<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>4</td>
</tr>
<tr>
<td>Mental warm-ups</td>
<td>25</td>
</tr>
<tr>
<td>1. Revising numbers and place value</td>
<td>39</td>
</tr>
<tr>
<td>2. Time</td>
<td>45</td>
</tr>
<tr>
<td>3. 3D shapes</td>
<td>49</td>
</tr>
<tr>
<td>4. Addition and subtraction</td>
<td>53</td>
</tr>
<tr>
<td>5. Multiplication and division of whole numbers</td>
<td>57</td>
</tr>
<tr>
<td>6. Measurement</td>
<td>61</td>
</tr>
<tr>
<td>7. Fractions</td>
<td>65</td>
</tr>
<tr>
<td>8. Extending decimals to thousandths</td>
<td>69</td>
</tr>
<tr>
<td>9. Tables and graphs</td>
<td>72</td>
</tr>
<tr>
<td>10. Operations on decimals</td>
<td>75</td>
</tr>
<tr>
<td>11. 2D shapes</td>
<td>79</td>
</tr>
<tr>
<td>12. Perimeter</td>
<td>82</td>
</tr>
<tr>
<td>13. Multiples and factors</td>
<td>83</td>
</tr>
<tr>
<td>14. More multiplication and division</td>
<td>86</td>
</tr>
<tr>
<td>15. Angles</td>
<td>88</td>
</tr>
<tr>
<td>16. Percentages</td>
<td>91</td>
</tr>
<tr>
<td>17. Working with money</td>
<td>93</td>
</tr>
<tr>
<td>18. Mass</td>
<td>95</td>
</tr>
<tr>
<td>19. Probability</td>
<td>96</td>
</tr>
<tr>
<td>20. Revising co-ordinates</td>
<td>98</td>
</tr>
<tr>
<td>21. Extending division and multiplication methods</td>
<td>101</td>
</tr>
<tr>
<td>22. Ratio and proportion</td>
<td>105</td>
</tr>
<tr>
<td>23. More multiplication</td>
<td>107</td>
</tr>
<tr>
<td>24. More graphs; summary statistics</td>
<td>109</td>
</tr>
<tr>
<td>25. Patterns and basic algebra</td>
<td>112</td>
</tr>
<tr>
<td>26. Time and timetables</td>
<td>114</td>
</tr>
<tr>
<td>27. Area</td>
<td>116</td>
</tr>
<tr>
<td>28. More division</td>
<td>119</td>
</tr>
<tr>
<td>29. Mixed calculations</td>
<td>121</td>
</tr>
</tbody>
</table>
This Teacher’s Guide is designed to support the component parts of Nelson International Mathematics 6. The guide covers Student Book 6 and Workbook 6.

Support is presented under the following headings:

- **Concept and skill development** – an overview of the topic, which outlines the objectives covered and the skills students will develop in the section.
- **Vocabulary** – highlights the keywords that you should use in your teaching. Using the correct terminology yourself and encouraging students to use the same, plays an important part in the development of sound mathematical thinking.
- **Resources needed** – a list of the items that you and the students can use for suggested activities.
- **Mental warm-ups** – It is useful to spend about ten minutes each day doing an oral and mental activity so that students get a chance to use known facts, sharpen and improve their mental strategies and practise and consolidate previously learned mental calculation strategies (such as partitioning, compensating or bridging through multiples of ten). You cannot expect the students to recall mental facts quickly unless they have practised and repeated these regularly.

We have provided a bank of sample mental warm-ups on pages 25–38. In most cases, these activities can be done with the whole class. Students can show answers using place value cards or mini-whiteboards, or write answers in their books or on scrap paper. Alternatively, in some cases, it may be more useful to have different students come up and write answers on the board.

Some teachers may prefer to choose activities which are linked to the concepts that will be covered in lessons that follow. For example, before teaching the section on calculating a mean in data handling, you may do a mental activity adding sets of two-digit numbers mentally or revise division facts. However, the mental activities are designed to focus on mental calculation strategies, so they will not always link to new concepts being taught.

- **Teaching ideas** – these are listed under Practical activities (suggestions for activities that introduce the topics in a lively and engaging way before students tackle theoretical or written work) and Using the Student’s materials (notes to take you through the pages of the Student Book with suggestions for class and group work). Many sections also have Workbook activities, which are activities the students can complete in the write-in workbooks.

- **Informal assessment questions to ask** – a list of the types of question that might help you assess the topic, including questions that can stretch higher-attaining students or to give lower-attaining ones more practice.

- **Common errors and misconceptions** – tips and advice to draw your attention to areas that students frequently find difficult or confusing, so you can prepare additional material in advance.
Key to icons

In the books, you will see icons identifying the main syllabus strand covered by a specific activity (or, in most cases, by a cluster of activities).

Number and calculation
Shape and space
Measures
Organising and using data

Note that the syllabus identifies problem solving as a separate strand. However, because problem solving arises in each of the four other strands, we have simply identified problem solving as one of the different kinds of activities you will find in the Student Book.

The table below gives you examples to show how and where the problem solving objectives from the primary mathematics framework are integrated and included in the Student Book and Workbook.

Problem solving

Problem solving is integrated throughout the materials. The following table lists the problem solving objectives and gives one or two examples to show where this objective is specifically covered in the book. However, remember, the students will use problem solving skills throughout this course and that there are many opportunities to meet each objective built into the materials.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>6Pt1 Choose appropriate/efficient mental or written strategies to carry</td>
<td>pages 156–7</td>
</tr>
<tr>
<td>out a calculation involving addition, subtraction, multiplication and</td>
<td></td>
</tr>
<tr>
<td>division</td>
<td></td>
</tr>
<tr>
<td>6Pt2 Understand everyday systems of measurement in length, weight,</td>
<td>Chapters 2 and 6</td>
</tr>
<tr>
<td>capacity, temperature and time and use these to perform simple</td>
<td></td>
</tr>
<tr>
<td>calculations</td>
<td></td>
</tr>
<tr>
<td>6Pt3 Check addition with a different order when adding a long list of</td>
<td>pages 24 and 101</td>
</tr>
<tr>
<td>numbers; check when subtracting by using the inverse</td>
<td></td>
</tr>
<tr>
<td>6Pt4 Recognise 2D and 3D shapes and their relationships, e.g. a cuboid</td>
<td>Chapters 3 and 11</td>
</tr>
<tr>
<td>has a rectangular cross section</td>
<td></td>
</tr>
<tr>
<td>6Pt5 Estimate and approximate when calculating, e.g. use rounding and</td>
<td>page 119</td>
</tr>
<tr>
<td>check working</td>
<td></td>
</tr>
<tr>
<td>6Ps1</td>
<td>Explain why they choose a particular method to perform a calculation and show working</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>6Ps2</td>
<td>Deduce new information from existing information and realise the effect that one piece of information has on another</td>
</tr>
<tr>
<td>6Ps3</td>
<td>Use logical reasoning to explore and solve number problems and puzzles</td>
</tr>
<tr>
<td>6Ps4</td>
<td>Use ordered lists or tables to help solve problems systematically</td>
</tr>
<tr>
<td>6Ps5</td>
<td>Identify relationships between numbers and make generalised statements using words, then symbols and letters, e.g. the second number is twice the first number plus 5 ((n, 2n + 5)); all the numbers are multiples of 3 minus 1 ((3n - 1)); the sum of the angles of a triangle is 180°</td>
</tr>
<tr>
<td>6Ps6</td>
<td>Make sense of and solve word problems, single and multi-step (all four operations), and represent them, e.g. with diagrams or on a number line; use brackets to show the series of calculations necessary</td>
</tr>
<tr>
<td>6Ps7</td>
<td>Solve simple word problems involving ratio and proportion</td>
</tr>
<tr>
<td>6Ps8</td>
<td>Solve simple word problems involving percentages, e.g. find discounted prices</td>
</tr>
<tr>
<td>6Ps9</td>
<td>Make, test and refine hypotheses; explain and justify methods, reasoning, strategies, results or conclusions orally</td>
</tr>
</tbody>
</table>

In the Student Book, and in this Teacher’s Guide, you will see small icons next to some of the practical activities suggested for each topic. These icons indicate a specific type of activity.

This icon indicates a practical activity, which develops mathematical understanding through the use of manipulatives. Typical manipulatives used at this level include: blocks, dice, abaci, counters, measuring sticks, items used for non-standard measures, for example, paperclips or books for length; bottles or tins for capacity, and so on. Sometimes practical activities do not involve manipulatives, for example, they might instead require students to explore their own movements or actions.

This icon indicates an activity involving construction, building or craft work. For example, students might cut out 2D shapes, build 3D shapes from modelling clay, cut out symmetrical shapes, and so on.
This icon indicates an activity involving discussion, debate or any other oral work. For example, students might talk about which method they found easiest or fastest for solving a specific problem. You may also see the same icon for singing, clapping or any other activities that develop listening and speaking skills.

This icon indicates an activity involving writing or drawing. For example, students might fill in answers to number sentences or questions.

This indicates a problem solving activity.

**Fundamental principles**

This series makes the following assumptions about the teaching of mathematics:

- Students need concrete experiences in order to acquire sound mathematical understanding.
- Like adults, students learn best when they investigate and make discoveries for themselves. Students refine their understanding and develop conceptual structures by talking about their own thinking and working.
- Individual students develop at different rates.
- Students learn in a variety of different ways.
- Students will become more mathematically able if allowed to develop reliable personal methods of working; the formal recording used by mathematicians is very difficult for most students to understand.
- The conventions of mathematics should be taught only when students are confident in their own knowledge, concepts and skills.
- Calculators and computers are tools with which students must become familiar in order to function effectively in the future.
- Students need plenty of opportunities to apply what they have learnt, and to relate their mathematics work to other areas of the curriculum and to their lives in general.
- Students learn mathematics most effectively when they enjoy and see relevance in what they are doing.

This course offers a wide range of mathematical experiences which reflect current thinking on the most effective ways of teaching and learning mathematics at the primary level. It recognises the professionalism of the teacher, and acknowledges that teachers are the best judges of experience appropriate for their own students. It does not impose an inflexible structure. Instead it provides a wide variety of practical activities, pencil and paper exercises and games linked to well-defined purposes or objectives. The teacher selects from this menu to meet the needs of classes, groups and individuals.
Frameworks for teaching

Summary of the approach

The learning framework of this course can be summarised as: do – talk – record.

Doing

Students develop their skills by manipulating apparatus, playing games, investigating patterns and rules, modelling problems and talking about their ideas with peers before they are expected to record their work.

Talking

Through discussion, the students can make sense of what they have been doing. They can thus begin to generalise from their experiences. The teacher’s central role is to create such situations and to judge when to intervene.

Most of the activities in this Teacher’s Guide will help you to facilitate discussion, and will encourage students to listen to each other and experiment with different ways of thinking about and solving problems.

Recording

At Stage 6, students are likely to have refined their skills and knowledge and developed the use of strategies that they find easy and useful for solving problems. They may still need to use informal and very personal methods (jottings) of recording steps in a process, or keeping track of what they have done. Jottings are an important step in moving towards non-standard methods of calculation (such as diagrams and jumps on a number line) that give the students a foundation for more concise standard written methods of recording.

It is very important that you allow, and in fact encourage, students to make use of jottings as they work. Here are some possible ways of doing this in the classroom:

- Do jottings of your own as you work out solutions. For example, if you are demonstrating how to calculate $144 \times 5$ you might jot the following on the board to show how you are thinking:
  
  \[
  \begin{array}{c}
  1440 \\
  720 \\
  \end{array}
  \]

- Talk through the jottings as you make them. For example, 144 times 10 is 1440, half of that is 720. This modelling process helps students to see that jottings are important and useful.

- Make space for jottings in the students’ exercise books. You can reinforce the importance of jottings as a means of showing your working by encouraging the students to jot as they work. If you only allow jotting on scrap paper, students may think it is not as important or valuable as their ‘real’ work in their book.

- Limit the use of prepared sheets with boxes for answers and no space for jotting down steps.
• Do activities where jotting is the point of the activity, for example, ask students to represent \( \frac{3}{4} \) visually in as many ways as possible, or ask them to work out problems where they will need to jot down interim steps to keep track of the process: for example, how many ways can you find of making one dollar using any combination of 50 cent and 10 cent pieces.

• Ask students to share their jottings and compare them to show that there are different methods of working. This can help the students to see that some strategies are more efficient than others and, in turn, refine their own thinking. In the ‘make a dollar’ task above you may find that some children draw coin combinations, others list them and those who are more able and confident may make a table and work more systematically. All of these methods may provide the correct answers, but obviously some will take longer than others.

In the early stages of using apparatus in a new way, recording may take the form of drawings or words and drawings. Some students will gradually find this time-consuming and will simplify their recording independently. Others may need your suggestions and encouragement. As a teacher, you will need to work out carefully when a student is ready to use a standard mathematical symbol or format, so that recording is based on full comprehension.

Although at Stage 6, you will teach students some standard written methods for operations on larger numbers, it remains crucial that you do not force children into formal and standard methods of recording calculations before they have fully grasped the process and are confident in the methods.

**Individual differences**

Everyone learns at their own pace, and in different ways, although experiences may be common. Adults in the real world bring a wide variety of approaches to their work, often ones they have devised for themselves despite many years in school learning standard methods. This course recognises individual differences and aims to give students the chance to explore the world of mathematics and solve problems in their own way. The course is also designed to provide equal opportunities to all students who may use it, regardless of their gender or ethnic, cultural or linguistic background.

**Developing mental strategies**

Adults perform many mathematical tasks mentally either because the tasks are simple, or because it is quicker to work things out in the head than use pencil and paper or a calculator. Too much work with paper and pencil can inhibit students from developing the flexibility and range of strategies necessary for efficient mental work.

A central aim in this course is to develop in students the ability to add or subtract numbers mentally, and to use quick recall of multiplication facts. Many of the activities encourage students to move directly from their own strategies with apparatus to working things out in their heads.
Students should be made aware of the role of mental methods as a first resort when a calculation is necessary, and not be led to believe that there is a particular method for a particular type of work, such as vertical presentation for ‘best work’, ‘answers only’ for mental arithmetic, or ‘working out’ only in rough books or on scraps of paper.

This Teacher’s Guide presents many ideas for oral work and suggests alternatives to the standard methods to help promote the development of effective mental methods. All arithmetical problems in this course are presented horizontally to encourage students to choose and use their preferred method.

One of the most significant changes to the Cambridge Primary Mathematics Curriculum Framework for 2012 onwards is the inclusion of a specific set of objectives under the category of Mental Strategies. These objectives aim to ensure that students are encouraged to use number facts and a range of mental strategies to add, subtract, multiply and divide. The idea is that these mental strategies are developed and used across all stages, and that students will continue to use them alongside more formal written methods as appropriate.

Mental calculation is important for both school-level mathematics and daily life, not least because it is often the most effective and simplest way to get an answer. At Stage 6 in the primary school, it is usually the most effective method for solving most of the problems that students are faced with. Teaching, and encouraging the use of, mental strategies helps students to realise that numbers are quantities (rather than just seeing them as separate digits). This in turn allows them to take advantage of the particular properties of the actual numbers involved in a problem and to decide which strategy lends itself best to solving it. Mental strategies also allow students to develop a good sense of equivalence in mathematics. At a basic level, this could be simply saying $5 + 6 = 5 + 5 + 1 = 11$, but it forms the basis of algebraic manipulation and the more abstract functions that students will have to deal with at higher levels.

Here are some of the reasons that researchers around the world give to support the idea that mental computation should be included at all stages in school curricula:

- Mental calculations account for more than 80% of the calculations that adults do in daily life.
- Mental calculation is essential for estimation. This is an important skill because many of the calculations we do in daily life do not require an exact answer. For example, these pies cost $1.90 each, can I buy three with $5? ($2 \times 3 = 6$, so no.) These pies are $1.90 each, I’m buying six and the seller is asking for $15, that can’t be right!
- You often need to do some mental calculation before you can use a calculator, and you need to have some idea of how big or small the answer will be to check that you have used a calculator correctly.
- When students have a range of mental strategies, they are able to find the easiest way of doing calculations.
Mental strategies rely on basic number relationships and they build on counting work from earlier grades, so they provide an excellent way for students to develop good number sense.

Many of the patterns and relationships that make up the study of mathematics are numerical, but they are too vast and numerous to learn by heart, so it makes sense to develop a concept of how these work, so that you can transfer the skills to solve previously unseen problems in creative ways. To make sense of this, you just have to think about place value and counting. Once students learn the rules for making numbers, they can read and write any number. We would not, for example, teach every single number from 10,000 to 100,000 in a rote way. Instead, we expect the students to apply their knowledge to make, read and write numbers in this range.

In the sections that follow, we will explore what it means to develop mental strategies both in theory and in the classroom. Then we will present a general approach to teaching mental calculation strategies, with some examples to show how this might work. The actual strategies themselves are dealt with in more detail in the student’s materials and teaching guidance by topic in this Teacher’s Guide.

What are mental strategies?

Essentially mental strategies are the individual methods we use to solve problems ‘in our heads’.

As an example, try to answer this question without doing any pen and paper calculation: how many 45c tickets can you buy with $10?

Once you have an answer, think about what you did to find the answer. Did you think in any of these ways?

- You can buy two 45c tickets with 1 dollar, so you can buy about 20 with $10.
- Ten 45s are 450. 450 and 450 is 900, that’s 20 tickets. You have one dollar left, so you can get two more, 22.
- 45 is almost 50, two 50s are $1, so I can buy about 20.

Very few adults will solve this problem by doing formal long division (1000 divided by 45) in their heads. This illustrates an important point about mental strategies – they do not involve simply visualising formal algorithms in your head and solving them without writing them down. Rather, mental strategies are the ways in which we use number facts that we have learnt by heart together with the relationships that exist between numbers and operations in order to solve problems. When you are teaching mental strategies for calculation, it is therefore crucial to focus on the mental processes that students use to get to the correct answer.

Recall of number facts is an important element of mental mathematics because other strategies use and depend on these. At Stage 6, students should know addition and subtraction facts to 20 by heart. They should also know multiplication facts to 100 (2 to 10 times tables). The daily mental mathematics time can be used to consolidate these facts. In general, if a student can give the answer to a known facts such as 9 × 7 within 2–3 seconds then you can tell that he or she has memorised and internalised it.
Implications for classroom practice

The Nelson International Mathematics series has the key mental strategies for each stage built into the student’s materials. There is additional support included in the Teacher’s Guide in terms of the teaching activities section for each topic as well as the sample daily mental maths activities to allow students to practise and refine their skills. In addition, we offer a series of parent cards that explain the approach and suggest how parents can support it in the home. The provision of these materials makes it easy for teachers to meet the objectives of the revised framework. However, the materials do not stand alone – your classroom methodology and the ways in which you teach, support and encourage students to use mental strategies are of utmost importance in implementing these objectives.

In a classroom where mental strategies are given their due importance, the teacher’s role would include:

• being flexible in recognising and accepting whichever strategies the students use (including allowing them to choose their own strategies as well as to work in different ways)
• using different mental strategies yourself and modelling them for the class so that they can compare them with the ones they are using
• helping students to think about their own strategies so that they can refine them and work towards more efficient strategies.

These examples demonstrate how the teacher’s behaviour and actions can support or hinder this approach.

A class is given the following subtraction: 73 – 27.

Note that the problem is given horizontally. This is the first element of a flexible approach because it does not force the students into thinking that they have to do vertical subtraction in columns with carrying.

Here are four students’ workings.

A  
73 – 27
+3 +3
76 – 30 = 46

B  
73 – 27
77 – 27 – 4
50 – 4
46

C  
73 – 27 = 46
70 + 3
27
43 + 3

D

All the students have the correct answer but they have found it using different strategies:

• Student A has used a strategy that involved adding the same amount to each number to get numbers that are easy to subtract.
• Student B has added four to the first number to get a number that is easy to subtract from and then subtracted the four again at the end using knowledge of bonds to ten.
• Student C has decomposed the larger number into 70 + 3 and then subtracted the 27 before adding the 3 back.
• Student D has used an empty number line and done the subtraction in parts, subtracting 20 first, then subtracting 3 to bridge to 50 before subtracting the last 4.

The teacher in this classroom has several options, for example:
• He or she can ask the class to put their hands up to give the answer. This focuses on the answer and ignores the processes by which the students worked the answer out. It also makes it difficult for those students who are still trying to work things out, because the quicker students put up their hands and try to get the teacher’s attention, distracting them and making it difficult to think.
• Similarly, the teacher can ignore how these students have worked and do a column subtraction to show the class how to get to the answer.

Both of the above choices are counter-productive as they do not help the students develop confidence and in fact, moving straight to the ‘old fashioned’ algorithms has been shown to undo students’ understandings of place value.

When you value mathematical thinking and reasoning, you must make time to discuss how students got to their answers. This may involve modelling their solutions on the board and having the students verbalise and explain what they did. The students will learn from these explanations and showing them different options allows them to compare their own methods and strategies with those of others and to decide whether to move to a strategy they find more efficient. Modelling solutions and explaining thinking also makes the mathematics visible to students who may not have grasped it. When you just give students an answer, the mathematical strategies are invisible to them – they cannot see how you worked it out.

Here is the working of a fifth student.

\[\begin{align*}
73 &- 27 \\
27 &- 4 \\
50 &
\end{align*}\]

This student has subtracted 7 from 3 and automatically used negative numbers (even though this has not been taught to the class at this stage). She then subtracted 50 from 70 before treating the negative number like a subtraction.
The last example is a good one to emphasise the teacher’s role. In many primary classrooms (and in fact in some primary maths textbooks) students are taught ‘you cannot take a larger number away from a smaller number’ because the teacher wants them to borrow from the next place value before subtracting. However, this is an incorrect and very misleading statement (particularly as students will have to deal with integer subtraction at higher stages). The student in the last example is totally comfortable with negative numbers and she does in fact use them correctly. A flexible teacher will share this method with the class and allow them to discuss it without insisting that they use it. If some children say ‘you cannot take 7 from 3’ a flexible teacher will ask them why not, and perhaps use examples such as ‘borrowing’ money or the integer number lines that students have used for temperature to show that in some cases you can. Of course, using a calculator to find 3 – 7 will also show that you can get a negative answer.

**Teaching mental calculation strategies**

The general approach to teaching strategies for mental calculation can be seen as three steps:

- **Introduce the strategy**
- **Reinforce the strategy**
- **Assess students’ mastery of the strategy**

Each of these steps is discussed in more detail below.

**Introducing the strategy**

One method of teaching a strategy is to give the class an example of a calculation for which the strategy would be useful and then to ask the students to find the answer to see whether any of them select and use the strategy. For example, you want to teach them how to multiply by multiples of ten by rewriting the multiple as $10 \times n$.

- Start by writing the multiplication $35 \times 40$ on the board.
- Ask the students how they could find the answer.
- If one of the students suggests viewing it as $35 \times 10 \times 4$ ask them to explain the strategy to the class with your help.
- If no one suggests this, model the strategy yourself. Your modelling could include concrete materials (such as place value charts or a diagram showing that $40 = 10 \times 4$). At the demonstration phase, your modelling should include jottings to show the steps in the process.
- Discuss the thinking behind the strategy as you model it. For example, it is quite hard to multiply by 40, but it is easy to multiply by 10 and by 4, so I am going to write 40 as $10 \times 4$. I am going to multiply 35 by 10 first. Do you remember what happens to the digits when we do that? (Prompt class to say that the digits move left and we use 0 as place holder for units.) Now I have $350 \times 4$. I’m going to work this out by doubling. Double 35 is 70, so double 350 is 700 and double 700 is 1400.
• Next, do some more examples using appropriate numbers to demonstrate the logic of the strategy and discuss when it would be useful (i.e. what numbers would it work with?). If you like, you can show the students examples of when this would not be the most useful strategy. (For example, if the calculation is $\times 50$ it may be faster to multiply by 100 and halve the answer, or if the calculation is $49 \times 40$, it may be better to use compensation strategies and work out $50 \times 40 = 2000$ and then $-49$.) Remind the students that the choice of strategy depends on which methods they prefer and which numbers they find easiest to work with.

Reinforcing the strategy
The key components for reinforcement are:

• Providing lots of similar examples to practise the strategy in isolation and develop competence in using it. You will find that the Student Book and Workbook provide pages of examples for specific strategies as they are developed.

• Getting students to talk about and explain their thinking and methods as they use them. As they become more confident in using a strategy, they may find shorter and more efficient methods.

• Allow (and in fact encourage) jottings and pen and paper workings as you develop mental methods.

The activities you use to reinforce a strategy should be varied in type and presentation, so that students do not treat it as a rote activity, and structured in ways that encourage maximum participation. You will find suggestions to help you do this in the teaching guidelines section for each topic.

When you introduce a strategy you will need to allow sufficient time for the students to explore it and become comfortable with how it works. As they become more competent in using it, you can reduce the time spent on different activities.

Once most of the class are using the strategy confidently, your role is to help them integrate the strategy with others that they use. One method of doing this is to provide activities that include a mix of calculations, some of which are not suited to the particular strategy. It is often useful to present a mixed exercise, ask the class to look at the problems and then spend some time discussing which strategies students think will work best for different problems. Encourage them to identify the properties of the numbers that suggested each strategy to them.

Assessing whether students can use the strategy
Assessing mental strategies should take a variety of forms. However, the main aim of you classroom assessment is to see whether the students can work efficiently and accurately by choosing an appropriate strategy rather than to test the use of a particular strategy. So, for example, you may use ‘timed’ tests in which the students compete against themselves to recall facts and do mental calculations over a set period (such as a test a day for five days) in order to improve their own time and/or accuracy. You will find examples of timed tests in the Workbook.
You can also play games to assess mental computation skills. Games such as ‘beat the calculator’ that the students play in pairs offer an opportunity for you to observe the students as they work and to record any observations that you make.

One method of assessing whether the students can recall facts and use mental strategies is to gauge the time it takes them to respond to a question. As mentioned earlier, response time for known facts should be 3 seconds or less. With the other mental strategies, a good response time is 5–10 seconds (depending on how difficult the problem is). Bear in mind though, that is a goal to work towards rather than a strict guideline. When students are beginning to use a strategy, you would allow them as much time as they need to apply it and answer the problem.

Talking to students in small groups or one-to-one is also important for assessing their competence, particularly if what they jot down is unclear or incomplete. Asking questions about how they were thinking will allow you to see whether they understand the strategy and whether or not they can use it.

Calculators

It is essential that students learn to use a calculator confidently, understand what the display means and check that the answer is correct. It is likely that the students in your class are already familiar with mobile phones, computers and other gadgets. Many of them will already know how to use numbers in electronic equipment properly. However, you cannot assume that they have this knowledge; make sure that they develop it through regular use of calculators in the classroom.

Activities involving the calculator are integrated into work on number, measures and data. In addition there are many activities in which calculator use, even if not specifically mentioned, may be appropriate. The calculator fits into mathematics learning in a number of overlapping ways, outlined below:

Mental calculations

In many activities, we use the calculator keys after a mental arithmetical operation in order to arrive at the desired result, for example:

The display shows 17.5 and students need to make it up to 29.8. They will have to work out that +12.3 is appropriate before entering it on the calculator.

This type of activity encourages estimation and the reversing of operations. Most calculator activities in the course are of this type.

Formation of concepts

Calculator activities encourage generalisations or abstractions about number. As an example, you will find that students quickly extend their number range far beyond that prescribed in the syllabus if they use a calculator regularly. Evidence has shown that students understand very large, very small and negative numbers more thoroughly at a younger age through the availability of calculators.
**Translation**
Translating between concrete experiences and their symbolic representation proves extremely difficult for many students. The calculator provides one way of becoming more fluent in this translation, as students can replicate concrete operations through the symbols on the keyboard and display, and check that the answer matches.

**Checking**
The calculator can be used to check the results of computations attempted mentally or on paper. This should encourage mental estimation. It may be worth considering that the calculator could be used in the first instance, and mental and/or written methods used to check.

**Arithmetical or algebraic logic**
School calculators commonly use ‘arithmetical logic’. This means that they perform number operations in the sequence in which they are entered, without regard to the conventions of algebraic logic, where multiplication and division take precedence over addition and subtraction.

A student entering:

\[3 + 4 \times 5 - 2\]

into an arithmetical calculator will arrive at the answer 33,

whereas an algebraic calculator would calculate the multiplication first:

\[3 + (4 \times 5) - 2\]

\[= 3 + 20 - 2\]

\[= 21\]

The algebraic calculator accepts all the entries but does not organise and process the information until the \(=\) is pressed. The arithmetical calculator, on the other hand, gives a subtotal each time an operation sign is pressed.

This difference is significant, especially when dealing with functions and number chains. If students are using arithmetical calculators, and the hierarchy of the operations is important, they will need to use brackets and understand the precedence of the multiplication and division signs over addition and subtraction signs.

**Computers**
The use of a computer can support students’ learning of mathematics in a variety of ways. Obviously, your use of computers will depend on the resources available at your school. However, it is useful to know about the range of technologies available, as it is likely that your school’s resources will increase as time goes on.

- **CD-Roms** are discs that contain electronic files with plenty of reference information. They may include an array of printable materials such as worksheets and practice sheets, tests, resources such as graph paper, maps, and so on.
• **Games** enable students to apply their mathematical skills through fun, interactive activities. Many educational games are designed to develop specific skills. If you have these available at your school, try to build in the use of games regularly each week. Find games that reinforce the specific areas of mathematics in which your students need regular practice. If there are specific games that are popular with your class, you may want to use game time as a reward for completing classwork or homework.

• **The Internet** is a rich resource for teaching suggestions as well as a source of much reference material. Keep a list of maths teaching websites that you use regularly. If you find articles of particular interest, download and print them, and add them to your resource files.

The BEAM mathematics project website (www.beam.co.uk) offers a full list of all their teaching support resources as well as a range of free resources (click on the ‘free resources’ tag). The free resources include downloadable worksheets for classroom or extension use and discussion papers and articles related to developments in primary mathematics to support professional development of maths teachers.

You can also find a wide variety of materials to support your planning, teaching and assessment of Cambridge Primary Mathematics on www.cie.org.uk.

There are interesting articles, research and activities on the Plus Magazine website of the University of Cambridge. (http://plus.maths.org).

**Exploring and investigating**

Primary mathematics has traditionally tended almost exclusively towards short, directed tasks which results in ‘right’ or ‘wrong’ answers. The activities in this course provide a balance between short, fairly self-contained activities and open-ended investigations which can be returned to and developed over a long period of time.

Most of the activities are designed to develop students’ awareness of the range of mathematical possibilities open to them when tackling a mathematical task. As much as possible, allow the students to take control, make decisions, and explore the many avenues that can arise from a simple starting point.

Even ‘dead ends’ and ‘mistakes’ provide valuable experiences, stimulating further questioning and exploration. A student freely investigating with a calculator, pressing a few ‘wrong’ keys, for example, is likely to have a better ‘feel’ for, and interest in, our number system than the student who is only allowed to use the calculator for checking the answers to ‘sums’.

Students should always be encouraged to ask ‘What if?’ and ‘Why?’ when investigating. These questions may lead to uncharted territory, new challenges, fresh understanding and the development of new skills.

Many investigations have no final solution or easily accessible generalisation for the students. Some have a simple pattern or rule which may be discovered and explained. However, many students will want to know
why certain patterns repeat, and offer explanations about the rules which
govern them. This is the first step towards generalisation, and teachers can
encourage this by asking, for example: ‘Why is the same number added each
time?’ or ‘Can you guess what will happen next?’

The value in investigations lies in students pursuing them to the limits of
their ability, and in the new skills that are acquired on the way. For some
students the early, often concrete, experimentation is enough to give them
confidence, and increase their enjoyment in using skills already acquired.

Sources of investigation

Many everyday objects can provide rich sources of investigative work. The
hundred square, addition square and multiplication square all contain many
fascinating patterns. Students can also explore patterns in solid and flat
shapes, such as the relationships between faces, edges and vertices of 3D
shapes, and the relationships between sides, corners and angles of 2D shapes.

Use investigations to enrich the introduction of new concepts. For example,
you can introduce number patterns through developing number chains, and
introduce geometric patterns through explorations of colour arrangements
on peg boards. Students can explore the relationship between area and
perimeter, and between volume and the dimensions of cuboids.

As they develop an investigative approach, help students to become
systematic in the way they work. This will help them to understand the
structure and formal approaches of mathematical theory.

Mathematics in real life

Some students may struggle to understand the relevance of mathematics in
their everyday lives. This course places great emphasis on making students
aware of the relevance of mathematics to their own real lives.

In this Teacher’s Guide, you will find ideas for using the student’s own
environment as a stimulus for mathematical activities. The Student Book
and Workbook frequently require students to look at the mathematics in
the classroom, the playground and their own homes. Each set of activities
and problems requires new skills and fresh understanding. Many questions
are open-ended or have no exact solution, and students are asked to make
predictions, generalisations and estimates, and to evaluate their own
answers. Encourage this skill in all areas of the curriculum.

Students use their understanding of mathematics at home and at school, in
situations such as sorting toys or books, working out the times of television
programmes, making patterns, helping to prepare food and playing board or
card games.

In school

In school, there are many opportunities for you to teach mathematics
through familiar situations, so that the students experience its usefulness
and appreciate the order and sense that mathematics gives to life. For
example, students can identify the date each day, as well as the time
at various points throughout the lesson. Registration, dinner money, timetables, sorting and putting away equipment will provide a range of relevant experience in data work, measures and shape and space as well as number.

**Play**

Students of all ages should have opportunities to play both in and out of school. This offers them the freedom to explore new situations, to make discoveries for themselves and to be creative. Unfamiliar mathematics equipment should be introduced through play, with the students exploring the functions and possibilities inherent in the materials. A good example of this is to experiment with pairs of compasses by drawing patterns and pictures before using them as mathematical instruments.

Construction kits offer students the opportunity to explore shapes and inverse operations, through building and dismantling.

**At home**

Part of the teacher’s role is to involve parents and guardians in the students’ learning. Parents need not be limited to supervising their children’s homework. There are many activities that can involve the parent actively in the child’s learning, and that can provoke mathematical discussion and language at home.

Parents can be encouraged to extend their children’s mathematical understanding through playing board and card games and by encouraging them to help with normal home activities such as cooking, gardening, cleaning and organising the home, drawing up plans and measuring when redecorating, and estimating how many or how much when shopping.

The Nelson International Mathematics scheme offers a set of parent cards that explain the approach taken in the series and suggest how parents can support it in the home. You can guide parents to these online resources, or you may like to print these out and send them home with the students.

Many of the students will also voluntarily help and encourage younger brothers and sisters in games and getting organised.

Family visits and holidays give students the opportunity to see environments different from their own, and to experience time and distance.

They are also likely to be budgeting pocket money, saving for special things and predicting how long it will take them to afford treats.

Students may have computer games that require them to use a variety of mathematical skills. They are likely to see and use a wide range of electronic equipment at home, which demands mathematical skills to be used properly.
Many students will also be responsible for their own timekeeping and have a degree of responsibility for others.

Some homes will not actively encourage girls to use construction kits, computers or calculators, and some parents will not be confident of their own mathematical skills or understanding. As a teacher, you can help a great deal by making explicit the mathematical content of everyday experiences and activities.

This book contains many suggestions for investigations, problems and research that students and parents can work on at home. Games made from suggestions in the scheme could become the core of a ‘lending library’ of games for students to take home for a period of time, to play with parents, or brothers and sisters. This would not only link home and school but also give parents and teachers a basis for discussion.

**Organisation**

**The classroom**

Each teacher will have preferences about how best to organise the available space. However, here are some useful guidelines for any classroom, irrespective of how it is arranged.

**Storage**

Keep equipment easily accessible. Check it periodically to make sure no pieces are missing or broken. Clearly label all items and encourage students to make their own decisions about what they need.

**A mathematics centre**

This may or may not be where the equipment is stored, but it will be a part of the classroom that is bright and attractive with displays of students’ work and other mathematical stimuli. The centre is a place for students to go at odd moments in the day, to be challenged with mathematics-related questions and activities.

Questions and activities should be provided by both teachers and students for interactive problem solving, for example: ‘The answer is 15.2. What was the question?’, inviting students to write out their suggestions. A number pattern or sequence, on a series of cards organised by the students, may be ‘secretly’ altered by the teacher, and the students have to discover what has changed, and put it right.

The BEAM organisation offers a wide range of primary mathematics resources including manipulatives (place value cards, large dice, dominoes, fraction grids and spinners), games and online resources that are a useful and enriching addition to any classroom mathematics centre. You can see the full range of BEAM products on their website www.beam.co.uk or you can request a catalogue from your local Nelson Thornes representative.
The students

Class teaching
At times it is efficient to work with the class as a whole, perhaps when introducing a new topic. The scheme offers plenty of ideas for this kind of approach. The planned work needs to be suitable for all the students, with individual needs and ability taken into account in subsequent group or individual follow-up activities.

Group work
You can group students in similar or mixed-ability groups, to suit the purpose of the work. This offers students the opportunity to collaborate, to discuss their work with each other and the teacher, for peer teaching to take place and for the work to be matched to their needs. It enables the teacher to work simultaneously with a number of students and this minimises the need for repeated explanations to individuals.

Working individually or in pairs
At times you may need students to work as individuals or in pairs. This can allow you to provide extra help to students who need it, or to stimulate and challenge the higher attaining students. Working individually gives students the opportunity to concentrate on their own thinking, to develop this through investigations and problem solving, to work quietly and in private, and to experiment with materials. Students working in pairs have the opportunity to develop collaborative skills, to play games together and to share ideas in an investigation.

Assessment and record keeping
A significant part of a primary teacher’s day is spent on the informal evaluation of a student’s or group’s learning, and in deciding what the next learning experiences should be.

Assessment can be both formal and informal, and can serve a number of functions. On-going observations and discussions with students can give teachers valuable diagnostic and formative information on which to base their teaching. Students’ written and practical work can yield valuable insight into the current stage of their conceptual development and the extent to which they are developing effective skills.

Ideally, assessment should take place throughout the year and its goal should be to support the students as they learn and develop their mathematical skills. For this to happen, the students need to be actively involved in both their own learning and their assessment. This means that they should understand how they are going to be assessed and how their success will be measured, they need to begin to evaluate themselves, to set targets for themselves and to reflect on their own learning so that they become more and more self-confident in mathematics.

For assessment to support the development of learning, assessment styles must be varied and relevant to the students. The programme of assessment should present opportunities for students to talk about and demonstrate what they have learned, through oral work, worksheets, exercises, tasks, projects, tests and other activities.
**Facilitating assessment**

- Give students a variety of tasks that require them to apply different skills, for example, writing tasks, using concrete apparatus or working with money. In this way the students are able to show what they know and can do in different and exciting ways.

- Think about the most appropriate way to assess a task or activity and identify the skill that you need to assess. This will help you to decide what assessment technique is most suitable at any time.

- Develop your own observation sheets to use as the students work through the activities in a topic and use this to observe and assess skills and learning. Here is an example of an observation and recording sheet for an activity in which the students build a model using 3D shapes.

<table>
<thead>
<tr>
<th>Date:</th>
<th>Students’ names</th>
<th>Cannot name shapes easily; struggles to build a model; cannot draw the shapes</th>
<th>Can name and identify a few of the 2D and 3D shapes; has difficulty in drawing shapes</th>
<th>Can identify and name most of the shapes correctly; has difficulty drawing some of them; uses limited shapes in the model</th>
<th>Can identify, name and draw all of the shapes and uses a variety of shapes in their model</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Watch, observe and ask students questions as they work through topics, rather than only assessing the final product. This will allow you to see where they have difficulty and to address problems that may impact on understanding.

Use a range of different contexts for assessment (individual, peer, group, oral, written) and keep clear and well-organised records of your observations and any marks you allocate. This is not only useful for your own purposes, but it also equips you to report back to parents and guardians about their children’s progress.

**Formal testing**

From Level 3 onwards, you may want to include testing as part of the learning process. Some schools will opt for outside tests from different curriculum providers, but it is useful to introduce the idea of mental and written testing as these will be used as the students progress through school.
In this course, we provide assessment suggestions for different activities and topics in the Teacher’s Guide. Cambridge Primary provides end of stage tests, called Progression Tests, for Stages 3–6. The tests are designed to allow measurement of students’ progress and identification of their strengths and weaknesses.

To help teachers prepare students for the Cambridge Progression Tests, we have provided a set of tests in the same style and format as questions in the Progression Tests.

Seven tests are provided for this stage. Tests 1–6 are intended to consolidate work as students progress through the stage. The relationship between these tests and the chapters is as follows:

Test 1: Chapters 1–5
Test 2: Chapters 6–10
Test 3: Chapters 11–15
Test 4: Chapters 16–20
Test 5: Chapters 21–25
Test 6: Chapters 26–29

The final test, ‘Stage 6 Practice Test’, covers the entire Stage 6 curriculum and is intended for use as a practice for the Cambridge Progression Test.
Mental maths activities bank

You should aim to do a mental maths activity that takes about ten minutes each day.

This section contains some examples that you can use as is, or adapt to suit your own classroom. We have tried to provide a range of different types of activities (factual recall, games, grids, tables, problem solving and puzzles) to show some of the ways in which you can approach the mental maths part of the lesson. However, this is not a definitive list and some activities will appeal more to some classes and teachers than others. If you need additional ideas and suggestions, there are several useful websites for teachers which give ideas and resources. Type ‘mental maths warm-ups’ into your search engine and you will be directed to a range of sites covering this topic. One very useful site is www.transum.org which offers a range of maths activities including a ‘starter of the day’ many of which can be used with electronic whiteboards or screen projectors attached to the computer.

As you read through the activities remember:

- Most of these activities can be repeated by simply using different values. Many of them can also be adapted to make them simpler or more difficult.
- Many of these activities can be done with no resources. However, some require you to prepare grids and/or game boards or to supply students with apparatus such as dice or cards. We suggest that you keep the materials you develop and use them to build up a mental maths resource bank of your own. For example, when you prepare grids or tables with missing values, or magic squares with a wrong number, do this on card and, if possible, laminate the card so that it can be re-used. Lamination also means that students can use dry-wipe markers on the cards and these can be cleaned easily. Another option is to prepare apparatus on computer and to print these out onto overhead transparency sheets. These can be stuck onto white card to make a re-usable resource that can be wiped clean.

To make it easier for you to select activities to match what you are doing and that meet your students’ needs at different times, we have organised them into six sections:

1. Place value and number sense
2. Rounding and estimating
3. Mental problem solving
4. Calculation skills
5. Calendars and time
6. Shape, space and measures
1. **Place value and number sense**

Write any number on the board, for example 302 645.

- Ask students to say the number aloud.
- Ask different students to say how many hundred thousands, ten thousands, tens, units, etc. there are.
- Point to a digit and ask students to say its value.
- Ask students to reverse the digits and say the number.
- Let students make five different numbers using digits from the given number in any order.
- Let them exchange these and say each other’s numbers aloud.
- Repeat the place value questions using numbers the students have made.

Place the students in groups of two. Give them instructions such as:

- count forwards in ten thousands from 400 000 to 800 000
- count forwards in tens from 495 890 to 500 020
- count backwards in hundreds from 450 000 to 400 000.

Give groups of students a set of five or six mixed digits (on cards). Instruct the groups to make:

- the smallest possible number
- the largest possible number.

Ask the students to write a five- or six-digit number on paper. Choose one student to come to the front of the class and display his or her number. Ask, whose numbers are greater than this? Let the students display their numbers. Repeat for smaller than. Choose one student at random. Let her or him come up and stand to the left or right of the other one (depending on whether their number is smaller or greater) displaying their number. Choose other students who should come up and position themselves appropriately between the ‘numbers’ already on display.

Write a list of positive and negative numbers on the board. For example:

12  -3  0  -5  -4  9  5  -7  -1  1  -9

Draw a blank number line on the board with only the start and finish marked.

Ask the students to find the smallest number. Write this on the left-hand side of the scale. Repeat for the greatest number, writing it on the right-hand side of the scale.

Ask students to volunteer to come up to the board. Let them choose one of the numbers and have them position it on the scale as accurately as they can. Once all the numbers have been placed, discuss whether there are any inaccurate placements. Let the students decide and suggest how to move the numbers if necessary. This activity can be adapted to work with decimals, fractions, mixed numbers and whole numbers.
Give the students some possible digits for each place value and ask them to work out how many numbers are possible with a given number of digits. For example:

- The hundreds place can have: 2, 3, 4 or 5.
- The tens place can have: 1, 2, 3, 4, 5 or 6.
- The units place can have: 0, 1, 2, 3.
- How many three-digit number can you make?

Prepare a set of 40 cards with the digits 0–9 repeated four times. (If your classes are larger than 36, you will need more cards.) Shuffle these and deal 6 cards at random to small groups of students. Give the students a task to make (using all the cards):

- the biggest possible number
- the smallest possible number
- the number as close as possible to 1 000 000
- a number less than 500 000.

You can vary the task by changing the instructions and changing the number of digits. (For example, make the largest possible three-digit number.)

Give the students a set of number cards with the digits from 0–9. They should draw two at random and write them as a fraction with a denominator of 100. Repeat this five or six times. They then complete a table like this one for each fraction they made.

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Simplest form</th>
<th>Decimal</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g. 60/100</td>
<td>3/5</td>
<td>0.6</td>
<td>60%</td>
</tr>
</tbody>
</table>

2. Rounding and estimating

To practise and reinforce rounding off mentally, draw a grid like this one on the board. If you are going to reinforce rounding to the nearest ten, make sure the numbers all have a value other than 0 in the units place.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>456</td>
<td>1275</td>
<td>499</td>
<td>109</td>
</tr>
<tr>
<td>3245</td>
<td>6501</td>
<td>1295</td>
<td>1082</td>
</tr>
<tr>
<td>3509</td>
<td>8024</td>
<td>8019</td>
<td>876</td>
</tr>
<tr>
<td>103</td>
<td>562</td>
<td>901</td>
<td>1052</td>
</tr>
</tbody>
</table>

You can ask students to copy the grid, and have them rewrite the numbers, rounding them to a given place value as they go (for example, the nearest 10, the nearest 100). Alternatively, you can tell the class that you are going to round these numbers to the nearest ten. Then work through the grid, pointing at the numbers and asking different student to give the rounded number. Repeat this for different place values.
Draw an empty 0–10 000 number line with the thousand intervals marked but not labelled. Hand out a selection of four-digit numbers to different students and have them come up and stick these in the appropriate positions on the number line. Allow the class to comment and discuss the placement of the numbers. Let the students decide whether any placements are inaccurate and move the numbers as necessary.

If you have some way of displaying a large picture in the classroom, it is useful to show a photograph of a number of items (for example, a tray of beans, stitches in a knitted jersey or bees on a hive) and ask the students to estimate how many there are. Let them explain how they got to their answer.

Write a set of six numbers on the board. For example, a set of three- and four-digit numbers like these:

593  3199  5804  7083  908  427

Let the class estimate to find which two numbers should be added to get the total closest to a given number. For example, which two should we add to get the total closest to 10 000?

You can easily adapt this activity to deal with subtraction.

Let the students work in pairs. Ask them to choose any five digits and write them down. (You can vary this by stipulating digits can or cannot be repeated.) Tell students to check that their partner has written down five digits before you give the target number to prevent them cheating. Write a target five-digit number on the board. For example 40 000. Let the students arrange the digits they have chosen to make the number closest in value to 40 000. Let them compare numbers and decide whose is closest. Play a few times using different target numbers.

Play a calculator game in which the students work in pairs. One student should enter a four-, five-, or six-digit number. The other should try to wipe-out the digit in a given place value without changing any other digits. You instruct them, for example, to wipe out the hundred. If the number is 345 234, the student needs to know to subtract 200 to do this. Repeat, with the other student choosing the number.

Write a set of four digits on the board, two of these must be 5 and 9. For example: 6, 1, 5 and 9
Ask the students to make a decimal fraction that rounds to a suitable whole number, for example, make a decimal fraction that rounds to 60.

Students can then make 59.6 or 59.61.

Give them some different target numbers. For example, a number that rounds to 62. Students can then make 61.5 or 61.9, 61.59 and 61.95.

3. **Mental problem solving**

Play a game with periods of time. Write a time period on the board (for example, 186 days). Then ask the students to estimate and write down how many weeks, months, hours, etc. this is. Repeat this for different units (for example, 4 weeks, 8 months).

Display the traditional rhyme ‘As I was going to St Ives’

*As I was going to St Ives*

*I met a man with seven wives*

*Every wife had seven sacks*

*Every sack had seven cats*

*Every cat had seven kittens*

*Kittens, cats, sacks, wives*

*How many were going to St Ives?*

Let the students work out the total number of kittens, sacks, cats and wives (although the answer to this riddle is 1 as it’s the narrator going to St. Ives!). Ask them to explain how they worked it out. Change the activity by changing the numbers. For example, I met a man with seventy wives …

Play number combination games involving more than one operation. For example:

- Use each digit 1, 3, 4, 6 and 9 once only to make a calculation that gives 3280.

To find digits that work, do a calculation yourself. $91 \times 36 + 4 = 3280$. Then write them in size order for the students.

Goldbach’s conjecture says that any even number can be written as the sum of two odd prime numbers. For example, $6 = 3 + 3$; $8 = 3 + 5$.

Ask the students to express numbers in a given range as the sum of two odd primes. For example, write all the even numbers from 30 to 50 as the sum of two odd primes.

Make a letter-number code in which you give the letters of the alphabet a numerical value. This can be simple, such as A = $1$, B = $2$, C = $3$ and so on till Z = $26$. Ask students questions such as:

- What is the value of your first name in this code?
- What is the value of your family name?
- Can you find a word that is worth $50$?
Can you find a word that is worth more than $75?
Can you make a word worth at least $200?

Logic puzzles such as the following are fun for students and involve a fair amount of mental calculation to solve.

- I have a 7l and a 5l container. How can I use these to accurately measure 4l of water? (Answer: Fill the 7, pour it into the 5 leaving 2. Empty out the 5. Pour the two from the 7 into the 5. Fill the 7. Pour from the 7 to fill the 5. This will use 3l and leave 4l in the 7l container.)
- How can you measure 1 litre with a 3l and a 5l container?

Ask the students to work out how many ways there are to make a dollar using any combination of 1c, 2c, 5c, 10c, 25c and 50c coins? This activity encourages students to work systematically and to use jottings to keep track of their thinking. The most successful students will start either with the largest coins or the smallest like this:

- 50 + 50
- 50 + 25 + 25
- 50 + 25 + 10 + 10 + 5
- 50 + 25 + 10 + 5 + 5 + 5

You can make this problem easier by limiting the coin combinations.

Test understanding of mathematical terms and vocabulary by posing worded problems to be solved mentally. For example:

- Find the number that can be increased by 3 to make 21.
- What is the product of 4 and a number 5 greater than 4?
- What is the square of the difference between 16 and 7?
- What number do you get if you halve the product of 9.8 and 100?
- What is the sum of 345 and double 90?

4. Calculation skills

Draw an empty 2 × 6 grid on the board. Get the students to copy it into their books.

Fill in the numbers from 1–12 on the grid in random order. For example:

<table>
<thead>
<tr>
<th>6</th>
<th>1</th>
<th>10</th>
<th>11</th>
<th>8</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>5</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>12</td>
</tr>
</tbody>
</table>

Give the students a multiplier (for example, × 7 which suits work on converting weeks to days). They then fill in the product of multiplying each number on your grid by 7.

Use number grids like the ones below to practise mental addition and subtraction. The operations are given across and down. Students can work in any order to fill in the missing values.
For subtraction, make sure you start with a large enough value to avoid negative numbers at too early a stage.

You may like to make a variety of these grids on laminated cards (one per side) and hand these out to students in random order for mental practice. Remember you can adapt them to work with decimal values as well.

Give one student a number, for example 7, and ask him or her to double it. Point to students at random and see how far you can get with doubling the number. To change it, add or subtract a value to get a different value. For example, once the students get to 448, say something like: next student, subtract 8. Now halve the values. Remember, halving is more difficult as the students will get to fractional values as soon as they have to halve an odd number. When this happens you can change the pattern by getting them to add a value such as 9 1/2.

Play target number games. Give the class a number. This is the target number. Either let different students suggest different ways of getting to this number using whichever operations they like, or ask everyone to find ten different ways of getting to the number. For example, the target number is 86. Students could make the target by 80 + 6, 90 – 4, 8.6 × 10, 860 ÷ 10 and so on. To make the game more challenging you can give instructions for operations. For example, make the target by adding three numbers, or make the target by doubling any number and then subtracting, and so on.

Play a timed time-table game using whole numbers or decimals. Give the students the first five multiplications to establish the pattern. For example:

1 × 2.5
2 × 2.5
3 × 2.5
4 × 2.5

Ask them to write the answers and to continue with the table to see how far they can get in a given time.
Ask the students to find the sum of all the numbers from 1 to 10, 25, 50 and so on. This will encourage them to add quickly, but also to jot down reminder totals as they go.

Provide incomplete multiplication tables such as these and ask the students to find the missing values. This requires them to think strategically and to use inverse operations to find the missing values.

<table>
<thead>
<tr>
<th>×</th>
<th></th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>36</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>×</th>
<th>8</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>1800</td>
<td>320</td>
</tr>
<tr>
<td></td>
<td>336</td>
<td></td>
</tr>
<tr>
<td></td>
<td>392</td>
<td></td>
</tr>
</tbody>
</table>

You can generate many of these tables yourself, but remember you need at least one horizontal and vertical multiplier and at least four values for the students to find the missing values. You can extend these to a higher number range as the students become more competent at multiplication.

Provide a sheet of operations that form equivalent pairs with one odd one out. These could be equivalent fractions, decimal fractions paired with mixed numbers or percentages of amounts. Ask the students to find the odd one out and to explain how they decided this was the odd one out. Here is a short example using fractions of amounts:

<table>
<thead>
<tr>
<th>³⁄₁₀ of 100</th>
<th>⁹⁄₁₀ of 20</th>
<th>¹⁄₁₀ of 90</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼ of 80</td>
<td>⅓ of 27</td>
<td>¼ of 256</td>
</tr>
<tr>
<td>¼ of 72</td>
<td>½ of 150</td>
<td>½ of 60</td>
</tr>
</tbody>
</table>

Make a set of cards with the digits 1 to 7 written on them. Display these on the board. Draw a grid like this one on the board:
Ask the students to find ways of organising the digits so that the totals along any line (horizontal, vertical and diagonal) are the same. Encourage them to explain how they thought this out.

Make a set of cards with the digits 1 to 6 written on them. Draw a grid like this on the board.

```
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

Ask the students to find ways of organising the digits so the sum of the vertical digits (the column) is equal to the sum of the horizontal ones (the row).
You can make this more difficult by changing the instructions. For example:

- Arrange the digits so the sum of the horizontal row is 2 greater than the sum of the vertical column.
- Arrange the digits so the sum of the column is double the sum of the row.

Give each pair of students a die or a spinner with single-digit numbers on it. Let them take turn to roll the die and multiply the value they roll by a given multiple of ten (for example, × 40). They should take turns to roll five numbers and record their answers. Let them add up the products for the five calculations at the end to see who got the highest score. Work out the difference between the scores mentally too.

Play ‘minus the money’ in pairs. Each student starts with an amount of $10. They take turns to roll a die and multiply the result by 10 (or any number you choose to reinforce). They must subtract that many cents from their total. They continue to play until one player has no money left.

Prepare a series of magic squares with one incorrect value. Ask the students to find the incorrect number and explain how they decided it was incorrect. They should also suggest what the correct value is.

These examples use decimals with one place, but you can use decimals to hundredths, whole numbers, fractions and a mix of fractions and decimals to reinforce calculation in those areas.
Number puzzles such as the examples here are massively useful for mental calculation.

Arrange the digits from 1 to 6 so that the sum on each line is equal.

```
2.8  3.5  3.0
3.3  3.1  2.9
3.2  2.6  3.4
7.1  7.3  6.9
6.6  6.8  7.0
6.7  7.2  6.5
```

Arrange the digits 1 to 9 so that the sum of each line is equal.

```
9.3  9.2  9.7
9.8  9.4  8.9
9.1  9.6  9.5
```

The highlighted number is the incorrect one: this is for your information only.
Arrange the digits 1 to 7 so that the sum on each line is equal.

![Diagram of seven circles arranged in a pattern with spaces to fill in numbers.]

Use all the digits from 1 to 7 only once each, to make a sum that adds up to 100.

Check that students can apply knowledge of multiples, factors and divisibility rules using a simple activity like this one. Write a starting number on the board (for example, 64). Ask the students to jot down as many multiplications as possible to make this number. Repeat for other starting numbers including some prime numbers. You can also use decimal values once the students have had some practice in working with them.

Prepare decimal versions of the multiplication square. Point to the square and have different students give the product. For example:

<table>
<thead>
<tr>
<th>×</th>
<th>0.1</th>
<th>0.2</th>
<th>0.5</th>
<th>0.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Repeat this several times over a period of time, changing the values to reinforce multiplication facts and their translation to decimal values. Repeat for division as well.

Play games where students have to get three or four in a row (a variety of noughts and crosses) using the ideas of equivalence between fractions, decimals and percentages. Let the students play in pairs. Give each pair a prepared grid with suitable families of fractions on it. For example:

<table>
<thead>
<tr>
<th>1/10</th>
<th>1/5</th>
<th>1/2</th>
<th>18/40</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/50</td>
<td>6/20</td>
<td>1/25</td>
<td>4/25</td>
</tr>
<tr>
<td>9/100</td>
<td>9/10</td>
<td>3/5</td>
<td>9/10</td>
</tr>
<tr>
<td>9/20</td>
<td>4/5</td>
<td>11/20</td>
<td>28/100</td>
</tr>
</tbody>
</table>
To play, the students take turns to claim squares by offering an equivalent fraction (or decimal or percentage). To re-use the boards, let them place counters on the squares they claim. The aim is to make a row of three (or four) and at the same time to prevent your partner from making a row of three (or four).

5. Calendars and time

The patterns on calendars provide many opportunities for mental skip counting and pattern work. Use the fact that the dates each month on a calendar offer a number of sequences. In a row, the difference is easy, because the dates count up in ones. The columns offer numbers with a difference of 7 and, on diagonals, the difference is either 6 or 8. The sum of three consecutive numbers will be 3 times the first number + 3 times the difference between them. Provide a blank calendar for a month with some dates filled in and let the students work on the missing ones (and only those). For example, fill in the first one and then let the students work out the dates going diagonally.

Prepare a table like this one for display in the classroom:

<table>
<thead>
<tr>
<th>Time in place that is 4 hours ahead of us</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.15 pm</td>
</tr>
<tr>
<td>2.30 am</td>
</tr>
<tr>
<td>Half past five in the afternoon</td>
</tr>
<tr>
<td>10 to 6 in the morning</td>
</tr>
<tr>
<td>25 past 9 at night</td>
</tr>
<tr>
<td>Midnight</td>
</tr>
</tbody>
</table>

Point to different blocks on the table and let different students give the missing values.

6. Shape, space and measures

Use a variety of solid objects (a few boxes, a can and ball) to build a small tower in the classroom. Give the students questions to answer. For example:
• How many faces are there altogether in this structure? How did you work this out?
• How many corners (vertices) are there? How did you work this out?

Prepare an overhead transparency with a set of angles on it. Give the size of each angle in degrees and ask the students which angles can be put together to fit onto a straight line. The example below is an easy one as it only uses multiples of five and ten. To make it more difficult, include combinations such as 124 + 56 or 21 + 19 + 140. Jumble the angles so the students have to think about how to combine them to make 180.

You can also do this activity using sectors of a circle. Ask the students which sectors or slices can fit together to make a circle (sums to 360).

Play a missing angle game. Explain that you know two angles of a triangle and ask the students to find the size of the third one. (In other words, the value needed to make the sum total 180.) For example:

90 + 30 + □
50 + 80 + □
34 + 56 + □

Show the class a hard-cover book such as a dictionary. Give them dimensions for the book. For example, tell them that the covers are 5 mm thick and the pages are 3.5 cm thick. Get the students to work out the height of a pile of 3, 5, 10, 25 and 100 books. Vary the activity by:

• adjusting the dimensions and the numbers of books in the pile
• telling the students that the books need to be packed on a shelf of a given length (for example 1.2 m) and let them work out how many books can fit onto the shelf.

Practise converting measures as well as multiplying and dividing by multiples of ten using tables like these ones. Prepare a variety of different tables and hand them out at random for students to complete.
\[ \begin{array}{c|c}
\rightarrow \times 10 & \\
\leftarrow \div 10 & \\
2.3 & \\
0.8 & \\
14 & \\
4.5 & \\
\end{array} \]

Draw several quadrilaterals (use rectangles, squares, parallelograms, rhombuses and kites) on the board and give their perimeter in different units. Let the students work out possible dimensions for the sides. To do this they need to calculate but also apply the properties of the different shapes.
1 Revising numbers and place value

<table>
<thead>
<tr>
<th>1: Place value and number concepts</th>
<th>Student Book pp 5–10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Workbook pp 4–9</td>
</tr>
</tbody>
</table>

**Objectives**

- **6Nn2** Know what each digit represents in whole numbers up to a million
- **6Nn3** Know what each digit represents in one- and two-place decimal numbers
- **6Nn8** Round whole numbers to the nearest 10, 100 or 1000
- **6Nn11** Order and compare positive numbers to one million, negative numbers to an appropriate level
- **6Nn12** Use the $>$, $<$ and $=$ signs correctly
- **6Nn13** Estimate where four-digit numbers lie on an empty 0–10 000 number line
- **6Nn20** Recognise the historical origins of our number system and begin to understand how it developed
- **6Nc13** Find the difference between a positive and negative integer, and between two negative integers in a context such as temperature or on a number line

**Vocabulary**

Hundred, thousand, million, numeral, place value, expanded form, digit, round, approximate, estimate, greater than, less than, order, nearest, negative number.

**Resources needed**

Large flashcards showing a selection of numbers to 1 million; 0–9 digit cards and, if available, place value cards; 0–9 dice; an atlas or world map to locate cities.

**Mental warm-up activities**

Select suitable activities from the mental warm-up activity bank.
Concepts that may be unfamiliar in this topic

Locating numbers on empty 0–10000 number lines

Although students will have used number lines in the earlier stages, they are now required to locate four-digit numbers on an empty 0–10000 number line. You may need to spend some time looking at number lines with different intervals to make sure that the class can work out what each interval represents and equate the value of a number to its correct position on the number line. Discuss how students can work to place numbers most accurately by estimating distances and by measuring and working out set intervals. For example, if a 10 cm line represents 0–10000, then 1 cm represents an interval of 1000. The 2 cm mark represents 2000 and so on. Inbetween intervals can be worked out using students’ knowledge of fractions. For example, the number 2500 must lie halfway between 2 and 3 cm.

Calculating the difference between a negative and positive or two negative integers

Students have already worked with negative numbers in the context of temperature. At this stage, they need to extend that work to use the thermometer scale in the same way as they would use a more generic number line to calculate differences. Encourage the students to use jottings and their own empty number lines to find solutions to problems in this area. However, you may need to watch the direction in which the students ‘jump’ on their own number lines.

Teaching ideas

Practical activities

Start the year by exploring the history of our number system. Ask the students why they think people needed to invent numbers. Tell the class that the earliest counting systems used tallies rather than numbers. For example, to count their goats, African farmers use a ‘many-counting bag’. As the goats left the kraal in the morning, the goatherd placed one stone per goat into the bag. Without counting, he therefore knew how many goats there were. In the evening, when the goats returned to the kraal, the goatherd removed the stones, one per goat. Ask students what it meant if there were any stones left in the bag (some goats had not returned!) or if there were not enough stones (some new goats have appeared in the herd, which may mean the goatherd has brought home someone else’s goats). Other tally systems used notches on a stick. At the start of a count the person placed one notch per item down one side of the stick. To check the count again later, the person notched the other side. Spend some time discussing the disadvantages of this system. Talk about the problems we might have today if we had no numbers for counting. Make sure the students understand that tally systems of counting did not use place value and that many older tally systems had no numbers associated with amounts.
Talk about other systems of counting. Explain that many cultures counted using parts of the body. The most obvious example of this is our fingers. Let the students spend some time answering the question ‘What is the highest number you can count to using your hands?’ Allow them to explain their systems, and take into account that Asian students may know how to use methods of finger counting using joints (India, China and Japan). If they know these, let them explain how they work. If you have access to the Internet, you can ask students to find out more about gesture and finger counting systems used in different parts of the world.

Tell the students that Indians in Peru and Bolivia (South America) still use a system of string and beads (chimpu) to count and record large numbers. The diagram on Workbook page 4 shows how this system works for four-digit numbers.

Get the students to make their own chimpus for showing four-digit numbers. Give them string and beads and let them use these to represent given numbers. Have them check each other’s representations. When they have played around with this for a bit, ask them how they would represent five- and six-digit numbers in this system. Again remind the students that this is a counting system, not a number system. In the past, the Indians would not have had numbers for the amounts shown on the chimpu.

If your classroom is multi-lingual, ask the students what languages they can count in. Discuss where the numbers come from in each language, for example, in Greenland, five (tadlimat) means hand, while in Paraguay, the Luli Indians say ‘is yaoum’ (both hands) for ten.

Ask the students what they already know about our Hindu-Arabic number system. Explain briefly that our system is called the Hindu-Arabic system because Hindus contributed to developing it (including using 0) and Arab traders who used it carried it to the other parts of the world. The system we use today has only been widely used since the 1500s, because at this time trade became very important and traders found the older systems of finger counting, tallies and Roman numbers too clumsy to use for calculations. The use of ‘Arabic’ numerals became more widespread, and today it is used almost everywhere in the world. The ways in which the Arabic numerals were written has changed over time (examples are given on Workbook page 5).

Try to get the students to tell you some of the advantages of this system, such as: it only uses ten digits and you don’t have to tally, it is a base 10 decimal system, so you can use place value to represent any number, it has a zero which can be used a place holder. Remind them though that these are not new ideas: the Babylonians and South American Indians used place value thousands of years ago, the Chinese used negative numbers thousands of years ago and the Ancient Egyptians had systems of fractions thousands of years ago.
Ask a group of students to stand up. Give each student a card showing a number less than 1000000. Get the rest of the class to instruct the group so they stand showing the numbers in order from smallest to largest or largest to smallest. Give another student another number card and ask them to position themselves in the line. Ask students to say a number that could lie between two of the numbers in the line.

Give students a set of place value cards or several sets of 0–9 digit cards. Say numbers less than 1 million and ask the students to lay out the cards to show that number.

Draw a place value chart on the board. Put numbers into the chart and use it to help students say the numbers aloud. Say a number and ask students to come up and write the number in the chart.

Ask a student to pick out six-digit cards and stick them on a board in a line for the rest of the class to see. Select another student to say aloud the number that has been made.

Give a group of students a set of six cards with a mixture of digits on. Ask them to arrange the cards to make the smallest or largest number they can. Can they make other numbers? Can they order the numbers they have created? How many different numbers can they make?

Draw a row of six boxes on the board. Ask students to make a copy of this on paper. Explain to the students you are going to roll a 0–9 die six times (if a die is not available pick a card from a set of digit cards and then return it to the pack and shuffle). Each time they must select a box to put the number in. Once placed, the number cannot be moved. The aim is to have created the largest number when all six boxes have been filled. Discuss with students the strategies they used to make decisions about where to place numbers. Repeat trying to make the smallest number.

Write a multiple of 10 on the board. Tell students you are thinking of a number that when rounded to the nearest 10 is the number on the board. Invite students to tell you what the number could be. Also ask: ‘What numbers could it not be? Why?’ Repeat with multiples of 100.

Remind students how they rounded numbers to the nearest hundred and thousand. Write six-digit numbers on the board and ask students to round them to the nearest thousand. Ask students to suggest what the numbers would be rounded to if they were rounded to the nearest hundred thousand. Ask students to explain why they think their ideas might be right. Build on students’ ideas to highlight that we use exactly the same strategy as we did when rounding smaller numbers, that is we look at the digit immediately to the right of the hundred-thousand digit and use this to decide whether to round up or down.
Write several five- and six-digit numbers on the board. Ask students to order them from largest to smallest. Encourage students to explain how they made their decisions about where to place numbers.

Ask students what they think half a million would be. Record suggestions, asking students to explain why they think their idea is right. Build on students’ suggestions to establish that half a million is 500,000. Repeat for one-quarter and three-quarters of a million.

Make a number of cards with positive and negative temperatures written on them. Ask one student to come up to the front and display the temperature on their card. Ask the class who has a temperature that is warmer than this. Let them display their temperatures and check that they are correct. Repeat for colder temperatures. Next, get students to come up and stand in a row (to simulate a number line) and give instructions such as: ‘I need a temperature that is at least 5 degrees lower than this.’ Let the volunteer position her or himself correctly, then follow with ‘I need a temperature that is in-between these two temperatures’. Repeat using different conditions and instructions to order five or six temperatures. Then ask for another starting temperature and begin again.

**Using the Student’s materials**

Use Workbook page 4 to explore the ideas of counting and representing numbers using a chimpu. This is a fun activity, but it does offer some important concepts related to place value which will be followed up in the Student Book and Workbook pages in this topic.

Use Workbook page 5 to explore how the numerals we use today have developed and been written over time. The work on the number of angles in each numeral is widely debated, but it makes for an interesting activity and discussion. You might like to extend this by looking at how all the digits from 0 to 9 are represented on digital displays by highlighting different ‘parts’ of a seven segment rectangular display. Display the blank ‘8’ on the board and have the students show how they would represent each number on this LED display.

Ask students to complete Workbook page 6 as a baseline assessment. You can use the completed worksheets to assess how well they know place value and numbers. Once you have done this, have the students work on their own or in pairs to complete the activities on Student Book page 5.

Once you have done some teaching and practical activities related to ordering numbers and placing them on a number line, have the students work on their own to complete Student Book page 6. Use Workbook page 7 to assess that they are confident in working with number lines. Remind them that they can use the number line in the workbook to help them find the numbers they need in question 2.
Work through Student Book page 7 with the class. Check their answers. Use Workbook page 8 as additional practice in rounding.

Once you have done some practical work and mental warm-up activities using decimals, work through Student Book page 8 with the class. Remind them that this is not new work and that they worked with decimal fractions in previous years. Pay particular attention to question 4 where the students write money amounts to make sure they recognise that money amounts always have two decimal places, even when the hundredths place is 0.

Do some skip counting backwards in intervals and bridging through 0 (using a number line if necessary) to remind the students that our number system uses negative number to represent amounts below zero. Let the student’s work through Student Book page 9 to revise negative numbers and to remind students how to read a scale that extends into the negative. Once students have completed Workbook page 9, let them check each other’s completed number lines and discuss any discrepancies.

Let the students work in pairs to complete the activities on Student Book page 10. Check their answers and ask different students to explain what strategies they used to solve the worded problems. Spend some time discussing bank statements and the ways in which they use negative and positive numbers. Ask the students to suggest other contexts in which negative numbers are used (to indicate movement in an elevator (up and down), to indicate depth below sea level (negative measurements), weight loss, changes in exchange rates or prices and so on). Encourage them to say how the numbers are used and what they mean in different contexts.

**Assessment questions to ask**

- Tell me a number that goes between these two integers. Which of the two integers is it closest to?
- Can you put the correct sign, < or >, between these numbers?
- How do you order a set of numbers? Which part of each number do you look at to help you?
- What is the value of each digit in this decimal?
- How would you explain to someone how to round a number to the nearest 10/100/1000?
- Which is colder, a temperature of 0°C or a temperature of –2°C?
- What is the difference between a temperature of 2°C and a temperature of –2°C?
Common errors and misconceptions

Students may struggle to say large numbers correctly and resort to simply saying the digits of the number in order. Do not allow them to do this and work with them, identifying the value of each digit, saying the numbers in expanded form and using this to move to saying them correctly.

Students may struggle to write and/or say numbers where zero is a place holder, for example, 4056, 304786, etc. If this is a problem, spend time asking students to enter numbers into a place value chart and then say them in expanded form, emphasising where there is a zero in a column and what that means.

2 Time

<table>
<thead>
<tr>
<th>2: Time</th>
<th>Student Book pp 11–15</th>
<th>Workbook pp 10–11</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6Mt1</td>
<td>Recognise and understand the units for measuring time (seconds, minutes, hours, days, weeks, months, years, decades and centuries); convert one unit of time to another</td>
<td></td>
</tr>
<tr>
<td>6Mt2</td>
<td>Tell the time using digital and analogue clocks using the 24-hour clock</td>
<td></td>
</tr>
<tr>
<td>6Mt3</td>
<td>Compare times on digital and analogue clocks, e.g. realise quarter to four is later than 3:40</td>
<td></td>
</tr>
<tr>
<td>6Mt6</td>
<td>Use a calendar to calculate time intervals in days, weeks or months</td>
<td></td>
</tr>
<tr>
<td>6Mt7</td>
<td>Calculate time intervals in days, months or years</td>
<td></td>
</tr>
<tr>
<td>6Mt8</td>
<td>Appreciate how time is different in different time zones around the world</td>
<td></td>
</tr>
</tbody>
</table>

Vocabulary

Calendar, week, month, year, leap year, decade, century, time, a.m., p.m., time zone, time difference, later, earlier.

Resources needed

Calendar for class display, materials to make a class calendar; one calendar (can be small) for the current year for students to use; world map to locate places and time zones; clock faces; globe if possible; telephone book.
Mental warm-up activities

Select suitable activities from the mental warm-up activity bank.

Concepts that may be unfamiliar in this topic

Vocabulary associated with time periods

Some students may not know the terms decade and century in the context of time. Spend some time talking about the prefixes deca- (meaning ten) and cent- (meaning hundred). Encourage the class to find other words that relate to tens and/or hundreds. For example, a decagon is a ten-sided shape, a decathlete competes in ten different events, a century in cricket means 100 runs, a centimetre means 1/100th of a metre, and a cent is 1/100th of a dollar (or other currency). You may also like to develop a school or family ‘time-line’ using years to show that students have been alive for just over one decade, while their parents and grandparents will have been alive for more years, and therefore more decades.

Time zones and time differences

The idea that different places experience different times may be familiar to the students if they have travelled to other countries, or had some experience of televised events taking place at different times. For example, a soccer or cricket match played in another country may be taking place at night, but they watch it live in the morning. If you have access to a globe, you can demonstrate why different places have night and day (and therefore different times of night and day) at the same time. Use a torch to represent the sun and shine it onto the globe. The side facing the torch is lit, while at the same time the places ‘at the back’ of the globe are not lit. Explain that in terms of the Earth, this means they are dark, because the sun cannot reach them in this position. Slowly turn the globe, showing the class that the places that were in the dark now move into the light. In other words, they start their day. At the same time, the places on the other side of the globe move out of the light into the dark, starting their night. Stress that this takes place at the same time to make the point that morning in one part of the world is evening in another. Show how the places move through the times of day (and night) and repeat this again the next day. Find your own country and find countries that have night when you have daytime and so one. Once the students understand the reasons for time differences, it is easier for them to grasp that one place may be one or more hours ahead or behind them in time.

Teaching ideas

Practical activities

Display a large calendar for a whole year. Ask the class to explain what information they can get from a calendar. Spend some time discussing why people have calendars and what they use them for.

If you have not already done so, make a class calendar for the term. Draw up a grid (or download a blank one from the Internet; there
are many available) for the term. Write the dates on the blocks. Spend time with the class marking holidays, feast days and other important national, community or school events. Ask students whose birthdays fall in this term. Add their names to the appropriate days on the calendar. Ask questions as you go to check understanding of terminology. For example, sports day is on 7 November. How many weeks’ time is that? Which holiday comes up next? How many weeks is it till the end of the term? And so on.

Invite students to the front of the class in pairs. Ask one student to say a time and the other to demonstrate the time on a large clock face. Alternatively, ask a student to set the clock and another student to tell the time. Ask them how they know that a time is in the morning or afternoon (a.m. and p.m.). Introduce the idea of the 24-hour clock and remind them how to read and write times such as 16:00.

Say events of the day to students, for example, lunchtime or end of school day, and ask them to set the clock face to the time when the event is likely to happen. Include events that may be different for different students or on different days and ask students to show possible answers and explain the decisions they make. Let them say and write the times as a.m. and p.m. times and then as 24-hour clock times.

Have a discussion about why sporting matches or events that take place in other parts of the world are sometimes broadcast at odd times on local television. Make sure that the students understand that different places in the world have different times. If possible, you could use a globe to show how the Earth turns and how this affects which parts are facing the Sun at any one time (those places have daytime).

Use the local telephone directory to check the time differences between your country and other places (most telephone directories have this information where they give the international dialling codes).

**Using the student’s materials**

Work as a class through Student Book page 11. Revise the concepts and make sure students understand the vocabulary before moving onto the exercise. Ask students to complete the tables, then check them and ask different students to explain how they found the answers. Make sure the tables are all correct before moving onto questions 2–5 because students need to refer to them to find the number facts they need to solve the problems. Spend time as a class solving and then discussing strategies used to find the answer to question 6. Show the class how to use a number line to solve problems involving conversion of units of time. For example, they can use the number fact that there are 35 days in 5 weeks like this:
15 weeks and 4 days.

This is an important strategy in this topic because time is not a decimal system and remainders need to be given in units of time, rather than as decimal fractions of the units. If students do this problem on a calculator, they will get an answer of 15.57 and may mistakenly think this is 15 weeks and 57 days rather than 15 weeks and 57/100 weeks.

Allow the students to work in pairs to complete Student Book page 12. Observe them as they work to make sure they can read and work with a calendar. Use Workbook page 10 as an informal assessment task to check that students can apply what they have learnt about calendars in the context of this year’s calendar.

Use Student Book page 13 and Workbook page 11 to revise basic concepts of time and units of time.

Let the students work in pairs to complete Student Book page 14. Check their work to make sure they can use the 24-hour clock system.

Work through Student Book page 15 with the class. Make sure the students can read and make sense of the map. Once you are happy they can do so, let them work in pairs to complete the activities. Spend some time sharing the strategies that students used to solve the problems.

Assessment questions to ask

- What is the difference between a year, a decade and a century?
- How many hours in __ days?
- How is this calendar organised?
- What do these letters/numbers mean on the calendar?
- How are weekends shown on the calendar?
- How much time passes from here to here? (Point to a date and move across one day or down one row.)
- What time does the clock show?
- Can you set this clock to show 10.53 a.m.?
- Why don’t people in other places have lunch at the same time as us?
- Which places have times later than ours?
- Which places have times earlier than ours?
- How do you work out what time it will be in another country?
**Common errors and misconceptions**

Many students find it very difficult to tell the time and much of this is to do with the different ‘values’ the numbers on the clock face have depending on whether we are looking at the hour hand or minute hand. Students need to be able to see a clock face and experiment with what happens as the hands move around it. They need to have regular experience of telling the time and thinking into the past and future, and working out how long it is since something happened or until something is going to happen.

Students often forget that there are 60 minutes in an hour and 60 seconds in a minute. Make sure they understand that time is not a decimal measure. When you read 24-hour times such as 23:00, try to avoid saying ‘23 hundred hours’ as this tends to reinforce the decimal ideas in student’s minds. Rather read 24-hour times as ‘23 zero zero hours’. If students persist, show them a real digital clock and make sure they can see that the time changes to the next hour after 22:59. In other words, it does not count up to 99. Let them articulate why this is the case.

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**3 3D shapes**

<table>
<thead>
<tr>
<th>3: Revising 3D shapes</th>
<th>Student Book pp 16–19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workbook</td>
<td>12–14</td>
</tr>
</tbody>
</table>

**Objectives**

<table>
<thead>
<tr>
<th>6Gs2</th>
<th>Visualise and describe the properties of 3D shapes, e.g. faces, edges and vertices</th>
</tr>
</thead>
<tbody>
<tr>
<td>6Gs4</td>
<td>Recognise and make 2D representations of 3D shapes including nets.</td>
</tr>
</tbody>
</table>

**Vocabulary**

Solid, cube, cuboid, pyramid, prism, triangular prism, cylinder, face, vertex, vertices, edge, net.

**Resources needed**

A variety of different solid shapes to examine: these could include everyday items such as food boxes; flashcards showing names of 3D shapes; blocks or cubes; card; glue; scissors; an open box (cube or cuboid); squared grid paper.

**Mental warm-up activities**

Select suitable activities from the mental warm-up activity bank. Students will not be doing much calculation work in this topic, so try to build in some mental calculation practice as well.
Concepts that may be unfamiliar in this topic

The vocabulary related to properties of solids

Students may not know the correct terms faces, vertices and edges. Teach these terms by showing them the parts of different shapes. Always use the correct terms when you talk about shapes and encourage the students to do the same so they become confident using them. If the students struggle with this, display a 3D model in the classroom with the faces, edges and vertices labelled so that they can refer to it as necessary.

Making 2D representations of 3D shapes

Students have worked with visual representations in earlier stages and may have built simple nets. It is a very worthwhile activity to let students cut out nets and actually fold them up to build shapes as it somehow reinforces the idea that you can use different nets to make the same shapes, and that shapes can be ‘flattened’ out and drawn as a set of joined faces. Cardboard food boxes are an excellent resource for demonstrating how to flatten a shape and refold it to make the box.

Teaching ideas

Practical activities

Display a variety of 3D shapes in front of the students; these could include everyday items like food containers. Ask students to name the shapes they recognise. Put flashcards showing shape names on a table and ask students to sort the shapes and place them next to the appropriate card. Ask students if they can think of any common objects that could be added to each set.

Hold a shape out for the students to see. Ask students to point to a face, an edge and a vertex. Ask questions such as: How many faces has this shape got? What shape is this face?

Hide a shape – for example, an open book – behind a screen. Describe the shape to the students telling them, for example, how many faces it has and what shape the faces are. Ask students to guess what the hidden shape is. Repeat asking a student to select and hide a shape and give clues to the other students.

As before, hide a shape behind a screen. This time encourage students to ask questions about the shape to which you can give ‘yes’ or ‘no’ answers, for example, ‘Does it have eight faces?’ After each question, students can guess what the shape is. Again, repeat, this time asking a student to select and hide a shape and answer the other student’s questions.

Show students a selection of model prisms and pyramids. Ask them to sort the shapes into two categories and name each one. Ask students to describe the general features of a prism, for example; two opposite, identical faces; and of a pyramid.
Spend some time deconstructing cardboard boxes (see Student Book page 19). Have the students work in pairs or small groups to take a box apart in a way that leaves all the pieces stuck together. Once they have managed, let them draw the ‘pattern’ or net of the box. Then, have them fold it up again to remake the box. Spend some time looking at the different nets that are possible for a cuboid box. For example, you can cut open a cuboid box in these different ways:

Don’t show these to the class, as they will investigate options for opening the box themselves.
Ask students what is meant by the ‘net’ of a shape. Develop their answers until there is a clear definition. Look together at nets of different shapes (such as those on Student Book page 18) and ask students to name the shapes each net will make. Encourage students to explain how they know what shape will be created.

Once you have done some work on the nets of cubes and cuboids, show the class a more unusual-shaped container. For example, a pencil box shaped like a triangular prism, a box of chocolates or sweets in a pyramid shape. You will need to see what shapes are available to use locally. Spend some time discussing what the net of the box will look like. Discuss the shapes and number of faces and ask students to sketch the nets before you demonstrate by flattening the box. If you have time, you may like to get the students to build their own gift boxes using nets. Allow them to choose their own designs.

**Using the Student Book and Workbook**

- Work through Student Book page 16 with the class to make sure they remember and can use the vocabulary related to 3D shapes.
- Let the students work in pairs to complete Student Book page 17 and Workbook page 12. Check the answers as a class.
- Remind the students that a net is a ‘plan’ of the shape. If necessary, cut open a box to show them the net. Let the students work on their own to complete Student Book page 18 and Workbook page 13.
- Let the students work in small groups to complete Student Book page 19. If necessary, give each group a cereal box to investigate its possible nets. Have some grid paper available for the groups to use in case they need to cut out and model the nets of cubes.
- Once you are sure the students understand the concept of a net and the fact that different nets can be used to produce the same solid shape, let them work in pairs to complete Workbook page 14. Again, have grid paper available so they can cut out nets and model them as necessary. The second task is difficult and if the students struggle with spatial reasoning you may wish to leave it out. The second part of the activity involves some knowledge of translations because students will need to rotate some of the shapes to fit the ‘pieces’ made by the nets into the box. (Note though, that we have chosen a box that can be used without requiring the students to flip (reflect) the shapes.) The concept of fitting shapes together to fill a space is similar to the computer game ‘Tetris’ that some students may know. Allow students who really struggle with this task to trace and cut out the nets so that they can physically manipulate them. However, all students will need to think carefully and probably need to rearrange their shapes, so make sure they work in pencil to do the task. You can extend the task by giving the students other shapes with an area of 60 cm² to fill with the shapes, but be aware that many of the solutions will involve flipping some of the shapes. (See the answer section for two more options.)
Assessment questions to ask

- How could you group these shapes into sets? What are the criteria for each of your sets?
- How many faces/edges/vertices does this shape have?
- Can you describe this shape to me?
- Can you draw me a net for a triangular prism/pyramid/etc.?
- What will this shape look like from the front? Will it look the same from the side/back? Why or why not?

Common errors and misconceptions

Some students may have difficulty with the terminology used when talking about the properties of 3D shapes. Regularly use the correct terminology by playing games that involve them in describing shapes or listening to descriptions to identify shapes.

When drawing nets, some students may find it difficult to do this accurately. Support students in using a ruler, positioning tabs, cutting out, etc. where required.

4 Addition and subtraction

<table>
<thead>
<tr>
<th>Objectives</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6Nc1</td>
<td>Recall addition/subtraction facts for numbers to 20 and pairs of one-place decimals with a total of 1, e.g. 0.4 and 0.6</td>
</tr>
<tr>
<td>6Nc6</td>
<td>Add/subtract a near multiple of 10, 100 or 1000, or a near whole unit of money, and adjust, e.g. 3127 + 4998, 5678 − 1996</td>
</tr>
<tr>
<td>6Nc11</td>
<td>Add two and three-digit numbers with the same or different numbers of digits/decimal places</td>
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<tr>
<td></td>
<td>Note: decimals are covered again in Chapter 10</td>
</tr>
</tbody>
</table>

Vocabulary

Add, sum, total, partition, place value, subtract, difference, estimate, round.

Resources needed

Place value tables; calculators; number cards, straws or beads.
Mental warm-up activities

Select suitable activities from the mental warm-up activity bank.

Concepts that may be unfamiliar in this topic

Adding and subtracting larger numbers

There are no fundamentally new concepts in this topic. Instead, students are expected to revise and extend the strategies they already know for addition and subtraction to work with larger numbers. For example, they will extend their knowledge of adding and subtracting near multiples of 10 and 100 to include near multiples of 1000. They will also find the sum and difference of numbers with different numbers of digits and/or decimal places.

Strategies for adding and subtracting with adjustment

One of the objectives in this topic is to practise using adjustment strategies, and many of the examples in the student materials therefore involve numbers that lend themselves to this strategy. However, please remember that the aim is not to force students to use a particular strategy, and ultimately, the ‘correct’ strategy is the one that makes sense and is easiest for the student.

Adjusting can take different forms. It will be useful to model and discuss both of the following methods as you work through this topic:

Adjusting one number to make an easier calculation. Students will often use compensation strategies that involve rounding one number to make calculations easier. For example to add 327 + 496, a student may think like this:

To add 496 I will add 500

327 + 500 = 827

I added too much, so I need to take away the 4 that I added

827 – 4 = 823

The important point here is that you can add to one of the numbers to make the calculation easier as long as you take what you have added away again at the end.

Make sure that students understand that this works for subtraction as well. For example, to find 381 – 148, as student may think like this:

I’ll work with 380 because that is easier. 380 – 148 = 232

But I subtracted 1 at the beginning, so my answer is too small. I need to add back the 1 that I subtracted. 232 + 1 = 233, so, my answer is 233.

Whether the students add or subtract at the end depends on how they adjusted the numbers in the beginning. Make sure they understand that if they round up (add to one number) they have to subtract again at the end, and if they round down (subtract from one number) they have to add that difference back again at the end.

Adjusting both numbers to keep the result the same. Students often instinctively use this strategy for addition even in the early stages. For example, instead of adding 16 + 14 they may think of this as 15 + 15 = 30.
They realise that they can add to the one number if they subtract the same amount from the other number and still get the same result. Much of this understanding will come from early work on combining sets of concrete objects. Students realise quite quickly that if they take (subtract) one counter from set A and ‘add’ this counter to set B, they still have the same overall number of counters.

Many students find this harder to understand and apply to subtraction. However, it is a powerful strategy to use to make subtraction easier. The difference is that the students have to add the same amount to both quantities for the result to remain the same. For example, 434 – 298 is much easier to calculate if you work out that 298 is close to 300 and add 2 to both numbers: 436 – 300 = 136.

The key element in this strategy is that you adjust both numbers in the beginning, and you therefore do not have to compensate afterwards. You can show the students how this works using concrete apparatus and easy examples. For example, use counters to show that the difference between 9 and 5 is 4:

![Counter difference example]

Add the same amount (1 or 2 or 3) to both rows of counters to show that the difference remains the same. Similarly, if you subtract the same number of counters from both rows, the difference remains the same. Make sure the students understand that this works for bigger numbers as well. For example, if we had 397 counters and 142 counters we could add three to both of them to get 400 and 145 and the difference would still be 255.

Remember that some students will already feel comfortable using concise and written methods and allow them to use these if they choose to do so.

**Teaching ideas**

**Practical activities**

- Students could use number cards, straws or beads to represent numbers. A number is represented as so many hundreds, so many tens and so many units.

- Students could practise adding and subtracting using number cards, blank number lines, straws or beads. This could be done in small groups with one student devising a calculation and the other students carrying it out.
Students could work in pairs with a calculator. One student sets a four-digit addition question and the second student answers it. The first student then checks the answer with the calculator.

Write $2367 + 4109 + 1863$ on the board. Below the calculation write $10339$, $8339$ and $5339$. Ask students to guess which is the right answer. Ask students to explain how they made their choice. Talk about how to use rounding to estimate and check answers.

Using the Student Book and Workbook

Let students work independently to complete Student Book page 20. Check their work and use it to assess how well they know their addition facts. If necessary do some drill and practice work to reinforce these.

Work through Student Book page 21 as a class, reinforcing the use of different methods and encouraging estimation and approximation. Workbook page 16 is a fun, problem solving activity that they can do on their own or in pairs.

Let students work in pairs to complete the puzzles on Workbook page 15. Let them discuss and check each other’s solutions.

Let the students work on their own through Student Book page 22. Talk about how you could find the missing values in the problem solving activity and allow students to suggest and try out different methods. They can mark each other’s work or you could mark their work.

Let the students work independently to complete Workbook page 17. Check their work and use it to assess how well they can subtract.

Work through Student Book page 23 as a class, reinforcing the use of different methods and encouraging estimation and approximation. Talk about how you could find the missing values in the problem solving activity and allow students to suggest and try out different methods.

Work through Student Book page 24 with the class. Make sure they understand that subtraction is the inverse of addition and how to use inverse operations to check solutions and find missing values. Let the students complete Workbook page 18 independently.

Assessment questions to ask

- What is $48$ add $77$?
- What is $296$ add $159$?
- What number has $4$ thousands, $8$ hundreds, $2$ tens and $7$ units?
- What is $3134$ add $5633$?
- What is the difference between $2783$ and $4418$?
- What is $8498$ to the nearest thousand?
Common errors and misconceptions

Some students tend to use calculators mechanically without thinking what they are doing and consequently they write down answers that are not sensible. They should do a rough approximation of the sum in their heads before they do the calculation. For example, the sum $3186 + 4612$ is approximately $3000 + 4500$, so we would expect an answer around $7500$. If the answer obtained is very different to this, we have made a mistake on the calculator.

5 Multiplication and division of whole numbers

<table>
<thead>
<tr>
<th>5: Multiplication and division of whole numbers</th>
<th>Student Book pp: 25–33</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Workbook pp 19–24</td>
</tr>
<tr>
<td><strong>Objectives</strong></td>
<td></td>
</tr>
<tr>
<td>6Nn4  Multiply and divide any whole number from 1 to 10 000 by 10, 100 or 1000 and explain the effect</td>
<td></td>
</tr>
<tr>
<td>6Nc3  Know and apply tests of divisibility by 2, 4, 5, 10, 25 and 100</td>
<td></td>
</tr>
<tr>
<td>6Nc17 Use number facts to generate new multiplication facts, e.g. the $17\times$ table from the $10\times$ and $7\times$ tables</td>
<td></td>
</tr>
<tr>
<td>6Nc18 Multiply two-, three- and four-digit numbers (including sums of money) by a single-digit number and two- or three-digit numbers by two-digit numbers</td>
<td></td>
</tr>
<tr>
<td>6Nc19 Divide three-digit numbers by single-digit numbers, including those leaving a remainder, and divide three-digit numbers by two-digit numbers (no remainder) including sums of money</td>
<td></td>
</tr>
</tbody>
</table>

Note: Long division is in Chapter 28

Vocabulary

Multiply, divide, partition, multiple, remainder, product, rules of divisibility.

Resources needed

Number lines; number tracks; Cuisenaire rods; beans; straws; counters; demonstration multiplication grid; multiplication grids; squared paper; calculators.
Mental warm-up activities

Select suitable activities from the mental warm-up activity bank. You could also use the daily multiplication and division tests in the Workbook as warm-up activities in this topic.

Concepts that may be unfamiliar in this topic

Divisibility rules for 4 and 25

Students worked with divisibility rules for 2, 5, 10 and 100 in Stage 5. In Stage 6 they will revise the rules and extend them to include 4 and 25.

Multiply and divide by 1000 and explain the effect

Students should already understand how to multiply and divide by 10 and 100 and explain what happens when they do so with reference to the place value system. In Stage 6 they will extend their knowledge to include multiplication and division by 1000.

Extend multiplication strategies to larger numbers and multiply by two-digit numbers

Students will revise the strategies they already know for multiplying by a one-digit number and then build on those to develop a set of strategies for multiplying by a two-digit number. The work they do on generating further multiplication facts from known facts provides an important foundation for this work.

Remind the students that different problems lend themselves to different strategies and that they should choose the most efficient one for each problem. A number of strategies, including concise written methods, are shown in the Student Book, but you may like to check that the students are able to use and explain the following mental strategies before moving onto written methods:

- Compensating to make calculation easier: for example $9 \times 47 = (10 \times 47) - 47 = 470 - 47 = 470 - 40 - 7 = 430 - 7 = 423$.
- Partitioning using place value: for example $8 \times 52 = (8 \times 50) + (8 \times 2) = 400 + 16 = 416$
- Working with equivalent expressions: students should realise that they can adjust the numbers in a multiplication by dividing one and multiplying the other by the same factor (they already applied a similar principle in addition with adjustment). For example, to find $6 \times 25$, they may choose to divide 6 by 2 and multiply 25 by 2 to get $3 \times 50 = 150$.

Extend division strategies to a higher number range

Division by a single-digit number with remainder was limited to a quotient of 30 in Stage 5. This year, students will work with bigger numbers and also refine their strategies to move towards more efficient methods of division. You may want to make sure that students are aware of the following strategies for division by modelling examples and discussing them with the class:
• Compensating to make division easier. For example, to find 76 ÷ 4, they may round 76 to 80 (i.e. add an extra 4) and do the easier division 80 ÷ 4 = 20, but I added an extra 4, so I need to subtract 1 from the answer. Make sure students do not subtract 4 to get an answer of 16 by encouraging them to talk about what they are doing and applying inverse operations to check. Say things like: 80 ÷ 20 = 4, that means that 20 × 4 = 80. I only need 76, so that is one less four. 19 × 4 = 76.

• Dividing in stages using known facts and halving. For example, 96 ÷ 4 is the same as 96 ÷ 2 ÷ 2; 96 ÷ 2 = 48, 48 ÷ 2 = 24. Check by using inverse operations: 4 × 24; 4 × 25 = 100 – 4 = 96.

Make sure the students realise that the solution to a division remains the same if you multiply or divide the number to be divided and the number you are dividing by, by the same factor. For example, 12 ÷ 3 = 36 ÷ 9 and 96 ÷ 4 = 48 ÷ 2. This concept is important as it underpins later work on division by a decimal. For example, when students needs to divide 16 by 0.2 they can multiply both number by 10 and do the division as 160 ÷ 2 to get the same result.

Remember that some students will already feel comfortable using concise and written methods and allow them to use these if they choose to do so.

Teaching ideas

Practical activities

Students in pairs test each other on times tables up to 10.

Students could use multiplication tables and/or times-table grids to test themselves or other students on their tables.

Arrange a ‘times-table’ competition by dividing students into teams of 4 or 5 and getting them to write questions to use for testing other teams on their tables.

Students could use beans (counters) to help them with the division of two-digit numbers.

Students could work in pairs with a calculator. One student sets a two-digit or three-digit division question and the second student answers it. The first student then checks the answer with the calculator.

Using the Student Book and Workbook

Workbook page 19 should be used to test and enhance times-tables knowledge. Do one column per day as a class. Time the students and let them record how many mistakes they make each day. Encourage them to improve their accuracy and time.

Let the students work in pairs to complete Student Book page 25. Ask the students to explain how they can use multiplication squares to find division facts. Make sure they can point to a number on the table, use one factor as the divisor and find the other factor.
We have already mentioned that students need to use known facts to derive facts they have not memorised. Use Student Book page 26 to generate multiplication facts for the ×11 to ×19 times tables by combining known facts. Spend some time discussing how you can do this using the table they already know. When students know how to derive further facts, they are more able to develop efficient calculation strategies. The basic premise here is that multiplying by 18, for example involves adding the products of the number times 10 to the product of the number times 8. So \( n \times 18 \) is the same as \( n \times 10 + n \times 8 \). This idea forms the basis of multiplication by higher two-digit numbers. Once you are sure the students understand the ideas in this lesson, allow them to work in pairs to complete Workbook page 20.

Work through Student Book page 27 as a class. Make sure the students can see the patterns involved in multiplication by powers of 10 and that they can apply the rules they see to their own mental working. Let them complete Workbook page 21 on their own as a timed test.

Work through Student Book page 28 with the class, focusing on different methods of multiplying and encouraging them to use their times tables to work out the answers as they go. Discuss the worded problems and let class suggest how they will solve them.

Student Book page 29 explains how to extend multiplication strategies to multiply by two-digit numbers. Work through several examples with the class and discuss the strategies they use to find the answers before asking them to complete the calculations. Spend some time discussing the worded problems and ask the students what strategies they think will be most efficient for solving them.

Work through Student Book page 30 as a class. Make sure students are confident using short division with remainders before moving on. Once you have done this, use Workbook page 22 as daily practice for one week to reinforce concepts. Before moving onto worded problems let the class work through Workbook page 23 to practise and reinforce their division strategies. Spend some time discussing how they reached their answers.

Many of the problems students have with worded problems stem from them not understanding the problem rather than being unable to do the mathematics involved in finding a solution. Use Student Book page 31 to develop and discuss the steps involved in solving problems and also to explore the language used in worded problems and what different terms mean. Discuss the problems on the page and let the students say what they will do to solve them before asking them to do so.

Introduce and discuss with the whole class the rules of divisibility in Student Book page 32. This is quite an interesting topic for most students and they like checking numbers to see if they obey the rules. Let them work through Student Book page 33 once you have gone through the rules. Explain how they should complete Workbook page 24 and let them work with a partner to complete it.
Assessment questions to ask

- What is $213 \times 3$?
- What is $423 \times 8$?
- What is $3926 \times 4$?
- What are the multiples of 7 up to $10 \times 7$?
- What is [any number] multiplied by 10/100/1000?
- What is $72 \div 6$?
- What is the remainder from the division sum $85 \div 7$?
- What is the result of $84 \div 7$?
- What is $456 \div 4$?
- What is $810 \div 5$?

Common errors and misconceptions

Students will not be able to use calculators to check the answers to division where there is a remainder as the calculator will divide the remainder and give the answer in the form of a decimal.

Some students are reluctant to show their full working in calculations like divisions involving regrouping, thinking, rather misguided, that putting down the minimum of working makes them appear in some way more clever. Point out that by jumping steps and not showing working they are risking making silly errors – which is not clever at all. Also, if errors have been made, it makes your task as the teacher more difficult in determining what has gone wrong so the student can receive appropriate help.

6 Measurement

<table>
<thead>
<tr>
<th>6: Measurement</th>
<th>Student Book pp 34–40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workbook pp 25–26</td>
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</table>

<table>
<thead>
<tr>
<th>Objectives</th>
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<tbody>
<tr>
<td>6M1</td>
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<tr>
<td>6M2</td>
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<tr>
<td>6M3</td>
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<tr>
<td>6M4</td>
</tr>
<tr>
<td>6M5</td>
</tr>
</tbody>
</table>
Vocabulary
Metric, base units, millimetre, centimetre, metre, kilometre, milligram, gram, kilogram, millilitre, litre, length, distance.

Resources needed
Rulers; metre sticks; measuring tapes; other measuring instruments for demonstration.

Mental warm-up activities
Select suitable activities from the mental warm-up activity bank. You might like to focus on activities that revise multiplication and division by 10, 100 and 1000 and to use decimals as the basis for warm-ups.

Concepts that may be unfamiliar in this topic
Converting between units of measure
Students have previously only converted from larger units to smaller units (by multiplying). For example, express 5 m in cm. In Stage 6 they will apply their knowledge of decimals and place value to convert between any units of measurement with place values to thousandths (three decimal places). Guidelines for teaching the students how to do this can be found in Student Book page 36.

Kilometres
Students will extend the knowledge of units of length to include kilometres. This is a more abstract unit which you cannot easily demonstrate in the classroom. It is useful to relate it to distances in metres so that students can get a sense of how far (how long) a kilometre is. For example, a full size football field is generally 100 m long. (The standard length is 105 m.) You can use this fact to help students realise that they would have to run up and down the field ten times to cover 1 kilometre.

Imperial units
Although students may have heard of or used Imperial units in their daily lives, they have not dealt with them formally before. This is a good opportunity to talk more about how the decimal measuring system developed to match the decimal number system we use, whilst older measuring systems were based on body measurements such as a foot, a cubit and a yard.

Explain to the class that almost all of the countries in the world have adopted the metric system of measurement. The USA, Liberia and Myanmar are the only three countries to still officially use the Imperial system. The Imperial system has its own units of measuring length and it is not a decimal system. Although the Imperial system is not the official system in other countries, people still use some Imperial measurements. For example:

- Surfers often give the size (height) of a wave in feet. An 9–10 foot wave is about 2.7–3.0 m high.
- People may know their height in feet. A person who is 6 foot tall is about 1.8 m tall.
• People in England often use miles to talk about longer distances and speed limits in many places are given in miles per hour. A speed limit of 30 miles per hour is about 50 km per hour.

• People may talk about ½ litre bottles of milk or other liquids as being about a pint.

When you work with conversions between Imperial and decimal units it is acceptable to use ‘rule of thumb’ approximations rather than exact values.

**Teaching ideas**

**Practical activities**

Ask students what units they know for measuring length. Once ‘centimetre’ has been offered as an answer, ask them if they know of a smaller unit. Ask students to look at their rulers and notice that a centimetre is broken up into ten smaller divisions. If no one knows what these are called introduce the term ‘millimetre’. Ask students to suggest things that we would need to use millimetres to measure. Encourage them to think of not only small things but also situations where large things need to be measured very accurately, for example, in building work. Extend this discussion to metric units for mass and capacity.

Write various measurements on the board, for example, ‘the length of a pencil’, ‘the distance between these two towns’, ‘the mass of a brick’, ‘how much water a cup holds’, etc. Ask students to name a sensible unit for measuring these.

Ask students how many centimetres are in a metre. Ask: ‘Knowing there are 10 mm in every centimetre, how many millimetres must there be in a metre?’ Having established the answer, ask students what fraction of a metre a millimetre must be. Draw a place value chart going from metres to millimetres on the board. Use this to practise writing millimetres as metres and vice versa. Extend this to units of mass and capacity.

On the board write kilometres, metres, centimetres and millimetres. For each, ask students to think of things that would be best measured in that unit. Record suggestions, encouraging students to explain how they made their decisions. Ask students how many metres are in a kilometre. Having established the answer, ask students what fraction of a kilometre a metre must be. Draw a place value chart going from kilometres to metres on the board. Use this to practise writing metres as kilometres and vice versa. Repeat for units of mass and capacity.

Write 5 cm 6 mm on the board. Ask students how many millimetres that is in total. Encourage students to explain how they worked it out, for example, ‘There are 50 mm in 5 cm so it is 50 + 6, which is 56 mm.’ Repeat for other examples. Ask students to measure various lines in millimetres. Demonstrate the need to line up the ruler correctly in order to get an accurate measurement.
Revise with students rounding to the nearest tenth. Draw a number line on the board labelled from 2.45 to 2.47 with the thousandths divisions marked in. Say numbers to the students such as 2.452 and ask them to position them on the number line and say which hundredth they are nearest to. Include examples such as 2.455 and revise that, when rounding, if the number is half-way between two points we always round up. Tell students that rounding to the nearest tenth is called ‘approximating to one decimal place’ and rounding to the nearest hundredth is called ‘approximating to two decimal places’.

Ask students to draw a scale plan of the classroom. They will need to measure the dimensions of the room and the key pieces of furniture, agree a scale and then draw their plan, measuring and drawing accurately with a ruler.

Write a length on the board, for example, 5.6 cm. Ask students to use a straight edge to draw a line they think is about this length. Using a ruler, ask students to measure their lines and see how accurate their estimate was. Points could be awarded for degrees of accuracy, for example, 2 points if you were within 5 cm, 3 points if you were within 2 mm, 5 points if you were within 1 mm. After ten goes, see who has the most points.

**Using the Student Book and Workbook**

Work through Student Book page 34 with the class to revise decimal units of measure.

Let the students work in pairs to complete Student Book page 35. Discuss their answers and any disagreements as a class. Use Workbook page 25 to check that students can read and make sense of different scales.

Work through Student Book page 36 with the class. Revise place value as necessary for conversions. Demonstrate how to work and talk through the examples. Then have the students complete Workbook page 26 on their own.

Discuss Student Book page 37 as a class. Let the students spend some time using rulers and measuring tapes to find the lengths of items in the classroom before asking them to complete the activities.

Make sure the students can read and understand the distance tables on Student Book page 38 before having them complete the activities.

Let the students complete Student Book page 39 independently. Discuss their answers and let the students explain how they worked them out.
Once you have discussed the Imperial system and its origins with the class read through the information in the table on Student Book page 40 with the class. Ask the students to name any other non-metric measurements they know. Ask them to suggest decimal alternatives for each and try to establish a rough conversion factor. Let the students work in pairs to complete the activity. Discuss how they solved the problems.

**Assessment questions to ask**

- What units would you use to measure this quantity? Why?
- Can you give me an example of when we need to measure accurately using millimetres/milligrams/millilitres?
- Can you convert this measurement which is in centimetres to metres? Repeat for other units.
- What is meant by ‘approximating to one decimal place’? Can you explain how to approximate a measurement to one decimal place?
- How many litres/kilograms/metres are there in 2000 ml/mg/m?

**Common errors and misconceptions**

The main errors students are likely to make with this work are in converting between units of measurement. Many of these errors will come down to a misunderstanding of place value and the decimal point. By giving students plenty of experience in ordering measurements, saying conversions out loud and placing measurements in a place value chart, this can be avoided.

### 7 Fractions

<table>
<thead>
<tr>
<th>7: Fractions</th>
<th><strong>Student Book</strong> pp 41–47</th>
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</thead>
<tbody>
<tr>
<td><strong>Workbook</strong> pp 27–31</td>
<td></td>
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<tr>
<td><strong>Objectives</strong></td>
<td></td>
</tr>
<tr>
<td>6Nn21</td>
<td>Compare fractions with the same denominator and related denominators, e.g. $\frac{3}{8}$ with $\frac{7}{8}$</td>
</tr>
<tr>
<td>6Nn22</td>
<td>Recognise equivalence between fractions, e.g. between $\frac{1}{100}$s, $\frac{1}{10}$s and $\frac{1}{2}$s</td>
</tr>
<tr>
<td>6Nn24</td>
<td>Order mixed numbers and place them between whole numbers on a number line</td>
</tr>
<tr>
<td>6Nn25</td>
<td>Change an improper fraction to a mixed number</td>
</tr>
<tr>
<td>6Nn26</td>
<td>Reduce fractions to their simplest form, where this is $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$ or a number of fifths or tenths</td>
</tr>
</tbody>
</table>
Vocabulary

Fraction, mixed number, improper fraction, numerator, denominator, equivalent, simplest terms, common denominator, multiple, factor, common factor, simplest form.

Resources needed

Flashcards showing a variety of fractions; large fraction equivalent chart for display on wall; wholes and parts of wholes to demonstrate mixed numbers, for example, pictures of three whole cakes and half a cake.

Mental warm-up activities

Select suitable activities from the mental warm-up activity bank.

Concepts that may be unfamiliar in this topic

Reducing fractions to their simplest form

This year, students will apply what they know about equivalence to simplify fractions. They will only work with fractions that can be reduced to halves, quarters, fifths or tenths. This work relies on multiplication and division facts that the students already know, so you may want to reinforce and practise these facts as you work through this unit.

Teaching ideas

Practical activities

Write a fraction on the board, for example, $\frac{2}{3}$ or $\frac{4}{7}$. Ask students if they can remember the correct name for the top number of the fraction and the bottom number of the fraction. Remind them of ‘numerator’ and ‘denominator’ if necessary. Ask students to explain what the numbers mean and use their responses to establish that the denominator is the number of parts the whole has been divided into and the numerator tells us how many of these parts we have. Draw shapes on the board divided into equal parts, for example, a shape divided into quarters and a copy of the same shape divided into eighths. Shade a fraction of one shape, for example, $\frac{1}{4}$, and ask students how much of the other shape must be shaded to make the two diagrams look the same. Repeat for other examples. Give a group of students a flashcard each showing different fractions. Ask the rest to give the group step-by-step instructions to reposition themselves so the cards are in order from smallest to largest. Give another student a card and ask them to position themselves on the line.

Once you are clear that the students understand the concept of common fractions, display pictures of whole objects and parts of objects; good examples are whole pizzas and slices, whole cakes and parts of cakes, pairs of shoes and an odd shoe, boxes full of crayons and a box with 3 of the 8 crayons (or another fraction). Ask the students how they could express each amount. Model an example such as ‘I have two and a half cakes’ if necessary. Show the students how to write mixed numbers and teach the term ‘mixed number’.
Use the same pictures to show how a mixed number can be expressed as an improper or ‘top-heavy’ fraction.

Ask a group of students to stand up. Vary the activity above by giving each student a card showing an improper fraction or mixed number. Get the rest of the class to instruct the group so they stand showing the numbers in order from smallest to largest or largest to smallest. Give another student another card and ask them to position themselves in the line. Ask students to say a mixed number or improper fraction that could lie between two of the numbers in the line.

Hold up a card showing a mixed number. Invite a student to convert it to an improper fraction. Repeat holding up an improper fraction and asking students to convert it to a mixed number. Encourage students to explain how they did their conversion.

Write two fractions on the board, for example, \( \frac{2}{3} \) and \( \frac{3}{4} \). Ask students to say a fraction that could go in between these two fractions. Encourage students to explain how they chose their fraction.

Write a fraction in the middle of the board. Go round the class asking students to say an equivalent fraction and record answers. How many different fractions can they say? Are there any more? How do they know?

Look at the fraction wall showing equivalent fractions and show students how to use a ruler or straight edge card to compare two fractions. Ask students how they think they could use the fraction wall to order three fractions.

Write statements on the board, such as \( \frac{2}{3} \) are more than \( \frac{3}{5} \). Ask students to say whether the statements are true or false and how they know.

Write a fraction on the board, for example, \( \frac{1}{4} \). Ask students to use their fraction wall to find a fraction that is the same. Remind students that these fractions are called ‘equivalent fractions’. Repeat until there are several pairs of equivalent fractions on the board. Ask students to look at each pair and see if they can spot anything about the numerator and denominator in each pair. Use students’ answers to work towards the idea that equivalent fractions can be found by multiplying or dividing the numerator and denominator by the same number.

Write a fraction on the board that is not in its simplest form, for example, \( \frac{12}{16} \). Either by using a fraction wall or by any other method of their choice, ask students to tell you equivalent fractions. If no one comes up with \( \frac{3}{4} \) or \( \frac{6}{8} \), look at a fraction wall together and add them to the list. Ask students which of the fractions is most recognisable to them, i.e. ‘Which would you find easiest to position on a number line?’ Establish that \( \frac{3}{4} \) has most meaning for them and this is why we always like to ‘express’ fractions in their ‘simplest terms’, i.e. using the lowest
possible denominator. Remind students that to find an equivalent fraction we can multiply or divide the numerator and denominator by the same number. If we are looking for a fraction in its simplest terms we must divide. Write a different fraction on the board, for example, $\frac{10}{25}$, and ask students to tell you it in its simplest form. Encourage them to explain how they found their answer, i.e. ‘I divided the numerator and denominator by 5’. Next give students a fraction such as $\frac{16}{24}$ and ask them to simplify it. Ask students to explain how they found their answer. Many students are likely to do more than one division, for example, dividing by 4 then 2. Establish whether anyone managed to simplify the fraction in one step and either using their ideas, or by leading students from the multi-step approach they took, highlight the advantages of doing just one division. Ask students to list the factors of 16 and 24 and tell you what the highest common factor is. Point out that this is the same as the number used to simplify the fraction in one step. Repeat for other examples.

**Using the Student Book and Workbook**

- Let the students work through Student Book page 41 and Workbook page 27 on their own. Use their work to assess how much they already know about fractions.

- Work through Student Book page 42 with the class. Make sure students understand the terms ‘mixed number’ and ‘improper fraction’ and that they can see the relationship between these before asking them to complete the activities. Use Workbook page 28 as an informal assessment.

- Demonstrate how to convert between mixed numbers and improper fractions and ask students to complete some examples before asking them to complete Student Book page 43.

- Revise equivalent fractions with the class by working through Student Book page 44. Let the students complete the activities in pairs.

- Work through some examples from Student Book page 45 with the class. Let the students work independently to complete the activities and Workbook page 29. The concept of simplifying a fraction is crucial. Make sure the students understand how to do this, revising factors and multiples as necessary.

- Work through the examples on Student Book page 46 with the class. Make sure they understand the concept of a common denominator before moving onto the activities. Complete the Student Book activities in pairs, then have the students work through Workbook page 30 on their own.

- Spend some time working through the examples on Student Book page 47 and, if necessary, do additional examples using a number line.
before asking the students to complete the activities on this page. Once they are confident, have them complete Workbook page 31. Check and discuss their answers.

Assessment questions to ask

- Can you give instructions to someone explaining how to convert an improper fraction to a mixed number?
- Can you explain how to change this mixed number into an improper fraction?
- Give me a fraction that is equivalent to \( \frac{3}{5} \) but has a denominator of 25. How did you do it?
- How did you cancel this fraction to its simplest form?
- How do you know when you have the simplest form of a fraction?
- How would you explain to someone how to order a set of fractions and mixed numbers? What tips would you give them?
- Can you give me a fraction that lies between these two fractions? How did you make your choice?
- Can you write a word problem that would have the answer \( \frac{2}{3} \)?

Common errors and misconceptions

Students notoriously have difficulties with fractions. Many of these difficulties seem to arise from an over reliance on the part of a whole model and this always being presented through shaded diagrams. It is important for students to see fractions as numbers that can be ordered on a number line and compared. They also need to be aware that the ‘whole’ can be a quantity and thus, for example, 12 out of 24 can be expressed as a fraction.

When simplifying, students may not always reduce the fraction to its simplest terms. Encourage them to check for common factors before they decide their work is finished.
Vocabulary
Decimal, tenths, hundredths, thousandths, place value, decimal place.

Resources needed
Flashcards showing a variety of decimals; place value notation cards; 0–9 digit cards and decimal point cards; a die.

Mental warm-up activities
Select suitable activities from the mental warm-up activity bank.

Concepts that may be unfamiliar in this topic
Rounding numbers to a given decimal place (tenths and hundredths)
Students have already learned how to round numbers to a given place and how to round decimals to the nearest whole number (Stage 5). In Stage 6 they need to extend their understanding to round decimals to a given number of places. The actual strategies for rounding are not new, but students need to remain aware of place value.

Teaching ideas

Practical activities
Ask a group of students to stand up. Give each student a card showing a decimal number. Get the rest of the class to instruct the group so they stand showing the numbers in order from smallest to largest or largest to smallest. Give another student another number card and ask them to position themselves in the line. Ask students to say a number that could lie between two of the numbers in the line.

Give students a set of place value cards or several sets of 0–9 digit cards and a decimal point card. Say decimal numbers and ask the students to lay out the cards to show that number.

Draw a place value chart on the board. Put numbers into the chart and use it to help students say the numbers aloud. Say a number and ask students to come up and place the number in the chart.

Draw a row of six boxes on the board, putting a decimal point before the last two boxes. Ask students to make a copy of this on paper. Explain to the students you are going to roll a 0–9 die six times (if a die is not available, pick a card from a set of digit cards and then return it to the pack and shuffle). Each time they must select a box to put the number in. Once positioned a digit cannot be moved. The aim is to have created the largest number when all six boxes have been filled. Discuss with students the strategies they used to make decisions about where to place numbers. Repeat trying to make the smallest number.
Use calculators to generate decimal number sequences, for example, ‘start at 0.2 and go up in 0.3 intervals’. Discuss what happens when a place value position is bridged.

**Using the Student Book and Workbook**

- Work through some examples with the class to make sure they understand place value to thousandths before asking them to complete the activities on Student Book page 48 and Workbook page 32.

- Make sure the students remember that they have to look at the tenths, then the hundredths and lastly the thousandths to compare the size of decimals. Work through some of the examples on Student Book page 49 before asking the students to complete them.

- Work through Student Book page 51 with the class. Students are likely to have a range of strategies of their own to solve problems related to money. Spend time discussing these and relate working with money to decimals as this can help the students make meaningful connections between mathematics in the real world and the work they do at school.

- Let the students work independently to complete Student Book page 50 once you have revised rounding to the nearest tenth and hundredth. Use Workbook page 33 to assess that they can do this.

**Assessment questions to ask**

- What is this digit in this number worth?
- How do you say this number?
- When ordering these decimals what did you look at first? Then what did you do?
- Which numbers do you find hardest to order? Why?
- Can you give me a number that lies between 3.2 and 3.3? How many answers do you think there are to this question?
- Can you give instructions to someone to explain how to round numbers to the nearest tenth/hundredth?

**Common errors and misconceptions**

There are many common misconceptions surrounding the concept of decimals. Some students see the numbers after the decimal point as a mirror of those before, thus thinking of 34.56 as ‘thirty-four point fifty-six’. This leads to incorrect comparison of numbers as, for example, if students were to compare 34.56 with 34.7 they would feel 34.56 is larger as ‘fifty-six is bigger than seven’. To avoid this it is important to use place value charts or notation cards to emphasise the value of digits in a number and regularly
practise how to correctly say numbers. Another common error relates to sequences of decimals, for example, ‘0.6, 0.7, …’ When reaching 0.9 students often follow with 0.10, the line of thinking being ‘nine tenths, then ten tenths’. Time needs to be spent with students thinking about what is meant by ten tenths and diagrams often help clarify this. Using a place value chart can show how 0.1 and 0.10 are the same.

### 9 Tables and graphs

<table>
<thead>
<tr>
<th>9: Tables and graphs</th>
<th>Student Book pp 52–59</th>
<th>Workbook pp 34–40</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6Dh1</td>
<td>Solve a problem by representing, extracting and interpreting data in tables, graphs, charts and diagrams, e.g. line graphs for distance and time; a price ‘ready reckoner’ for currency conversion; frequency tables and bar charts with grouped discrete data</td>
<td></td>
</tr>
<tr>
<td>6Dh4</td>
<td>Explore how statistics are used in everyday life</td>
<td></td>
</tr>
</tbody>
</table>

**Vocabulary**

Frequency table, tally, total, grouped frequency, bar graph, axis, axes, title, line graph, scale.

**Resources needed**

Dice; magazines or newspapers; samples of graphs from real life.

**Mental warm-up activities**

Select suitable activities from the mental warm-up activity bank.

**Concepts that may be unfamiliar in this topic**

**Explore how statistics are used in everyday life**

This year students will be expected to make sense of data in real life contexts. This is an important skill as we are faced with many examples of graphs, tables and ‘statistical facts’ in the media on a daily basis. It is important that students begin to think critically about how data is used and that they understand that data can be misleading if it is represented in particular ways.
**Teaching ideas**

**Practical activities**

Place the students in small groups. Let them take turns to roll two dice 50 times and to record how many times a score (from 2 to 12) is rolled. Write the numbers from 2–12 (the possible scores) on the board. Record how many times each score was rolled by the different groups (use the format $n + n + n$, e.g. $2 + 5 + 6$ for the frequencies). Total the number of times each score was rolled. Explain that you can make a frequency table of the results by putting the results into groups. Draw a grouped frequency table on the board using the groups 1–3, 4–6, 7–9 and 10–12. Write in the frequencies, making sure the students realise these come from the totals you recorded earlier. Work as a class to draw a bar graph showing the data.

Give each group a short section of text from a newspaper or magazine article. Let them count and tally the number of letters in each word in their article and then draw a grouped frequency table to show the data. Once they have done this, let them draw a bar graph to show the data.

If the students struggle with the grouped frequency concept, continue with practical activities such as letting them count the number of letters in each student’s first name or tossing a single die a number of times and recording the results.

Give students opportunities to collect data about themselves or school life and display it using graphs.

Let the students work in groups to collect examples of unusual graphs from real life sources and make a poster showing these. Encourage them to talk about what the graph shows and why it is unusual.

**Using the Student Book and Workbook**

Use Student Book page 52 and Workbook page 34 to revise the concept of a frequency table and to assess that the students can complete tables for ungrouped data before moving on to grouped data.

Work through Student Book page 53 with the class. Once you are sure they have grasped the concepts, let them work through Workbook page 35 on their own. The groups are given for the data, so it is relatively simple for the students to organise the table.

Let the students work in pairs to complete Student Book page 54 and to carry out the number plate survey. Make sure they choose a safe place to do the survey.
Work through Student Book page 55 as a class. The grids for completing the graphs can be found on Workbook page 36. Check that the students can draw a bar graph and label it correctly.

Introduce the topic of line graphs and work through Student Book page 56 with the class before letting the students complete Workbook page 37 on their own as an informal assessment.

Let students work in pairs to complete Student Book page 57 and Workbook page 38. Walk around and check that they are able to do this while they are working.

Let the students discuss the graphs on Student Book page 58 in pairs before discussing their ideas as a class. Use Workbook page 39 to assess whether students can interpret an unusual graph and translate it into a more usual format.

Student Book page 59 is a fun activity based on the heights of the world’s tallest buildings (as at 2012). Once you have worked through and discussed the questions, let the students work on their own to draw a graph of the world’s tallest towers on Workbook page 40. Give them a chance to show their completed graphs to each other.

Assessment questions to ask

- How could we group this data?
- What can we call this graph?
- What labels should I put on the axes?
- Can you tell me three facts you know from looking at this graph?
- Can you make up a question that could be answered using this graph?
- Which of these graphs do you think shows the data best? Why?
- What tips would you give someone about drawing this type of graph?

Common errors and misconceptions

Students may struggle to choose appropriate and equally sized groups for data. Help them by telling them to look at the number range, for example, 1–12, and then dividing it by a factor to make equal groups. Point out that you do not want too few or too many groups.

Some students may make presentation errors when drawing graphs. For example, not titling the graph or giving axes labels. Discuss with students why it is important to fully label graphs. It might be useful to have a checklist for constructing graphs displayed in the classroom.

Encourage students to interpret graphs critically and realise when they are deliberately presented to mislead. One way of supporting students is to show them examples of graphs used in newspapers, etc. and reflect on what they tell us.
10 Operations on decimals

<table>
<thead>
<tr>
<th>Objectives</th>
<th></th>
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<tbody>
<tr>
<td>6Nn5 Multiply and divide decimals by 10 or 100 (answers up to 2 decimal</td>
<td></td>
</tr>
<tr>
<td>places for division)</td>
<td></td>
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<tr>
<td>6Nn10 Make and justify estimates and approximations of large numbers</td>
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<tr>
<td>6Nn23 Recognise and use the equivalence between decimal and fractional</td>
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<td>forms</td>
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<tr>
<td>6Nn27 Begin to convert a vulgar fraction to a decimal fraction using</td>
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<td>division</td>
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<tr>
<td>6Nc1 Recall addition and subtraction facts for numbers to 20 and pairs</td>
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<tr>
<td>of one-place decimals with a total of 1, e.g. 0.4 + 0.6</td>
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<tr>
<td>6Nc2 Derive quickly pairs of one-place decimals totalling 10, e.g. 7.8 and</td>
<td></td>
</tr>
<tr>
<td>2.2, and two-place decimals totalling 1, e.g. 0.78 and 0.22</td>
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<tr>
<td>6Nc4 Use place value and number facts to add or subtract two-digit whole</td>
<td></td>
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<tr>
<td>numbers and to add or subtract three-digit multiples of 10 and pairs</td>
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<tr>
<td>of decimals, e.g. 560 + 270; 2.6 + 2.7; 0.78 + 0.23</td>
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<tr>
<td>6Nc5 Add/subtract near multiples of 1 when adding numbers with one</td>
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<tr>
<td>decimal place, e.g. 5.6 + 2.9, 13.5 – 2.1</td>
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<tr>
<td>6Nc9 Double quickly any two-digit number, e.g. 78, 7.8, 0.78; derive</td>
<td></td>
</tr>
<tr>
<td>corresponding halves</td>
<td></td>
</tr>
<tr>
<td>6Nc11 Add two- and three-digit numbers with the same or different numbers</td>
<td></td>
</tr>
<tr>
<td>of digits/decimal places</td>
<td></td>
</tr>
<tr>
<td>6Nc12 Add or subtract numbers with the same and different numbers of</td>
<td></td>
</tr>
<tr>
<td>decimal places, including amounts of money</td>
<td></td>
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</tbody>
</table>

Mental warm-up activities

Select suitable activities from the mental warm-up activity bank.
Concepts that may be unfamiliar in this topic

Convert vulgar fractions to decimals using division

Students need to realise that vulgar fractions can be changed to decimal fractions. To teach this, we will rely on their understanding of equivalent fractions and division by 10 and 100. So, for example, to convert \( \frac{1}{4} \) to a decimal, students can rewrite the fraction as \( \frac{25}{100} \) and then divide by 100 to get 0.25. Once they have understood this idea, they can move onto working with a calculator to do the conversions. This will raise issues of rounding because some fractions will produce recurring (and non-terminating) decimal places.

Extend operations on decimals to higher numbers and different decimal places

Although the concepts in this chapter are not new, students will need to extend their understanding of decimal operations to work with larger numbers, more than two numbers at a time and decimals with different numbers of decimal places in the same operation.

Vocabulary

Decimal, tenths, hundredths, thousandths, place value, decimal place, recurring, rounding.

Resources needed

Flashcards showing a variety of decimals; place value notation cards; 0–9 digit cards and decimal point cards; a die; calculators.

Teaching ideas

Practical activities

Write additions and subtractions of decimals horizontally on the board and ask students to try and solve them mentally or by using pictures. Use their ideas to assess their understanding of the concepts of addition, subtraction and place value. Discuss methods with the students and allow them to use them instead of written methods if they find them easier. For example, students may find it easier to do subtraction by adding on using a blank number line for support, for example, 4.08 – 1.72 could be seen as: ‘Starting at 1.72, I add 8 hundredths to get to 1.8, I add 2 tenths to get to 2, I add 2 to get to 4 and I add 8 hundredths to get to 4.08. This gives me an answer of 2.36.’

Write addition and subtraction calculations on the board with a choice of answers. Ask students to identify the correct answer and discuss what errors have been made that result in the incorrect answers.

Write an addition or subtraction calculation on the board involving decimals. Ask students to write a word problem that matches the calculation. Discuss students’ problems and identify whether they make sense and which ones students think are good problems and why.
Give students a selection of flashcards showing decimals and fractions. Ask students to arrange the cards in order from largest to smallest or vice versa. Encourage students to explain how they made their decisions and how they compared fractions and decimals.

Invite a student to pick flashcards from a pile and make a decimal to show to the class. Students must find the product of the decimal and 10/100/1000. Compare answers and if there is disagreement, ask students to explain how they found the answer and reason why theirs is correct. Through this discussion establish the correct solution. Repeat for division.

Using the Student Book and Workbook

Use Student Book page 60 to revise multiplying and dividing by 10 and 100. Let the students complete the calculator investigation on their own. Talk about their results as a class and work through the examples. Encourage students to explain the effects of these with reference to place value. Let them complete Workbook page 41 to check that they are confident in this area. Let the students work independently through Student Book page 61 and Workbook page 42 in class.

Use Student Book page 62 to revise multiplication facts and model how these can easily be extended to work on decimals.

Revise converting fractions to decimals by division as necessary before letting students work through the conversions on Student Book page 63.

Use a calculator to demonstrate recurring decimals. Make sure the students can see that there is a difference between 0.3 and 0.3333333, referring to earlier work on ordering and comparing decimals. Show them how to truncate and mark recurring digits, then have them complete Student Book page 64.

Students should already have memorised pairs of single-digit decimals that make 1. Work through Student Book page 65 with the class to revise and extend these known facts. Let students work independently to complete Workbook page 43.

Demonstrate and discuss different strategies for adding and subtracting decimals (including column methods) by working through the examples on Student Book page 66 with the class. Let the students work independently to complete the calculations.

Student Book page 68 requires the students to apply what they know about working with decimals to halve and double amounts of money. Work through the examples with the class before having them complete the activities on this page and on Workbook page 44.

Spend some time discussing the problems on Student Book page 69 with the class to identify what is being asked and what strategies students would use to solve the problems. Let the students work in pairs to complete the calculations.
Give the students time to discuss the worded problems on Student Book page 67 before having them complete the work on their own. Discuss strategies used, and answers, as a class once they have completed the work.

Demonstrate how to add and subtract decimals in columns by working through the examples on Student Book page 69 with the class. Once they understand, have them work independently to complete the calculations. Use Workbook page 44 as additional practice to reinforce skills and concepts.

Give the students time to discuss the worded problems on Student Book page 50 before having them complete the work on their own. Discuss strategies used, and answers, as a class once they have completed the work.

Let the students complete the calculator investigation on Student Book page 51 on their own. Talk about their results as a class and work through the rules and examples. Use Workbook page 30 as ongoing practice to reinforce skills in this area. Let the students work independently through Student Book page 52 and Workbook page 31 in class.

Revise place value and multiplication of two-digit numbers as necessary before working through Student Book page 53 as a class. Let the students complete Workbook page 32 as a timed test.

Revise short division with whole numbers as necessary before working through Student Book page 54 as a class. Let the students complete Workbook page 33 in pairs, checking their answers with a calculator.

Discuss with the students strategies for solving the word problems on Student Book page 55 before asking them to complete the work on their own.

**Assessment questions to ask**

- When doing this addition/subtraction I reached this answer. Is it correct? Why not?
- Can you explain to me the steps you went through to answer this question?
- Can you use estimation to check these answers?
- Can you convert this length given in centimetres into metres?
- How would you explain to someone how to multiply a decimal by ten/one hundred?
- What is the approximate answer to this multiplication/division?
- When I marked your work, I saw these three answers for this division. Which is the right answer? What have students done wrong to reach the other answers?
Common errors and misconceptions

Some students are likely to make mistakes carrying out the addition and subtraction algorithms. It is important to identify whether or not this is due to a misunderstanding of place value. One way of doing this is to give students examples of calculations that have been answered incorrectly and ask them to identify where mistakes have been made. If necessary, return to work on place value before looking at the algorithms again.

Assuming students can confidently multiply and divide numbers, the biggest difficulty they are likely to encounter will be to do with place value. It is important not simply to teach students rules for multiplying and dividing with decimals, but also ensure they are clear about why the rules work. For example, when multiplying decimals by ten, although students may see it as ‘moving the decimal point one place’, they need to be aware that it is actually the digits that are each becoming ten times bigger and thus are ‘moving’ up a place. This can be demonstrated using a place value chart.

<table>
<thead>
<tr>
<th>11: 2D shapes</th>
<th>Student Book pp 70–76</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Workbook pp 45–46</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Objectives</th>
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</thead>
<tbody>
<tr>
<td>6Gs1</td>
</tr>
<tr>
<td>Classify different polygons and understand whether a 2D shape is a polygon or not</td>
</tr>
<tr>
<td>6Gs3</td>
</tr>
<tr>
<td>Identify and describe properties of quadrilaterals (including the parallelogram, rhombus and trapezium) and classify using parallel sides, equal sides, equal angles</td>
</tr>
</tbody>
</table>

Mental warm-up activities

Select suitable activities from the mental warm-up activity bank. Students will not be doing much calculation work in this topic, so try to build in some mental calculation practice as well.

Concepts that may be unfamiliar in this topic

Names and properties of 2D shapes

Although students have previously worked with the names of shapes and spent some time dealing with the properties of triangles, they may not know the names of different polygons and quadrilaterals in particular. The activities in the Student Book and Workbook will help them develop their understanding in these areas.
**Vocabulary**

Equilateral, isosceles, scalene, base, polygon, vertex, vertices, quadrilateral, square, rectangle, parallelogram, rhombus, kite, trapezium.

**Resources needed**

Set squares; protractors; flashcards showing a variety of different triangles; a collection of different polygons made out of card; geo-boards; elastic bands.

**Teaching ideas**

**Practical activities**

Hold up a flashcard showing a triangle. Ask students to say what type of triangle it is. Encourage students to say how they know, for example, ‘It is an equilateral triangle because all the sides are equal.’

Ask students to draw a picture made completely out of different types of triangle. Ask them to colour all the equilateral triangles one colour, the isosceles another, and so on.

Write a criterion on the board, for example, ‘Use 6 equilateral triangles and 4 isosceles triangles.’ Ask students to construct a pattern that fits the criterion.

Hide a polygon behind a screen, such as a piece of thick paper. Gradually move the shape so some of it is revealed. Ask students to suggest what the shape might be and why. As more of the shape is revealed ask students to change their answers, for example, ‘It can’t be a triangle because there are already three vertices on show.’ Continue until the shape is revealed.

Invite a student to describe a shape by its properties and ask other students to identify it.

Write statements on the board such as ‘A triangle has three equal sides’ or ‘A parallelogram has two equal diagonals.’ Ask students to say whether the statement is ‘true’, ‘false’ or ‘sometimes true’. Encourage students to justify their answers.

**Using the Student Book and Workbook**

Use Student Book page 70 to revise the names of polygons and to assess that the students can recognise and classify shapes.

Use Student Book page 71 to revise the classification of triangles using the side and angle properties. Make sure the students know the correct terminology and that they can name triangles using combined properties, for example, obtuse-angled, isosceles.
Student Book page 72 involves the students measuring sides and angles in order to develop their own understanding of the properties of different quadrilaterals. Once they have completed this investigation have a class feedback session to discuss what they found out. Use Workbook page 45 to assess that they can apply this knowledge.

Let the students complete Workbook page 46 before letting them work through Student Book page 73. If possible, supply geo-boards and elastic bands so the groups can model the shapes before drawing them.

Work through Student Book page 74 with the class. Make sure they understand that all shapes with two pairs of opposite and equal parallel sides are parallelograms, so squares, rectangles and rhombuses are parallelograms as well. Let the students work independently to draw the shapes accurately and then let them check each other’s work.

Let the students work in pairs to complete Student Book page 75. Have a class discussion about the statements and their decisions.

Use Student Book page 76 to assess that students can read and interpret instructions correctly and that they are able to use a ruler and protractor to draw accurate shapes.

**Assessment questions to ask**

- Can you sort these triangles into four groups? Can you name each group and describe the properties of the triangles in the group?
- Can you tell me some facts about parallelograms?
- Can you give me some instructions to draw a hexagon?
- Is it possible for a quadrilateral to have only three right angles? Why?
- What can you tell me about the diagonals of a parallelogram?
- What is meant by the term ‘regular polygon’? Can you show me an example of a regular polygon?

**Common errors and misconceptions**

Students may find it difficult to remember the names of the different types of triangle and will need plenty of practice at identifying triangles and stating their specific properties. When constructing triangles, some students will find it difficult to use a protractor correctly and this will need to be carefully demonstrated with key points on how to use it.

Students may have difficulties measuring the angles of shapes correctly and will need to be reminded about how to use a protractor properly.

There is a lot of terminology and information for students to remember in this unit. Help students to engage with it by putting statements on the board such as ‘A parallelogram has four right angles’ and asking students to say whether the statements are true, false or sometimes true.
One way of encouraging students to use correct terminology is to model it yourself. Avoid referring to shapes using names such as arrowhead or diamond as these are not mathematical terms and they end up confusing students.

12 Perimeter

<table>
<thead>
<tr>
<th>12: Perimeter</th>
<th>Student Book pp 77–78</th>
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<tbody>
<tr>
<td></td>
<td>Workbook pp 47–48</td>
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<table>
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<tr>
<th>Objectives</th>
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</thead>
<tbody>
<tr>
<td>6Ma1 Measure and calculate the perimeter and area of rectilinear shapes</td>
</tr>
<tr>
<td>6Ma3 Calculate perimeter and area of simple compound shapes that can be split into rectangles</td>
</tr>
<tr>
<td>Note: Area is covered in Chapter 27</td>
</tr>
</tbody>
</table>

Vocabulary
Perimeter, sides, formula.

Resources needed
Rulers; calculators.

Mental warm-up activities
Select suitable activities from the mental warm-up activity bank.

Concepts that may be unfamiliar in this topic
There are no new concepts in this topic. Students will build on what they already know about finding the perimeter of shapes by measuring and/or using a formula to find the area of rectangles and composite shapes.

Teaching ideas

Practical activities

Revise with students what is meant by the ‘perimeter’ of a shape. Work with individual students to show them how to measure and draw lines accurately.

Using the Student Book and Workbook

Revise the concept of perimeter with the class and then have the students complete Student Book page 77 and Workbook page 47.
Let the students complete Student Book page 78 and Workbook page 48 independently. Discuss their answers and let the students show some of the rectangles they draw, with dimensions.

Assessment questions to ask

- What is the perimeter of this shape?
- How do you know how long this side of the shape is?

Common errors and misconceptions

In working with perimeter of compound shapes, students may struggle to work out the missing lengths. Encourage them to separate the shape into two sets of lines. Look first at horizontal lines. Draw a complete length and use it to work out the lengths of the missing bits. Repeat for vertical sides.

13 Multiples and factors

<table>
<thead>
<tr>
<th>13: Multiples and factors</th>
<th>Students’ Book pp 79–82</th>
<th>Workbook pp 49–50</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6Nn6</td>
<td>Find factors of two-digit numbers</td>
<td></td>
</tr>
<tr>
<td>6Nn7</td>
<td>Find some common multiples, e.g. for 4 and 5</td>
<td></td>
</tr>
<tr>
<td>6Nn17</td>
<td>Recognise odd and even numbers and multiples of 5, 10, 25, 50 and 100 up to 1000</td>
<td></td>
</tr>
<tr>
<td>6Nn19</td>
<td>Recognise prime numbers up to 20 and find all prime numbers less than 100</td>
<td></td>
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<tr>
<td>Note: Odd and even numbers are covered in Chapter 25</td>
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</tr>
</tbody>
</table>

Vocabulary

Multiple, factor, product, array, prime, common factor, common multiple.

Resources needed

Flashcards showing the key vocabulary listed above.

Mental warm-up activities

Select suitable activities from the mental warm-up activity bank.
Concepts that may be unfamiliar in this topic

Terminology

Students have worked with multiples and factors previously but they may have forgotten the names and may still get confused between the terms. In this topic, the correct vocabulary and terms are reinforced and students work to find the multiples and factors of different numbers.

Prime factors

Students may not know the term prime number. In this chapter the term is introduced and the students learn to recognise and find prime numbers. They will then apply their knowledge of prime numbers to find prime factors of different numbers.

Teaching ideas

Practical activities

- Hold up a vocabulary flashcard and ask students to give you sentences incorporating the word.
- Write a two- or three-digit number on the board and ask students to describe its properties, for example, whether it is a square or prime number, what its factors are, what some of its multiples are, etc.
- Write a two-digit number on a piece of paper that is kept concealed. Students must ask you questions to which you can reply ‘yes’ or ‘no’ in order to try and guess the number. Encourage them to ask questions relating to number properties, for example, ‘Is it a multiple of 6?’ along with questions about, say, the size of the number. Discuss with students what your answer tells them and which numbers your answer eliminates. When the students guess the correct number reveal the paper to confirm this. Invite a student to write a number down and respond to other students’ questions.
- Write a two-digit number on a piece of paper that is kept concealed. Give students clues about your number, some relating to its properties, in order for them to guess your number. When the students guess the correct number reveal the paper to confirm this. Invite a student to write a number down and give the rest of the class clues.
- Remind students what is meant by the term ‘factor’. Write a number, for example, 24, on the board. Ask students to say factors of the number and record them. Ask students how we can be sure we have found all the factors of 24. Talk about starting from 1 and pairing this with the number it would be multiplied by to get 24, then going through 2, 3, etc. in a similar way until all factor pairs have been recorded. Illustrate factor pairs by drawing arrays for 24 or making them on a geo-board. Repeat for another example. Make sure students are aware that odd numbers can have several factor pairs as well as even numbers, for example, 45.
Write a number, for example, 24, on the board. Ask students to tell you all the factors of the number. When all the factors have been listed, ask students to tell you which of the factors are prime numbers and establish that these are called ‘prime factors’. Take a pair of factors for the number, for example, 4 and 6, and ask students what the factors of each of these numbers are and establish that you are left with 2, 2, 2 and 3 all of which are prime numbers. Explain to the students that these are the prime factors of the original number and if we multiplied them altogether we would get 24. Choose another pair of factors originally listed, for example, 3 and 8, and repeat the process. Highlight to students that you end up with the same set of prime factors for 24.

Show students how to set out factor trees and highlight that it does not matter which factor pair for a number you start with, you will always get the same prime factors.

Ask students to explain what is meant by the word ‘multiple’. Use their ideas to draw out a correct understanding. Put a single-digit number on the board and ask students to tell you multiples of the number. Repeat with other examples. Put the numbers 6 and 8 on the board. Ask students to list the first five multiples of each number. Looking at these lists ask students to tell you which is the smallest number that both 6 and 8 go into; having established the answer of 24 explain to students this is called the ‘lowest common multiple’. Now look again at 6 and 8 and ask students to tell you the prime factors of each number.

Write 12 and 18 on the board. Ask students to list all the factors of each number. Ask students which are factors of both numbers. Looking at these, establish which of these common factors is the highest.

Using the Student Book and Workbook

Use Student Book page 79 to revise basic concepts around multiples and discuss the problem solving activity as a class once the students have completed it.

It is important that students can work confidently with factors as they will use the knowledge and skills to factorise numbers into prime factors. Use Student Book page 80 to assess how much they remember. Let students complete Workbook page 49 independently as a test to see that they can factorise numbers.

Work through the teaching text on Student Book page 81 with the class. Then have them sort the prime numbers in the Workbook on page 50. Once they have done this, let them complete the Student Book activities on their own.
Work through Student Book page 82 with the class. Show them that they can start with any pair of factors to make a factor tree. Even if they work in a different order to a partner, they will all end up with the same product of prime factors.

**Assessment questions to ask**

- Can you list all the factors of this number?
- Can you give me three multiples of this number?
- Which of these numbers are prime numbers? How do you know?

**Common errors and misconceptions**

There is a lot of terminology in this unit that students need to be familiar with and that they may find confusing, for example, finding factors instead of multiples and vice versa. To overcome this, have short regular activities where students have to use the terminology to describe numbers and their properties.
Concepts that may be unfamiliar in this topic

There are no new concepts introduced in this topic, instead students are expected to apply and extend what they already know about multiplication and division to further refine their calculation skills.

Teaching ideas

Practical activities

You can repeat any of the practical activities related to multiplication and division from pages xx–xx of this Teacher’s Guide as necessary.

Using the Student Book and Workbook

Let the students work in pairs to discuss the problems on Student Book page 83 and then have them complete the activities on their own. Let the students work in pairs again to complete Workbook page 51 and develop and explain methods and strategies for multiplying by multiples of tens.

Revise the methods of multiplying on Student Book page 84 with the class. Let the students work on their own to complete the activities. Then use Workbook page 52 to assess their skills and accuracy.

Work through the examples on Student Book page 85 as a class. Let the students work independently to complete the activities.

Revise the division strategies on Student Book page 86 with the class. Then have the students work independently to complete the activities. Discuss their answers to question 4 as a class.

Use Student Book page 87 to assess whether students can confidently multiply and divide and that they can move between these operations freely. Discuss their answers as a class and allow time for students to explain how they decided what to do in each case, and what they actually did to find the answers.

Assessment questions to ask

- How can I quickly multiply or divide by a number ending in zero?
- What is 35 multiplied by 20/30/50, etc.?
- What is 360 divided by 20? and similar questions.

Common errors and misconceptions

The main errors in this work are likely to be as a result of incorrect table facts. Revise the multiplication and division facts related to the 2 to 10 times tables as necessary.
15 Angles

Objectives

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>6Gs5</td>
<td>Estimate, recognise and draw acute and obtuse angles and use a protractor to measure to the nearest degree</td>
</tr>
<tr>
<td>6Gs6</td>
<td>Check that the sum of the angles in a triangle is 180°, for example, by measuring or paper folding; calculate angles in a triangle or around a point</td>
</tr>
<tr>
<td>6Gp2</td>
<td>Predict where a polygon will be after one reflection, where the sides of the shape are not parallel or perpendicular to the mirror line, after one translation or after a rotation through 90° about one of its vertices</td>
</tr>
</tbody>
</table>

Vocabulary

Angle, right angle, protractor, vertex, arm, acute, obtuse, perpendicular, complementary, supplementary, reflex, vertically opposite rotation.

Resources needed

Flashcards; set squares; card; scissors; protractors.

Mental warm-up activities

Select suitable activities from the mental warm-up activity bank.

Concepts that may be unfamiliar in this topic

Accurate measuring of angles (to the nearest degree)

In Stage 5 students were only expected to give angle sizes correct to 5 degrees. In Stage 6 you will need to focus on more accurate measurements and make sure they know how to correctly position and use a protractor to find the size of angles.

Sum of angles in a triangle

Students already know that the angles on a line total 180 degrees. In Stage 6 they will learn that the three angles of any triangle also total 180 degrees. For some students this may be a difficult concept if they relate angle size to the actual dimensions of the triangles. It is important to do some practical activities in which the students actually tear off the angles of a triangle and place them next to each other along a straight edge so
that they can see this fact is always true. Angle sums are fundamental to later work in geometry.

**Rotation**

Students have not worked with rotation previously. They need to understand that a rotation is a turn. You can use the hands of a clock face to demonstrate turns, but you should also use cut out shapes and stick pins to demonstrate how a shape can be turned (90 degrees only) around a point. At this level, the shapes will only be rotated around one of their vertices.

**Teaching ideas**

**Practical activities**

- 🗣️ Ask students to look around the room and identify right angles, acute angles and obtuse angles.

- 📚 Hand out flashcards showing different angles. Ask students to arrange themselves in a line showing the angles in order of size. Encourage students to talk about how they compared the angles.

- 📚 Hold a flashcard up showing an angle. Ask students to draw an angle smaller or larger than the one shown.

- 📚 Hold two flashcards up showing angles of different sizes. Ask students to draw an angle that is smaller than one of the cards and larger than the other.

- 📚 Hold a flashcard up showing an angle. Ask students to estimate the size of the angle. Use a protractor to see who was the closest.

- 📚 Revise with students what is meant by a right angle. Remind students how to measure a right angle using either a set square or folded circle. Ask students to point to right angles they can see around the room, for example, the corner of a window or table. Show students how to line up their set square or folded circle to establish whether angles are smaller or larger than a right angle. Emphasise the need to have the point of the measurer on top of the vertex of the angle and one edge of the measurer lined up with one arm of the angle.

- 🖋️ Draw a four-point compass on the board and use it to remind students that a full turn is 360°, a half turn or straight line is 180° and a quarter turn is 90°. Demonstrate to students how to use their protractors to measure and draw angles.

- 🖋️ Ask students to draw four triangles of any size and measure and record the three angles of each triangle. Ask students to say what they notice about the three angles. If necessary prompt them to find the total in each case. Establish that it is always 180°. Where there are inaccuracies, help students measure their angles more accurately.
to ensure that they are convinced by the rule. It is helpful to prove the rule by asking each student to draw and cut out a triangle and tear off the three corners. These can then be arranged on a straight line to show that the angles always total 180°.

**Using the Student Book and Workbook**

- Let the students work in pairs to complete Student Book page 88. Make sure they can both measure and draw angles.

- Work through the examples on Student Book page 89 with the class. Let them complete the activities on this page and Workbook page 53 on their own.

- Let the students work independently through Student Book page 90 and Workbook page 54.

- Let students work in pairs to complete Student Book page 91 and Workbook page 55.

- Do the examples on Student Book page 92 on the board and make sure the students know that $x$ stands for the missing angle. Let them complete the activities on this page and Workbook page 56 on their own.

- Let the students work in pairs to complete Student Book page 93 and Workbook page 57.

**Assessment questions to ask**

- Can you estimate the size of this angle?
- What important tips would you give someone to help them use a protractor properly?
- Can you label each of these angles: acute, obtuse, right angle or reflex?
- Is the statement ‘the angles of a triangle add up to 180°’ always true? How do you know?
- Can you find this missing angle without measuring? How did you do it?

**Common errors and misconceptions**

Many students are likely to struggle to use a protractor correctly. It is important to demonstrate how to line up a protractor properly and how to read the correct value off the protractor. Encourage students to think about the answer they get and whether it makes sense; for example if they have read 165° off their protractor yet are looking at an acute angle, something must be wrong.
16 Percentages

<table>
<thead>
<tr>
<th>Objectives</th>
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</thead>
<tbody>
<tr>
<td>6Nn28</td>
</tr>
<tr>
<td>6Nn29</td>
</tr>
</tbody>
</table>

**Vocabulary**

Per cent, percentage, fraction, decimal, convert, discount.

**Resources needed**

Flashcards showing fractions less than one, decimals less than one and percentages.

**Mental warm-up activities**

Select suitable activities from the mental warm-up activity bank.

**Concepts that may be unfamiliar in this topic**

**Discount**

Most of concepts in this topic should be familiar to the students as they have previously worked with percentages. The idea of percentage used in the context of discount is introduced, although the actual calculations in this section are not new to the students.

**Teaching ideas**

**Practical activities**

- Write a number in a circle in the middle of the board, for example, 320. Coming from the circle draw ‘arms’ and label each with a percentage, for example, 10%, 25%, 5%, 45%, etc. At the end of each arm invite a student to write the amount of 320 the percentage is. Encourage students to find their answers mentally and discuss the strategies they used, for example, ‘I found 10% by dividing by ten and I knew 5% would be half that.’

- Ask students to design a poster explaining how to find percentages of quantities and how to calculate what percentage one quantity is of another. Discuss the key points they included on their posters.
Create a class poster showing percentages in use in everyday life.

Remind students how to find percentages of quantities by converting the percentage into a fraction then finding the fraction of the quantity. Where sensible, encourage students to use mental methods, for example, if finding 60%, find 10% by dividing by 10 and then multiply by 6.

If possible show students real examples of discounts being shown in percentages, i.e. newspaper adverts, shop posters, etc. Demonstrate to students how to find sale prices if we know the original price and the discount.

Demonstrate how to convert a fraction into a percentage by multiplying by 100. If necessary, clarify the method to the students by building on their previous knowledge that they need to get a denominator of 100 and then they will know the percentage. Taking the example \(\frac{24}{40}\), an equivalent fraction with a denominator of 10 could first be found, then one with a denominator of 100. Comparing the two methods will show that they reach the same answer.

Hand out flashcards to students and ask them to order the cards from smallest to largest. Encourage students to explain how they made their choices, especially how they compared fractions or decimals with percentages.

Show students a card and ask them to express the amount on the card in two other ways.

Using the Student Book and Workbook

Use Student Book page 94 and Workbook page 58 to revise the concept of a percentage as a part of 100.

Work through the conversion examples on Student Book page 95 with the class, revising earlier work on decimal to common fraction conversions as necessary. Let the students complete the conversions on pages 95 and 96 on their own. Use Workbook page 59 to assess that they can convert and order mixed sets of numbers.

Students have already found fractions and percentages of amounts. Use Student Book page 97 to revise the concepts and practise the skills. You can allow students to use a calculator for some of the tasks as this is the method most likely to be used in real life.

Let the students work independently to complete the practical and problem solving activities on Student Book page 98 and Workbook page 60. Check the results in groups or as a class.
Make sure students understand the concept of discount before working through Student Book page 99 with the class. Let them complete Workbook page 61 to assess that they can calculate percentages of amounts and work out discounted prices.

**Assessment questions to ask**
- What percentages can you work out easily in your head?
- ‘To calculate 10% of a quantity you divide by 10, so to find 30% of a quantity you divide by 30.’ Is this statement true? Why not?
- Can you explain how you find a percentage of a quantity?
- Can you explain how to find out what percentage 24 is of 36?
- Which is larger, this fraction or this percentage? How do you know?
- I have converted this decimal into this percentage getting this answer. Am I right? Why not?

**Common errors and misconceptions**
If students are just taught a rule for finding percentages of quantities or calculating what percentage one quantity is of another, they are unlikely to remember it or use it correctly. It is important to discuss with students why the method works. This can be done by continually thinking about what we mean by percentage and building rules up together, using diagrams to illustrate what is happening.

In order to manage this work easily, students must be confident in their understanding of what fractions, decimals and percentages are and have a feel for the size of any given one. They must also be able to divide a decimal by a whole number. If necessary, before starting the work, revise these concepts with the students.

### 17 Working with money

<table>
<thead>
<tr>
<th>17: Working with money</th>
<th><strong>Student Book</strong> pp 100–103</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Workbook</strong> pp 62–63</td>
<td><strong>Objectives</strong></td>
</tr>
<tr>
<td>This topic addresses a number of objectives related to number, measures and problem solving. Additionally, it focuses on the correct use of a calculator</td>
<td></td>
</tr>
</tbody>
</table>

**Vocabulary**
Decimal, sale, service charge, total cost, change.
Resources needed

No special resources are needed, although calculators will be needed for checking work.

Mental warm-up activities

Select suitable activities from the mental warm-up activity bank.

Concepts that may be unfamiliar in this topic

No new concepts are introduced in this section. Students will need to apply what they already know about decimals and percentages to solve problems involving money amounts, change and service charges. They also revise the skills involved in checking calculations by adding in reverse order and by performing inverse operations.

Teaching ideas

Practical activities

You can repeat any of the practical activities related to decimal operations and percentages as necessary.

Using the Student Book and Workbook

Let the students work in pairs to discuss the strategies they could use before they solve the problems on page 100 of the Student Book.

Explain that it is very important to check money calculations as you could end up losing money if you don’t. Demonstrate how to check columns of figures by adding down and up using a calculator. Let the students work on their own to complete the activities. Let them work in pairs with a calculator to check the calculations on Student Book page 101 and Workbook page 62.

Let the students work in pairs to complete the activities on Student Book pages 102–103.

Assessment questions to ask

- How could you check that you added this list of numbers correctly?
- What would you pay for (give various items and prices)?
- Can you afford these items if you only have $50? (Estimate.)
- What is 10% of (various amounts)?

Common errors and misconceptions

Students may get confused with money amounts on a calculator, as it will truncate the decimal and not include two decimal places for whole number answers and answers with no hundredths. Remind them that 0 is a place holder and that the convention for writing money is to include the zeros to the right of the decimal place, even if they are not strictly necessary.
### 18: Mass

**Student Book** pp 104–105  
**Workbook** no pages

| Objectives          |  
|---------------------|--------------------------|--------------------------|
| 6Ml1                | Select and use standard units of measure. Read and write to two and three decimal places |
| 6Ml2                | Convert between units of measurement (kg and g, l and ml, cm and mm) using decimals to three decimal places, e.g. recognising that 1.245m is 1m 24.5cm |
| 6Nn16               | Recognise and use decimals with up to three places in the context of measurement |
|                     | Note: other units are covered elsewhere |

**Vocabulary**  
Kilogram, gram, weight/mass.

**Resources needed**  
None.

**Mental warm-up activities**  
Select suitable activities from the mental warm-up activity bank.

**Concepts that may be unfamiliar in this topic**

**Calculation in context**  
Although the context in this topic is mass, the focus is on using and extending the students’ skills in calculating with decimals (including money), converting units of measurement and also understanding how standard units are used in everyday life.

**Teaching ideas**

**Practical activities**  
Revise with students rounding numbers to one and two decimal places. Write a measurement on the board, such as 5.368 kg, and ask students to round it to the nearest kilogram, $\frac{1}{10}$ kg and $\frac{1}{100}$ kg. Look at the addition example in Student Book page 104. Highlight how we can consider all the measurements initially in grams only and then convert into kilograms and grams at the final stage. If necessary revise with students how to add several four-digit numbers.
Ask the students to find information about the cost of sending parcels by post in your country. They will be able to find this information from a post office or agency. They may also be able to get rates from courier companies. Let them bring tables and other information about rates to class and use these to generate questions and additional activities. Working with data in the form of tables is an important data handling skill and this is a good context for doing so.

**Working with the Student Book and Workbook**

- Allow the students to use a calculator to complete the activities on Student Book page 104.
- Let the students solve the problems on Student Book page 105 in pairs.

**Assessment questions to ask**

- Can you explain to me how to add these two weights?

**Common errors and misconceptions**

The main errors students are likely to make with this work are in converting between units of measurement. Many of these errors will come down to a misunderstanding of place value and the decimal point. By giving students plenty of experience in ordering measurements, saying conversions out loud and placing measurements in a place value chart, this can be avoided.

### 19 Probability

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Student Book pp 106–108</th>
<th>Workbook no pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>6Db1</td>
<td>Use the language associated with probability to discuss events, to assess likelihood and risk, including those with equally likely outcomes</td>
<td></td>
</tr>
</tbody>
</table>

**Vocabulary**

Event, chance, probability, likely, equally likely, equal chance, even chance, no chance, impossible.

**Resources needed**

A set of ten cards (five red, five white); an opaque bag; cubes; beads or balls in different colours.
Mental warm-up activities
Select suitable activities from the mental warm-up activity bank.

Concepts that may be unfamiliar in this topic
Equally likely outcomes
Students have already used the language of probability to describe the chance of different events. In this topic they will begin to use dice and spinners to develop the idea that some outcomes are random and equally likely. This is an important concept that they will return to in later years when they begin to calculate probability using numbers.

Teaching ideas
Practical activities

Draw a large probability scale on the board. Let the class suggest events and then say how likely they are to happen. Make sure they can confidently use the vocabulary of probability.

Put the ten coloured cards (five red, five white) in a bag or box. Tell the class you are going to pull out and replace a card ten times. Ask them how many times out of ten they expect you will get a red card. Do the activity and let the students tally how many times you draw red or white. Discuss the results and whether or not this is what they expected. Stress the idea that you are equally likely to draw red or white each time you choose.

Put a mixed selection of cubes (or balls or beads) into a bag. Choose 1 red, 3 blue and 6 green, for example. Repeat the activity above. Discuss why red is less likely than blue or green to be drawn from the bag.

Using the Student Book and Workbook

Let the students work in pairs to complete Student Book page 106. Share the results as a class.

Let the students work in pairs to complete Student Book page 107.

Let the students work in pairs to solve the problems on Student Book page 108.

Assessment questions to ask
• What is the chance of ...?
• Can you give me an example of an event that is certain?
• Can you give me an example of an event that is impossible?
Common errors and misconceptions

Students may struggle to recognise that the probability of an event may not match the actual outcome. For example, the probability of a coin landing on heads or tails is equally likely, but you may throw a head five times in a row. Let the students carry out experiments and trials to show that results vary and that the predicted probability may not occur all the time.

20 Revising co-ordinates

<table>
<thead>
<tr>
<th>20: Coordinates and transformations</th>
<th>Student book pp 109–114</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Workbook pp 64–66</td>
</tr>
<tr>
<td><strong>Objectives</strong></td>
<td></td>
</tr>
<tr>
<td>6Gp1</td>
<td>Read and plot co-ordinates in all four quadrants</td>
</tr>
<tr>
<td>6Gp2</td>
<td>Predict where a polygon will be after one reflection, where the sides of the shape are not parallel or perpendicular to the mirror line, after one translation or after a rotation through 90° about one of its vertices</td>
</tr>
</tbody>
</table>

Vocabulary

Quadrant, axes, origin, co-ordinates, transformation, translation, reflection, flip.

Resources needed

Overhead projector (OHP) grid for demonstrating concepts; mirror.

Mental warm-up activities

Select suitable activities from the mental warm-up activity bank.

Concepts that may be unfamiliar in this topic

Co-ordinates in all four quadrants

Previously students have worked with co-ordinates in the first quadrant only. Now, they will need to extend the ideas they already have to include points in all four quadrants. It is important that you stress that we can extend the axes on the grid to include negative numbers just as we extended the number line below 0. Playing games with coordinates and grids can help the students work confidently with the extended grid (Cartesian plane) and this is important as this grid will form the basis of work with functions and relationships in higher stages.
Reflection where sides of shapes are not parallel or perpendicular to the mirror line

Students have already worked with reflections where the sides are parallel or perpendicular to the mirror line. Now they will need to extend these ideas to reflect shapes that are in any position. They may find this difficult at first and you will need to give them lots of practical activities and allow them to use cut outs and mirrors if necessary to find the position of the reflected shape.

Teaching ideas

Practical activities

- Draw a grid on the board (or use the OHP). Draw a shape on the grid and then perform a transformation on it and draw the new shape. Ask students to describe the transformation.

- Draw a shape on the grid and the same shape at a different position. Ask students to take it in turns to perform a transformation on the original shape until it lies on top of the second shape. What is the fewest number of transformations they need to use?

- Ask pairs of students to sit opposite each other with a screen, for example, an open file, between them. Give each student squared paper. One student must draw a shape on their paper and move it using one or more transformations. They must then describe to their partner where to draw the shape and how to move it to its new position. Once their partner has followed the instructions both students must reveal their work and see if it is the same.

- To develop these ideas further, draw a shape on the grid and let one student give instructions on where to move it to, while another student follows those instructions.

- Demonstrate to students how to use a mirror to reflect a shape. Place this on the axis of a grid and show students how squared paper can help them draw the reflection of shapes. Point to a point, for example, a corner on one of the original shapes and the corresponding corner on the reflection. Ask students to look at how far away each point is from the mirror line and establish they are the same distance away, in a perpendicular direction. Repeat with other points.

Working with the Student Book and Workbook

- Let the students work through Student Book page 109 and Workbook page 64 to assess their skills in working with position on a grid.
Introduce the extended Cartesian plane and work through the examples on Student Book page 110. Let the students complete the activities on Student Book page 111 in pairs. Use Workbook page 65 to assess whether students can plot points in all four quadrants.

Work through Student Book page 112 as a class. You may need to model the reflections with the class using cut out shapes and an actual mirror. If you reproduce the grids on OHP transparencies you can easily demonstrate this in the classroom. Bear in mind that many students, even at higher levels, struggle to visualise reflections and will often trace and cut out shapes or fold along the mirror line to find the position of the transformed shape. Allow and encourage the students to explore practical and concrete methods as they need to.

Let the students work in pairs to complete the practical activities on Student Book page 113.

Use Student Book page 114 and Workbook page 66 to check that the students are able to work with reflections, translations and rotations of shapes. They can work independently or in pairs to do this. Observe the students as they work and assist them as necessary if they struggle with any of these activities.

**Assessment questions to ask**

- Look at the two positions of this shape. Can you describe the movement of the shape from position 1 to position 2?
- Which movement was used to move this shape from A to B?
- Can you move this shape following these directions?
- What are the fewest number of movements you need to perform to move this shape from A to B?
- Where will this shape be if we reflect it about this line.

**Common errors and misconceptions**

When reflecting shapes, students sometimes do not appreciate that each point of the image must be the same distance away from the mirror line at a perpendicular direction, and simply draw a copy of the shape on the other side of the line without thinking about the orientation of the image. Using a mirror to check their work can help prevent this.

There is a lot of terminology within this area of maths that students need to be familiar with and sometimes they will confuse transformations. Plenty of practice with students describing movements is necessary to avoid this.
21 Extending division and multiplication methods

21: Extending division and multiplication  
**Student Book** pp 115–122  
**Workbook** pp 67–68

<table>
<thead>
<tr>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>6Nc14</td>
</tr>
<tr>
<td>6Nc16</td>
</tr>
<tr>
<td>6Nc18</td>
</tr>
<tr>
<td>6Nc19</td>
</tr>
<tr>
<td>6Nc20</td>
</tr>
<tr>
<td>6Nc22</td>
</tr>
</tbody>
</table>

Note: Long division is in Chapter 28

**Vocabulary**
Multiply, divide, remainder, product.

**Resources needed**
No special resources are needed in this unit, although calculators are useful for checking work.

**Mental warm-up activities**
Select suitable activities from the mental warm-up activity bank. The timed mental division problems on Workbook page 67 can be used as mental warm-ups as you teach this topic.
Concepts that may be unfamiliar in this topic

Division strategies
Although students have already done work on division strategies, they may still find division difficult. It is crucial to revise division as repeated subtraction but also to highlight to students that subtracting one number at a time is not the most efficient method because it takes too long. By modelling and discussing other strategies you are more likely to see students understanding concepts and adopting efficient written methods for division.

Teaching ideas
Practical activities

You can use jottings on the board to model possible strategies for dividing by a single-digit number. For example, tell the class that you want to divide 172 by 4, then ask them how they could do this using compensation (this strategy was covered earlier in the course). Three examples are given below. Model the working like this:

**Ex. 1**

\[
172 \div 4 \\
172 + 8 = 180 \\
\begin{array}{cccc}
100 \\
25 & 25 & 25 & 25 \\
80 \\
20 & 20 & 20 & 20 \\
-2 & -2 & -2 & -2
\end{array}
\]

I added 8 to 172, so each share has an extra 2

\[
25 + 20 - 2 = 45 - 2 = 43
\]

**Ex. 2**
You can also model division by inverse operations using jottings like this:

\[
172 \div 4 \\
What multiplied by 4 will give me 172? \\
4 \times 40 = 160 \\
12 left over \\
4 \times 3 = 12 \\
40 + 3 = 43
\]

**Ex. 3**
Similarly, you can model halving:

\[
172 \div 4 = 172 \div 2 \div 2 \\
86 \\
43
\]
Get the students to investigate division with remainders by asking them to draw five different straight lines in their books. They should then measure the lines in millimetres and work to show how they could divide each line into different numbers of parts. (For example, divide the first line into two equal parts, the second into three equal parts, the third into five equal parts, the fourth line into eight equal parts and the last line into ten equal parts.) Spend some time discussing solutions and get the students to explain their strategies using lines which you draw on the board and measure in cm.

Write two-digit by two-digit and three-digit by two-digit multiplications on the board and for each question put a choice of three answers, one being the correct one. For example, $36 \times 25$ with a choice of 340, 900 and 968. Ask students to look at the answers and without doing the calculation say which is the correct answer. Discuss how they know, for example, by estimating or using a known fact such as that multiplying by 25 will give an answer ending in a 0 or 5.

Write a criterion for solving a word problem on the board, for example, ‘must be solved by multiplying a three-digit number by a two-digit number’ or ‘must be solved by dividing a four-digit number by a two-digit number’. Ask students to think of a word problem that would match the criterion. Discuss which problems are correct, what key words could be used in a problem, for example, product, altogether, etc. and which problems students think are the best and why.

Roll a 0–9 die four times to generate two two-digit numbers. Ask students to find the product as quickly as they can. Ask the quickest finisher to talk through his or her calculation.

Set a context for students to need to explain how to do multiplication and division questions. For example, an alien is visiting the school who wants to know how we do maths on Earth; a student in the class has been ill and now needs to catch up on missed work; a time capsule is being buried for future generations and we would like to include an example of how to do multiplication and division. Ask students to work together to write a clear explanation of how to approach calculations.

Ask students to write three target numbers on a piece of paper, for example, 276, 358 and 495. Use a die labelled 2, 3, 20, 30, 200, 300. Each time you roll a number the students must place it next to one of the three target numbers. As numbers are rolled, students can use any maths operations on the numbers next to a target to try and produce that target. Stop rolling the die when a student has managed to make all three targets. Ask them to talk through their calculations.
Using the Student Book and Workbook

Use Student Book page 115 to revise and consolidate the concepts associated with mental division. Let the students work through the activities without using a calculator and, if you have not used the Workbook timed tests as mental warm-ups, let the students work through these over the next few days. Remember to discuss which divisions they found easiest when they have done all five sets.

Work through the examples on Student Book page 116 with the class. Let the students work independently to complete the divisions. Check that they can express the remainders as fractions.

Use Student Book page 117 to revise strategies for dividing by repeated subtraction. Encourage the students to articulate why it is more efficient to subtract in chunks before asking them to do the divisions. Do not insist on a particular strategy for these.

Work through the examples on Student Book page 118 with the class. Let the students work in pairs to solve the problems. Make sure they make sense of the context and use it to decide whether or not they need to round the answers. Use Workbook page 68 to test that the students can divide and work with remainders in different ways.

Use Student Book page 119 to revise estimating products and quotients. Check that the students can do this.

Use Student Book page 120 and 121 to revise multiplication of four-digit numbers by single digits. Check that the students can do this before moving on to multiplying larger numbers.

Let students work on their own to do the calculations and solve the mixed problems on Student Book page 122.

Assessment questions to ask

- Can you explain to me the method you used to find your answer?
- In this money problem, my calculator gives me an answer of 3.2. What does this mean?
- Which of these calculations are correct/incorrect? What has this person done wrong? How could you help him or her do it right?
- What clues can you look for in word problems to help you know whether to multiply or divide?
- Can you make up a word problem that could be solved using multiplication/division?

Common errors and misconceptions

Students may make mistakes in calculations due to mental arithmetic errors, for example, incorrect times tables, errors in addition or subtraction. Encourage students always to check their calculations and also estimate to consider whether an answer is likely to be correct.
Some students may struggle with written methods due to not understanding how they work or incorrectly remembering stages. To help students, always encourage them to ‘have a conversation in their head’ about what they are doing at each stage of the calculation and model this with examples. Give students examples of correct and incorrect worked examples and ask them to mark them and identify where mistakes have been made.

When students multiply by a two-digit number they may forget that the digit on the left is a number of tens and not a number of units. For example, they may write:

\[
\begin{array}{c}
3 & 4 \\
2 & 1 \\
\hline
6 & 8 \\
3 & 4 \\
1 & 0 & 2
\end{array}
\]

It is essential that they remember to include a zero when multiplying by ten.

\[
\begin{array}{c}
3 & 4 \\
2 & 1 \\
\hline
6 & 8 & 0 \\
3 & 4 \\
7 & 1 & 4
\end{array}
\]

### Concept and skill development

In this unit students will explore unequal sharing and how to compare quantities. They will be introduced to the term ‘ratio’ and solve some simple word problems.

### Vocabulary

Ratio, share in the ratio ..., proportion.

### Resources needed

Coloured beads or construction blocks.
Mental warm-up activities

Select suitable activities from the mental warm-up activity bank.

Concepts that may be unfamiliar in this topic

Proportional reasoning

Students often struggle with proportional reasoning when they have to solve problems involving ratio and proportion. You can help them understand the concepts if you do practical activities in which you lay out items in specific ratios or multiply and/or divide them in the given proportion. A proportion can be given as a fraction, as a decimal or as a percentage. ‘What proportion?’ means ‘What fraction?’, or ‘What decimal?’, or ‘What percentage?’

Example:

There are 4 squares altogether.
1 out of 4 squares is grey ($\frac{1}{4}$, 0.25, 25%)
3 out of 4 squares are white ($\frac{3}{4}$, 0.75, 75%)

We could say that:
The proportion of grey squares is 1 in every 4
The proportion of white squares is 3 in every 4

Teaching ideas

Practical activities

- Ask students to make patterns with beads or blocks where the colours appear in given ratios, for example, ‘the ratio of blue to yellow beads is 2 to 3’.
- Ask students to make up problems involving ratio. Discuss their ideas and establish which problems make sense. Ask other students to solve their problems.
- Show students a recipe designed for 4 people. Ask students to work out what quantities of each ingredient they need if they want to feed 6 people.
- Ask students to design a poster explaining ratio and giving examples of when ratio might be used in real life.
- Introduce students to the concept of ratio. Use students and resources to model examples, for example, make a row of students line up where the ratio of boys to girls is 2 to 3; or make a pattern of beads on a string where the ratio of one colour bead to another is 4 to 1, etc.

Using the Student Book and Workbook

- Use Student Book page 123 and Workbook page 69 to revise and teach the concept of ratio as unequal sharing. Let the students work through the activities independently. Observe them as they work to make sure they understand the concepts.
Work through Student Book page 124 with the class. Let the students work through the examples on their own. Then let them explain how they solved each problem.

At this level, there is no need to discuss direct and indirect proportion. All the students need to understand is that amounts increase and decrease in proportion to each other and that they can use the relationship to solve simple problems. Work through Student Book page 125 with the class, then let the students solve the problems on their own.

Let students work in pairs to discuss and then solve the problems on Student Book page 126. Use Workbook page 70 to informally assess understanding of proportion.

**Assessment questions to ask**

- There are 15 girls and 5 boys in a class. Can you give me a sentence describing this class using the word ‘ratio’?
- Can you write a question that has the answer 2 to 3?
- Can you write a word problem involving ratio that has the answer 30?
- Can you give me examples of when I might use ratio in real life?

**Common errors and misconceptions**

Students may confuse the terms ‘ratio’ and ‘proportion’, and they need to understand when each is appropriate. These concepts can often be secured by providing the students with a range of practical activities in which they can see the effects of ratio (one quantity compared to another) and proportion (one part compared to the whole). For example, mixing squash in a given ratio, such as 1 part squash to 4 parts water, or by using the students themselves to demonstrate proportion. For example, make a row of students in the front of the class and ask questions such as:

What proportion of the group are girls?
What is the ratio of boys to girls?
What proportion of the group has long hair?
What is the ratio of long hair to short hair?

### 23 More multiplication

<table>
<thead>
<tr>
<th>23: More multiplication</th>
<th><strong>Student Book</strong> pp 127–130</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
<td><strong>Workbook</strong> p 71</td>
</tr>
<tr>
<td>6Nc7</td>
<td>Use place value and multiplication facts to multiply/divide mentally, e.g. 0.8 × 7, 4.8 ÷ 6</td>
</tr>
<tr>
<td>6Nc15</td>
<td>Multiply near multiples of ten by multiplying the multiple of ten and adjusting</td>
</tr>
</tbody>
</table>
Vocabulary
Property, product, factors, sum, difference.

Resources needed
No particular resources are needed for this topic although students who have not memorised their facts may do better in the investigations if you allow them to use a calculator because this removes the anxiety over recalling facts and allows them to focus on the properties in use.

Mental warm-up activities
Select suitable activities from the mental warm-up activity bank.

Concepts that may be unfamiliar in this topic
Meta-cognition
In this topic, students investigate and use different strategies and properties of multiplication with the main aim of understanding and articulating what is involved. This meta-cognition or ‘thinking about your thinking’ can help students to make sense of strategies and understand better which ones are useful in different calculations.

Teaching ideas
You can re-use any of the practical activities you have previously used for demonstrating and modelling multiplication.

Using the Student Book and Workbook
Let the students work in pairs to complete the investigations on Student Book page 127. Give them sufficient time to discuss their ideas and have a plenary session in which they share these with the rest of the class. Use the activities on Workbook page 71 to assess how well students understand and can articulate their ideas.

Work through Student Book page 128 as a class, explaining and discussing the properties in the table before asking the students to complete the activities. Allow time for the class to discuss the properties of division (question 3). Make sure they understand that division by 0 is not possible in mathematics ($n/0$ is undefined) and also that dividing 0 (nothing) into pieces still gives nothing.

Use Student Book page 129 as an informal assessment to check that the students can use the arithmetical properties of multiplication.

Assessment questions to ask
- Look at this calculation. Can you tell me what this student did?
- Is this a good strategy? Why or why not?
- What other methods could we use to do this calculation?
- How can we use a known fact to find this product?
Common errors and misconceptions

Some students may try to use formal written methods before they fully understand the concepts involved in multiplication because they think they have to. This makes them focus too hard on remembering rules and as a result they ignore the other strategies that they can use when they get stuck. Encourage students to use earlier, more secure, mental strategies to increase confidence and continue to discuss why different strategies are useful in different situations. Stress the importance of estimating and jottings to support thinking and improve calculation skills.

24 More graphs; summary statistics

<table>
<thead>
<tr>
<th>24: Graphs and statistics</th>
<th>Student Book pp 131–135</th>
<th>Workbook pp 72–73</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6Dh1</td>
<td>Solve a problem by representing, extracting and interpreting data in tables, graphs, charts and diagrams, e.g. line graphs for distance and time; a price ‘ready reckoner’ for currency conversion; frequency tables and bar charts with grouped discrete data</td>
<td></td>
</tr>
<tr>
<td>6Dh2</td>
<td>Find the mode and range of a set of data from relevant situations, e.g. scientific experiments</td>
<td></td>
</tr>
<tr>
<td>6Dh3</td>
<td>Begin to find the median and mean of a set of data</td>
<td></td>
</tr>
<tr>
<td>6Dh4</td>
<td>Explore how statistics are used in everyday life</td>
<td></td>
</tr>
</tbody>
</table>

Vocabulary

Average, mean, mode, median, range.

Resources needed

Reading books aimed at different age ranges of children.

Mental warm-up activities

Select suitable activities from the mental warm-up activity bank.

Concepts that may be unfamiliar in this topic

Mean, median and range

Students have previously only used the mode as a summary statistic. In this topic they will learn to find the median (middle value) and mean (arithmetic average) of a set of data. They will also find the range (difference between
the highest and lowest data values). These are crucial concepts that will be used over and over in statistics at higher levels. It is important to stress that the mean, median and mode are all averages and to encourage students to use the correct terms from the outset.

**Teaching ideas**

**Practical activities**

- Give students opportunities to collect data about themselves or school life and display it using graphs.

- On the board write 30 everyday words that are familiar to students. Cover them with a screen or large cloth. Tell students they will be shown the words and have one minute to remember as many as possible. Do not allow students to write anything down. Reveal the words for one minute for students to look at; then hide them again. Go round the class finding out how many words each student correctly remembered, and record results on the board. Use this data to find out the mean number of words remembered.

- Show students a range of reading books aimed at different age ranges. Ask students how they might be able to identify which book was for which age range if they were not familiar with the stories. Use students’ ideas to write a hypothesis, for example, ‘Books for older children have more long words in them.’ Ask students how they think they could test their idea and use their ideas to set up a test of the books. For example, students might consider a page of each book and find out the average length of words on the page. Talk with students about the importance of the size of a sample and pool their results to increase the sample size and gain a more accurate analysis. Discuss students’ findings and whether their hypothesis is true.

- Introduce students to the average ‘mode’. Ask students to compare the mean and the mode of sets of data and discuss when one or the other might be useful to know. Highlight that the mode is not affected by rogue values in the same way that the mean is, and when this might be useful to know.

- Ask students whether they have heard the word ‘average’ before and what they think it means. Build on students’ ideas to establish the correct meaning. Encourage students to think about why it might be useful to know averages. Build on this to introduce students to the particular average, ‘mean’, and demonstrate how to calculate the mean of a set of numbers.

- Give students opportunities to calculate the mean and mode of data about the class, for example, the modal shoe size of students, the mean number of people in families, etc. Explain that modal value is the same as mode.
Using the Student Book and Workbook

Let the students work independently through Student Book page 131 and Workbook page 72 to revise the basic concepts covered in grouped data and bar charts to show data from experiments.

Let the students work through Student Book page 132 and Workbook page 73 to check that they can read and draw line graphs.

Use Student Book page 133 to revise the concept of the mode. Let the students complete the activities on their own.

Work through the teaching material on Student Book page 134 with the class to teach them to find the median of a set of data. Let the students work in pairs to complete the activities.

Work though the material and examples on Student Book page 135 with the class to teach them to find the mean and median of a set of data. Let the students work independently to complete the activities.

Assessment questions to ask

- Can you tell me three facts you know from looking at this graph?
- Can you make up a question that could be answered using this graph?
- Which of these graphs do you think shows the data best? Why?
- What tips would you give someone about drawing this type of graph?
- Can you explain to me how to find the mean/mode of a set of data?
- Can you think of an example when it would be useful to find the mean/mode of a set of data?
- For this set of data I have calculated this mean. What does this tell you?
- Why is the mean and mode of this set of data so different?
- Which numbers are having an effect on the mean of this set of data, perhaps resulting in a misleading value for the mean?
- How do I find the median of a set of data?
- When would it be useful to use the mean/mode?
- What are the highest and lowest values in this set of data? How do they affect the mean/mode?

Common errors and misconceptions

Some students may make presentation errors when drawing graphs. For example, not titling the graph or giving axes labels. Discuss with students why it is important to fully label graphs. It might be useful to have a checklist for constructing graphs displayed in the classroom.

Encourage students to interpret graphs critically and realise when they are deliberately presented to mislead. One way of supporting students is to show them examples of graphs used in newspapers, etc. and reflect on what they tell us.
Most students will find it relatively straightforward to find the mean and mode of sets of data. What they find harder to do is interpret what this tells them about the data. It is very important to challenge students regularly to tell you what the mean or mode for a set of data means. One way of doing this is to allow students to investigate simple hypotheses and use the mean and/or mode to test them.

Some students may make arithmetical errors when calculating the mean. Encourage them to look at the data once they have done their calculation and decide whether it looks sensible or not.

### 25 Patterns and basic algebra

<table>
<thead>
<tr>
<th>25: Number patterns</th>
<th>Student Book pp 136–142</th>
<th>Workbook pp 74–76</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6Nn1</td>
<td>Count on and back in fractions and decimals, e.g. 1/3, 0.1s and repeated steps of whole numbers (and through zero)</td>
<td></td>
</tr>
<tr>
<td>6Nn15</td>
<td>Recognise and extend number sequences</td>
<td></td>
</tr>
<tr>
<td>6Nn18</td>
<td>Make general statements about sums, differences and multiples of odd and even numbers</td>
<td></td>
</tr>
</tbody>
</table>

**Vocabulary**

Pattern, rule, number machine, input, operator, process, output, inverse operation, number sentence, increase, decrease, difference, product.

**Resources needed**

Rods and cubes as needed to make patterns.

**Mental warm-up activities**

Select suitable activities from the mental warm-up activity bank.

**Concepts that may be unfamiliar in this topic**

There are no new concepts in this unit. Students will build on their earlier experiences of skip counting (including counting in fractional amounts and bridging through 0) and number pattern work to further develop and extend their understandings of patterns and relationships. This topic forms the foundation of later work in algebra.
Teaching ideas

Practical activities

There are practical, pattern building activities built into this unit. Encourage students to make and model patterns and problems to help them solve them.

Using the Student Book and Workbook

Let the students work through Student Book page 136 on their own. Let them use manipulatives to build patterns if they need to.

Work through the teaching material on Student Book page 137 with the class. Build the pattern but show how it can be worked out mathematically as well. Let the students work in pairs to complete the activities and record their results on Workbook page 74.

Let the students work independently through Student Book page 138 and Workbook page 75 to revise and build on their understanding of repeating an operation with different inputs.

Show the class how to work backward using inverse operations to find the missing operators in number machines. Let students complete Student Book page 139 show that they can do this.

Use Student Book page 140 to check that the students remember the difference between odd and even numbers and that they can work out whether a total will be odd or even by just looking at the numbers being added. Use Workbook page 76 to encourage students to explain patterns in words.

Let the students work in pairs to complete Student Book page 141. Check that they are able to make general statements about odd and even numbers.

Work through the examples of sequences on Student Book page 142 with the class. Let the students work through the activities on their own and then have a class discussion about their answers and how they worked them out.

Assessment questions to ask

- What is the rule for making this pattern?
- How many counters/rods would I need to build the next shape/the tenth shape?
- What is the rule for getting from this input to this output?
Common errors and misconceptions

Students may not realise that there are different options for continuing (find the next term) a pattern when they are not given a rule for generating the pattern. If this happens, try to give students experience in working with a variety of different patterns (in which the terms increase or decrease). Students begin to understand pattern rules when they are allowed to work with real objects to manipulate and build shape patterns before they move on to number patterns.

Students often forget to give important information when they are asked to give a rule for a pattern. You can stress the importance of giving all the relevant information by following the rule students give you. This allows them to see that they have left things out and that the pattern doesn’t work when you follow their incomplete rule.

Students find it hard to describe patterns in mathematical language. When you start working with shape patterns, encourage students to look at all the elements of the pattern (shapes, colours, position and orientation, growth in size and so on). This helps them to see what is important when you describe a pattern. Model and use correct terms such as ascending, descending, first term, next term, sequence and so on to allow students to become comfortable and secure in using the correct terms themselves.

26 Time and timetables

<table>
<thead>
<tr>
<th>Objective</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6Mt1</td>
<td>Recognise and understand the units for measuring time: seconds, minutes, hours, days, weeks, months, years, decades and centuries; convert one unit of time into another</td>
</tr>
<tr>
<td>6Mt4</td>
<td>Read and use timetables using the 24-hour clock system</td>
</tr>
<tr>
<td>6Mt5</td>
<td>Calculate time intervals using digital and analogue times</td>
</tr>
</tbody>
</table>

Vocabulary

Time, timetable, digital, analogue, time interval.

Resources needed

Analogue and digital clocks and clockfaces; a range of timetables using 12-hour and 24-hour times.
Mental warm-up activities

Select suitable activities from the mental warm-up activity bank.

Concepts that may be unfamiliar in this topic

Converting between units of time

Students have not formally converted between units of time in previous years although they have converted metric measurements. Time is often a problematic concept for students because it is not decimal and they get the wrong answers particularly when they use a calculator to solve problems such as: how many hours and minutes are there in 147 minutes? If they enter 147 ÷ 60, they will get 2.45. Many students will incorrectly give the answer as 2 hours and 45 minutes because they do not realise that have to work out that this is not 2 hours and 45 minutes, but two hours and 45/100 of an hour, which is only 27 minutes. When you teach this type of conversion, we recommend that you demonstrate the process using a number line as we have done on Student Book page 143. This makes it clear to the students that they have 27 minutes left over after subtracting two lots of 60 minutes. Once they realise this, you can ask them to find the answer on a calculator and discuss why this is given in a different format.

Practical activities

Use an analogue clock to demonstrate time intervals to the class before attempting to calculate these. Show a starting time on the clock. Write the ending time on the board and then move the hands, counting and recording hours and minutes to find the interval. Then show the students that they can do this in their books using ‘time line’ number lines.

Play a game called ‘How much longer?’ in groups. Let students take turns to identify an event and a time in the school day and then pose a ‘how much longer’ question for the others to answer. For example: ‘The start of assembly is 8.15. How much longer is it until first break?’ Let the students compare and discuss the strategies they use to work out the answers.

Ask students to find examples of timetables used in daily life and make a class display of these.

Place students in groups and let each group develop five problems using one of the timetables displayed in the classroom. (Make sure they specify the timetable.) Exchange problems between the groups and let them solve the problems and then check each other’s solutions.

Using the Student Book and Workbook

Work through Student Book page 143 with the class. Make sure the students are able to work with number lines to solve time problems. If necessary, work through some further examples to reinforce the concept. Let the students complete the activities in pairs.
Discuss how to covert units of time with the class before asking the students to work independently through Student Book page 144. Check the answers as a class and discuss strategies as well as common errors that may arise.

Use a range of local timetables to make sure students know how to read and work with timetables before asking them to complete Student Book page 145 in pairs or small groups. Observe students as they work to make sure they are able to make sense of different timetable formats.

**Assessment questions to ask**

- How long is it from [time] to [time]?
- Which is longer: [] minutes or [] hours? (and variations of this)
- How many minutes are there in [] hours?
- How long does it take you to do your homework? Give your answer in hours and minutes, minutes only and seconds only.
- What does this [point to an item] mean on this timetable?
- How are times given on this timetable?
- At what time would you … (activity related to timetable)?

**Common errors and misconceptions**

Students may treat time as a decimal quantity. Revise units of time and continue to demonstrate how to work out time intervals using time lines and counting on and back to find the correct answers.

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### 27 Area

<table>
<thead>
<tr>
<th>27: Area</th>
<th><strong>Student Book</strong> pp 146–150</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Workbook</strong> pp 77–78</td>
<td><strong>Objectives</strong></td>
</tr>
</tbody>
</table>

| 6Ma1 | Measure and calculate the perimeter and area of rectilinear shapes |
| 6Ma2 | Estimate the area of an irregular shape by counting squares |
| 6Ma3 | Calculate perimeter and area of simple compound shapes that can be split into rectangles |

Note: perimeter is covered in Chapter 12

**Vocabulary**

Area, square units, rectangle, formula.
Resources needed
Squared grid paper; an atlas or large clear map of your continent

Mental warm-up activities
Select suitable activities from the mental warm-up activity bank.

Concepts that may be unfamiliar in this topic
Estimating the area of irregular shapes on a grid
In this topic students will learn how to estimate the area of irregular shapes using a grid of square units. This requires them to think about which squares to include and exclude when they estimate and then to sum the ones they have included to find the total area in the correct units.

Teaching ideas
Practical activities

Write an area on the board, for example, 24 cm². Ask students if they can construct shapes with this area (on a cm² grid if possible). Encourage students to move away from rectangles and try and construct triangles or other shapes. Compare the shapes students draw.

Revise how to find the area of a rectangle with students. Draw a compound shape on the board and ask students how they think they could find the area of the shape. If necessary tell them that the only skill they need to use is knowing how to find the area of a rectangle. Build on students’ ideas to decide how to break the shape down into rectangles, find the area of each and then find the total area.

Ask students to design a poster all about area. It could show the methods they would use to find the area of compound shapes and how they can be used in real-life situations.

Show the students an irregular shape (try to include some half squares, more than half squares and less than half squares in the area of the shape) drawn on a grid and ask them how we can find its area. They should remember earlier work on tiling areas and say that you can count the blocks. Discuss which blocks you will include. Point out that all complete squares need to be counted. Count these, marking them as you go. Record how many you counted. Next find the half squares. Count these, marking them as you go. Establish that the area is half the number of squares (in other words, 2 half squares make one complete square). Record the area covered by half squares. Next, count the areas that cover more than half a square. Mark these as you go and record the number. Tell the students you will ignore any areas covering less than half a square. Cross these out on the diagram. Total the areas you have recorded to find the estimated area of the shape. Record this and write the correct units alongside it.
Use an atlas or large map to show the students that countries are irregular shapes and that they cover different areas. By looking at the map, ask the students to rank countries in terms of area (from smallest to largest, the three largest and so on). Explain that the actual area of each country is normally given in km² in the country facts section (gazetteer) of an atlas. Use this to check the answers students gave if possible.

**Using the Student Book and Workbook**

- Let the students work independently through Student Book page 146 to revise basic concepts of area.
- Model dividing compound shapes into rectangles to find the total area for the class. If they struggle with this, you may need to do more examples. Let the students complete Student Book page 147 and use Workbook page 77 to assess whether students can find the missing lengths of sides and find the area of compound shapes.
- Work through Student Book page 148 as a class. Once you are sure the students understand the concepts, let them complete Workbook page 78 on their own.
- Let the students work in pairs to complete Student Book page 149. Check the answers as a class and let students explain how they got to their answers if they disagree. You may like to ask students to check their estimated areas by comparing them with those given in an atlas or on the Internet.
- Let students work in pairs to solve the problems on Student Book page 150.

**Assessment questions to ask**

- How would you find the area of this compound shape? Is there another way of splitting the shape?

**Common errors and misconceptions**

As with perimeter problems, students may struggle to work out the missing lengths. Encourage them to separate the shape into two sets of lines. Look first at horizontal lines. Draw a complete length and use it work out the lengths of the missing bits. Repeat for vertical sides.

Students may struggle with the idea that they can simply ignore areas of less than half a square when they estimate the area of irregular shapes. Stress that they are estimating and that if they joined the areas they have ignored to the areas they have counted that are greater than half a square, these often balance out and allow for a fairly accurate estimation.
# 28 More division

## Objectives

<table>
<thead>
<tr>
<th>Objective</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6Nc10</td>
<td>Divide two-digit numbers by single-digit numbers, including leaving a remainder</td>
</tr>
<tr>
<td>6Nc19</td>
<td>Divide three-digit numbers by single-digit numbers, including those leaving a remainder and divide three-digit numbers by two-digit numbers (no remainder) including sums of money</td>
</tr>
<tr>
<td>6Nc21</td>
<td>Relate finding fractions to division and use them as operators to find fractions including several tenths and hundredths of quantities</td>
</tr>
</tbody>
</table>

## Vocabulary

Divide, remainder, subtract, carry over.

## Resources needed

Calculators should be used for checking work and to divide decimals.

## Mental warm-up activities

Select suitable activities from the mental warm-up activity bank.

## Concepts that may be unfamiliar in this topic

### Long division

In this topic students will extend their known strategies for division to division of three-digit numbers by two-digit numbers in the operation known as long division. You need to ensure that students have a good understanding of division as both repeated subtraction and grouping before moving onto formal written methods and algorithms for long division. Students should not be forced to use formal written methods before they are ready to do so.

## Teaching ideas

### Practical activities

You can repeat any of the practical division activities from previous work on this topic.

Once you have done some work on long division, provide examples of incomplete calculations and let different students suggest how they could complete these. Here are some examples you could use.
Using the Student Book and Workbook

Use Student Book page 151 to revise basic division facts and divisibility rules, including division with a remainder. Let the students work independently to do the calculations then check answers and discuss strategies as a class before moving on.

Use Student Book page 152 to teach the class how to carry out long division. Model the examples, and repeat these using different numbers as necessary. Make sure you estimate before you calculate to encourage the students to do the same. Let the students work in pairs to complete the calculations.

Use Student Book page 153 as an informal assessment task to make sure the students can do long division. Allow them to use whichever strategies they feel most comfortable using and encourage them to explain why they have chosen these strategies.

Work through the examples on Student Book page 154 with the class. Focus on how a calculator displays decimal amounts and remind the students that money amounts need two decimal places. Ask them what it means when a calculator gives the result 4.5 in a calculation involving money (this is 4 dollars and 0.5 of a dollar, which is equivalent to 4 dollars and 50 cents: we write this as $4.50). Let the students work on their own using a calculator to complete Workbook page 79.
Let students work in pairs to complete Student Book page 155 as a consolidation of work on division. Check answers and discuss strategies used to solve the problems.

Assessment questions to ask

- What did you do to solve this problem? (Describe each step)
- My calculator gives [] what does that mean?
- I estimate the answer to be [] does that seem right to you? Why or why not?
- What is [any number] divided by []? How did you work this out?
- Sally says [a number] divided by [another number] is [give wrong answer]. Is she correct? How could you check?

Common errors and misconceptions

Students may get confused about which number gets divided (they may incorrectly see 40 ÷ 10 as equivalent to 10 ÷ 40). You can use practical activities such as dividing a length of string to show that these are not the same thing.

Students may struggle because they feel they need to use formal written methods too early. You can avoid this by continually modelling and encouraging the use of different strategies and methods.

### 29 Mixed calculations

<table>
<thead>
<tr>
<th>29: Mixed calculations</th>
<th>Student Book pp 156–157</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workbook</td>
<td>no pages</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>This chapter addresses a number of problem solving objectives and includes revision of mental methods and use of correct mathematical vocabulary</td>
</tr>
</tbody>
</table>

Use Student Book pages 156 and 157 to consolidate concepts taught in Stage 6, including the steps in problem solving. Let the students discuss the problems to decide what is required and what strategies they think would be most useful before they work through these activities.