<table>
<thead>
<tr>
<th>Contents</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>4</td>
</tr>
<tr>
<td>Mental warm-ups</td>
<td>24</td>
</tr>
<tr>
<td>1 Number and place value</td>
<td>43</td>
</tr>
<tr>
<td>2 3D shapes and nets</td>
<td>48</td>
</tr>
<tr>
<td>3 Counting on and back</td>
<td>52</td>
</tr>
<tr>
<td>4 2D shapes and symmetry</td>
<td>57</td>
</tr>
<tr>
<td>5 Addition and subtraction</td>
<td>61</td>
</tr>
<tr>
<td>6 Measuring length</td>
<td>64</td>
</tr>
<tr>
<td>7 Rounding and estimating</td>
<td>67</td>
</tr>
<tr>
<td>8 Time</td>
<td>70</td>
</tr>
<tr>
<td>9 Multiplication and division</td>
<td>73</td>
</tr>
<tr>
<td>10 Measuring mass</td>
<td>76</td>
</tr>
<tr>
<td>11 Division</td>
<td>79</td>
</tr>
<tr>
<td>12 Reading tables and diagrams</td>
<td>83</td>
</tr>
<tr>
<td>13 Fractions</td>
<td>87</td>
</tr>
<tr>
<td>14 Measuring capacity</td>
<td>90</td>
</tr>
<tr>
<td>15 More adding and subtracting</td>
<td>93</td>
</tr>
<tr>
<td>16 Right angles</td>
<td>97</td>
</tr>
<tr>
<td>17 Working with money</td>
<td>99</td>
</tr>
<tr>
<td>18 Position and movement</td>
<td>102</td>
</tr>
<tr>
<td>19 Fraction and mixed numbers</td>
<td>104</td>
</tr>
<tr>
<td>20 Graphs and tables</td>
<td>106</td>
</tr>
<tr>
<td>21 More multiplying and dividing</td>
<td>108</td>
</tr>
</tbody>
</table>
This Teacher’s Guide is designed to support the component parts of Nelson International Mathematics 3. The guide covers Student Book 3 and Workbook 3.

Support is presented under the following headings:

- **Concept and skill development** – an overview of the topic, which outlines 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 23–42. 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 multiplying by a multiple of 10, you may want to do a mental activity revising multiplication facts as students will use these to do the multiplications, or place value as they will be partitioning numbers. 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 Book and Workbook** (notes to take you through the pages of the WorkBook 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 present 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).

1. Number and calculation
2. Shape and space
3. Measures
4. Organising and using data

Note that the syllabus identifies problem solving as a separate strand. However, because problem solving arises in each of the three 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><strong>Objectives</strong></th>
<th><strong>References</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3Pt1</strong></td>
<td>Choose appropriate mental strategies to carry out calculations</td>
</tr>
<tr>
<td><strong>3Pt2</strong></td>
<td>Begin to understand everyday systems of measurement in length, weight, capacity and time and use these to make measurements as appropriate</td>
</tr>
<tr>
<td><strong>3Pt3</strong></td>
<td>Make sense of and solve word problems, single (all four operations) and two-step (addition and subtraction), and begin to represent them, e.g. with drawings or on a number line</td>
</tr>
<tr>
<td><strong>3Pt4</strong></td>
<td>Check the results of adding two numbers using subtraction, and several numbers by adding in a different order</td>
</tr>
</tbody>
</table>
| 3Pt5 | Check subtraction by adding the answer to the smaller number in the original calculation | SB 25  
|      |                                             | WB 25 |
| 3Pt6 | Check multiplication by reversing the order, e.g. checking that $6 \times 4 = 24$ by doing $4 \times 6$ | SB 44 |
| 3Pt7 | Check a division using multiplication, e.g. check $12 \div 4 = 3$ by doing $4 \times 3$ | SB 53, 54  
|      |                                             | WB 44 |
| 3Pt8 | Recognise the relationships between different 2D shapes | SB 21, 22  
|      |                                             | WB 20 |
| 3Pt9 | Identify the differences and similarities between different 3D shapes | SB 13, 14  
|      |                                             | WB 11 |
| 3Pt10| Estimate and approximate when calculating, and check working | Throughout |
| 3Pt11| Make a sensible estimate for the answer to a calculation, e.g. using rounding | SB 77  
|      |                                             | WB 46, 59 |
| 3Pt12| Consider whether an answer is reasonable | Throughout |
| 3Ps1 | Make up a number story to go with a calculation, including in the context of money | SB 83 |
| 3Ps2 | Explain a choice of calculation strategy and show how the answer was worked out | Throughout |
| 3Ps3 | Explore and solve number problems and puzzles, e.g. logic problems | SB 5, 11, 75  
|      |                                             | WB 26 |
| 3Ps4 | Use ordered lists and tables to help to solve problems systematically | SB 75  
|      |                                             | WB 13, 23 |
| 3Ps5 | Describe and continue patterns which count on or back in steps of 2, 3, 4, 5, 10, or 100 | SB 16, 17  
|      |                                             | WB 17, 18 |
| 3Ps6 | Identify simple relationships between numbers, e.g. each number is three more than the number before it | SB 17, 94  
|      |                                             | WB 38 |
| 3Ps7 | Identify simple relationships between shapes, e.g. these shapes all have the same number of lines of symmetry | SB 13, 23  
|      |                                             | WB 21, 22 |
| 3Ps8 | Investigate a simple general statement by finding examples which do or do not satisfy it, e.g. when adding 10 to a number, the first digit remains the same | SB 46, 73, 91  
|      |                                             | WB 38 |
| 3Ps9 | Explain methods and reasoning orally, including initial thoughts about possible answers to a problem | SB 15, 62  
|      |                                             | WB 8 |
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, 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 3, students will 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 $40 \times 5$ you might jot the following on the board to show how you are thinking:

\[
40 = 4 \times 10 \times 5 \\
4 \times 5 = 20 \\
20 \times 10 = 200
\]

• Talk through the jottings as you make them. For example, I am going to write 40 as $4 \times 10$; I’m going to multiply $4 \times 5$ first because I know that fact. 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 $\frac{1}{2}$ 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 3, you will begin to 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 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 × 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 1000 to 10 000 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 3, students should know addition and subtraction facts to 20 by heart. They should also know multiplication facts for the 2, 3, 5 and 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 $2 \times 7$ 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**  
\[73 - 27 = 56\]  
\[70 + 3\]  
\[27\]  
\[53 + 3\]

**D**

\[\begin{array}{c}
-4 \\
46
\end{array}\]
\[\begin{array}{c}
-3 \\
50
\end{array}\]
\[\begin{array}{c}
-20 \\
53
\end{array}\]
\[\begin{array}{c}
\text{\phantom{-20}} \\
70
\end{array}\]

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 place value on 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.

\[ 73 - 27 \]

\[ 27 \]

\[ - 4 \]

\[ 50 \]

\[ 46 \]

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:

1. **Introduce the strategy**
2. **Reinforce the strategy**
3. **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 \( 5 \times 40 \) on the board.
- Ask the students how they could find the answer.
- If one of the students suggests viewing it as \( 5 \times 10 \times 4 \) 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 5 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 placeholder for units.) Now I have $50 \times 4$. I’m going to work this out by doubling. Double 50 is 100, and double 100 is 200.

• 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), 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 your 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 Student’s 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.

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 15⅓. 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.

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 1–3
- Test 2: Chapters 4–7
- Test 3: Chapters 8–10
- Test 4: Chapters 11–13
- Test 5: Chapters 14–17
- Test 6: Chapters 18–21

The final test, ‘Stage 3 Practice Test’, covers the entire Stage 3 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. Many of these sites offer a range of maths activities many of which can be used with electronic whiteboards or screen projectors attached to the computer.

Arrow cards

Many place value and calculation activities can be demonstrated and/or answered using place value arrow cards. Arrow cards are a set of place value cards with an ‘arrow’ or point on the right-hand side. Students can organize the cards horizontally or vertically to represent numbers in expanded notation. They can overlap cards and line up the arrows to form multi-digit numbers.

These are an important teaching and learning resources and it would be useful to have a set available for each student. In Stage 3, the students only need to work with numbers to 1000, so you only need to prepare 100s, 10s and units cards. At higher levels these can be extended to as many places as needed and also to the right to show decimal places.

Copy and enlarge the card templates. Print them onto stiff paper or card. Cut along the diagonal line from top to bottom to form the arrow. If possible, laminate the cards to make them more durable. (If you are making a set for each student, you may like to send the cards home for parents or carers to cut out.)
A basic set of hundreds, tens and units arrow cards consists of:

<table>
<thead>
<tr>
<th>9</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Introducing the cards to the students**

If the students have not previously worked with arrow cards, you will need to teach them how to use them.

- Begin by pointing out the arrows on the cards. Explain that these arrows always go on top of each other when you are making a number.
- Get the students to sort their cards into units, tens and hundreds.
- Once students have sorted the cards, ask them to show you some numbers starting with numbers that only use one card. For example: Show me 3, 6, 7, 10, 40, 60, 100, 500, 900.
- Demonstrate how to build up numbers using arrow cards, for example to make 45 we need 40 and 5.

```
4 0
5
```

- Make sure that students use the correct cards starting with the card of highest place value. In this case 40 is placed first and the 5 is placed on top.
- Repeat for numbers in the hundreds like this:
• Check that the students can build numbers by calling out some numbers and having them show you.
• Show a number with 0 in the tens place, for example 109. Point out that you don’t need a zero tens arrow card to build this number because when you place the 9 you can still see the 0 from the hundreds card.
• As students build numbers they will begin to make connections and observations. For example, they may notice that building the numbers is the same as adding numbers. For example, $30 + 5 = 35$. This is an important observation that forms the basis for partitioning numbers and written methods at later stages. Encourage the students to share their observations with the class.

There are ideas for using the arrow cards in different ways in the activity section that follows.

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

Use arrow cards and spend some time building numbers in which the order of digits is reversed, for example 39 and 93 and 198 and 891 to make sure the students understand that the position of the digit is important. Discuss the value of the digits in the numbers that the students build.

Ask the students to make as many numbers as possible with a 1, 2 and 3 in any place. (They will need to work in groups and combine their cards to build these, or they will need to record as they make each number to keep track.) Repeat with different digits.

Play some games with the arrow card to challenge the students to think carefully. For example:

- Build a number whose digits add up to ten (73, 64 and so on).
- How many numbers smaller than 100 can you build with 4 in the tens position?
- Build a three-digit number with the tens digit one less than the hundreds digit and the units digit one less than the tens digit. What is the highest number you can make? What is the lowest number you can make? Why?
- I am a number between 200 and 300 with one zero. What number could I be? (and similar)
- I am a number between 400 and 600 with one five. What number could I be? (and similar)
- Build a number that reads the same from back to front.
- Build a number whose name rhymes with nine (other rhyming numbers could rhyme with bun (one); you (two); me (three); door (four); alive (five); sticks (six); heaven (seven); late (eight).

You can also use the arrow cards to reinforce counting activities. These activities are useful because they require the students to physically build numbers and then partition them to replace digits and this helps them make sense of calculations involving two- and three-digit numbers. Some activities are:

- build a number that is 10 more than 37
- build a number that is 10 less than 83
- build a number that is a hundred more than 234
- build a number that is a hundred more than 29.

Students might find it easier to count by hundreds as the number names use the same vocabulary (three hundred and … four hundred and …) whereas when you count in tens, you need to use the vocabulary of ten, twenty, thirty etc. It is therefore important to count on and back in tens from any number (and not just to teach rote counting of decade numbers) so that students realise that 34 is ten more than 24 and so on.

Display six sequences of numbers each with some numbers missing. Point to a missing number and let the students guess what it is. Repeat for each missing number.
Choose a three-digit number and display it. Ask the students to read it, identify how many hundreds, tens and units it has and then count on and back in steps of ones or tens from the number. Play a game in which the students have to take turns to make up a ‘fact’ about the number. For example, it is ten more than 345, it is bigger than 300, it is between 300 and 400, it is odd, it is a multiple of five, its tens and units digits are the same (and so on). Obviously as students learn more about numbers they will be able to give more complex facts, but at the beginning of the year aim to get three or four facts per number.

Display a place value table marked with H T U.

<table>
<thead>
<tr>
<th>H</th>
<th>T</th>
<th>U</th>
</tr>
</thead>
</table>

Let the students copy this into their books and then play a game in pairs. They should take turns to toss a dice and write the number facing up in one of the places. For example, if they get a 6, they may write it in the H, T or U place. Change the aim of the game so that sometimes the winner is the student who makes the biggest number and other times it is the student that makes the smallest number. You can vary this by using dice marked with numbers other than 1 – 6.

You can vary the game above by starting with a target number. For example, 325. The students then place their digits aiming to get a number that is as close to 325 as possible. The winner is the student whose number is closest to 325.

Ask the students to jot down a three digit number. Once they have all done so, display any three-digit number of your own. The students then have to count from their number to your number. They will need to decide whether to count back or forwards and how to make it easiest for themselves. For example, if you display 320 and the student has 765, he or she may count back in ones (of one five) to get to 760, then in hundred to get to 360, then in tens to get back to 320. Encourage number line jottings to support the counting at this stage. For example:

```
320 360 460 560 660 760 765
```

Play ‘Guess the number’ either as a class or in groups. Let students choose a two or three digit number (state which) and make them jot it down. The group then takes turns to ask questions to try and guess the number. The student who has the number may only answer ‘yes’ or ‘no’.
Do a range of activities in which the students have to count in given steps. Vary these according to what you are doing in class and the number range that the students are working in. Start the year by revising place value to 100, then move onto numbers to 1000. For example:

- Count from 99 to 125
- Count back in twos from 250 to 240
- Count in tens from 415 to 535
- Count back in tens from 650 to 600
- Count in hundreds from 324 to 524

Ask questions based on counting back and forwards using a number line marked from 0 to 1000 in intervals of 10 or 100. Some possible questions are:

- What is 10 more than 450?
- What is 10 less than 900?
- What is 100 more than 600?
- What is 100 less than 150?
- What is 100 less than 1000?
- What is 100 more than 350?
- What is 100 more than 490?

Make up a set of questions based on a three-digit number. For example, display the number 235 and ask students to write or say the number that has:

- five more tens
- three fewer ones
- two fewer hundreds.

Do lots of activities using place value charts. For example:

Here is a place value chart showing the number 85:

<table>
<thead>
<tr>
<th></th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

What number is shown on this chart? (202)

<table>
<thead>
<tr>
<th></th>
<th>100</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>500</th>
<th>600</th>
<th>700</th>
<th>800</th>
<th>900</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

Write the number in words. (Two hundred and two)

If you make a large chart and laminate it, you can use wipe-dry pens to underline or circle the numbers each time. If you are using an electronic chart you can highlight the boxes you are referring to as we have above.

Let the students say each number in words, and then write it in numerals.
Tell the students to listen carefully as you say some numbers and then write them down. For example, you may read out a set of numbers such as:

- four hundred and thirty-five
- nine hundred and three
- five hundred and ninety-nine
- three hundred and seven
- five hundred and seventy.

Read out some numbers and ask the students to jot down the value of one particular digit. For example, what is the value of 3 in each of these numbers?

- 163
- 435
- 349
- 138

(When you do this kind of activity, make a list of numbers in advance to make sure the numbers you use only have one digit with the value you are looking for!)

Write a selection of three-digit numbers on cards. If you make numbers with similar digits, it makes the activity a little more demanding. Display the number cards randomly on the board. For example:

![Number cards](image)

- Say numbers aloud in words and ask students to come and identify the number you said. For example three hundred and twenty-five.
- Let the students reverse the digits and say the numbers aloud. (If you are going to do this, be clear about what they should do with a 0 in the units place or do not use any numbers with 0 in the units place.)

Ask the students to write down any three-digit number. Write a random set of three-digit numbers on the board.

- Let the students make number sentences using your numbers and the number they have written down using the <, > or = signs.
- Let the students use mental strategies and jottings to find the difference between the numbers in their number sentences. Spend some time talking about the strategies they suggest.

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 numbers can you make?

Play bingo with the class. You will need three or four sets of 0 – 9 digit cards. Let the students work in pairs to write five three- or four-digit numbers on a grid like this one:

```
456  321  999  408  765
```

Shuffle the cards. Draw three cards at random (or four if you are making four-digit numbers) and call out or display the digits. For example, five, six and seven. The students use the digits to try and make the numbers on their grid (in any order). If they are able to make one of their numbers, they can cross it out. (So this pair could make 765 and cross it out.) The first pair of students to cross out all their numbers can call out Bingo – they win the game. It is useful to record the digits that you call each out each time to resolve any disputes that may arise about numbers.

Display a number of mixed numbers for the class and let them write them in order from greatest to smallest or vice versa. Try to give some variety, including mixed numbers with the same whole number and different fractional pieces, for example $\frac{5}{2}$, $\frac{5}{4}$ etc to encourage students to compare the whole number and the fractional part to decide how to order them. Place the numbers in position on a number line.

Make a chart of ten equivalent fractions including some errors. Give the students a time limit to find, write down, and correct the incorrect number sentences.

$$\frac{1}{2} = \frac{4}{8} \quad \frac{1}{2} = \frac{6}{10} \quad \frac{1}{5} = \frac{1}{4} \quad \frac{2}{10} = \frac{1}{2}$$

Give each student a grid of squared paper, for example a rectangle $4 \times 10$ blocks. Instruct them to colour fractional parts. For example, colour half red, colour one tenth green.

2. Rounding and estimating

Ask the students to jot down a three-digit number. You can specify that it should have three different digits or throw dice to generate random three digit numbers. Once they all have a number, make a ‘human number line’ with ten students standing in a row displaying the multiples of hundred (0; 100; 200 ... 1000). Students then take turns to display and read out their own number and then hand it to the number line student with the closest hundred. Continue to use number lines to illustrate, then visualise rounding. Mark off the line in tens when rounding to the nearest 10 and hundreds when rounding to the nearest 100. For example: 234 is nearer to 230 than to 240.
Write several three-digit numbers on the board. Round each to the nearest 10 or 100 (choose one place value to round to per activity). Make sure some of the rounded values are incorrect. For example:

(rounding to the nearest 100)
234 → 200
266 → 200
412 → 420
388 → 400
399 → 400

Ask the students to find the incorrectly rounded numbers and to correct them. Repeat this using different numbers and rounding to different places.

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.

<table>
<thead>
<tr>
<th>456</th>
<th>275</th>
<th>499</th>
<th>109</th>
</tr>
</thead>
<tbody>
<tr>
<td>245</td>
<td>501</td>
<td>195</td>
<td>108</td>
</tr>
<tr>
<td>509</td>
<td>824</td>
<td>801</td>
<td>876</td>
</tr>
<tr>
<td>103</td>
<td>562</td>
<td>901</td>
<td>105</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.

Write a multiple of a hundred on the board and draw six arrows pointing to it. Challenge the students to write down six numbers that would round to this hundred. For example:

Write six numbers that would round to 300:
Ask the students to make a three-column table like this one:

<table>
<thead>
<tr>
<th>100</th>
<th>200</th>
<th>300</th>
</tr>
</thead>
</table>

Read out 20 numbers in the range from 50 to 349. As you say each number, the students should write it in the correct column to show the nearest 100. For example, if you say 105, the students should round it to 100 and write it in that column.

Display a set of numbers and ask the students to estimate and find pairs that meet certain conditions. For example if you are working with multiples of 50 that make 1000, you might choose numbers such as:

45 950 760 50 450 549 245 760

Ask questions such as: which pairs will give a total that is close to 1000? Which pairs will give more than 1000? Which will give less? And so on. Encourage the students to verbalise their thinking rather than just try to work out the answers. For example, 45 is close to 50, so 950 and 45 will be close to 1000. Repeat for different combinations and purposes as needed.

Estimate totals to 100 by playing ‘Do I have enough money?’ with the class. For example, I have a 100 dollars and I want to buy two items of $60. Do I have enough? Depending on your local currency you could also play this game by displaying say four quarters (25 c coins) and asking if its enough money to buy an item costing $1.25 and so on. Stick to low amounts at this stage.

Prepare an estimation jar. Use a glass jar or plastic container and fill it with items such as beans. Let the students jot down how many beans they think there are in the jar. (as a range). Then, show them a smaller container filled with the same items and tell them how many there are. For example, this jar has 100 beans in it. How does that affect your estimate? Discuss how their estimates would change if you used larger/smaller items to fill the jar. Discuss how you could, check the estimates and then count the items in groups of tens or other appropriate groups.

Display a number of calculations for the class and ask them to estimate the answers. Focus on the rounding and estimation skills and not the answers. For example:

48 + 72 Estimate 50 + 70 = 120
98 – 35 Estimate 100 – 40 = 60

You can also adapt this by displaying the calculations with mixed up estimated answers for the students to match.

Prepare a table like this one using prices (or measures) and have the students complete it.
3. Mental problem solving

Test understanding of mathematical terms and vocabulary by posing worded problems to be solved mentally. For mental maths activities at Stage 3 level, you could place the students in pairs and select one or two problems from the list below per mental maths session. Spend some time talking about how the students solved the problem and compare strategies as a class.

Some possible problems:

- Find the number that can be increased by 10 to make 81
- What is the product of 4 and a number 3 greater than 4?
- What is the difference between 16 and double 40?
- What number do you get if you halve the product of 8 and 10?
- What is the sum of 45 and double 15?
- Give me a pair of two-digit numbers with a difference of 12.
- If the sum of two numbers is 180 and one of the numbers is half of 80, what is the other number?
- Which three numbers could have a total of 64? Are there any others?
- Find four pairs of numbers with a difference of 9 (or any value).
- How many lengths of 10 cm can you cut from 86 cm?

And so on.

Pose some money problems for the class. Pose some money problems for the class. Again, at this level you would allow students to work together and only expect them to tackle one or perhaps two problems per sessions. For example:

- How many different ways can you make 50c? Encourage the students to organise their answers using lists and/or tables. Check their answers as a class to reinforce adding sets of small numbers and to show that repeated addition (of say 5c + 5c + 5c ...) is the same as multiplying by 10 and that multiplying is faster.
- I want to donate $1 to charity each week by collecting small coins. I have collected 64 cents so far this week, how much more do I need?
- Make 42 cents using the smallest possible number of coins.
- I save 9 dollars a week. How many weeks till I have saved $90? $99?
- The price of a 45c juice is doubled, what is the new price?
- An item costing $42 is on half-price sale. What is the new price?
Extend students by asking them to make up their own problems related to money. You can give them prices, allow them to work with local adverts or give them prompts such as, the answer is 42 cents, what is the question? Or make us a story sum to match this calculation: 90 cents – 23 cents = 67 cents

Give the students some logic puzzles to solve. There are many examples of these and the ones you choose will depend on the ability levels in your classroom. Here are some typical examples.

- Jess is 7 years older than her sister. Their combined age is 25. How old are Jess and her sister?
- The sum of two numbers is 140 and there is a difference of 10 between them. What are the two numbers?
- A farmer has chickens and goats in a yard. If there are 5 heads and 14 legs, how many goats are there?
- If it takes Mr Jones 4 minutes to cut a piece of pipe into two parts, how long would it take him to cut it into 5 parts? (Students may say 4 × 5 = 20 minutes. Bear in mind that to make five parts, he only needs to do 4 cuts, so the answer is 16 minutes.)
- Amira has the digits 1 to 7 written on cards. How many pairs of cards add up to 8? How many groups of three cards can you make that add up to 10?
- Find a number between 1 and 20 which gives a remainder of 1 when divided by 3.
- My gran will be 80 in two years time. In which year will she be 90?
- On Friday 150 people went to a school play. On Saturday 40 more people attended. How many people attended altogether on the two nights?

Write a number on the board. For example 20. Ask, how could you put 20 things into equal groups? How many things would be in each group? How do you know? Record the groupings and encourage the students to find as many possibilities as they can. (2 groups of 10, four groups of 5, five groups of 4, 10 groups of 2). Repeat for other numbers to 100.

Read out a number of statements. These should relate to the work you are doing, or have done recently. Ask the students to say whether the statements are true or false.

Here are some examples related to shapes:

- a rectangle has four equal sides
- a square has four right angles
- a circle has one straight side
- a triangle has three right angles
- a pentagon has six sides.

Here are some examples related to measures:

- there are 10 cm in a metre
- 1 cm is shorter than 1 metre
- \( \frac{1}{2} \) litre is the same as 500 ml
- there are 100 grams in a kilogram
- \( \frac{1}{4} \) of a metre is 25 cm
- a metre rule is 100 cm long.
Here are some examples related to number:
- half of 50 is 25
- double 32 is 65
- 500c is the same as $5
- $1 is less than 120 cents
- 100 – 82 is 18
- half of 100 is 50

4. Calculation skills

Prepare a set of ‘target’ numbers. For example 24 and 60. Ask the students to write as many calculations as they can to get to each number. You may want to limit this to focus on particular operations. For example, write as many addition sentences as you can with this answer. Or you can leave it open ended and challenge the class to find as many different operations as possible.

Give the students a ‘rule’ for generating a sequence. Write the first few numbers and let them find the next five. For example:

The rule is add 10: 11, 21, 31
The rule is subtract 4: 200, 196, 192 ...
The rule is times 2: 1, 2, 4, ...
The rule is half the number: 520, 260, 130 ...

You can adapt this by giving the students sequences and letting them identify the rules. For example:

35, 30, 25 (minus 5)
550, 650, 750 (plus 100)
450, 445, 440 (minus 5)
58, 61, 64 (plus 3)
2, 4, 8, 16 (double or times 2)

Prepare some mapping diagrams and let the students complete them. For example:

You could also use a diagram like this to show an inverse operation.

Use the true or false strategy to test vocabulary and also to apply calculation skills. Give students a statement and have them say whether it is true or false. Discuss how they decided. For example:
1 multiplied by 7 is 8
2 times 3 is 6
The difference between 6 and 15 is 9
The sum of 3, 4 and 9 is 15
15 taken away from 40 is 25
Four lots of 8 are 48
The product of 4 and 7 is 28
50 divided by 10 is 3
9 times 10 is 900
45 divided by 5 is 9

Use the properties of shapes to reinforce multiplication and division facts.
For example, display a triangle. Ask how many sides in 3, 5 and 10 triangles.
Similarly, ask things like: I have a number of triangles. There are 27 sides.
How many triangles are there? Repeat for other shapes and numbers.

Prepare some simple number puzzles, such as magic squares.
For magic squares, make sure the students understand that all rows, columns and diagonals must total the same number. It is easier if you tell students what the total should be, and if they really struggle, you may give them the missing digits. For example, use the digits 1–9 (once each) to get a total of 15 in each magic square. Here is one example:

\[
\begin{array}{ccc}
2 & 9 & 4 \\
7 & 5 & 3 \\
6 & 1 & 8 \\
\end{array}
\]

Complete these:

\[
\begin{array}{ccc}
3 & 6 & \_ \\
\_ & \_ & 2 \\
\_ & \_ & \_ \\
\end{array}
\qquad
\begin{array}{ccc}
6 & \_ & 9 \\
\_ & \_ & 3 \\
\_ & \_ & \_ \\
\end{array}
\qquad
\begin{array}{ccc}
\_ & \_ & 8 \\
7 & 5 & \_ \\
\_ & \_ & \_ \\
\end{array}
\]

However, you can also give them more challenging ones like this:
The total in this square is 30. Find a set of numbers that will make it work.

\[
\begin{array}{ccc}
12 & 16 & \_ \\
\_ & \_ & \_ \\
\_ & \_ & 18 \\
\end{array}
\]

Or, a blank square with a total and the students have to find their own solutions. For example:
For this square fill in numbers to get a total of 34 in all directions:

You can spend time investigating what happens if you add the same number to each number in the magic square, if you times each number by 2 or by 10 and so on.

For this puzzle, the totals across three bubbles (in a line) must be the same. Fill in the numbers from 1 to 11 in the bubbles so that each straight line has the same total.

If students find this challenging, suggest they try a simpler case or cases first:

Use the numbers 1, 2, 3, 4 and 5 in the circles so that the total along each line is the same.
Students will discover, possibly by trial and improvement that the middle number must be 3.

Extend to using 6 circles around the inner circle and the numbers 1, 2, 3, 4, 5, 6 and 7. This time the middle number must be 4.

There are many variations on number puzzles available. A simple internet search will provide lots of examples that you can use in your classroom.

Give the students a set of 5 two-digit numbers and challenge them to use pairs of the numbers to make (and solve) as many different subtractions as they can. For example:

\[43 \quad 62 \quad 69 \quad 93 \quad 87\]

Set challenges such as: Write five different two digit numbers that total 100. Do not use 0 as a digit in any of the numbers. Write four different two digit numbers that total 100.

Prepare sections of multiplication tables and display them for students to complete as quickly as possible. For example:

\[
\begin{array}{ccc}
| & 1 & 4 & 7 \\
2 & & & \\
5 & & & \\
10 & & & \\
\end{array}
\]

\[
\begin{array}{ccc}
| & 3 & 6 & 2 \\
4 & & & \\
2 & & & \\
10 & & & \\
\end{array}
\]

Prepare a ‘dartboard’ like this one: You can use any numbers in the inner circle.
Give the students a target number and ask them to find the missing score on the outer ring. This can be used for all four operations (one at a time).

You can adapt this activity by filling in numbers in all the sectors. Tell the students some conditions. For example, that you score double for the outer ring and 10 times the number in the inner ring. Point to different numbers and let the students say the score. If you want to challenge them, point to two numbers and let them work out the total score.

Play a game in which the students have to make a total of 4 using the digits from 1 to 9 (one at a time) and any operations they wish. For example to make 4 using only 1s: $1 + 1 + 1 + 1 = 4$; using only 2s: $2 + 2$ or $2 \times 2$

Using 3s, $(3 \times 3 + 3) \div 3$. Another variation of this is to try and make all the numbers to 10 using only one number and any operations, for example using only 3s. $3 \div 3 = 1$; $(3 + 3) \div 3 = 2$ and so on.

Play a ‘cross the river’ game. Draw a number of rocks on the board and write different two- and three-digit numbers on them. Tell the students they can cross to the next rock if they can give an operation to get there.

Prepare a set of three-digit additions. Write the answers on the board and give the six digits used in the calculation in size order alongside. Let the students rearrange these to form an addition that works. For example:

```
463 1 1 2 2 3 4  (students have to make 321 + 142)
```

Repeat this for subtraction but stick to two-digit numbers at this stage.

Prepare a series of short quizzes (10 to 15 questions) with mixed operations and mental strategies. Use these as the mental warm-up activities at intervals. Read the questions aloud and display them one by one for the class. Allow 20 to 30 seconds for the students to answer before moving on. (So, a 10 question quiz would take 5 minutes to complete.) The students can prepare a table and keep track of their results for different quizzes. Below are three sample quizzes, but bear in mind, you’d need to have taught the topics before you include questions on them.
Sample Quiz 1
1. 3 more than 6
2. 4 plus 8
3. 55 plus 20
4. take 7 from 20
5. 10 less than 55
6. by how much is 90 greater than 65?
7. What is 5 times 8?
8. What is three times 0?
9. 9 fives is?
10. How many twos in 24?
11. Share 40 counters among 10 girls
12. What is the total of 17c, 50c and 23c?
13. Increase 28c by 34c
14. What is half of 18
15. what is the difference between 48 and 53?

Sample Quiz 2
1. Write in words the number that is 10 more than 532.
2. How many tens are there in 430?
3. Round 125 to the nearest 10.
4. What is 1/5 of 20?
5. How many minutes in half an hour?
6. 6 × 9 =
7. 24 ÷ 6 =
8. 21 ÷ [ ] = 7
9. 19 + 37 =
10. 400 + 600 =
11. What is the time five minutes after 3.40?
12. How many weeks pass in 28 days?
14. Double 60.
15. 800 + [ ] = 1000

Sample Quiz 3
1. Arrange in order from smallest to largest: $4\frac{1}{2}, 3\frac{1}{4}, 4\frac{1}{4}$
2. Write three hundred and twenty three in figures.
3. What is the difference between 700 and 1000?
4. How many jumps of 5 will you need to get from 0 to 50?
5. 65 + 66 =
6. 97 – 8 =
7. 134 + 9 =
8. 327 – 8 =
9. 47 + [ ] = 100
10. 85 – 45 =
11. 9 × 4 =
12. 34 + 19 =
13. 135 + 49 =
14. Is 552 a multiple of 5?
15. 499 less 100 =

5. Calendars and time

Write a start and end date on the board. Ask the students to work out how many days and how many school days there are in between these dates. Allow them to consult a calendar if necessary and encourage them to share their answers. Discuss how you can check this and do so.

Work out dates based on counting in tens. Ask students questions such as, it is the 2nd of June. What is the date 10 days later? And so on. Avoid bridging months unless you allow the children to work with a calendar.

Pose questions based on current dates (you can have a calendar on display for this). For example. Starting this week, write down:
- the dates of the next four Fridays
- the date on Saturday
- the dates of the next three Tuesdays
- the date a week ago today.
Prepare a time quiz to test knowledge of units and vocabulary. Students can either say or write the answers. Here are some sample questions.

- How many weeks in a year?
- How many days in two weeks?
- How many months in two years?
- What is the sixth month of the year?
- How many days are there in a year?
- Which month comes before September?
- What day is two days after Thursday?
- What is the first day of the week?
- How many weeks in half a year? Quarter of a year?
- Which is the shortest month?
- How is a leap year different to a normal year?

Ask students to write or show the time:

- 15 minutes before 2 o’clock
- 5 minutes after 1.15
- 10 minutes before 5.30
- Half an hour after 4 o’clock.

6. Shape, space and measures

Pose some questions related to mass. For example. Say which item weighs the most in each pair:

- an apple or a brick
- a pencil or an apple
- a kilogram of apples or your shoe
- a litre of cola or a glass of water
- a basketball or a tennis ball
- an empty cup or a full cup.

You can adapt this to work with length and capacity.

Ask students to write estimates of the lengths of various familiar items in appropriate units. For example, a shoe, your book, a desk, a pin, a pencil, the door of the classroom and so one. Discuss what a reasonable estimate might be in each case.

Prepare a grid with columns and rows labelled (stick to letters on the horizontal axis and numbers on the vertical axis). Draw 2D shapes or 3D objects in the squares and ask questions such as:

- Where is the red triangle?
- In which block is the blue square?
- What is in C3? And so on.

Display a number of lengths (to make 100s) and ask the students to combine them to make lengths of 1 metre. You can repeat this for mass and capacity using pairs to make 1000.
Use the mental warm-up session as an opportunity to explore solids and shapes used in buildings. You can find pictures of homes, places of worship and/or murals and decorative patterns from a range of sources. Display these and spend some time identifying and naming the shapes used in construction, symmetrical and other properties. If the students struggle with 2D representations of 3D objects, show them real items such as dice, soccer ball, cereal box and let them name these and then find pictures of them to make the connection between the real item and its representation.

Display a number of 2D shapes (or 3D objects) labelled A to F. Display the correct names of the shapes in a mixed order and ask the students to match them up.

Show students a real 3D objects such as box. Show it from different angles, then remove it from view. Ask them to draw all its faces. As an alternative, show a set of faces and ask the students what shape they could build using them. (for example six squares to make a cube, two triangles and three rectangles to make a triangular prism.

Display a large measuring scale from 0–1000 ml marked in intervals of 100. Draw a line on it to show a capacity (such as 200 ml). Tell the students you are going to drop stones into the liquid. Each stone increases the water level by 50 ml. Show different numbers of stones and let the students write the amounts that would be shown on the scale. You can also adapt this to an activity increasing or decreasing mass.
1: Numbers and place value

<table>
<thead>
<tr>
<th>Objectives</th>
<th>3Nn1</th>
<th>Recite numbers 100 to 200 and beyond.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3Nn2</td>
<td>Read and write numbers to at least 1000.</td>
</tr>
<tr>
<td></td>
<td>3Nn5</td>
<td>Understand what each digit represents in three-digit numbers and partition into hundreds, tens and units.</td>
</tr>
<tr>
<td></td>
<td>3Nn9</td>
<td>Place a three-digit number on a number line marked off in multiples of 100.</td>
</tr>
<tr>
<td></td>
<td>3Nn10</td>
<td>Place a three-digit number on a number line marked off in multiples of 10.</td>
</tr>
<tr>
<td></td>
<td>3Nn11</td>
<td>Compare three-digit numbers, use &lt; and &gt; signs, and find a number in between.</td>
</tr>
<tr>
<td></td>
<td>3Nn12</td>
<td>Order two- and three-digit numbers.</td>
</tr>
</tbody>
</table>

**Vocabulary**

Hundred, thousand, place value, numeral, digit, order, multiple, plus number names to 200.

**Resources needed**

Flashcards with numbers to 1000, 1–200 number chart (see below), 0–9 digit cards, place value arrow cards (see page 25), number lines for counting marked in tens, and hundreds.

**Mental warm-up activities**

Select suitable activities from the mental warm-up activity bank or focus on counting activities using the number chart and number lines (there are some suggestions under the practical activities below.

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

**Numbers beyond 100 (working with 3-digit numbers)**

The students need a good grounding and understanding of both place value (tens and units) and the numbers to 100 to develop a full understanding of the number system and basic operations. Although many of them will
have counted beyond 100, this year the numbers are formally taught and reinforced before the students work with three-digit numbers and count to 1000. It is a good idea, particularly early in the year, to give daily practice of counting both orally, and using charts and number lines. Bear in mind that where students home language is not English, the number names could be expressed differently in the home language, many languages use the format ‘three and twenty’ rather than the English ‘twenty three’ and this can lead to confusion if students do not get enough practice saying the numbers in English and associating them with their numerical representation.

**Place value to thousands (partitioning into hundreds, tens and units)**

In this chapter students will build on the skills they have used with two-digit numbers and extend them to working with three-digit numbers (place value, value of digits, positioning numbers and comparing numbers). Students will work with larger numbers and use different number lines and intervals to position numbers and also to estimate the position of larger numbers. All of these skills need to be practised and reinforced well so that the students can transfer them to working with an even greater range of numbers as they move through later stages.

**Teaching ideas**

**Practical activities**

 القادس: 

Revise counting to 100 orally. Let the students sit in a circle and count around the group in ones, twos, fives and tens. Count quickly, slowly, loudly and softly. Start at different numbers (for example 29) and let the students continue. Vary the activity by counting forwards and backwards.

Use a 1–200 chart like the one on page 45 to teach the students how to say and recite numbers from 100 to 200. This will help them deal with higher numbers in the hundreds range as they work through the suggested activities that follow.

Play a game called ‘guess the number’. Write some numbers on cards and stick them face down on the board. Let the students try to work out what numbers you have written down by asking you questions. Explain that you will only answer ‘yes’ or ‘no’, so they need to ask questions like: ‘Is it bigger than 120?’, ‘Is it an odd number?’, ‘Is it a multiple of 5?’, and so on. Repeat this for different numbers and, if you like, allow the students to play their own games in groups.

Make a large copy of the grid for each group. Give the students a set of instruction to move counters to different positions on the grid (for example, count ten forward, count three back, jump three lots of ten, go forward 50, and so on). Later on, this activity can be extended to revise rounding the nearest ten. Give the students a number (say 143) and ask them to place their counter on the number with the nearest ten.
Choose a starting and ending number with the class. Ask questions such as how many jumps of ten would I need to get from the starting number to the end number? Which number is half-way between these two numbers? Is the difference between the numbers more or less than 50? How can you check this? And so on.

Let the students play a game in threes to make three-digit numbers. They should throw three dice and make as many numbers as they can with the facing values. For example, if they throw 1, 4 and 3 they can make 134, 143, 314, 341, 413 and 431. Let them say the numbers. For each number, let them say how many hundreds, tens and units it has, for example 134 has one hundred, three tens and four units. Discuss why they can only make one number when they throw trebles (there is the same number of hundreds, tens and units).

Make a selection of 1–200 grids with numbers missing. These can be random or you can select a pattern (for example leave out every third number, or leave out all multiples of 5 or 10). Hand these out for the students to complete. If you use laminated versions, they can be reused. As students become more confident, they could use blank grids to prepare a missing number grid for their partner to complete.
Select small sections of the grid (cut it up to make strips, blocks and irregular sections (for example a T-shape) and display these. Ask the students to say which numbers will appear before this section, above this section, after this section and under this section.

Before moving onto higher numbers, provide plenty of opportunities for students to write numerals above 100. Read or say numbers and let students come up to the board to write the number. Use lots of numbers that could be confusing, for example 154 and 145.

Use place value tables and arrow cards to teach place value to hundreds. There are instructions for making arrow cards and ideas for using them on page 24.

Students should have as much practice as time allows in using number cards, rods and counters to represent three-digit numbers. Make sure that students understand the significance of the three digits, hundreds, tens and units, by demonstrating the value of the three digits in partitioned numbers. For example, the number 123 can be written as: 1 hundred + 2 tens + 3 units, or 100 + 20 + 3

Spend some time talking about the concept of 1000. Ask students questions such as: Where would you see 1000 things? Are the 1000 students in our school? Do you walk more or less than 1000 steps in a day? It is quite a large number for young children and they need to have some sense of its magnitude.

Make and use a number line marked in hundreds from 0 to 1000 and teach the students how to use it. Also show them how to read and interpret simple in between numbers such as the number half-way between 400 and 600. Ask questions like, how many jumps of 100 does it take to get from 200 to 500? (And so on). How many groups of 500 can we make with 1000? (or 200, or 250).

Make and use a number line marked in tens. At this stage you may want to work with numbers in the 100 to 500 range, starting with a number line from 100 to 200 to reinforce reciting numbers between 100 and 200.

Play a game in which you place three digit numbers on a number line with one or two numbers in the wrong position. Get the students to find the incorrect numbers and move them to the correct place on the number line.

**Using the Student Book and Workbook**

Once the students have done some revision activities related to number to 100 and place value (tens and units) and you are sure they remember and understand the concepts, you can have them work through page 5 in the Student Book. Question 1 can be written down, while Question 2 can be done orally. Let the students discuss the problem in groups and have them explain how they reached their answers. Use Workbook page 4 to assess that students can work with place value and that they can express amounts using both numerals and number names.
Once you have taught the concepts and moved onto numbers beyond 200, let the students work independently to complete Student Book page 6. Use Workbook page 5 to make sure students understand place value and that they can interpret and identify numbers made with arrow cards. Let them check each other’s work to make sure they can write numerals and number names correctly.

Make sure each student, or each group of students has a set of place value arrow card to use as they work through Student Book page 7. You may want to also provide each group with a large blank place value table and counters to help them understand and demonstrate concepts. Let the students work in pairs to complete the activities in the Student Book and then have them work on their own to represent and compare the numbers on Workbook page 6.

Student Book page 8 is a little more challenging as students have to work out what is wrong with each representation and then correct it. Once they have done this, let them check and correct the place value of each underlined digit on Workbook page 7. Check and discuss the answers.

Work through some practical activities using number lines before working through the example on Student Book page 9 with the class. Make sure the students know how to read and interpret number lines marked in intervals before asking them to complete the activities. Use Workbook page 8 to check that they are able to place number son a number line. Allow some time to discuss how they made their decisions in activity 2.

Allow the students to use number lines to sort the numbers on Student Book page 10 if they need to. Check their answers and use Workbook page 9 to reinforce and consolidate the ideas.

Revise the correct use of the < and > symbols with the class before they work through Student Book page 11. Let the students work independently to complete Workbook page 10 and have them check each other’s answers and discuss any differences that arise.

**Assessment questions to ask**

- How many tens and how many units are there in the number 29? What about 92?
- A number is composed of 2 hundreds, 3 tens and 6 units. What is the number?
- What number is missing from the sequence 172, 173, . . . , 175?
- What number appears immediately above 173 on a 1–200 number grid? And so on.
- What number appears immediately below 145 on a 1–200 number grid? And so on.
- How many units are in 100?
• How many tens are in 200?
• Make this number [any three digit number] with arrow cards. Say the number.
• What is the value of ‘2’ in the number 235?
• What is the value of ‘5’ in the number 357?
• Complete the following number track.

234 235 236 237 238

• What do each of the digits stand for in the number 372?
• Complete this number pattern: 610, 615, 620, . . . , . . . , . . . , . . . , . . .
• Write these numbers in order of increasing size: 654, 649, 594, 694, 549

Common errors and misconceptions
Some students have difficulty interpreting the value of the digits in a number. For example, if asked the value of the ‘4’ in the number 147, the students will say it is 4. It will help their understanding if students think of the number as the sum of so many hundreds, tens and units, i.e. the number 147 as the sum of 100 + 40 + 7. It will also help to use place value arrow cards to build numbers.

Students may get confused with numbers like 105 and write 150. Continue to give lots of place value practice, and encourage them to use arrow cards to show the number using concrete apparatus.

Students frequently have a problem remembering which of the signs < and > means ‘more than’ and which means ‘less than’. Show students that ‘<ess’ spells less so they will remember that < is the sign for ‘less than’.

2 3D shapes and nets

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Student Book pp 12–15</th>
<th>Workbook pp 11–14</th>
</tr>
</thead>
<tbody>
<tr>
<td>3Gs3</td>
<td>Identify, describe and make 3D shapes including pyramids and prisms; investigate which nets will make a cube.</td>
<td></td>
</tr>
<tr>
<td>3Gs4</td>
<td>Classify 3D shapes according to the number and shape of faces, number of vertices and edges.</td>
<td></td>
</tr>
<tr>
<td>3Gs6</td>
<td>Relate 2D shapes and 3D solids to drawings of them.</td>
<td></td>
</tr>
<tr>
<td>3Gs7</td>
<td>Identify 2D and 3D shapes, lines of symmetry and right angles in the environment.</td>
<td></td>
</tr>
</tbody>
</table>

Note 2D shapes and symmetry are covered in Chapter 4 and angles are covered in Chapter 16.
Vocabulary
3D, solid, cube, cuboid, cylinder, prism, pyramid, face, vertex, vertices, edge, square, rectangular, triangular, net

Resources needed
Solids for demonstration (cube, cuboid, cylinder, triangular prism, square based pyramid); flashcards with the names of solids; flat shapes (triangles, squares, rectangles) coloured paper or card, scissors, magazines and other printed material from which students can cut out pictures of solid shapes used in a variety of ways, straws and modelling clay for making models.

Mental warm-up activities
Select suitable activities from the mental warm-up activity bank. You may want to reinforce counting and place value at this stage. Remember that students will not be working with number in this chapter, so you could also choose some simple addition facts at this stage.

Concepts that may be unfamiliar in this chapter
Mathematical vocabulary related to properties of solids
Students should know at least some of the names of solids from work done in Stage 2. However, they may have forgotten some and they may not know the correct terms for parts of the solids. Make sure you talk about 3D shapes using their correct names and that you use the correct terms (face, vertex and edge) when you refer to parts of the shape. Exposure to the terms and insistence on their use will help students and allow them to talk about shapes in the correct way.

Classifying solids according to their properties
In Stage 2, students sorted shaped according to their properties. Now they will classify shapes based on the number of faces they have and the shape of those faces. They need to begin to learn that prisms have two matching (congruent) end faces and that pyramids all have a base and triangular faces that meet at a vertex. It is important to show the students examples of the solids so they can see all the parts. Research done by Dr Alan Bishop has shown that students don’t always see 2D drawings of 3D shapes as solids, in fact, in some cases, where he showed students pictures of a cube built with straws and asked the students to build it, they built a replica of the 2D picture and not a 3D cube. Lots of practical activities will help students understand the abstract diagrams they are exposed to in mathematics.

Nets of solids
Solids can be made from a flat pattern or net. The net shows the faces of the solids and where these are joined to each other. It can be folded along the solid lines to build a model of the solid. Again, you should aim to show the students some boxes that are shaped like cubes and cut these open to show them the net.
**Teaching ideas**

**Practical activities**

1. Divide the class into groups and give each group a set of solid shapes. Get students in the group to name the shapes.

2. Students to work in pairs. One student describes the shapes of the faces of a solid and the other student has to name the solid.

3. Students could carry out a survey of the school to identify different solid shapes and explain how they are being used.

4. Challenge students to identify solid shapes in the environment. Initially, this could be restricted to the classroom or school but it could also be developed into a homework task. Students should be asked to explain the shapes of some things.

5. Lead a whole-class discussion in which students are shown different solids and asked to identify the shapes of faces and the number of them. Use a cube and a cylinder to demonstrate the difference between flat surfaces and curved surfaces.

6. Students can make a scrap book by sticking in pictures of solid shapes cut from magazines and other publications. Students should be asked to bring magazines into school prior to this activity.

7. Place a number of small solids in a bag and ask the students to put their hands in and feel for a shape without removing it. They should then describe it to their group and the group should try to guess what solid it is. The student who is describing can then take out the shape and they can see what it was.

8. Spend time classifying 3D shapes in different ways. Give each group of learners a set of mixed shapes and ask them to make two groups. They should then say what criteria they used to group the shapes. Once they have done this, ask them to regroup the shapes to make three (or four) groups. Again, give them time to explain the criteria they used. Activities like this allow students to study the solids closely and to see that there are different ways of classifying them using properties and characteristics.

9. Have the students investigate the shape of faces of different solids by sticking name cards onto each face and then removing these and counting and/or drawing them. They can also trace round solid shapes to get the shapes of the faces. If you have plastic shapes that fit together to build solids, you can also prepare activities in which students construct and deconstruct the shapes to find out more about the faces.
Demonstrate how to use drinking straws and lumps of sticky putty to build frameworks of shapes. You can also do this with construction sets if you have them.

Prepare sets of shapes and ask the students to decide which shape is the odd one out. For example, you may put a cube in a set of cuboids, or a prism in a set of pyramids, or include one cylinder in a set of cuboids.

If the students are able, use Carroll diagrams to sort a set of solids using different characteristics. For example, you could use this one to sort cubes and cuboids:

<table>
<thead>
<tr>
<th></th>
<th>Has six faces</th>
<th>Does not have six faces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faces are all square</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faces are not all square</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Using the Student Book and Workbook**

Once you revised the names of solids, read through the teaching text on Student Book page 12. Let the students complete activities 1 to 4 to check their understanding. Once they are confident with the names and properties of solids, let them spend some time building their own model shapes.

Revise the terms ‘faces’, ‘vertices’ and ‘edges’ as needed. Before you work through the activities, spend some time showing the students a real cube and discussing the fact that all the parts are not visible when you draw the cube. Let the students work through page 13 of the Student Book in pairs or groups and allow them to use their models or other solids to check their answers. It is quite challenging for them to work out the missing parts and they may not be able to do it without concrete apparatus. If they really struggle, you may choose to do this activity as a class, showing and counting the parts as you work through it. Use the Workbook page 11 to assess their ability to name shapes and identify their properties and to make sure they are able to use a table correctly to summarise information.

Use Student Book page 14 together with Workbook pages 12 and 13 to consolidate the work on solids and parts of solids. Again, you may need to make models available to the students for them to check their answers.

Use a real box to show the students how it can be cut apart and flattened to make a net. If you cannot find a cube, build your own one using an enlarged version of the net on Workbook page 13 and use that to demonstrate to the class. Let the students work in pairs to
complete Student Book page 15. If necessary, provide squared paper and allow them to cut out and fold up the nets shown to see if they can make them into cubes. Let the students each build their own cube using the net on Workbook page 13. This will take some time and students may find it challenging, so you may need to assist them.

Assessment questions to ask

• What shape is a box of cereal?
• What flat shapes form a cylinder?
• How many faces does a triangular prism have?
• Name a shape which has all flat faces.
• Name a shape that has flat and curved faces.
• How could you group these shapes into sets? (Show the students a set of shapes as you ask this.) How do you decide if a shape fits into a set or not?
• How many faces/edges/vertices does this shape have?
• Describe this shape to me.
• Can I make a cube with this net? Why or why not?

Common errors and misconceptions

Students may be confused about the difference between a cube and a cuboid, and should be reminded that a cube is a special type of cuboid in which all of the sides are exactly the same length. Similarly, students may be confused by the difference between a square and a rectangle and should be reminded that a square is a special type of rectangle in which all of the sides are the same length.

Some students may be confused by the terminology of shapes. Regularly use and reinforce the correct terms by playing games that involve the students describing shapes or listening to descriptions to identify shapes.

3 Counting on and back

<table>
<thead>
<tr>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>3Nn3</td>
</tr>
<tr>
<td>3Nn4</td>
</tr>
<tr>
<td>3Nn6</td>
</tr>
</tbody>
</table>
Vocabulary
Count on, count back, pattern, difference, more than, less than

Resources needed
Number strips, number lines, dice.

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

Concepts that may be unfamiliar in this topic
Counting on and back are not new concepts, the main difference in this stage is the size of the steps and the number range.

Counting on and back in steps of 3 and 4
Previously students have counted on and back in steps of 1, 2, 5 and 10. This year they will extend this to include steps of 3 and 4 (bearing in mind that they are also working with the 3 and 4 times tables this year). These number steps are fairly small, and students will still be able to use their fingers to help them count. Allow this, as it is a very natural way of find the difference between two numbers, and even adults will use their fingers as reminder tools when they do this.

Counting on and back in hundreds (linked to finding 100 more or less than a number)
Counting on and back in hundreds requires the students to apply what they know about place value to realise that they can focus on the hundreds digit when they are adding a chunk of 100 and that they can essentially ignore the other digits (except of course when they bridge from 900 to 1000). Once students realise this, they should then be able to use their fingers as ‘reminders’ to count forwards and backwards in hundreds.

Counting on and back is a crucial skill and students will use it again and again as they develop methods and strategies for adding, subtracting, multiplication (as repeated addition) and division (as repeated subtraction). It is essential that you spend time working with a range of different numbers and number lines marked in different intervals to teach, reinforce and consolidate this skill.

Teaching ideas

Practical activities
Use the 1–100 square to remind the students how to count on (ie move right and or down) and how to count back (ie move left and/or up), try to elicit the pattern for counting in tens (ie number one below is ten more, number one above is ten less). You can make a large copy of the one in the Student Book, or you could use the 1–200 chart on page 45 of this Teacher’s Guide instead.
Place the students in groups. Give each group a pile of stones or counters. Let the students count the stones in different ways. For example, let them count them one at a time, or in groups of 2s, 3s, 5s and 10s.

Let the students play a game in pairs using dice. One student should roll two dice to make a two digit number. The other should roll another dice to get a number to count on. They then count on for the next ten numbers using the combination they have made.

Let the students play a ‘guess my number’ game in groups. Instruct them to jot down five three-digit numbers without letting the others see them. They then take turns to describe their numbers to a partner using clues such as ‘it is three jumps of ten less than [150]. The partner should guess and jot down the number.

Use piles of 5c or 10c coins to demonstrate and encourage counting on in fives and tens. If you like, you can give a starting amount. For example, I have saved 800 cents already. Now I want to add these coins to my savings. How much will I have then?

Prepare a set of number tracks counting back and forwards in tens with missing numbers like these:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>235</th>
<th>245</th>
<th>265</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>380</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>490</td>
<td>500</td>
</tr>
</tbody>
</table>

Have the students work out the missing numbers. They can do this individually or you can go around the class and let students say the numbers.

Introduce the idea of a number line to the class. Use it to show how we can count on and back from any number. Start with a blank line marked in intervals. Write a three digit number on the left-hand mark. For example, 254. Point to the next mark and ask the class what it will be; they should say 255. Point to a mark five along from that and ask what it would be. Show that you can count on in ones to get there, or you can count in fives. Repeat this for several numbers and counting intervals, including counting back. In the early stages, learners may count each jump, as they become more confident with numbers and skip counting, they will be able to take larger jumps. The idea of ‘chunking’ or jumping in a bigger step is an important one that will be used when the students perform calculations on larger numbers.
Use a number line to show that we can count on and back in groups to add or subtract numbers. Demonstrate a range of different methods. For example:

Counting all the numbers – for example, $3 + 5$ can be seen as 3 jumps of 1 then 5 jumps of 1 like this:

![Number line showing 3 jumps of 1 then 5 jumps of 1](image)

Counting on starting at 3 and counting 5

![Number line showing counting on from 3](image)

Repeat this for subtraction. Make sure that the students can read a number line properly and that they count the intervals and not the markers when they work with them.

Show them that counting on and back in groups can also give you the answers to multiplication and division problems. For example, what is 4 lots of 3?

![Number line showing 4 jumps of 3](image)

How many groups of 5 are there in 20?

![Number line showing counting back by 5](image)

Number lines are very powerful models for learning addition and subtraction and students will use these methods throughout this year and extend them in later years to work with blank number lines to model more complex problems.
Using the Student Book and Workbook

Use Student Book page 16 to reinforce and consolidate counting and number patterns to 100. Encourage the students who find this difficult to use the 1 – 100 square on the page as an aid. Use Workbook page 15 to check that students are able to count in groups and work confidently with numbers to 100. Use Workbook page 16 as a fun activity. Let the students complete it on their own.

Once you have some work relating counting on and back to addition and subtraction, work through Student Book page 18 with the class. Check the answers to each section before moving on to make sure that the students understand the concepts. Use Workbook page 17 to reinforce ideas of 1 more and less, 10 more and less and 100 more and less. Check that the students know how to work with input and output flow diagrams before they start.

Student Book page extends counting patterns to 1000. Let the students work independently to complete the activities. Encourage them to draw and use number lines if they struggle. Use Workbook page 18 to check that they are confident working in the larger number range.

Assessment questions to ask

- What number is [1/2/5/10/100] more than [a given number]?
- What number is [1/2/5/10/100] less than [a given number]?
- I have a number that is 100 less than [234], what is the number?
- What number comes next: 344, 346, 348 …? (and similar)
- What number is missing from this pattern? [provide a counting pattern]
- Look at this number line, what jumps are we counting in? [show a suitable number line marked in intervals]
- Count in hundreds from 455 till you pass 900.

You can also adapt any of the Student Book and Workbook questions for informal assessment purposes.

Common errors and misconceptions

Some students may struggle when they have to bridge multiples of 10 or 100. For example, when they get to 259, they may forget the next number is 260, similarly, when they have to count over the ‘hundreds’ they may get confused. It helps to count orally and to chant and recite the numbers on a regular basis. Remember, this number range is higher than the students are used to.

Some students get confused with 1, 10 and 100 more or less than a number because they don’t fully understand place value. Encourage them to use the 1–100 grid and also to show numbers on number lines and, if necessary to build them using arrow cards (to reinforce the place value of the increase or decrease.)
4 2D shapes and symmetry

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Student Book pp 20–23</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3Gs1</strong></td>
<td>Identify, describe and draw regular and irregular 2D shapes including pentagons, hexagons, octagons and semi-circles.</td>
</tr>
<tr>
<td><strong>3Gs2</strong></td>
<td>Classify 2D shapes according to the number of sides, vertices and right-angles.</td>
</tr>
<tr>
<td><strong>3Gs5</strong></td>
<td>Draw and complete 2D shapes with reflective symmetry and draw reflections of shapes (mirror line along one side).</td>
</tr>
<tr>
<td><strong>3Gs6</strong></td>
<td>Relate 2D shapes and 3D solids to drawings of them.</td>
</tr>
<tr>
<td><strong>3Gs7</strong></td>
<td>Identify 2D and 3D shapes, lines of symmetry and right angles in the environment.</td>
</tr>
</tbody>
</table>

Note angles are covered in Chapter 16.

Vocabulary

Triangle, square, rectangle, pentagon, hexagon, octagon, circle, semi-circle, sides, vertices, angles, symmetry, mirror line, axis of symmetry, reflection, right angles.

Resources needed

Large symmetrical shapes to display lines of symmetry (isosceles triangle, equilateral triangle, square, rectangle, pentagon, hexagon and octagon); mirrors; coloured paper or card; scissors, pin-boards (if possible, if not, dotted paper).

Mental warm-up activities

Select suitable activities from the mental warm-up activity bank. Students will not be doing any calculating in this chapter, so you might want to focus on calculation activities.

Concepts that may be unfamiliar in this chapter

Octagon and semi-circle

Students should be familiar with the names of most of the common 2D shapes and they have revised some of these when they dealt with the faces of solids. New terminology that is introduced this year includes the octagon and semi-circle. Note that the circle is not a polygon. Technically in mathematics it is defined as a set of points that are all the same distance from a central point, but at this level, we define it simply by saying it is a round shape with no straight edges and no vertices.
Completing shapes about a line of symmetry and drawing reflections of shapes

Previously students were expected to identify shapes and patterns that were symmetrical and to draw in the lines of symmetry. Now they are expected to build on their understanding to visualise and then draw the ‘other half’ of a symmetrical shape and/or pattern. Some students will struggle to visualise this, and you may need to let them use mirrors to find the reflection or to trace the shapes and fold them to find the other half. This work will help them in later years when they deal with transformations more formally.

Teaching ideas

Practical activities

It may be useful to play a game of shape dominoes to revise the basic shapes and their correct names before you start teaching this unit. Here is a possible set of dominoes:
To play, arrange the students in groups of four; shuffle the domino card and deal 7 to each student. They then take turns to play, matching either a shape to its name or a name to its picture (as they would with ordinary dominoes). You can set rules for starting – for example, the students whose name starts with the earliest alphabet letter should start).

You can also revise and reinforce shape names using flashcards with the shapes on them. Show a shape and ask the students to name it, explaining how they decided that was the correct name (for example, it has four sides, all the sides are equal, so it is a square).

Spend some time sorting and classifying a range of flat shapes. Ask the students to find all the shapes with four sides, all the shapes with more than four sides and so on. Repeat the grouping activity you used for 3D shapes by asking the students to sort shapes into two groups, identifying the criteria used and then three or four groups.

Students can make a scrap book by sticking in pictures of flat shapes used in designs and patterns cut from magazines and other publications. Students should be asked to bring magazines into school prior to this activity.

Students can cut up one simple shape to make others. For example, a square can be cut to make four triangles; a rectangle can be cut to make a square and a smaller rectangle, etc.

Students cut out and use simple shapes (square, rectangle, triangle, circle) and use them to make compound shapes. Challenge each student to create a picture using only these shapes and use them as part of a display about shapes.

Students should cut out shapes in paper or card and explore whether they have any lines of symmetry by seeing if it is possible to fold one half of a shape exactly on top of the other.

Students work in pairs. One student constructs half a shape on a pin-board (or dotty paper) and the other student has to complete it so that it has a line of symmetry.

Students could use a mirror to draw shapes with one line of symmetry.

**Using the Student Book and Workbook**

Once you have done some revision and practical activities let the students work through Student Book page 20 to check that they remember the names of shapes and the terminology used to talk about them. Use the colouring activity on Workbook page 19 as a fun reinforcement of shape names.
Let students work on their own to complete Student Book page 21. Allow some time for them to draw and exchange shapes. Use Workbook page 20 to assess knowledge of shape names.

Work through Student Book page 22 with the class to check that they know the names of 2D shapes and that they are able to recognise their properties.

Introduce the concept of symmetry by pointing out things in the classroom which have lines of symmetry. Use a rectangular sheet of paper to demonstrate to students that, by folding the paper in half along its length, one half fits exactly on top of the other therefore the fold is along a line of symmetry. Repeat this by folding the paper along its width. It is also worthwhile showing students that folding the sheet along a diagonal produces two halves equal in size, but the fold is not along a line of symmetry as one half does not fit exactly on top of the other. Let the students complete the practical activities on Student Book page 23 to make sure they understand the concept. Use page 21 of the Workbook to assess that the learners can identify symmetrical shapes and draw a line of symmetry on a shape. The Workbook activity on page 22 should be used to teach the students to complete symmetrical shapes and patterns. This could be extended by cutting out multiple shapes using suitably folded newspapers.

Assessment questions to ask
- Name a shape which has six sides.
- Name a shape that has one straight side and one curved side.
- How could you group these shapes into sets? (Show the students a set of shapes as you ask this.) How do you decide if a shape fits into a set or not?
- How many sides/vertices does this shape have?
- Describe this shape to me.
- Where is the line of symmetry down your body?
- Name something else that has a line of symmetry.
- How many ways can you fold a rectangular sheet of paper exactly onto itself?
- How many lines of symmetry does a circle have?
- Which of these capital letters are symmetrical?

Common errors and misconceptions

Students may be confused by the difference between a square and a rectangle and should be reminded that a square is a special type of rectangle in which all of the sides are the same length.

Some students may be confused by the terminology of shapes. Regularly use and reinforce the correct terms by playing games that involve the students describing shapes or listening to descriptions to identify shapes.
Students should appreciate that a shape only has a line of symmetry if it can be folded along this line and one half of the shape fits exactly on top of the other. Some students are confused by lines drawn on some figures which divide them in equal halves, but are not lines of symmetry because one half doesn’t fit exactly on top of the other. Folding a rectangle along its diagonals is such an example.

5 Addition and subtraction

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Student Book pp 24–29</th>
</tr>
</thead>
<tbody>
<tr>
<td>3Nc1 Know addition and subtraction facts for all numbers to 20.</td>
<td>Workbook pp 23–27</td>
</tr>
<tr>
<td>3Nc2 Know the following addition and subtraction facts:</td>
<td></td>
</tr>
<tr>
<td>– Multiples of 100 with a total of 1000</td>
<td></td>
</tr>
<tr>
<td>– Multiples of 5 with a total of 100</td>
<td></td>
</tr>
<tr>
<td>3Nc11 Use the = sign to represent equality, e.g. 75 + 25 = 95 + 5</td>
<td></td>
</tr>
<tr>
<td>3Nc12 Add several small numbers.</td>
<td></td>
</tr>
<tr>
<td>3Nc16 Re-order and addition to help with the calculation, e.g. 41 + 54 by adding 40 to 54, then 1</td>
<td></td>
</tr>
</tbody>
</table>

Vocabulary

Add, subtract, count on, count back, addition, subtraction, sum, total, difference, left over.

Resources needed

Counters as necessary, 1–100 grids, number lines.

Mental warm-up activities

Select suitable activities from the mental warm-up activity bank or focus on adding and subtracting using the number chart and number lines.

Concepts that may be unfamiliar in this chapter

The concepts in this chapter should be familiar to students as they have previously learned number facts and worked with 10 and 100 more/less than a number. The aim here is to revise and consolidate facts, extend mental strategies and apply skills to work with larger numbers. The students may also begin to jump in larger steps along the number line when they add or subtract numbers. If you think they are ready for this, you should model it as you do examples with the class.
Teaching ideas

Practical activities

Spend some time reviewing the addition and subtraction facts that students are expected to know at this stage and remind them of the strategies they can use for adding and subtracting numbers mentally.

The students should know:

- Doubles facts to 20 (1 + 1, 2 + 2 etc)
- Plus one facts (counting on to find the number ‘after’)
- Facts for near doubles (numbers that are 1 apart), so for 5 + 6 think double 5 plus 1
- Plus 2 facts (skip counting in twos, for example 12 + 2 = 14
- Pairs that make 10 and 20 (bonds)

Use number strips, number lines and number tracks to assist with adding and subtracting.

Revise the use of the 1–100 number grid as a tool and method for carrying out addition and subtraction. Show students that each step down the number grid adds 10 and each step to the right adds one. Show them how to add two numbers by moving down and right across the grid. Show students that each step up the number grid takes 10 away and each step to the left takes one away. Show them how to subtract one number from another by moving up and left across the grid.

Play a memory game to reinforce number facts and equivalent forms of the same calculation. Make a set of cards with simple additions, subtractions and totals on them. For example these cards can be used to revise facts to 10.

```

<table>
<thead>
<tr>
<th>4 + 3</th>
<th>3 + 4</th>
<th>10 – 3</th>
<th>7</th>
<th>8 – 5</th>
<th>4 + 4</th>
<th>10 – 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>5 + 5</td>
<td>6 + 4</td>
<td>9 – 2</td>
<td>10 – 5</td>
<td>9 – 9</td>
<td>10 + 0</td>
<td>8 – 3</td>
</tr>
<tr>
<td>7 – 0</td>
<td>5 – 4</td>
<td>6 + 4</td>
<td>4 + 6</td>
<td>3 + 7</td>
<td>7 + 3</td>
<td>6 + 0</td>
</tr>
</tbody>
</table>
```

Cut these out, and shuffle them. Students play in small groups. The cards are all laid out face down and students take turns to turn over two cards. If they are equivalent, the student can remove them and score a point. If not, they turn the cards back over and the next student takes a turn. Continue till all the cards are turned over. Adapt the activity for numbers to 20 and groups of 3 or 4 small numbers.

Use two specially marked dice to play addition games for numbers to 20. Mark one die with the numbers 4, 5, 6, 7, 8 and 9, the other with 5, 6, 7, 8, 9 and 10. Students can roll these and see how quickly they can find the total. You can adapt this game to include subtraction by
marking the dice with the numbers 0 – 6 and 14 to 20 (or a similar range). Subtraction games must include the instruction to subtract the smaller number from the greater at this stage.

If it is appropriate, use small denomination local coins to make amounts to 20. Give an amount and ask how many more cents/pence you need to make 20. Say you had 20 and you dropped some coins, now you only have 13 cents, what is the value of the coins you dropped. Money is also a suitable context for teaching and reinforcing pairs of multiples of 5 that make 100.

**Using the Student Book and Workbook**

Once you have revised the basic number facts, let the students work on their own to complete Student Book page 24. Spend some time talking through the problem solving activity as a class.

Ask the students to work on their own to complete Workbook page 23. Observe them as they work to check that they know their number bonds to 20. Complete the tally activity as a class to reinforce counting in 5s. You may need to remind them how to tally before they do this.

Let the students work in pairs or small groups to complete Student Book page 25. Read through the worded problems with the class if necessary and make sure they understand them. Use Workbook page 24 to assess addition and subtraction. Activities like this with inputs and outputs are important as they lay the foundation for later work in algebra.

Work through the teaching activities on Student Book page 26 with the class. Point out that patterns are important and that recognising them can make it much easier to add and subtract numbers. You may also want to point out the students that addition to 100 and 1000 is particularly useful in the context of measurements before they work through activity 5.

Use the examples on Student Book page 27 and your own number line examples to show the students how to add multiples of 5 to make 100. Stress that $5 + 5 = 10$, and show them how to work this out using counting on in different intervals and how to re-order and partition the numbers to make the addition easier. Let the students complete the activities. Use Workbook page 25 as additional practise and reinforcement.

Discuss the methods shown on Student Book page 28 for adding several small numbers. Encourage the students to share their own methods as well and spend some time talking about what methods to use for different number combinations, stressing the value of making tens or twenties and adding pairs that ‘bond’ first. Students can then complete the sums. Use Workbook page 26 as additional practice.
Let the students work independently to complete the mental arithmetic timed trials on Student Book page 29 and Workbook page 27.

**Assessment questions to ask**

- What is 2 + 14? and so on.
- What is 20 – 8? and so on.
- What is the missing number in the calculation 9 + 8 = . . . ?
- What is the missing number in the calculation 16 – 5 = . . . ?
- What symbol is used for add?
- What is 20 take away 14?
- Find four numbers that add up to 16, and so on.
- Find four pairs of numbers with a difference of 5.
- Make up five addition/subtraction sums that have an answer of 10.
- I have [a multiple of 100], how much more do I need to make 1000?
- I’ve got 55 cents. How many more cents do I need to make 100?
- What is 100 less [multiple of 5]?

**Common errors and misconceptions**

Students will struggle if they cannot quickly recall basic addition and subtraction facts. Assist them to learn and memorise these by providing a range of activities to practice these on a regular basis.

Students sometimes have difficulty understanding what they are being asked in word problems. Some of the word problems on addition and subtraction should be discussed with the class and students should be shown how to extract the information needed to solve the problem from the information given.

### 6 Measuring length

<table>
<thead>
<tr>
<th>6: Measuring length</th>
<th><strong>Student Book</strong> pp 30–34</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
<td><strong>Workbook</strong> pp 28–29</td>
</tr>
<tr>
<td>3MI1</td>
<td>Choose and use appropriate units and equipment to estimate, measure and record measurements.</td>
</tr>
<tr>
<td>3MI4</td>
<td>Use a ruler to draw and measure lines to the nearest centimetre. Note mass and capacity are covered in chapters 10 and 14.</td>
</tr>
</tbody>
</table>
Vocabulary
Length, width, breadth, height, metre, centimetre, estimate, measure.

Resources needed
Metre stick or string, centimetre strips, rulers.

Mental warm-up activities
Choose suitable activities from the mental maths activity bank. You may want to focus on addition to 100 as you are dealing with cm and metres. This will also allow you to reinforce the work done in the previous chapter.

Concepts that may be unfamiliar in this chapter
Using a ruler to draw and measure lines in centimetres
You may need to spend some time teaching the students how to use their rulers properly and how to read the scales on them before asking them to draw and measure lines. Remind them that the markings on the ruler are a scale and that some divisions may be unmarked. Most school-type rulers will have centimetres marked and numbered and millimetre divisions shown, but un-numbered.

Standard units and the relationship between them
Although students began to use standard units of measure in Stage 2, this year they will formally learn about the metric system of measure and the place value relationships between units of length. The students can easily see the relationship between centimetres and metres if they use measuring tapes showing both units to find their heights and the lengths and/or height of longer items in the classroom. It is more difficult to show them the relationship between metres and kilometres, but you can teach this using examples such as the 10 000 metre race in athletics and distances from home to school.

Teaching ideas
Practical activities

- Reintroduce students to the metre as the unit of length and show them a metre stick. Give each student or group of students a metre stick and get them to measure various lengths, heights and widths. Distance should be expressed as ‘less than 1 m’, ‘between 1–2 m’ or ‘more than 2 m’.

- Students should estimate the length, width and height of the objects and then measure them using a metre stick. Answers need to be given to the nearest metre.

- Students should be given a piece of string 1 m long which they fold in half and cut into two equal pieces. Each piece of string will be $\frac{1}{2}$ m long. They should also be given a 30 cm ruler. The objects above should be re-measured to the nearest metre and half metre, and to the nearest metre and ruler length.
Challenge students to say why it might be difficult to measure lines that are not straight and how such lines can be measured. Show them how a piece of string can follow a curved line and then be held straight next to a metre rule to be measured.

Revise measurement in centimetres by discussing how to use a 10 cm strip or a ruler to measure accurately. Point out the scale and explain how measurements are taken by placing the zero at one point and reading the scale at the other. If bought rulers are used, instruct students to ignore the gradations between centimetre marks for the time being. All measurements should be taken to the nearest centimetre.

Students could use a ruler to measure the length of classroom objects in centimetres.

Students could draw polygons and measure the length of each of the sides in centimetres.

Students could use a strip of paper and a ruler to make a strip 2 m long, calibrated in centimetres, which can be used to measure students’ heights.

**Using the Student Book and Workbook**

Let the students work in pairs to complete Student Book page 30. Make sure they are able to use the metre measure to measure linear length.

Let the students work in pairs or small groups to complete the practical measuring activities on Student Book page 31. They should use Workbook page 28 to record their results. Encourage them to estimate before they measure.

Let the students work on their own with a ruler to measure the lines on Student Book page 32. Once they have done this, let them compare results with a partner and re-measure to resolve any differences.

Show the students how to measure compound distances like the stepped paths on Student Book page 33. This skill is important for later work on perimeter and area and on-going work with polygons. Let them work in pairs to measure, check and calculate each length. Let them complete the drawing activity (question 3) independently to make sure they are all able to do this. Consolidate and assess this lesson by working through Workbook page 29.

Extend work on centimetres to measurements to the closest centimetre by working through Student Book page 34 with the class.
Assessment questions to ask

- How many metres high is a door?
- If a piece of string 1 m long is cut into two equal pieces, how long is each new piece?
- What are the symbols for the metre and the centimetre?
- How many centimetres tall is your book?
- Draw a line 9 cm long.
- How many centimetres are equal to 1 m 20 cm?
- Wire 2 m 35 cm long was cut from a 5 m roll. How much wire was left?

Common errors and misconceptions

Students may find it very difficult to make realistic estimates of distance. Suggest that they have some reference which they can use when they are estimating. For example, the height of their book is about 20 cm, so 5 books laid end to end measure about 1 m.

Some students may be confused about how many centimetres are equal to one metre. In their work on weight and capacity they learn that there are 1000 g in 1 kg, and 1000 ml in 1 litre respectively, so they may fall into the trap of thinking that there are 1000 cm in 1 m. It is probably better not to go into explanations about millimetres as this will simply add to the confusion, rather keep pointing out that a metre is divided into 100 centimetres.

If students are using plastic or wooden rulers, they should be aware that the rulers may be slightly longer than its scale. For example, on a 30 cm ruler there are a few millimetres of ruler at either end of the scale. If this end part is included in a compound measure, the result will not be accurate. Similarly, if the students begin to measure from the edge of a rule and not from the 0 cm marking, their results will not be accurate.

7 Rounding and estimating

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Student Book pp 35–38</th>
<th>Workbook pp 30–31</th>
</tr>
</thead>
<tbody>
<tr>
<td>3Nn8</td>
<td>Round two-digit numbers to the nearest 10 and round three-digit numbers to the nearest 100.</td>
<td></td>
</tr>
<tr>
<td>3Nn13</td>
<td>Give a sensible estimate of a number as a range (e.g. 30 to 50) by grouping in tens.</td>
<td></td>
</tr>
</tbody>
</table>
Vocabulary
Place value, digit, unit, ten, hundred, round up, round down, estimate.

Resources needed
Small stones or beans for each group for estimating, large number lines to show position of different numbers to be rounded; jars of small objects (such as beans); sheets of shapes/objects for estimation or counting.

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

Concepts that may be unfamiliar in this chapter
Rounding to the nearest 100
Students have previously rounded two-digit numbers to the nearest ten. Now they will round three digit numbers to the nearest 100. Note that they are not required to round three-digit numbers to the nearest ten at this stage. It is far better to consolidate the ideas of rounding to a particular place than to confuse students by adding too many options to this.

Giving an estimate as a range
Previously students were expected to choose a sensible estimate (up to 100). Now they are going to extend their skills to give an estimate of their own within a reasonable range. For example, to say that there are between 20 and 30 sweets in a jar. To do this, the students need to mentally group the items in tens and count up to get an estimate.

Teaching ideas

Practical activities
Prepare a number of ‘rounding to 10’ number tracks such as this one:

| 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |

Use this to show students that the numbers 41, 42, 43 and 44 are closer to 40 than to 50. Similarly, 46, 47, 48 and 49 are closer to 50 than to 40. Point out that 45 is in the middle. Remind them that mathematics relies on rules and that all over the world, the rule is that if the number ends in 5, it rounds up to the next place. So, 45 is considered to be closer to 50 than to 40. Point to various numbers on different number tracks and ask the students to say which is the closest ten. If you like, use some vertical tracks too.

Repeat the ‘nearest 10’ activity for the nearest hundred using tracks or number lines in intervals of 10. For example:

| 400 | 410 | 420 | 430 | 440 | 450 | 460 | 470 | 480 | 490 | 500 |
Again, remind them that 450 is considered to be closer to 500 than 400. So we round up to the next hundred for all numbers from 450 to 499.

Leads a class discussion about when people estimate and why it is not always important to have an exact number. Use newspaper headlines relating to people at sports events, number of sweets in a pack or distances as examples.

Grab a handful of small objects, such as stones or beans. Ask the students to say how many they think you have grabbed. Count out the beans in fives or tens to check the estimate and get an exact number. Grab another, different handful of the same objects. Ask the students how many they think you have this time. Introduce the idea of a range by showing that each time you grab you get a similar amount (say between 30 and 40 beans). If they estimate in the range, they are likely to be close each time. Let them experiment by making their own grabs and coming up with a range for their hand size.

Prepare sheets or slides with a large number of different dots or shapes, start with all the same size and colour, show the class and ask them to estimate how many there are (as a range). Remove the card after a few seconds so they cannot count to get an answer. Repeat this with two colours and two different sizes. Discuss how you could count in groups and/or sections to check the estimates.

Show class a pile of ten coins or counters. Leave this as a reference and then make some larger piles for them to estimate again as a range how many coins there are (again, without giving them the time to count them).

**Using the Student Book and Workbook**

- Once you have revised rounding to the nearest ten, let the students work independently to complete Student Book page 35.

- Teach the class how to round numbers to the closest hundred. Leave a number line on display to help them. Let the students work on their own to complete Student Book page 36 and Workbook page 30.

- Let the students work in groups to complete the practical estimating activity on Student Book page 37.

- Use Workbook page 31 to discuss how you can make a reasonable and fairly accurate estimate when you can see or work out how many objects there are in a row, column or area. Work through the example of the beans on Student Book page 38 to reinforce this and then let the students complete the activities.
Assessment questions to ask

- Round [a number] to the nearest ten.
- What is the nearest hundred to [a three-digit number]?
- Is 145 closer to 100 or 200? Why? [and similar]
- I grab between 20 and 30 beans in a handful. About how many will I have in two handfuls?
- Look at this sheet of shapes. Estimate how many there are. Tell me how you thought about this?
- When is it useful to estimate?
- When would an estimate not be good enough?

Common errors and misconceptions

Students may struggle to round numbers to a given place if their understanding of place value is shaky. Reinforce the ‘nearest ten’ and ‘nearest hundred’ using number lines. If students struggle to read the position of numbers when the number line is divided into intervals other than ones, spend some time showing them how to read the labels and work out the intervals before deciding which number it is. Physically move objects along the line to show them the distance between the number and the closest hundred (or ten) is shorter.

Young students may not be able to estimate accurately without a context. Give them lots of practise using real objects and let them count to check that their estimate was close (or not). They will improve with experience and exposure.
Vocabulary

Time, hours, minutes, seconds, analogue clock, long (minute) hand, short (hour) hand, digital clock, o’clock, half past the hour, quarter past the hour, quarter to the hour, a.m., p.m., five past/to, ten past/to, twenty past/to, twenty-five past/to, January, February, March, April, May, June, July, August, September, October, November, December, month, week, year.

Resources needed

Analogue clock and digital clock, both large enough for display purposes; calendar large enough to display.

Mental warm-up activities

Select suitable activities from the mental maths activity bank.

Concepts that may be unfamiliar in this chapter

Time to the nearest minute

Students have previous only worked with time to the nearest half hour. However, they are likely to have a good sense of time and be able to tell time on digital clocks as these are so common.

Calculate time intervals in hours and minutes

Last year, students measured time intervals in seconds and minutes, now they will begin to work in more abstract terms to calculate longer time intervals in hours and minutes. The school day is a good context for teaching this in a meaningful way. Use clock faces and/or time lines to show the intervals between school starting and ending, school starting and first break, maths lesson and the next lesson and so on.

Read a calendar and calculate time intervals in weeks or days

This is the first time students will be formally expected to work with a calendar although they should have seen these at home and school. Spend some time showing the class different versions of calendars and let them talk about how they are set out and the information they provide. Make sure they understand what abbreviations used on calendars mean and be aware that some calendars may show two dates on the same day when a month ends with just one day left over.

Teaching ideas

Practical activities

Students can work in pairs. One student says a time and the other student has to move the hands on a clock face to show the time on the hour, half hour, quarter past the hour and quarter to the hour. Alternatively, one student sets the time on a clock face and the other student has to say the time.
Students work in pairs using a digital clock. One says the time and the other sets the display using a 12 h display option.

Point out to students that the hour hand on an analogue clock goes around twice during the course of a day; once between midnight and midday, and once between midday and midnight. Ask students what problem arises when telling the time. Each time is repeated so we need some way of telling the difference between say, 3 o’clock in the night and 3 o’clock in the afternoon. Introduce a.m. and p.m.

Point out to students that the face of an analogue clock is divided into 12 and since there are 60 minutes in an hour, each division corresponds to 5 minutes. Demonstrate the positions of the hands of a clock at five past the hour, ten past the hour, quarter past the hour, twenty past the hour, twenty-five past the hour and half past the hour. When you are happy that students have understood, continue by demonstrating twenty-five to the hour, twenty to the hour, quarter to the hour, ten to the hour and five to the hour.

Using the Student Book and Workbook

Let the students work in pairs to complete Workbook page 32. Once they have worked with and ordered times in minutes, let them work through Student Book page 39.

Let the students work independently through Student Book page 40 and Workbook pages 33-34. If they struggle, repeat some of the practical activities to teach them how to tell time.

Let the students complete Student Book page 41 in pairs or small groups. Once you have checked the answers, let them complete the practical activity on Workbook page 35.

Let students work though Student Book page 42 on their own. Assess their understanding before asking them to complete Workbook page 36.

Discuss the worded problems on Student Book page 43 with the class and let students suggest how to solve each one before asking the students to complete the page in pairs.

Assessment questions to ask

- What time is it on a clock when the big hand points to 12 and the little hand points to 3?
- What time is it when the clock reads 10:30?
- When the time is 04:15, is it a quarter past four or a quarter to four?
- Is 8 a.m. 8 o’clock in the morning or 8 o’clock in the evening?
- What time is it on a clock when the little hand points to between 1 and 2 and the big hand points to 5?
• When the time is 08:35, is it twenty-five past eight or twenty-five to nine?
• School starts at 8.15. Lunch is at 12 o’clock. How many hours and
  minutes pass from the start of school to lunchtime? (and similar)
• Which month comes between June and August?
• How many days is it from [date] to [date]?
• How many weeks is it till the school holidays start? (and similar)

Common errors and misconceptions

Some students may own digital watches and may be able to tell the time
correctly using them. Do not assume that they can tell the time equally well
using an analogue clock. The ability to interpret the positions of the hands
on an analogue clock is a different skill from reading a digital display.

Students often have trouble remembering the number of days in the
different months of the year. They should use the following rhyme to
remind them:

‘30 days have September,
April, June and November;
all the rest have 31,
excepting February alone;
which has 28 days clear
and 29 in each leap year.’

9 Multiplication and division

<table>
<thead>
<tr>
<th>9: Multiplication and division</th>
<th>Student Book pp 56–63</th>
<th>Workbook pp 34–37</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3Nc3</td>
<td>Know multiplication/division facts for $2 \times$, $3 \times$, $5 \times$ and $10 \times$ tables.</td>
<td></td>
</tr>
<tr>
<td>3Nc4</td>
<td>Begin to know $4 \times$ table.</td>
<td></td>
</tr>
<tr>
<td>3Nc5</td>
<td>Recognise two-and three-digit multiples of 2, 5 and 10.</td>
<td></td>
</tr>
<tr>
<td>3Nc6</td>
<td>Work out quickly the doubles of numbers 1 to 20 and derive the related halves.</td>
<td></td>
</tr>
<tr>
<td>3Nc21</td>
<td>Multiply single-digit numbers and divide two-digit numbers by 2, 3, 4, 5, 6, 9 and 10.</td>
<td></td>
</tr>
<tr>
<td>3Nc25</td>
<td>Understand and apply the idea that multiplication is commutative.</td>
<td></td>
</tr>
<tr>
<td>3Nc26</td>
<td>Understand the relationship between multiplication and division and write connected facts. Note division is handled in more detail in chapter 11.</td>
<td></td>
</tr>
</tbody>
</table>
Vocabulary
Times, times-tables, multiple, divide, inverse operation.

Resources needed
Number lines and number tracks, times-table fans, multiplication grids, cards or objects grouped in similar amounts to demonstrate repeated addition.

Mental warm-up activities
Select suitable activities from the mental maths activity bank or play games and do activities related to learning the times tables.

Concepts that may be unfamiliar in this topic
Times tables facts and importance of knowing these
It is crucial that students learn their times tables facts and that they can recall these automatically within 2–3 seconds. They will use these facts over and over as they perform calculation in this, and later stages. Students need to understand how the facts are derived and also to recognise the patterns in the tables as well as learn them. Use a range of different activities (such as those in the Student Book and Workbook and Mental Warm-ups Activity Bank) to teach and reinforce tables rather than just reciting them.

Connecting multiplication and division
As students learn their tables, it is important for them to recognise that knowing a multiplication fact also gives them two division facts. Teach them to ask the question: What times four gives me 36? (for example) and show them that knowing $4 \times 9$ means they can answer $36 \div 4$. This is a fundamental concept but some students will not automatically make the connection if you do not point it out and reinforce it.

Teaching ideas
Practical activities

 Students arrange beans (counters etc.) in pairs. They add up the number of beans in one pair, two pairs, etc.

 Students arrange beans (counters etc.) in sets of three, four and five. They add up the number of beans in one set, two sets, etc.

 Show the students pictures of grouped objects (a pair of socks, a three-wheeled tricycle, an ox with four legs and a pack with five lollies in it). Let them say how many socks, wheels, legs, lollies, etc. there would be if each student in their group had one of the objects shown.

 Let them explain how they worked this out.

 Students experiment with beads to prove to themselves that two sets of four contain the same as four sets of two. They should think of other examples like this using their 2, 3, 4 and 5 times tables.
Students in pairs test each other on times tables up to 5. Students could use multiplication tables and/or times table fans to test themselves or other students on their tables.

Arrange a ‘times table’ competition by dividing students into teams of 4 or 5. Ask the students to write questions that they then use to test other teams.

Put students in groups of five. Hand out the same number of counters to each student. Let them skip count to find out how many counters there are altogether. They can record their results in a table like this one:

<table>
<thead>
<tr>
<th>No of Students</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of counters</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Vary the amounts of counters to develop the concept of repeated addition and multiplication for the tables you are teaching.

Ask students to name things that come in threes, like wheels on a tricycle. Get students to make ten groups of three using counters. Ask the class how many counters are in one group of 3, two groups of 3, etc. Write the total down on the board each time. Ask students to explain the pattern. Reinforce the pattern obtained by counting in threes using a number line. Show students that, starting at zero and jumping 3 each time, they get the same pattern of numbers as when they added the sets of 3 together. Summarise the 3 times table with a whole-class session. Show students that 2 groups of 3 can be written as $2 \times 3$ etc. Identify ‘×’ as the sign we use for multiplication. Repeat this for other tables, and groups of four as needed.

Using the Student Book and Workbook

Work through Student Book page 44 and Workbook page 37 with the class to revise what they already know and to assess how well they know their tables before you move on.

Work through Workbook page 38. The colouring and patterning activities are very useful for revising and consolidating the facts that students already know. Once they have completed the activities, they can use their patterns to help them find answers if they don’t remember the facts. Once they have done this, let them work in pairs to complete Student Book page 45. Pay attention to how well they can translate written statements into mathematical sentences.
Teach the class about multiples and point out and discuss the patterns made by multiples of 2, 5 and 10 using Student Book page 46. Let the students work in pairs to complete the activities on that page. Use Workbook page 39 to check that the students can identify multiples.

Let the students work independently to complete Student Book page 47. Use Workbook page 40 to assess how well they know their multiplication and division facts and patterns for the three times table.

After doing some practical activities on multiplying by 4, let the students work in pairs to complete Student Book page 48. Use Workbook page 41 as a mixed exercise to check general table knowledge.

**Assessment questions to ask**

- What is 2 times, 3 times, 4 times, 5 times or 10 times a number?
- How many are there in 4 groups of 2?
- What are 3 sevens?
- Starting on 16 and making 3 jumps of 4 along a number line, what numbers do you land on?
- How many groups of 5 are needed to make 30?
- How else can 4 sixes be written?
- If one mango costs $6, how much will 8 mangos cost?

**Common errors and misconceptions**

It is essential that students are familiar with their times tables. Rote learning of tables at this stage will provide students with a resource that will be useful for the rest of their lives. If tables are neglected at this stage, students will be hindered in their progress later in their mathematics course.

## 10 Measuring mass

<table>
<thead>
<tr>
<th>10: Measuring mass</th>
<th>Student Book pp 49–52</th>
<th>Workbook pp 42–43</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3Ml1</td>
<td>Choose and use appropriate units and equipment to estimate, measure and record measurements.</td>
<td></td>
</tr>
<tr>
<td>3Ml2</td>
<td>Know the relationship between kilometres and metres, metres and centimetres, kilograms and grams, litres and millilitres.</td>
<td></td>
</tr>
<tr>
<td>3Ml3</td>
<td>Read to the nearest division or half division, use scales that are numbered or partially numbered.</td>
<td></td>
</tr>
<tr>
<td>3Ml5</td>
<td>Solve word problems involving measures. Capacity is covered in chapter 14.</td>
<td></td>
</tr>
</tbody>
</table>
**Vocabulary**

Weight, weigh, kilogram, gram, balance, scale, interval.

**Resources needed**

Balance or shop scales (a simple balance can be made with a coat hanger), sand, bags large enough to hold 1 kg of sand, kitchen scale calibrated in kilograms, 2 kg bag of flour or rice, a variety of objects for weighing, weighs more/weighs less spinner.

Note, the correct terminology for ‘weights’ in kilograms is mass. However, as we use the word ‘weight’ in everyday language to talk about the mass of objects, we have used that term consistently in this chapter.

**Mental warm-up activities**

Select a range of suitable mental warm-ups from the mental maths activity bank.

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

**Relationship between kilograms and grams**

As with length, the students need to learn that there is a decimal relationship between units of mass. At this stage, they only work with kilograms and grams and they need to understand that there are 1000 grams in a kilogram. They should also realise that 500 g is equivalent to half a kilogram. Students do not need to multiply and divide by 1000 at this stage, so they will not work with conversions between units beyond expressing mass in different ways.

**Reading scales**

Some students may not be familiar with measuring scales and may still struggle to read them or to work out what the intervals are. You may need to spend some time teaching them how to do this before you ask them to read and record measurements.

**Solving worded problems involving measures**

The concept of a worded problem is not new to the students, but they may forget to include units (or even to consider units) when they have to solve problems related to measures. Discuss problems with the class and talk about what is being asked to help them see the importance of including units in answers.

**Teaching ideas**

**Practical activities**

It is useful to introduce this unit with a ‘hefting’ activity. Hefting simply means holding things up to compare or guess their weight. Give the students a plastic bag with a 1 kilogram object in it (sugar or flour or a 1 litre plastic bottle filled with sand or water). Let them hold this in one hand and pick up items in the other hand. They should compare the mass and say whether each item hefted is ‘less than’, ‘more or less equal to’, or ‘more than’ 1 kilogram.
Students can make a simple balance by attaching a bag to each end of a coat hanger, using bulldog clips, and suspending the coat hanger from a hook or nail. A coat hanger balance must be suspended away from the wall so it is free-moving.

Students should estimate the weights of a group of objects and then use 1 kg, $\frac{1}{2}$ kg and $\frac{3}{4}$ kg weights to check the accuracy of their estimates. Objects should be ordered in terms of increasing weight.

Students can work in pairs with a ‘weighs more/less’ spinner. One student chooses an object and spins; the second student has to identify an object that weighs more or weighs less than the other Student’s object. This can be verified using a balance.

Students should use a kitchen scale which is calibrated in kilograms to weigh some objects. Spend time talking about how you read the scale and what the divisions mean.

Using the Student Book and Workbook

Student Book page 49 is a practical weighing activity. The items weighed will depend on the resources and type of balance available.

Once you have done some practical work with scales and the divisions on them, work though the teaching example on Student Book page 50 with the class. Let the students work independently to complete the activities.

Make sure the students can read a scale before working through Student Book page 51 as a class. Spend time making sure the students understand how to read mass from a calibrated scale. Use Workbook page 42 to assess that they can read a scale.

Let them work with a partner to complete the practical activity involving their own mass on Student Book page 52. Read through the worded problem and discuss what is required before asking the students to solve it. Complete Workbook page 43 as additional practice in reading scales.

Assessment questions to ask

- What does ‘kg’ stand for?
- Arrange the following in increasing order of weight: $1\frac{1}{2}$ kg, $2\frac{1}{4}$ kg, 1 kg, 2 kg, $\frac{1}{2}$ kg.
- How many 500 g packets of butter have the same weight as a 1 kg packet?
- If a 1 kg block of cheese is cut into four equal pieces, what is the weight of each piece?
• Arrange the following in increasing order of weight: 3$\frac{1}{2}$ kg, 2$\frac{1}{4}$ kg, 4 kg, 2$\frac{1}{2}$ kg, $\frac{3}{5}$ kg.
• How many $\frac{1}{4}$ kg packets of beans have the same weight as a 2 kg packet?

Common errors and misconceptions
The word ‘kilogram’ is often contracted to ‘kilo’ by shopkeepers. Make sure students understand this.

In some countries, both kilograms and pounds are in everyday use and may be a source of confusion for some students. Explain that there are different units and that the metric system uses kilograms and grams. (The only countries who officially use the Imperial system of weights and measures are the USA, Myanmar and Liberia, all other countries have adopted the metric system although imperial measures are often used informally.)

11 Division

<table>
<thead>
<tr>
<th>11: Division</th>
<th>Student Book pp 53–57 Workbook pp 45–46</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives</td>
<td></td>
</tr>
<tr>
<td>3Nc3</td>
<td>Know multiplication/division facts for 2x, 3x, 5x and 10x tables.</td>
</tr>
<tr>
<td>3Nc21</td>
<td>Multiply single-digit numbers and divide two-digit numbers by 2, 3, 4, 5, 6, 9 and 10</td>
</tr>
<tr>
<td>3Nc23</td>
<td>Begin to divide two-digit numbers just beyond 10x tables, e.g. 60 ÷ 5, 33 ÷ 3</td>
</tr>
<tr>
<td>3Nc24</td>
<td>Understand that division can leave a remainder (initially as ‘some left over’).</td>
</tr>
<tr>
<td>3Nc26</td>
<td>Understand the relationship between multiplication and division and write connected facts</td>
</tr>
</tbody>
</table>

Vocabulary
Shared equally, sharing, groups, divide, division, remainder.

Resources needed
Number lines, beads, counters.

Mental warm-up activities
Choose suitable warm-up activities from the mental maths activity bank.
Concepts that may be unfamiliar in this chapter

Division facts

Students should know some division facts from earlier work on times tables. However, they may not have full mastery or recall of facts, so you need to continue to reinforce these. They will be dividing by all single digit numbers, so they also need to use strategies for dividing rather than just knowing facts.

Using a number line to divide

The concept of repeated subtraction is important for understanding division into equal groups. You may need to show students how to take away repeated groups using physical objects before or alongside work on the number line.

The concept of a remainder

As you progress, students will also work with repeated subtraction which leaves a remainder. This should be a fairly natural progression and the fact that you cannot take another group of the same size away shows clearly that there are some left over.

Teaching ideas

Practical activities

Students could explore different ways of dividing a number into equal sized sets. The numbers 12, 16, 24 and 36 will provide students with lots of different ways. Observe the students to see who still uses one-by-one sharing and who has moved onto grouping.

Students could use beans (counters) or a number line to find the number of sets of a particular size in a number. Using beans, they can simply arrange them into sets and count the number of sets. Using a number line, they start at the number and come down in jumps equal to the size of the set until they reach zero. The number of sets is equal to the number of jumps.

Students could divide different numbers of beans into sets of two and discover which left a remainder of one and which did not. From this they could identify a pattern of even and odd numbers.

Ask students to use beans (or counters) to discover how many different ways they could share 12 sweets out equally between 2, 3, 4 and 6 students. Write down their answers on the board and discuss them.

2 children get 6 sweets
3 children get 4 sweets
4 children get 3 sweets
6 children get 2 sweets.
Introduce the idea of dividing things into sets. Remind students of the different ways they were able to share 12 sweets equally and show them that:

- 12 is 2 sets of 6
- 12 is 3 sets of 4
- 12 is 4 sets of 3
- 12 is 6 sets of 2.

They should use beans to prove to themselves that this is true.

Use a number line to show how a number can be divided into sets of equal size. For example, start at 16 and come down in jumps of 4 to zero; since it requires 4 jumps, 4 sets can be made.

Remind students that we use the symbol ‘÷’ to represent division. Rewrite the different ways of sharing 12 equally using the ÷ sign.

- $12 ÷ 2 = 6$
- $12 ÷ 3 = 4$
- $12 ÷ 4 = 3$
- $12 ÷ 6 = 2$

Use a simple example to demonstrate to students that it is sometimes not possible to share equally and something may remain at the end of the sharing. For example, if we share 13 biscuits between 4 students they will each get 3 biscuits but there will be one biscuit remaining. Also, at this stage, introduce the term ‘divided into’ to mean the same as ‘shared equally among’. Division sentences can be written with both, for example ‘16 shared equally among 4’ can be written as ‘16 divided by 4’.

**Using the Student Book and Workbook**

Let the students complete Workbook page 44 independently before they work though Student Book page 53. Allow the students to use counters and concrete objects if they need to, but also encourage them to use know facts and number lines. Read through the worded problems with the class if necessary and make sure the students understand what they need to do.

Use Student Book page 54 to revise and consolidate division facts from times tables. Use Workbook page 45 to see whether the students can move confidently between multiplication and division and derive inverse operations from given facts/and or numbers.

Let the students complete the activities on Workbook page 46 and discuss the results before moving onto Student Book page 55. Give students a chance to explain how they worked out what was needed and how they worked to find the answers.
After some practical work involving number lines (including some divisions with a remainder), formalise the learning by having the students complete Student Book page 56.

Student Book page 57 moves the students beyond simple table facts to division of a larger number (just beyond table facts) by a single-digit number. Use number lines to teach the concept and reiterate earlier work on repeated subtraction. Bear in mind that the natural progression for students is to hop along the number in larger chunks. Some students may feel comfortable making a jump of 10 and counting two fives, while others will take a jump of 50 and count 10 fives. This is acceptable and should be encouraged as long as students understand and can express what they are doing.

Discuss the worded problems on Student Book page 58 with the class before asking the students to complete the activities on their own. Check the answers as a class and spend time discussing the strategies students used to find the answers.

**Assessment questions to ask**

- Six mangos are shared equally between three people. How many mangos does each person get?
- How many sets of 5 can be made from 10?
- There are 12 sweets in a bag. How many boys would get 2 sweets each if they were shared equally?
- What is the missing number in the following; $8 \div 2 = . . .$ ?
- Which of these numbers are even; 2, 5, 9, 11, 12?
- 6 buttons are shared equally into 2 groups. How many buttons are there in each group?
- 8 apples are shared equally between 4 people. How many apples does each person get?
- How many sweets would be needed so that when they were shared out between 5 people, each person got 2 sweets?
- If 14 cakes were shared equally between 4 children, how many cakes were left?

**Common errors and misconceptions**

The sign ‘/’ is commonly seen on calculators, computer keyboards and mobile phones. To avoid confusion in the future, if students ask about this, they should be told that the signs ‘/’ and ‘÷’ are used to represent the same thing.

Students sometimes have difficulty understanding what they are being asked in word problems. They should be shown how to extract the information needed to solve the problem from the information given.
12: Reading tables and diagrams

**Student Book** pp 59–61

**Workbook** pp 47–51

### Objectives

<table>
<thead>
<tr>
<th>3Dh1</th>
<th>Answer a real-life question by collecting, organising and interpreting data, e.g. investigating the population of mini-beasts in different environment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3Dh2</td>
<td>Use tally charts, frequency tables, pictograms (symbol representing one or two units) and bar charts (intervals labelled in ones or twos).</td>
</tr>
<tr>
<td>3Dh3</td>
<td>Use Venn or Carroll diagrams to sort data and objects using two criteria.</td>
</tr>
</tbody>
</table>

### Vocabulary

Table, row, column, totals, Venn diagram, overlap, intersect, shared, Carroll diagram, survey, rules.

### Resources needed

Large sheets of paper, chalk, rope, logic boxes for sorting, objects to sort (2D and 3D shapes are ideal for this), resources and instructions for survey if you are carrying one out.

### Mental warm-up activities

Select suitable activities from the mental maths activity bank.

### Concepts that may be unfamiliar in this chapter

**Sorting data using two criteria**

Students have previously sorted data using only criterion, for example, size, colour or shape. Now they are going to progress to classifying items according to two criteria. In most contexts this is not a problem for them. For example, the two-way table on Student Book page 59 sorts data by day and by student’s names. This is a familiar context, and the students are unlikely to struggle with it.

**Doing a survey**

This year, the students need to do their own investigation to answer a real life question. The example in the framework involves collecting data about populations (numbers) of mini-beasts. Some guidelines that may be useful
for this are given below. However, if it is not possible or desirable for you to investigate this particular topic, you may choose another one that is more suited to your environment and students. Some possible examples include:

- investigate which areas of the school are most popular with students during breaks
- investigate which day of the week your classmates like best
- investigate which colour is the favourite of most students in your class.

Mini-beasts are small living creatures without a backbone (invertebrates); the name mini-beasts is used because it allows you to talk about all these creatures without needing to use the correct terms (insects, arachnids, worms, etc). If the students are interested in this topic, you may like to extend it and do some classification activities (the science teacher will be able to assist with this).

The following mini-beasts are found in most places of the world.

- Slug
- Snail
- Locust
- Millipede
- Centipede
- Woodlouse
- Spider
- Beetle
- Earthworm
- Earwig
- Ant
- Bee
When you do an investigation, you will need to give clear instructions and spend some time preparing observation and recoding sheets. You will also need to make sure the students keep the data they collect (or keep it for them) so that they can use it later in the year to draw graphs.

**Teaching ideas**

**Practical activities**

Prepare a large chart, like the one below, either for the whole class or for groups of students. Let them complete the chart by filling in their own personal data. The data could include, name, gender, birth month, age, eye colour, hair colour, number of siblings, and so on.

Spend time examining the data on the chart to find coincidences and differences while teaching the words ‘table’, ‘row’ and ‘column’.

<table>
<thead>
<tr>
<th>Name</th>
<th>Boy or girl</th>
<th>Birth month</th>
<th>Age in years</th>
<th>Eye colour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ask the students to collect examples of tables from magazines and newspapers. Use these to make a class display. Focus on the idea that a table presents information in rows and columns and that the headings for each column tell you what is in it. Do not worry too much about the actual content of the tables, as much of it will be at an inappropriate level.

Set up two large intersecting circles in the school grounds using chalk or rope to make the circles. Sort the students into the circles or intersection using particular characteristics. For example, those wearing red or those wearing blue (you will need to identify characteristics that suit your class). Let the students work out what
criteria you are using to sort them, and discuss which students should go into the overlapping or intersecting parts of the circles (those wearing both red and blue). Let them draw their own diagrams to represent the sorting.

Prepare large blank Carroll diagram outlines for each group. Give them objects (cubes or shapes) and let them sort these correctly in the blocks on their template. Again, you can let them draw their own diagrams to record the sorting.

**Using the Student Book and Workbook**

- Use Workbook page 47 to check that the students are able to sort data into a table using one attribute.

- Work through the questions on Student Book page 59 as a class orally before letting the students complete the activity on their own. Give them some time to draw up their own table. Remember they will need to record their own TV viewing time for the week before you return to this as a class.

- If you are doing an investigation into mini-beast populations you can use Workbook page 48 as an introduction and data collection sheet. If not, you will need to develop a similar sheet for the students based on the actual investigation you want them to do.

- After you have done some work on Venn diagrams, let the students complete the activities on Student Book page 60. Give them some time to do the survey and to record their results. Use Workbook page 49 to check that they understand the concepts.

- Work through Student Book page 61 as a class orally before allowing the students to work through it in pairs. Give them some time to carry out the survey and to record their results. Use Workbook pages 50 and 51 to further develop the ideas taught in this lesson.

**Assessment questions to ask**

Any questions that involve finding the answer in a table, Venn diagram or Carroll diagram can be used. The questions will need to relate to the content of a table or diagram.

**Common errors and misconceptions**

Students may have difficulty distinguishing columns from rows. When you make and display tables, you may find it useful to add flashcard labels and arrows to indicate which is a column and which is a row.

Young students may struggle with the idea of triangle and not triangle (or banana and not banana). Make sure you give them plenty of oral practice with identifying items that are (one thing) and that are not (one thing). For example, you may want to hold up a range of writing materials and get the students to say whether each item is a pencil or not a pencil.
13 Fractions

<table>
<thead>
<tr>
<th>Objectives</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3Nn15</strong></td>
<td>Understand and use fraction notation recognising that fractions are several parts of one whole, e.g. ( \frac{3}{4} ) is three quarters and ( \frac{2}{3} ) is two thirds.</td>
</tr>
<tr>
<td><strong>3Nn16</strong></td>
<td>Recognise equivalence between ( \frac{1}{2}, \frac{2}{4}, \frac{4}{8} ) and ( \frac{5}{10} ) using diagrams.</td>
</tr>
<tr>
<td><strong>3Nn19</strong></td>
<td>Begin to relate finding fractions to division.</td>
</tr>
<tr>
<td><strong>3Nn20</strong></td>
<td>Find halves, thirds, quarters and tenths of shapes and numbers (whole number answers).</td>
</tr>
</tbody>
</table>

**Vocabulary**

Fraction, half, third, quarter, fourth, fifth, sixth, tenth, more than, less than, equivalent.

**Resources**

Fraction chart, fraction cards, fraction dice, large coloured shapes divided into different fractions, counters, sticks, string.

**Mental warm-up activities**

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

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

**Wider range of fractions (different denominators)**

Students will extend their understanding of fractions by working with a larger range of fractions and also working with non-unit fractions.

**Equivalent fractions**

The idea that one fraction is equivalent to another fraction is introduced in practical terms in this stage. Spend time making sure the students understand this concept as it is fundamental to on-going work in fractions and algebra at higher levels. Concrete examples are useful – chocolate bars with different blocks, strips of paper divided into different sized parts and cubes or tiles can all be used to show equivalence.

**Finding fractions of amounts (fractions as division)**

Students need to understand that a fraction of an amount can be found by dividing the amount by the denominator. For example, to find \( \frac{1}{4} \) of an
amount, you can divide the whole amount by 4. At this level, the focus is on simple unit fractions, but there are some challenging examples included in the activities so that more able students can explore the idea that you can also find \( \frac{3}{4} \) of an amount by dividing it into four and then multiplying the quarter by 3 to find \( \frac{3}{4} \).

**Teaching ideas**

**Practical activities**

Discuss how something might be divided into parts. Using a simple shape, such as a circle or a square, show students how, by drawing a line, the shape can be divided into 2 parts in lots of different ways: some ways producing 2 equal parts and other ways producing 2 unequal parts. Repeat the procedure but, this time, draw two lines to show how the shape can be divided into 4 equal parts.

Introduce (or revise) the words that describe the parts formed when an object is divided:

- into 2 parts – halves
- into 3 parts – thirds
- into 4 parts – fourths or quarters
- into 5 parts – fifths
- into 10 parts – tenths

Focus on dividing objects into 2 or 4 equal parts. Ask students how they could divide a sheet of paper into 2 or 4 equal parts. Extend this idea by getting students to decide where a line or lines could be drawn that would divide their desk, the board, the classroom, etc. into 2 and 4 equal parts. Students can use counters to test if fractions are equivalent. For example, they can divide 12 into 3 equal parts of 4, and 6 equal parts of 2. They then find out how many parts of 2 are equal to one part of 4, and 2 parts of 4.

Students could fold a sheet of paper in half; they could cut other suitable objects in half, such as a piece of Plasticine, a slice of bread, a length of string, etc.

Students could be given a simple jigsaw in which a picture has been glued onto card and cut up into 2, 3, 4, 5, 6 or 10 equal parts. Making the jigsaw would give examples of the number of parts in the whole. Students could make jigsaws and exchange them with other students. You can use this activity to demonstrate equivalence as well, give students the same picture divided into different fractions and let them build half. They can then say how many pieces they put together to make half.

Divide a square into 4 equal parts. Demonstrate to students that 1 part is equal to 1 quarter (or fourth), 2 parts are equal to 2 quarters and that 3 parts are equal to 3 quarters. Ask them which of these fractions is the same as one half. Repeat this for other fractions as necessary.
Focus on dividing objects into 3 equal parts by demonstrating using a simple shape such as a circle or a square. Introduce sixths by showing students that when an object is divided into thirds, each third can be divided into 2 parts. The result is 6 parts or sixths. Ask students how many sixths are equal to one third, two thirds and three thirds.

Students could carry out a survey of how fractions are used in everyday life.

Using the Student Book and Workbook

Once you have dealt with the correct notation for fractions, have the students work though Student Book page 62 on their own. Encourage the students to tell their partners how they solved the problem and invite some students to share their ideas with the class. You can use Workbook page 52 either as an introductory or as a consolidation activity.

Student Book page 63 deals with fractions of shapes and fractions of groups. It encourages the students to translate information from worded sentences to fractions. Once they have completed the Student Book activities, have them work independently to colour the fractions on page 53 of the Workbook.

Student Book page 64 introduces the idea of equivalent fractions. Once you have taught the concept, let the students work either on their own or with a partner to complete the activities.

Student Book page 65 deals with halves of amounts. This is an important concept and you need to make sure the students are able to divide groups of objects into half before moving on to other fractions of amounts.

Student Book page 66 extends finding fractions of amounts. Work through the example with the class and remind them that they know the times tables facts for small numbers and that they can use these to find the fractions. Let students complete the activities independently. Use Workbook pages 53 and 54 as additional practise.

Use Student Book page 67 and Workbook page 55 to consolidate the work on unit fractions. These mixed examples will ensure that students can work with any unit fraction.

Assessment questions to ask

- How many halves make a whole?
- How many quarters make a whole?
- A pizza is divided into 5 equal parts; what fraction of the pizza is each part?
- Into how many equal parts must a bar of chocolate be broken so that a group of students could have one tenth each?
• Name another fraction that is equal to four sixths.
• How many tenths make a half?
• A pizza is divided into 6 equal parts; what fraction of the pizza is 2 parts?
• Is three fifths more than, less than or equivalent to one half?
• What is one quarter of 16? (and similar)

Common errors and misconceptions

Students may be confused by the words ‘quarter’ and ‘fourth’. They should be told that they mean exactly the same and are equally correct. ‘Fourth’ comes from the pattern of fractions third, fourth, fifth, sixth, etc., whereas ‘quarter’ is more commonly used in everyday language.

14 Measuring capacity

<table>
<thead>
<tr>
<th>14: Measuring capacity</th>
<th>Student Book pp 68–71</th>
<th>Workbook pp 56–57</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3Mi1</td>
<td>Choose and use appropriate units and equipment to estimate, measure and record measurements.</td>
<td></td>
</tr>
<tr>
<td>3Mi2</td>
<td>Know the relationship between kilometres and metres, metres and centimetres, kilograms and grams, litres and millilitres.</td>
<td></td>
</tr>
<tr>
<td>3Mi3</td>
<td>Read to the nearest division or half division, use scales that are numbered or partially numbered.</td>
<td></td>
</tr>
<tr>
<td>3Mi5</td>
<td>Solve word problems involving measures.</td>
<td></td>
</tr>
<tr>
<td>3Nc2</td>
<td>Know the following addition and subtraction facts – multiples of 100 with a total of 1000.</td>
<td></td>
</tr>
</tbody>
</table>

Vocabulary

Capacity, litre, half-litre, millilitre.

Resources

A variety of domestic containers such as drinks bottles of varying capacity which are marked with their capacity in litres or millilitres; containers such as cups, beakers, etc., which are not marked with their capacity; bowls; water or sand.
Mental warm-up activities

Select activities from the mental maths activity bank. You may like to choose some activities related to finding pairs of multiples of 100 with a total of 1000 at this stage to remind the students of these facts.

Concepts that may be unfamiliar in this chapter

Relationship between litres and millilitres

As with length and mass, students will need to work with standard units of capacity and understand the relationship between them. Capacity is similar to mass in that 1000 ml = 1 litre, so you can remind the students of that. (milli- is from the Latin word for thousand).

Reading scales

Students have now worked with measuring scales in length and mass. They need to apply what they know and use their skills to read measurements in litres and millilitres.

Teaching ideas

Practical activities

Prior to studying this unit, students should be asked to examine information labels on various containers at home and look for any mention of ‘litre’. Students can work in groups.

The students could estimate and find the capacities of various containers by filling one with water or sand using a 1 l container calibrated to $\frac{1}{2} l$ and $\frac{1}{4} l$.

Students could use a measuring jug, a 1-litre bottle and a permanent marker to make their own calibrated container.

Students could carry out a survey of the capacities of containers used for different products.

Prior to this unit, students should be asked to collect and bring to school a collection of drinks bottles. Students can work in groups. Each group should be given a 1-litre container, such as a carton, which has been calibrated to $\frac{1}{2} l$ and $\frac{1}{4} l$. Students should estimate the capacity of a container to the nearest $\frac{1}{4} l$ and then measure it.

Follow up this activity by asking students to comment on the accuracy with which they are able to measure capacity using this technique. Some of the bottles and containers may have held exactly $\frac{1}{2} l$, $\frac{1}{4} l$, but the chances are that the majority did not. Develop the idea of the need for a smaller unit or sub-unit of capacity, and introduce the millilitre. Tell students that there are 1000 ml in one litre and the symbol for the millilitre is ‘ml’. Use a calibrated container, such as a measuring jug, to demonstrate that 1 l = 1000 ml, $\frac{1}{2} l = 500$ ml and $\frac{1}{4} l = 250$ ml.
Students should work in groups to measure the capacity of various containers using calibrated containers. Let them record their results in different formats.

Using the Student Book and Workbook

Student Book page 68 involves homework and practical activities. Decide how you will manage this in the classroom. Once the students have done some practical measuring activities, let them work through Workbook page 56.

Spend time dealing with equivalent units before working through Student Book page 69 with the class. Let the students work in groups to discuss the problem solving activity. Share the solutions with the class. Once they have done this, let them work alone to complete Workbook page 57.

Work through Student Book page 70 with the class. Remind them that they have already done work like this in both length and mass.

Let the students work in pairs to complete Student Book page 71. Check their answers to assess how well they can work with capacity.

Assessment questions to ask

- Arrange the following in increasing order of capacity: 2\frac{1}{2} l, 1\frac{3}{4} l, 3\frac{1}{2} l, 4 l, 1\frac{1}{4} l.
- How many \( \frac{1}{2} l \) bottles of lemonade are needed to fill a 4 l bottle?
- 4 small bottles of cola hold the same amount as a 3 l bottle. How much cola is in a small bottle?
- Two different-sized bottles together hold 2 l of water. If one of the bottles holds 1\frac{1}{4} l, how much does the other bottle hold?
- How many millilitres in (give litres and fractions of a litre amounts)?
- What is 500 ml equivalent to in litres?

Common errors and misconceptions

Students may see a variety of capacity units used on the contents labels of containers: centilitres (cl), centimetres cubed (cm³) and decimetres cubed (dm³). No attempt should be made to explain them at this stage, as this will only lead to confusion. Students should be told that the litre is a large unit and that, for smaller quantities, a sub-unit, the millilitre, is used.
15 More adding and subtracting

<table>
<thead>
<tr>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>3Nc6</td>
</tr>
<tr>
<td>3Nc7</td>
</tr>
<tr>
<td>3Nc8</td>
</tr>
<tr>
<td>3Nc9</td>
</tr>
<tr>
<td>3Nc10</td>
</tr>
<tr>
<td>3Nc14</td>
</tr>
<tr>
<td>3Nc15</td>
</tr>
<tr>
<td>3Nc16</td>
</tr>
<tr>
<td>3Nc17</td>
</tr>
<tr>
<td>3Nc18</td>
</tr>
</tbody>
</table>

Vocabulary
Add, subtract, total, sum, difference, double, halve, multiple, re-order, partition, calculate.

Resources needed
Number lines and arrow cards.

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

Concepts that may be unfamiliar in this chapter
The concepts here are not fundamentally new, but the students need to work with larger numbers and also to extend their repertoire of strategies for adding and subtracting, using known facts, patterns, jottings and
partitioning and place value as they need to. It will be very useful for each student or each group of students to have a set of arrow cards to use to partition and combine numbers. If you have not already made sets, there are instructions for doing so on page 25 of this guide.

Teaching ideas

Practical activities

Revise place value in a two-digit and three-digit number. It is essential that students appreciate that a two-digit number consists of a number of tens and a number of units. Discuss some examples of two-digit numbers, emphasising the value of each digit. For example, in the number 58, the digit 5 represents 5 tens which are 50, and not simply 5. Repeat for three-digit numbers.

Throughout the day, look for opportunities to add or subtract numbers by asking questions such as:

‘Which groups of students could we put together to make a group of 12?’
‘There are two rulers on that table, five on that one, and six on that. How many rulers are out?’
What is double this amount of pencils?
I’ve got 20 crayons but I only need half of them, how much is that?
And so on.

Prepare a set of number cards to teach doubling. Write each number from 1 to 20 twice and hand out the cards. Let the students find their partner (the person with the matching card) and let them say the total of the two cards.

Play a game of ‘darts’ with the class. Prepare a game board with two concentric circles divided into sectors. Write multiples of 5 (< 100) on the sectors and explain that if you hit the inner circle you get double the points. Ask the class to say how many points you’d get for different ‘hits’. Play a game where you place two darts (both can be doubles, or one double and one single). Let the students say what the score is for each dart, and the total score. Discuss the strategies they use for doubling the numbers. Challenge them to find halves by asking questions such as ‘I scored a double and got 50 points, what number did my dart land on?’

Teach the class how to use a blank number line as a schematic aid for calculation. Show them how to mark only the numbers they need for the calculation. For example to add 25 and 38, they might draw a line and mark the 38. Then they would jump in groups to get to the total of 63. Show them that they can jump in different ways. For example:
They could jump in tens and partition the units to bridge 60 like this:

Or they could take two bigger jumps like this.

Do as many examples as you need to make sure the students understand this important concept. Repeat for subtraction as well.

Use arrow cards to demonstrate how to add numbers by partitioning them using place value and then adding hundreds, tens and units before putting them back together to find the total. This is an absolutely fundamental skill that the students must understand if they are to succeed at calculating. For example, you might show the class how to add 38 to 141 like this:

38 = 30 + 8  
141 = 100 + 40 + 1  
100 + 70 + 9  
179  

Let the students work in pairs with their own sets of arrow card to do a range of different calculations.

Display flow diagrams with different operations (double, halve, + 10, + 100, − 10, − 100, + 50 and so on). Select suitable inputs and let the students work out the outputs. Repeat this for a range of outputs and ask them to work out the inputs. This helps them to realise they need to use the inverse operation to find the input (in other words, they need to subtract if the operation is addition, and halve the number if the operation is doubling).

Using the Student Book and Workbook

Work through the doubling activities on Student Book page 72 with the class. Make sure they understand how the diagram work and how to reverse the operations to find halves of numbers. Let the students complete the activities and spend time discussing the strategies they used to find the answers.
Use number lines to model addition and subtraction of ten and show the class how to compensate and use the strategy to add 9 and 11. Let the students complete the activities on their own. If they struggle, prepare some additional exercises to reinforce the strategy.

Work through the examples on Student Book page 74 with the class. Allow for some discussion and demonstration of using larger jumps once the students have understood the concept. Let students complete the activity and then have them work through Workbook page 58 to reinforce the concept. Spend some time discussing how they made up their own patterns for the last example.

After you have done some practical activities on partitioning numbers using place value arrow cards and you are confident the students can use number lines to add and subtract, let them work independently through Student Book page 75 and Student Book page 76. Discuss strategies and answers with the class.

Remind students how to round numbers if necessary and show them how to use rounded numbers to estimate what the answer to a calculation will be. Explain that we often use estimating in real life contexts to work out for example if we have enough money, and that it is a very useful skill for mathematics and life. There is quite a lot of work on Student Book page 77 and Workbook page 59, so you may want to split it over two or more lessons.

Student Book page 78 involves working with two- and three-digit numbers in the same calculation, so students must be confident with place value before you tackle this page. Work through the examples to reiterate partitioning numbers but let the students use the methods they find easiest to do the calculations. Use Workbook page 60 as a check and consolidation. Bear in mind that students may use subtraction rather than addition to check the calculations. Remind them that they can do working or make jottings in their notebooks if there is not enough space in the workbook.

**Assessment questions to ask**

- What number has 2 hundreds, 8 tens and 7 units? (And similar)
- What is 25 add 13? (And similar)
- What is 78 add 19? (And similar)
- What is the sum of [any two numbers]?
- What is the difference between [any pair of two digit numbers]
- How many tens are in a hundred? (And similar)
- What is 123 add 46? (And similar)
- What is 39 take away 16? (And similar)
Common errors and misconceptions

Students may attempt to count on instead of recalling addition facts and using patterns to add multiples of ten and a hundred. You can address this by discussing methods, and also by doing lots of practice of addition facts and combinations. Encourage modelling using arrow cards and/or number lines as well as jotting down addition facts to assist as this often makes the connection clearer for the students.

16 Right angles

<table>
<thead>
<tr>
<th>16: Right angles</th>
<th>Student Book pp 79–80</th>
<th>Workbook pp 61–62</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3Gs2</td>
<td>Classify 2D shapes according to the number of sides, vertices and right angles.</td>
<td></td>
</tr>
<tr>
<td>3Gs8</td>
<td>Identify right angles in 2D shapes.</td>
<td></td>
</tr>
<tr>
<td>3Gp3</td>
<td>Use a set square to draw right angles.</td>
<td></td>
</tr>
<tr>
<td>3Gp4</td>
<td>Compare angles with a right angle and recognise that a straight line is equivalent to two right angles.</td>
<td></td>
</tr>
</tbody>
</table>

Vocabulary

Names of 2D shapes, right angle, set square, quarter turn.

Resources needed

Paper circles and scissors, set squares.

Mental warm-up activities

Select suitable activities from the mental maths activities bank.

Concepts that may be unfamiliar in this chapter

The concept of a right angle being a part of the shape (rather than a quarter turn)

Previously the students have considered right angles to be part of a turn. Now we expect them to identify these at the vertices of 2D shapes. You may need to spend some time working with shapes and showing the students how to use their own right angle measure to check whether the angle of a shape is equivalent to a right angle.
Using a set square to draw a right angle

A set square is a triangular ruler that has two edges which are perpendicular. They are used to draw and/or measure right angles. However, you will need to show the students how to use these to draw right angles. It is not as simple as just drawing ‘round the corner’ of the set square because many of these have a slight curve on the right angled corner where they come out of the mould. Show the students how to properly use a set square and a straight edge (ruler) to draw a right angle like this:

Teaching ideas

Practical activities

- Give the students a set of shapes with some right angles (squares, rectangles and right angled triangles). Show them how to tearing the corners off the right-angled shapes and put them along a ruler to show that two right angles make a straight line.

- Demonstrate how to make a right angle by folding a circle as shown on page 79 of the Student Book. Then let each student make his or her own right angle. Let them spend time using their right angle to assess whether angles are right-angled or not. Revise the terms ‘greater than’ and ‘smaller than’ as necessary.

- Spend some time teaching the students how to use a set square to measure and draw right angles. Let them try it out and make sure they can do this before moving on.

- Prepare a large Carroll diagram like this one for display.

<table>
<thead>
<tr>
<th>Has a right angle</th>
<th>Does not have a right angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has three sides</td>
<td></td>
</tr>
<tr>
<td>Does not have three sides</td>
<td></td>
</tr>
</tbody>
</table>

Show the students a range of 2D shapes, let them name each one and then decide where it should go in the Carroll diagram.
Using the Student Book and Workbook

Once you have made right angles, let the students work in pairs to complete Student Book page 79 and the shape activities on Workbook page 61.

Let the students work on their own to complete Student Book page 80. Use Workbook page 62 to check that they can identify and measure right angles and that they can name and classify 2D shapes based on the number of right angles they have.

Assessment questions to ask

- Is this a right angle? How do you know?
- How can you check whether this is a right angle?
- How many right angles does this shape have?
- What is a set square? Can you show me how to use it?

Common errors and misconceptions

Students may think that an angle is smaller than 90° if they cannot see the arms or if the arms are different lengths (as on a clock face). Make sure they understand that the amount of turn has nothing to do with the length of the arms. Demonstrate this by using cardboard strips of different lengths joined with a split pin as needed.

17 Working with money

17: Working with money  
**Student Book** pp 81–83  
**Workbook** pp 63–65

<table>
<thead>
<tr>
<th>Objectives</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3Mm1</td>
<td>Consolidate using money notation.</td>
</tr>
<tr>
<td>3Mm2</td>
<td>Use addition and subtraction facts with a total of 100 to find change.</td>
</tr>
<tr>
<td>3Nc2</td>
<td>Know the following addition and subtraction facts:</td>
</tr>
<tr>
<td></td>
<td>Multiples of 5 with a total of 100.</td>
</tr>
<tr>
<td>3Nc13</td>
<td>Find complements to 100, solving number equations such as 78 + [ ] = 100</td>
</tr>
</tbody>
</table>

**Vocabulary**

Money, cent, dollar, cost, change, plus local currency names.
Resources needed

Currency notes and coins for demonstration. You can use local currency for this but remind the class that the course books use dollars and cents as a convention.

Mental warm-up activities

Select suitable activities from the mental warm ups activities bank.

Concepts that may be unfamiliar in this chapter

There are no fundamentally new concepts in this chapter but students will be required to make the connection between addition and subtraction facts to 100 and the fact that money amounts less than a dollar (or other whole units) represent part of 100 cents (or other smaller units). Bear in mind that many children have quite a sophisticated understanding of money amounts and they are often able to work out how much things cost and how much change they should get without even thinking about the mathematics involved in this.

Calculating change by counting on

It is important to teach the students that they can count on from the cost of an item to the amount tendered (given) to find the change. For example, if an item costs 25 cents and they pay with a $1 note, they will get 75 cents change. Counting up prevents them getting confused by a subtraction like 1 − 25 at this stage.

Teaching activities

Practical activities

- Ask students to note down the cost of three articles that cost between $1 and $100 the next time they go shopping with their parents or guardians. Check how the students recorded the amounts and make class display of the different ways in which money amounts are written in everyday life.

- Remind students about the different denomination coins used locally. Students will be familiar with the $1, $5, $10 and $20 notes from earlier work and should be told if there are also $50, $100 or larger denomination notes.

- Students will be familiar with seeing prices written in figures from their everyday experience. However it is essential to stress the importance of placing the decimal point in the correct position and inserting a zero if the number of cents is less than 10. Let students work in pairs to practise writing sums of money. One student says an amount of money in words and the other writes it down in figures.
Use real coins if possible and give students lots of opportunities to work with complementary pairs to find 100.

**Using the Student Book and Workbook**

- Work through the examples on Student Book page 81 with the students to revise money notation. Let the students work on their own to complete the activities. Let the students complete Workbook page 63 on their own and then have them work in pairs to compare their answers.

- Revise addition and subtraction facts for multiples of 5 and 10 to make 100 and teach the students how to make 100 with any number by working through the examples on Student Book page 82. Encourage students to share how they work with money amounts. Remind students that $1.00 = 100 cents before they work through the activities. Use Workbook page 64 as a challenge to see how the students make each amount up to 100. Let them compare and discuss their answers.

- Student Book page 83 involves money amounts, but the calculations rely on the 5 and 10 times table facts. Let the students discuss the problems in pairs and then have them work on their own to solve the problems. Workbook page 65 involves doubling and halving using money amounts. Students should be able to complete it on their own.

**Assessment questions to ask**

- How is the amount five dollars and thirty-seven cents written in figures? (And similar)
- Can you read this price for me? (show students a price)
- How many more cents do I need to make 100 if I have (give an amount)?
- I paid for an item with $1 and got 35 c change, how much did the item cost? (And similar)

**Common errors and misconceptions**

When using figures to represent a sum of money in which the number of cents is in single figures, students sometimes forget to place a zero in front of the number of cents so, for example, three dollars and eight cents is written as $3.8, which is equivalent to $3.80 and not $3.08.

Some students may be careless in placing the decimal point when a sum of money is written in figures. They should be reminded that this is important and, for example, $3.45 is very different from $34.5.
18 Position and movement

<table>
<thead>
<tr>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>3Gp1</td>
</tr>
<tr>
<td>3Gp2</td>
</tr>
</tbody>
</table>

Vocabulary
Clockwise, anti-clockwise, position, block, grid, direction.

Resources needed
Card or labels for shelves or lockers.

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

Concepts that may be unfamiliar in this chapter
Position on a grid
The concept of coordinates to describe position will be new to the students. This work is important as it forms the basis for later work where the students will plot points on a graph given two coordinates and also for work in social studies where they have to find the position of place on a map using latitude and longitude. It is important to teach students from the outset to give the coordinate on the horizontal axis first. For this reason you will see that all the grids have the letters across the bottom and the numbers on the vertical axis. This will help students work correctly in higher grades when they use numerical systems and when they have to work with ordered (x, y) pairs in algebra.

Teaching ideas
Practical activities
Demonstrate clockwise and anti-clockwise movements. Show the students the direction in which the hands of the clock move. Use some practical activities giving the students practice in creating clockwise and anti-clockwise movement – walking, making arm circles, and so on.
Label the four walls of the classroom with the numbers 12, 3, 6 and 9 (as they’d appear on a clock-face). Let the students take turns to direct each other between the desks to a place they have marked.

They should give direction and distance; for example, ‘Turn a quarter turn clockwise and walk past three desks.’

If possible, label the shelves or lockers in the classroom (use Student Book page 85 as a reference) and have the students identify and point out various locations using the letters and numbers you have labelled.

Show the class a game board with coloured squares (chess or draughts) and place a counter on one square of the board. Let the students suggest how they could give the position of the square that the counter is on. This should lead into numbering the squares.

**Using the Student Book and Workbook**

Let the students work in groups (possibly in the hall or on the playground) to play the game on Student Book page 84.

Once students understand clockwise and anti-clockwise directions, let them work alone or in pairs to complete Workbook pages 66 and 67.

Use Student Book page 85 as a teaching page and work through it with the class. Once the students are able to locate position and give the coordinates of an item, let them work in pairs to complete Workbook pages 68 and 69. Let each pair check another pair’s completed grid.

**Assessment questions to ask**

- Where is the . . . ?
- What is in block A4 and so on?
- Which block is to the right of block (give example)? (And similar)
- In which block is the (named item)? (And similar)?

**Common errors and misconceptions**

Students, and many adults, may not be able to work out clockwise and anti-clockwise turns without physically modelling the direction. This is fine and you should allow students to do that if they need to.

Students may get mixed up when they have to find position on a grid. As you are only working with alpha-numeric grids, remind them that the letter comes first. If you work with numbered grids, you can teach them that you have to go across before you can go up or down, relate this to walking across a floor and climbing up or down a ladder.
19 Fractions and mixed numbers

<table>
<thead>
<tr>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>3Nn17 Recognise simple mixed fractions, e.g. 1(\frac{1}{2}) and 2(\frac{3}{4}).</td>
</tr>
<tr>
<td>3Nn18 Order simple or mixed fractions on a number line, e.g. using the knowledge that (\frac{1}{2}) comes half-way between (\frac{1}{4}) and (\frac{3}{4}) and that 1(\frac{1}{2}) comes half-way between 1 and 2.</td>
</tr>
</tbody>
</table>

**Vocabulary**

Fraction, mixed number, number line, half-way, between.

**Resources needed**

Examples of mixed numbers in real life (food if appropriate, for example, 1\(\frac{1}{2}\) biscuits; or containers filled with sand or stones (2\(\frac{1}{2}\) boxes or bags)).

**Mental warm-up activities**

Select suitable activities from the mental warm ups activity bank.

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

**Mixed numbers**

This is the first time students formally deal with mixed numbers. However, the actual concept of a mixed number should not be unfamiliar to them as they may have come across amounts such as 1\(\frac{1}{2}\) litres, size 4\(\frac{1}{2}\) shoes and 3\(\frac{1}{2}\) slices of bread.

**Teaching ideas**

**Practical activities**

Show the class some practical examples of mixed numbers from everyday life. Discuss what it means when you have one and half cakes, or 2 and a quarter litres. Write the fractions on the board and stress that each one is composed of a whole number and a part of the whole (the fraction) so it is called a mixed number.
Give the students a set of containers (such as egg boxes or yoghurt cups) that hold the same amount and ask them to model amounts such as three and a ½ cups of sand. Use equipment and items that are available in your environment.

Draw a large number line marked in single intervals and ask the students to show you where you would place various mixed numbers. If you want to be accurate, then divide the intervals between the numbers into halves, quarters or tenths and use suitable fractions for placement. If not, simply let the students estimate the fractional amounts at this stage.

Using the Student Book and Workbook

Use Student Book page 86 to reinforce the discussion you have had with students about mixed numbers. If they seem unsure, work through the activity orally with the class and then ask them to complete it in writing. Let them complete the shading activity on Workbook page 70 on their own to show that they understand the concept.

Let the students work independently to complete Student Book page 87 once you have done some teaching using number lines. Use Workbook pages 71 and 72 to consolidate this work.

Assessment questions to ask

• What mixed fraction is shown by this picture?
• How is a mixed fraction different to a common fraction?
• Can you shade \(3 \frac{1}{5}\) for me?
• Where would these mixed fractions go on this number line?
• What mixed fraction is shown by this arrow on the number line? How do you know that?

Common errors and misconceptions

Some students may still struggle to interpret the position of fractions and mixed number on a number line. It helps if you use pre-divided lines like the ones in the Workbook and to get students to count the intervals and say how many equal parts each interval has been divided into.
Objectives

<table>
<thead>
<tr>
<th>3Dh2</th>
<th>Use tally charts, frequency tables, pictograms (symbol representing one or two units) and bar charts (intervals labelled in ones or twos).</th>
</tr>
</thead>
<tbody>
<tr>
<td>3Dh3</td>
<td>Use Venn or Carroll diagrams to sort data and objects using two criteria.</td>
</tr>
</tbody>
</table>

**Vocabulary**

Pictogram, bar graph, data, more than, less than, same as, tally chart, frequency.

**Resources needed**

No specific resources are needed, but if you want students to draw their own graphs, you may like to provide them with squared graph paper to work on.

**Mental warm-up activities**

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

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

The concepts in this chapter will be familiar to the students. The idea of a bar chart is new although they may previously have used block graphs with a one-to-one correspondence and these are fairly similar. Bar charts differ in that they have a scale against which you read off the length of height of the bar (in other words, you don’t count the blocks). This year, the interval on the scale will be simple with scales labelled in ones or twos only.

**Teaching ideas**

**Practical activities**

Students could devise and carry out a survey of 10 members of the class. For example, they could ask each student to choose their favourite drink from a choice of four. The student could present their results with blocks or Cuisenaire rods using a simple key of one block representing one student.
Students should work in pairs. One student could make up and display the results of a survey with different scale factors using Cuisenaire rods or blocks and the other student must interpret the results.

Students could practise recording data on a tally chart from the results of a survey.

Students could devise and carry out a survey of all of the members of the class. They could record their data in the form of a tally chart and draw a bar graph using a suitable scale factor.

Using the Student Book and Workbook

Work through Student Book page 88 with the class to revise and expand their understanding of symbols and the use of a key. Once you have done this, let the students work independently to complete Workbook page 73. Then have them work in groups to do the survey on Student Book page 88. They should use Workbook page 74 to record their results and draw their own pictograms.

Remind the students what a Carroll diagram is and revise concepts as needed before letting them work through Student Book page 89 and Workbook page 75. Use Workbook page 76 to assess understanding of bar graphs.

Let the students work in groups to carry out the survey on Student Book page 90. They should record their results and draw their graphs on Workbook page 77.

Use Workbook page 78 as a final consolidation of data handling.

Assessment questions to ask

• What does (this symbol) represent?
• How could I show (a number) cones/cars/books? And so on.
• How can you tell from a bar graph which item is the most popular?
• In a bar graph, one block represents two objects. How many objects do four blocks represent?
• How do we add numbers up to five in a tally chart?

Common errors and misconceptions

This unit contains some difficult vocabulary. Students may become confused by terms like ‘data’, ‘frequency’ and ‘tally chart’. Unfamiliar terms should be introduced with care and fully explained.

Students should take care when interpreting bar graphs with a key of 1: more than 1. They need to be aware that they have to read the scale of the graph carefully to find out what each bar represents.
21 More multiplying and dividing

<table>
<thead>
<tr>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>3Nn7 Multiply two-digit numbers by 10 and understand the effect.</td>
</tr>
<tr>
<td>3Nn14 Find half of odd and even numbers to 40, using notation such as $13\frac{1}{2}$.</td>
</tr>
<tr>
<td>3Nc19 Understand the relationship between halving and doubling.</td>
</tr>
<tr>
<td>3Nc20 Understand the effect of multiplying two-digit numbers by 10.</td>
</tr>
<tr>
<td>3Nc22 Multiply teens numbers by 3 and 5.</td>
</tr>
</tbody>
</table>

Vocabulary
Multiply, halve, double, partition, teen number.

Resources needed
Number lines, arrow cards.

Concepts that may be unfamiliar in this chapter
The concepts of multiplying and dividing are not new although students will continue to develop their strategies to work with a higher number range. The main difference in this chapter is that the students will combine concepts such as halving a number and fractions (half of an odd number is in fact a mixed number) and partitioning tens and units to make calculating easier (in this case tens and units to multiply teen numbers by 3 and 5).

Teaching ideas
Practical activities
You can adapt any of the practical activities for multiplying and dividing on pages 79–80 to suit this chapter.

Using the Student Book and Workbook
Use Student Book page 91 to revise multiplication by 10 and discuss the effect that this has on the number using the place value table and examples in the book. Let the students work on their own to solve the problems. Observe them as they work to see who can multiply by ten mentally. Use Workbook page 79 to consolidate the concepts.
Remind the students how to partition numbers into tens and unit using arrow cards as necessary. Show them that they can use this to multiply ‘teen numbers’. Do some examples as a class before asking the students to complete Student Book page 92.

Revise doubling and halving using the examples on Student Book page 93 and let the students complete the activities on their own. Check they can do this before moving on.

Use the practical example on Student Book page 94 to teach the students how to half an odd number. Then have them work through the activities here and on Workbook page 80.

**Assessment questions to ask**

- What is ten times (a number)?
- Can you tell me what happens when you multiply a number by 10?
- What is $3 \times$ (any teen number)?
- What is $5 \times$ (any teen number)?
- What is half of (a number)?
- Why do we get a mixed number when we find half of an odd number?
- What is half of (any odd number)?
- Half of a number is $11\frac{1}{2}$. What is the number?

**Common errors and misconceptions**

Students may talk about ‘adding a 0’ when they multiply by ten (and parents may inadvertently reinforce this). Remind them that adding 0 doesn’t change a number, while multiplying by 10 makes it ten times greater and so we don’t say that we add 0, we say that the digits move one place to the left and we write a 0 as a place holder.