2019) in a place-value grid and say each number aloud. Check students' written work, making sure that numbers that contained zeros are written correctly. *If that zero wasn't there, what would that number be? How do you know?*

Differentiated outcomes	
All students	should recognise and order numbers up to seven digits with support.
Most students	will recognise and order numbers closest to a given number of millions.
Some students	may extend to beyond seven digits and be able to explain their strategy.

Answers

Student Book page 7

Answers will vary because students use digit cards to make their own numbers. Check that their answers to the questions are correct for the numbers they have made. Note who has a good understanding of the place value of large numbers and the size of numbers, and who requires more practice in working with these numbers.

Practice Book page 15

	Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
(Provided)	5	1	9	5	5	3	4
1	1	5	5	7	6	9	2
2	5	5	9	5	7	5	0
3	5	0	1	9	2	3	1
4		3	4	7	2	2	2
5			4	0	0	7	5
6	7	1	9	9	7	2	9

Stretch zone: Check that students have written a suitable fact in millions.

1A Place value

Explore Student Book page 8 • Practice Book page 16

Specific learning focus

- Multiply and divide any whole number from 1 to 10 000 by 10, 100 or 1000 and explain the effect.

Global skills

- **Creative skills:** investigating

Key vocabulary

- place-value grid, power of 10, multiple of 10, tens of thousands, hundreds of thousands

Resources

- large digit cards 1–9 and sets for each pair of students
- calculators
- mini whiteboards and markers

Language support

Encourage students to explain their strategies and use the vocabulary of place value: ten thousand, hundred thousand, million. Ask, for example:

- *How many digits does this number have?*
- *What do you know about a 6-digit number?*

Introductory activity

Draw six boxes on the board. Ask students to copy these six boxes onto their whiteboards.

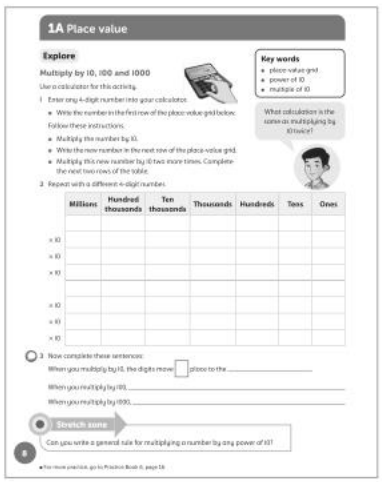
Choose six digit cards, one at a time, from the large set you have prepared. After each card is chosen, ask students to write the digit in one of their boxes so that, eventually, all six digits have been written in a box. *Make the largest number possible with these digits. Now make the smallest number possible with these digits.* Repeat this with a different set of six digits.

Main activity

Choose six digits from the large set of cards and make a 6-digit number. Ask students to count in thousands from the number you have made until they cross the ten thousands boundary into the next thousand. *Which digits change each time, and which stay the same?* Do this for counting in **tens of thousands** and **hundreds of thousands**, each time asking students to notice what is happening to each digit in the number. Repeat this process several times and then increase the number of digits so you are counting using 7-digit numbers.

Ask students to work in pairs on the activities on page 8 of the Student Book. Tell them to explain to one another what they notice ('When you multiply by 10/100/1000 …').

Encourage students to explain what they notice very carefully. If any students say to you that 'When you multiply by 10, you add a zero', ask them to multiply 123.4 by 10, as this will convince them that this is not always true: $123.4 \times 10 = 1234$ and not 123.40.


1A Place value

Explore

Multiply by 10, 100 and 1000

Use a calculator for this activity.

1 Enter any 4-digit number into your calculator.
- Write the number in the first row of the place-value grid below.

Follow these instructions.
- Multiply the number by 10.
- Write the new number in the next row of the place-value grid.
- Multiply this new number by 10 two more times. Complete the next two rows of the table.

2 Repeat with a different 4-digit number.

Key words
- place-value grid
- power of 10
- multiple of 10

What calculation is the same as multiplying by 10 twice?

	Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
× 10							
× 10							
× 10							
× 10							
× 10							
× 10							

3 Now complete these sentences:

When you multiply by 10, the digits move ☐ place to the .....

When you multiply by 100, ...

When you multiply by 1000, ...

Stretch zone

Can you write a general rule for multiplying a number by any power of 10?

▪ For more practice, go to Practice Book 8, page 16.

Differentiation

Supporting: Ask students to describe the patterns they notice.

Consolidating: Ask students for a general rule for multiplying and dividing by 10, 100 and 1000.

Extending: Ask students for a general rule for multiplying and dividing by **powers of 10**.

Stretch zone: *Can you write a general rule for multiplying a number by any power of 10?*

Students should recognise the place value aspect of moving digits to the left by the same number of places as there are zeros on the power of 10. For example, for multiplying by 10, the digits move one place to the left; for multiplying by 100, they move two places to the left and so on. Students may also recognise that the reverse is true when dividing by powers of 10, with digits moving to the right the same number of places as there are zeros.

Reflection time

Select one or two students who have a good understanding of place value. Choose students who explained their ideas well in their pairs. Ask them to share their explanation with the whole class. Ask the class, *Can you give me an example that shows this statement is incorrect?*

'When you multiply by 100, you add two zeros.'

Practice Book: Students complete Practice Book page 16. They can do this directly after the Main activity, as homework, or as the focus of a separate mathematics session to help students consolidate their learning and build fluency.

This activity will help to consolidate the vocabulary of place value that students have already learned. Encourage students to write a variety of facts, not just to reuse the same ones for each number.

Differentiated outcomes	
All students	should carry out the calculations using a calculator and notice the patterns.
Most students	will understand how place value effects the calculations.
Some students	will generalise beyond multiplying and dividing by 10, 100 and 1000.

Answers

1, 2 Student Book page 8

Students choose the numbers they will use. Check that their multiplications are correct and that they have written the digits into the correct places in the table.

3 When you multiply by 10, the digits move one place to the left.

When you multiply by 100, the digits move two places to the left.

When you multiply by 1000, the digits move three places to the left.

Practice Book page 16

Students will have different facts about each number, similar to the examples given. Check that their facts are correct and varied.

Stretch zone:

1 4 000 000

2 7 700 000

3 600 000

4 8 900 000

1B Rounding

Discover Student Book page 9 • Practice Book page 17

Specific learning focus

- Round whole numbers to the nearest 10, 100 or 1000.

Global skills

- **Creative skills:** exploring

Key vocabulary

- round to the nearest, 4-digit number

Resources

- large digit cards 0–9 and sets for each pair of students
- mini whiteboards and markers

Language support

Model key vocabulary. Ask, for example:

- *What is that number approximately equal to?*
- *Which digit do you need to look at?*
- *What is that number rounded up/down to the nearest 10?*
- *What is that number rounded up/down to the nearest 100?*
- *What is that number rounded up/down to the nearest 1000?*

Introductory activity

Ask four students to come to the front of the class. Ask each of these students to pick one of the large digit cards 0–9 and ask them to stand in a line, facing the class. Ask the rest of the class, in pairs, to work out how many possible arrangements of these four digits there are. As a class, rearrange the four students to form each number in order, smallest to largest. Encourage students to work systematically to check that they have all possible arrangements of the numbers.

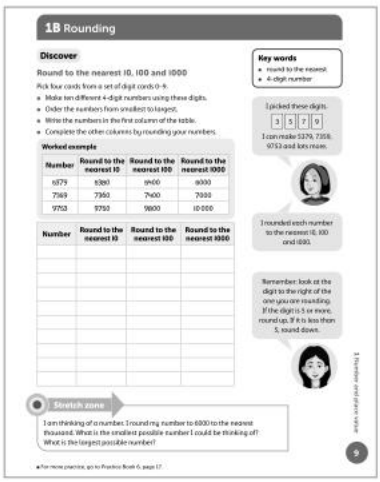
Main activity

Choose one of the 4-digit numbers from the Introductory activity and model, using an empty number line, how to round the number to the nearest 10. In the following example 7254 is used. *Which digit do we need to look at to* ***round this to the nearest*** *10?* Agree that it is the ones digits that determines whether to round up or down. Use the empty number line to show that 7254 comes between 7250 and 7260. Draw it on the number line. *Is 7254 nearer to 7250 or 7260?*

Repeat, rounding the same number to the nearest 100 and 1000, first agreeing which digit to look at and then modelling on a number line where it will come. For example, for the nearest 100, write 7254 between 7200 and 7300, just slightly closer to 7300; for the nearest 1000, write 7254 between 7000 and 8000 but much closer to 7000 on the line.

Repeat this process several times for different 4-digit numbers.

Look together at page 9 of the Student Book. Display on the IWB, if possible. Ask students to work in pairs and to take it in turns to create a number and then to round it. Their partner should check their answers. Look together at the worked example to show how four digits can be arranged and then how each number can be rounded. Ask individual students, *What is the 'rule' for rounding to the nearest 10, 100 and 1000?* They may spot the third speech bubble on page 9. Note which students have the clearest descriptions of their rules. These students can support you in Reflection time.


1B Rounding

Discover

Round to the nearest 10, 100 and 1000

Pick four cards from a set of digit cards 0–9.

- Make ten different 4-digit numbers using these digits.
- Order the numbers from smallest to largest.
- Write the numbers in the first column of the table.
- Complete the other columns by rounding your numbers.

Worked example

Number	Round to the nearest 10	Round to the nearest 100	Round to the nearest 1000
6379	6380	6400	6000
7369	7360	7400	7000
9753	9750	9800	10 000

Number	Round to the nearest 10	Round to the nearest 100	Round to the nearest 1000

Key words
- round to the nearest
- 4-digit number

I picked these digits.
3 5 7 9
I can make 5379, 7358, 9753 and lots more.

I rounded each number to the nearest 10, 100 and 1000.

Remember: look at the digit to the right of the one you are rounding. If the digit is 5 or more, round up. If it is less than 5, round down.

Stretch zone

I am thinking of a number. I round my number to 6000 to the nearest thousand. What is the smallest possible number I could be thinking of? What is the largest possible number?

For more practice, go to Practice Book 6, page 17.

1 Number and place value

9

Differentiation

Supporting: Model how to use a number line to support rounding.

Consolidating: Ask students to show you how they use a number line to support them.

Extending: Ask students to explain the rule for rounding.

Stretch zone: *I am thinking of a number. I round my number to 6000 to the nearest thousand. What is the smallest possible number I could be thinking of? What is the largest possible number?*

Check that students are using the agreed class rules to work out what the smallest and largest numbers are. The smallest number is 5500 and the largest number is 6499.

As a follow-up activity, ask students to find examples of large numbers in newspapers or magazines and round them to the nearest thousand. Alternatively, if the numbers are already rounded, ask, *What is the largest and smallest possible number before they were rounded?*