

# Numicon 5/NZ Year 6 Planning

The overviews and links in this document will help you to get the most out of your subscription to *Numicon Online NZ*.

You can follow *Numicon* as a complete teaching programme using the long-term plan provided here. Numicon 5 contains sufficient material to cover both your NZ Year 6 and NZ Year 7 teaching. This document contains NZ Year 6 planning guidance; a separate document is available for NZ Year 7.

You can also access the rich bank of activities and resources to supplement your teaching. Pick a topic on the long-term plan, click on it for details and to open it in the online handbook.

## Contents

[Click on a link below to go straight there!](#)

### Long-term plan

Page 2

This long-term plan shows you the recommended order for teaching the Numicon 5/NZ Year 6 Activity Groups over the school year. It includes links to the overview information for each Activity Group and links to open those activities in the online handbooks. Milestone markers on the plan take you to the skills and understanding children need to be secure in to help them progress.

Strand and Activity Group Number	Activity Group Title	Notes
Getting Started	Getting started with apparatus and imagery	
Numbers and the Number System 1	Working with numbers up to a million	
Numbers and the Number System 2	Exploring equivalence with fractions	
Numbers and the Number System 3	Understanding decimals	Activities 1–5 and 7–8 only Simplify activities 7–8 (tenths and hundredths only)
Geometry 1	Measuring angles	
Calculating 1	Developing fluency with adding and subtracting calculations and understanding inverse relationships	
Calculating 2	Strategies for bridging when adding and subtracting mentally	
<b>NPC Milestone 1</b>		

### Details for each unit of learning

Page 5

These are overviews for each Activity Group. They follow the order in the long-term plan and list every activity in the Activity Group. Log into your subscription to Numicon Online NZ first, then click on any activity to open it in the online handbook. When you're in the online handbook you can go to the Links tab and download the accompanying resources, including any Explorer Progress worksheets, photocopy masters or Explore More homework.

**Getting Started: Getting started with apparatus and imagery**

**Key mathematical ideas:** Patterns, adding, subtracting, multiplying, dividing, place value, mathematical thinking and reasoning

**Educational context:** This activity group helps children and teachers to become familiar with structured apparatus, including Numicon Shapes, number rods and base ten apparatus, and to make connections between the patterns and structures they see and their number ideas. Activities for the four calculating strands are also introduced.

**Building familiarity with the different apparatus will enable children to choose the resources they need to support them with their work in the rest of the Number, Pattern and Calculating 2 Tracking Resource Handbook. As children become more familiar with the different apparatus, encourage them to show their own and explain it. Once children are comfortable with the apparatus, ensure it is readily available and encourage them to select what they need for different activities. This activity group will give teachers valuable insights into children's mathematical understanding. This will help with initial assessment, which in turn may inform how teachers decide to group children. If children are not accustomed to working on co-ordinated activities some of their initial responses may be surprising. Encourage them to persevere and they develop the confidence to find things out for themselves. Children who have had limited or no previous experience using apparatus and imagery may need two or three days to explore these Getting Started activities before moving on to the Numbers and the Number System, Calculating, and Pattern and Algebra activity groups.**

**Learning opportunities**

- To connect Numicon Shapes, number rods and base ten apparatus with number ideas.
- To connect structured apparatus with numerals, number words and positions on a number line.
- To see and explain patterns in number relationships illustrated with structured apparatus.
- To describe number relationships using mathematical language.

**To revise the mathematical language for calculating operations:**

- To revise actions representing the symbols of arithmetic notation: +, −, ×, ÷, =.
- To revise use of 'is less/lower than' and 'is greater/higher than' symbols (< and >), respectively.
- To revise methods of adding, subtracting, multiplying and dividing.

**Terms for children to use**

number names to 100 and beyond, pattern, next, before, after, in between, ordinal number names (e.g. first, second, third), forms for comparing (e.g. small, smaller than, smaller, long, longer than, longest, few, fewer than, fewer, more than, less than, greater than), set, add, altogether, total, more, like away, subtract, difference, decrease, how many more to reach, ×, multiply, times, divide, share between, equal, visualise, factor, multiple, decimal, fractions

**Assessment opportunities**

Look and listen for children who:

- Use the terms for children to use effectively.
- Notice and describe the attributes of Numicon Shapes and number rods and use them to sort both shapes and rods in different ways.
- Refer to Numicon Shapes, number rods and base ten apparatus by number names, order them and describe relationships between them.
- Connect Numicon Shapes, number rods, numerals and number names with positions on a number line.
- Recognise and use the language for adding, subtracting, multiplying and dividing and the symbols +, −, ×, ÷, = and >, <.
- Use structured apparatus to illustrate their thinking.
- Describe relationships they see in structured apparatus using mathematical language.
- Use methods of adding, subtracting, multiplying and dividing effectively.

**If children have ongoing difficulties they are likely to need additional and differentiated support. Refer back to the Number Pattern and Calculating 2 and 3 Tracking Resource Handbooks for activities to establish children's understanding of earlier ideas. If any children are experiencing more fundamental difficulties, consider running the Numicon Intervention Programme for them.**

**Explorer Progress Book 5a, pp. 2–3**

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

**Explore More Copymaster 1: Talking About Numicon Shapes**

After completing work on Activity 1, give children Explore More Copymaster 1: Talking About Numicon Shapes to take home.

**Focus activities**

- What maths can you show with Numicon Shapes?
- What maths can you show with number rods?
- Find one base ten apparatus calculation.
- Describe connections between Numicon Shapes or number rods.
- Count the beads with Numicon Shapes.
- Supporting calculation with Numicon Shapes or number rods.
- What maths can you show with base ten apparatus?

### Assessment support

Page 45

Milestone statements help you assess progress throughout the year and inform your teaching and planning. They indicate the skills and understanding children need to be secure in as they progress through the teaching programme before they are able to successfully meet new ideas. This section includes a link to the set of question cards that can be used for assessment or self-assessment and to a tracking spreadsheet to help you record that information.

Milestone	Code	NPC / GMS	Numicon strand	AG	NC strand
<b>Number, Pattern &amp; Calculating 5 Milestone 1</b>					
By this point, children should be able to:					
Read, write, and convert between column and quantity values of numbers up to 1 000 000	NPC5:1a	NPC	NNS	NNS1	Number & place value
Count in steps of powers of 10 forwards and backwards from any number, and explain which digit changes when a place value boundary is crossed	NPC5:1b	NPC	NNS	NNS1	Number & place value
Explain equivalences between improper fractions and mixed numbers	NPC5:1c	NPC	NNS	NNS2	Fractions
Use knowledge of factors and multiples to recognize and explain equivalences between proper fractions	NPC5:1d	NPC	NNS	NNS2	Fractions
Read, write and order numbers with up to three decimal places	NPC5:1e	NPC	NNS	NNS3	Number & place value
Recognize and explain decimal and common fraction equivalents, e.g. 0.268 = 268/1000, including familiar common fraction equivalents, e.g. 1/5 = 0.2	NPC5:1f	NPC	NNS	NNS3	Fractions
Choose appropriate and effective mental or written methods to solve adding and subtracting number problems involving whole numbers up to 1000	NPC5:1g	NPC	C	C1 & C2	Addition & subtraction
Solve adding and subtracting problems involving fractions and decimal fractions efficiently	NPC5:1h	NPC	C	C1 & C2	Addition & subtraction
<b>Number, Pattern &amp; Calculating 5 Milestone 2</b>					
By this point, children should be able to:					

## Long-term plan for Numicon 5 (NZ Year 6)

There are two Numicon teaching handbooks for each year group – Number Pattern Calculating (NPC) and Geometry measurement and Statistics (GMS). Subscribers to *Numicon Online NZ* have access to a digital version of these. Print versions are also available (visit: [www.edushop.nz](http://www.edushop.nz)). The units in these books are called Activity Groups. They contain a collection of activities you can use with your class.

This long-term plan shows you the recommended order for teaching the Activity Groups over the school year.

- Click on a heading in the **first** column to get all the information for that Activity Group.
- Click on an Activity Group title in the **second** column to go straight to those activities in the online handbooks.

Numicon 5 is used across Year 6 and Year 7. In the long-term plan below, we have made recommendations about which Activity Groups and activities should be delivered in Year 6. In Year 7, some new Activity Groups and activities will be introduced, and some of those covered in Year 6 will be revisited and extended in order to ensure that understanding is secure before progressing to new learning.

Note: there are two Activity Groups within the long-term plan below that we have identified as 'Optional for Year 6'. Please use your professional judgement to decide whether to deliver these in Year 6 or whether to leave them for Year 7.

### Milestones

To help you monitor learning, the skills and understanding children need to be secure with as they progress through the programme have been captured in a series of milestone statements. Click on the milestone icons to see these. Extra support to help you use these is provided at the end of this document.







# Number, Pattern and Calculating 5

## Geometry, Measures and Statistics 5

### Statistics and Probability Booklet (*coming mid-April 2025*)

Each Activity Group should take around one week. However, some may take more/less time than others, so please use your professional judgment to fit the Activity Groups into your school year.

Strand and Activity Group Number	Activity Group Title	Notes
<b>Getting Started</b>	<a href="#">Getting started with apparatus and imagery</a>	
<b>Numbers and the Number System</b> 1	<a href="#">Working with numbers up to a million</a>	
<b>Numbers and the Number System</b> 2	<a href="#">Exploring equivalence with fractions</a>	
<b>Numbers and the Number System</b> 3	<a href="#">Understanding decimals</a>	<i>Activities 1–5 and 7–8 only Simplify activities 7–8 (tenths and hundredths only)</i>
<b>Geometry</b> 1	<a href="#">Measuring angles</a>	
<b>Calculating</b> 1	<a href="#">Developing fluency with adding and subtracting calculations and understanding inverse relationships</a>	
<b>Calculating</b> 2	<a href="#">Strategies for bridging when adding and subtracting mentally</a>	
<b>NPC Milestone 1</b>		
<b>Numbers and the Number System</b> 4	<a href="#">Estimating and rounding</a>	
<b>Calculating</b> 3	<a href="#">Further strategies for adding and subtracting</a>	
<b>Pattern and Algebra</b> 1	<a href="#">Exploring sequences and number patterns</a>	<i>Leave for Year 7</i>
<b>Geometry</b> 2	<a href="#">Transformations</a>	<b>Optional for Year 6</b>
<b>Numbers and the Number System</b> 5	<a href="#">Working with negative numbers</a>	<b>Optional for Year 6</b>
<b>Calculating</b> 4	<a href="#">Developing fluency with multiplying and dividing</a>	<i>Activities 1–3 and 5–6 only</i>
<b>NPC Milestone 2</b>		
<b>Numbers and the Number System</b> 6	<a href="#">Comparing and ordering fractions</a>	
<b>Pattern and Algebra</b> 2	<a href="#">Using inverse relationships to solve problems</a>	
<b>Calculating</b> 5	<a href="#">Written methods of adding</a>	
<b>Calculating</b> 6	<a href="#">Written methods of subtracting</a>	
<b>Calculating</b> 7	<a href="#">Multiplying and dividing by 10, 100 and 1000</a>	<i>Activities 1–4 and 6 only Simplify activities 3 and 6 (multiply/divide by 100 only)</i>
<b>NPC Milestone 3</b>		
<b>Measurement</b> 1	<a href="#">Metric and imperial units</a>	<i>Activity 1 only</i>
<b>GMS Milestone 1</b>		

Strand and Activity Group Number	Activity Group Title	Notes
<b>Pattern and Algebra</b> 3	<a href="#">Properties of number</a>	<i>Activities 4–7 only</i>
<b>Calculating</b> 8	<a href="#">Using mental methods for multiplying and dividing</a>	
Calculating 9	<a href="#">Division with remainders</a>	<i>Leave for Year 7</i>
<b>Geometry</b> 3	<a href="#">Exploring angles</a>	
Calculating 10	<a href="#">Proportion and ratio</a>	<i>Leave for Year 7</i>
Calculating 11	<a href="#">Percentages</a>	<i>Leave for Year 7</i>
<b>NPC Milestone</b> 		
Measurement 2	<a href="#">Interpreting charts and graphs</a>	<i>Leave for Year 7</i>
Numbers and the Number System 7	<a href="#">Solving problems with fractions, decimals and percentages</a>	<i>Leave for Year 7</i>
<b>Pattern and Algebra</b> 4	<a href="#">Looking for patterns and generalizing</a>	<i>Activities 1 and 4–6 only</i>
<b>Statistics and Probability</b> 1	Statistical investigations and data visualizations ( <i>coming mid-April 2025</i> )	
Measurement 3	<a href="#">Calculating area and perimeter</a>	
<b>GMS Milestone</b> 		
<b>Calculating</b> 12	<a href="#">Written methods of multiplying</a>	
Measurement 4	<a href="#">Estimating volume and capacity</a>	
<b>Calculating</b> 13	<a href="#">Written methods of dividing</a>	<i>Activities 1–3 only</i>
<b>Calculating</b> 14	<a href="#">Calculating fractions of amounts</a>	<i>Activities 1–2 only</i>
Statistics and Probability 2	Investigating probability ( <i>coming mid-April 2025</i> )	<i>Leave for Year 7</i>
<b>NPC Milestone</b> 		
Measurement 5	<a href="#">Working with area and perimeter</a>	<i>Leave for Year 7</i>
<b>GMS Milestone</b> 		
Measurement 6	<a href="#">Scale drawing</a>	<i>Leave for Year 7</i>
Calculating 15	<a href="#">Calculating with fractions</a>	<i>Leave for Year 7</i>
<b>Calculating</b> 16	<a href="#">Solving problems involving several steps</a>	
Measurement 7	<a href="#">Solving problems involving time, money and measures</a>	<i>Activities 2–7 only</i>
<b>GMS Milestone</b> 		
<b>Pattern and Algebra</b> 5	<a href="#">Using equivalence to solve problems</a>	
<b>Pattern and Algebra</b> 6	<a href="#">Logic and reasoning</a>	
<b>NPC Milestone</b> 		

# Getting Started: Getting started with apparatus and imagery

**Key mathematical ideas** Pattern, Adding, Subtracting, Multiplying, Dividing, Place value, Mathematical thinking and reasoning

## Educational context

This activity group helps children and teachers to become familiar with structured apparatus, including Numicon Shapes, number rods and base-ten apparatus, and to make connections between the patterns and structures they see and their number ideas. Actions for the four calculating symbols are also introduced.

Building familiarity with the different apparatus will enable children to choose the resources they need to support them with their work in the rest of the *Number, Pattern and Calculating 5 Teaching Resource Handbook*. As children become more familiar with the different apparatus, encourage them to shut their eyes and visualize it. Once children are comfortable with the apparatus, ensure it is readily available and encourage them to select what they need for different activities.

This activity group will give teachers valuable insights into children's mathematical understanding. This will help with initial assessing, which in turn may inform how teachers decide to group children. If children are not accustomed to working on open-ended activities some of their initial responses may be superficial. Encourage them to persevere until they develop the confidence to find things out for themselves.

Children who have had limited or no previous experience using apparatus and imagery may need two or three days to explore these Getting Started activities before moving on to the Numbers and the Number System, Calculating, and Pattern and Algebra activity groups.

## Learning opportunities

- To connect Numicon Shapes, number rods and base-ten apparatus with number ideas.
- To connect structured apparatus with numerals, number words and positions on a number line.
- To see and explain patterns in number relationships illustrated with structured apparatus.
- To describe number relationships using mathematical language.

- To revise the mathematical language for calculating operations.
- To revise actions representing the symbols of arithmetic notation: +, −, =, ×, ÷.
- To revise use of 'is less/fewer than' and 'is greater/more than' symbols (< and >, respectively).
- To revise methods of adding, subtracting, multiplying and dividing.

## Terms for children to use

number names to 100 and beyond, pattern, next, before, after, in between, ordinal number names (e.g. first, second, third), terms for comparing (e.g. small, smaller than, smallest, long, longer than, longest, few, fewer than, fewest, more than, less than, greater than), set, add, altogether, total, more, take away, subtract, difference, decrease, how many more to reach ... ?, multiply, times, divide, share between, equal, visualize, factor, multiple, decimal, fractions

## Assessment opportunities

Look and listen for children who:

- Use the terms for children to use effectively.
- Notice and describe the attributes of Numicon Shapes and number rods and use these to sort both Shapes and rods in different ways.
- Refer to Numicon Shapes, number rods and base-ten apparatus by number name, order them and describe relationships between them.
- Connect Numicon Shapes, number rods, numerals and number names with positions on a number line.
- Recognize and use the language for adding, subtracting, multiplying and dividing and the symbols +, −, ×, ÷, =, < and >.
- Use structured apparatus to illustrate their thinking.
- Describe relationships they see in structured apparatus using mathematical language.
- Use methods of adding, subtracting, multiplying and dividing effectively.

If children have ongoing difficulties they are likely to need additional and differentiated support. Refer back to the *Number Pattern and Calculating 3 and 4 Teaching Resource Handbooks* for activities to establish children's understanding of earlier ideas. If any children are experiencing more fundamental difficulties, consider running the Numicon Intervention Programme for them.

## Explorer Progress Book 5a, pp. 2–3

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 1: Talking About Numicon Shapes

After completing work on Activity 1, give children Explore More Copymaster 1: Talking About Numicon Shapes to take home.

## Focus activities

1. [What maths can you show with Numicon Shapes?](#)
2. [What maths can you show with number rods?](#)
3. [Finding how many without counting](#)
4. [Describing relationships between Numicon Shapes or number rods](#)
5. [Cover the board with Numicon Shapes](#)
6. [Supporting calculating with Numicon Shapes or number rods](#)
7. [What maths can you show with base-ten apparatus?](#)

# Numbers and the Number System 1: Working with numbers up to a million

**Key mathematical ideas** Counting, Place value, Ordering, Mathematical thinking and reasoning

## Educational context

This activity group is designed to help children generalize what they know about place value from their handling of smaller numbers to reading, writing and interpreting much larger numbers. Children's success will depend on their existing understanding of how we name numbers up to 1000.

Children are introduced to everyday contexts in which larger numbers are important, and are invited to read both the 'column' and the 'quantity' values of the digits in larger numbers. They try to visualize larger numbers with the aid of base-ten apparatus, and explore the relationships between powers of 10 (1, 10, 100, 1000, and so on).

They build on this work to investigate counting in steps of powers of 10 starting at any number, to order larger numbers, and to read, write and compare larger numbers represented with Roman numerals. Note that children are not expected to use the language of 'powers' until later in their maths learning; they instead consider, e.g. 'steps of 10, 100 and 1000'.

This work has important links with Numbers and the Number System 3, in which children are invited to generalize their understanding of place value in the other direction – that is, to the right-hand side of the decimal point – so as to name increasingly small decimal fractions.

## Learning opportunities

- To develop understanding of the quantity and column value of numbers to 1000, extending to 10 000.
- To find the position of numbers to 1000 on a number line.
- To know that 1000 is equivalent to 10 groups of 100.
- To be able to visualize, describe or draw 2-, 3- and 4-digit numbers.
- To understand the role of 0 as a placeholder.
- To connect knowledge of numbers to measures.
- To appreciate that the base-ten system is used in other cultures.

## Terms for children to use

estimate, in between, number names to 1 000 000, place value, base-ten, multiples of 10, steps of ... , placeholder, zero, column value, quantity value, more than, less than, Roman numeral

## Assessment opportunities

Look and listen for children who:

- Use the terms for children to use effectively.
- Show understanding of the quantity value of larger numbers in real-world contexts.
- Read 6-digit numbers represented in different ways, e.g. on measuring instruments and place value grids.
- Explain how to represent numbers greater than 10 000 with base-ten apparatus.
- Write 6- and 7-digit numbers.
- Connect column and quantity value in numbers up to 1 000 000.
- Use 0 as a placeholder in numbers up to 1 000 000.
- Count in steps of 1000 from any number, recognizing which digit changes when a place value boundary is crossed.
- Use < and > symbols to order numbers with up to seven digits.
- Read and write Roman numerals up to 1000 (M) and recognize year numbers written in Roman numerals.

## NPC Milestone 1

- Read, write, and convert between column and quantity values of numbers up to 1 000 000 (NPC 5:1a)
- Count in steps of powers of 10 forwards and backwards from any number, and explain which digit changes when a place value boundary is crossed (NPC 5:1b)

## Explorer Progress Book 5a, pp. 4–5

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 8: Charity Fundraiser

After completing work on Activity 4, give children Explore More Copymaster 8: Charity Fundraiser to take home.

## Pupil Book 5, pp. 2–5

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Reading larger numbers](#)
2. [Reading meters and recording large numbers](#)
3. [Visualizing a million](#)
4. [Extending the place value frame](#)
5. [Exploring equivalence in place value](#)
6. [Counting in powers of ten](#)
7. [Ordering 5- and 6-digit numbers](#)
8. [Reading Roman numerals](#)



# Numbers and the Number System 2: Exploring equivalence with fractions

**Key mathematical ideas** Fractions, Equivalence, Mathematical thinking and reasoning

## Educational context

This activity group develops children's existing understanding of equivalent proportions, e.g. one half is also two quarters, three sixths, and so on. It introduces the terms 'proper fraction' and 'improper fraction', and improper fractions and mixed numbers. Conversion between improper fractions and mixed numbers enables children to consider the relationship between fractions and dividing, which they will explore further in Calculating 9. It also gives children a first introduction to the idea of multiplying a fraction and a whole number, e.g.  $\frac{1}{4} \times 10 = \frac{10}{4} = 5$ .

Children approach the idea of equivalent fractions in the practical context of scaling up a recipe, and are then encouraged to explore the numerical relationships involved using structured resources and increasingly abstract mathematical reasoning.

This work is essentially concerned with developing children's communication about proportions and relationships between fractions. Encourage them to discuss and use a variety of imagery and contexts illustrating equivalences, and corresponding forms of fraction notation.

Since communicating is at the heart of these activities, give children plenty of time to discuss and explain their thinking.

## Learning opportunities

- To recognize mixed numbers and improper fractions and convert from one form to the other.
- To recognize equivalent proper fractions  $< 1$ .
- To generate equivalent proper fractions  $< 1$ .

## Terms for children to use

part-whole relationship, comparing, equivalent fraction, denominator, numerator, proportion, ordinal number names, for every, in every, unit fraction, proper fraction, improper fraction, mixed number, factor, common factor, multiple, times, divide, equivalence, equivalent to, scale up, scale down, reduce, simplest form

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Explain equivalences between improper fractions and mixed numbers.
- Use dividing to convert improper fractions to mixed numbers.
- Use knowledge of factors and multiples to recognize and explain equivalences between proper fractions.
- Use knowledge of multiples and factors to create equivalent fractions and illustrate these with structured apparatus.
- Explain that, when scaling up, proportions need to be constant, so both numerator and denominator are multiplied by the same number.

## NPC Milestone 1

- Explain equivalences between improper fractions and mixed numbers (NPC 5:1c)
- Use knowledge of factors and multiples to recognize and explain equivalences between proper fractions (NPC 5:1d)

## Explorer Progress Book 5a, pp. 6–7

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 9: More, Equal or Less?

After completing work on Activity 5, give children Explore More Copymaster 9: More, Equal or Less? to take home.

## Pupil Book 5, pp. 6–9

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Introducing improper fractions and mixed numbers – halves](#)
2. [Exploring connections between improper fractions and mixed numbers – halves](#)
3. [Exploring connections between improper fractions and mixed numbers – quarters](#)
4. [Converting mixed numbers to improper fractions](#)
5. [Recognizing equivalent fractions](#)
6. [Using equivalence to scale recipes up](#)
7. [Illustrating equivalence with Numicon Shapes](#)

# Numbers and the Number System 3: Understanding decimals

**Key mathematical ideas** Fractions, Equivalence, Multiplying (scaling structure), Place value, Mathematical thinking and reasoning

## Educational context

These activities build on the ideas introduced in the Number, Pattern and Calculating 4 Teaching Resource Handbook, Numbers and the Number System 6 and 8, and help children make connections between common fractions (explored in Numbers and the Number System 2) and decimal fractions. Both of these types of fraction are used to describe proportions, but in different notation – rather like describing the same thing in different languages.

Building on children's experience, e.g. from the *Geometry, Measurement and Statistics 4 Teaching Resource Handbook*, Measurement 3, 4 and 5, measuring is used here to provide a relevant context, as a situation in which parts or proportions of units often need to be described. Digital measuring instruments are used to emphasize the frequency with which decimals occur in everyday life, as well as to give children experience of converting between units and to emphasize that adding 0s to the right of a decimal number does not change its value.

Children explore the relationship between fractions and dividing, using a calculator to find and investigate common and decimal fraction equivalents by entering dividing calculations. They are also introduced to thousandths.

Much use is made of visual imagery to illustrate proportions. In particular, double number lines are used to illustrate equivalence and base-ten apparatus to illustrate thousandths. The overall aim is for children to develop their communicating about parts and proportions using the language of both decimal and common fractions, and as a result to appreciate their equivalence.

## Learning opportunities

- To interpret decimal notation in the context of measuring and convert between measurements in different units, e.g. between kilograms, kilograms and grams, and grams.
- To recognize the equivalence between decimal numbers and common fractions, including mixed numbers, e.g.  $0.23$  and  $\frac{23}{100}$ ,  $5.268$  and  $\frac{5268}{1000}$ .
- To know the decimal equivalents of familiar common fractions, including  $\frac{1}{4} = 0.25$ ,  $\frac{3}{4} = 0.75$ ,  $\frac{1}{5} = 0.2$  and  $\frac{1}{10} = 0.1$ .
- To use the relationship between fractions and dividing to use a calculator to convert between common and decimal fractions.

- To recognize thousandths represented as decimal and common fractions, and understand their size and place value relationships with hundredths, tenths and ones.
- To use understanding of place value to read, write, order and compare numbers with up to three decimal places, including identifying numbers within a given interval.

## Terms for children to use

ones, tenths, hundredths, thousandths, equivalence, unit of measure, common fraction, decimal fraction, decimal point, place value, whole number, decimal place, part-whole relationship, in between, interval

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Read and interpret decimal numbers shown on digital measuring equipment.
- Appreciate that adding 0 to the right of a decimal number does not change its size.
- Convert measurements between units, making use of decimal notation, e.g. between kg, kg and g, and g.
- Read and write numbers with up to three decimal places.
- Position decimal fractions on a number line.
- Explain the relationships between ones, tenths, hundredths and thousandths.
- Explain common fraction and decimal equivalents, e.g.  $0.323$  and  $\frac{323}{1000}$  and illustrate them on a number line
- Recognize familiar decimal and common fraction equivalents, e.g.  $\frac{1}{2} = 0.5$ ,  $\frac{3}{4} = 0.75$ ,  $\frac{1}{5} = 0.2$  and  $\frac{1}{10} = 0.1$ .
- Recognize the relationship between fractions and dividing including using a calculator to find the decimal equivalent of a common fraction, e.g.  $\frac{1}{5} = 1 \div 5 = 0.2$  and
- Represent decimal fractions with base-ten apparatus.
- Give decimal numbers which lie between given consecutive whole numbers, tenths or hundredths, e.g. between 6 and 7,  $6.4$  and  $6.5$ ,  $6.43$  and  $6.44$ .
- Compare and order decimal numbers by looking at the most significant digits first.

## NPC Milestone 1

- Read, write and order numbers with up to three decimal places (NPC 5:1e)
- Recognize and explain decimal and common fraction equivalents, e.g.  $0.268$  including familiar common fraction equivalents, e.g.  $= 0.2$  (NPC 5:1f)

## Explorer Progress Book 5a, pp. 8–9

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 10: Fraction Pairs

After completing work on Activity 3, give children Explore More Copymaster 10: Fraction Pairs to take home.

## Pupil Book 5, pp. 10–13

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Revisiting the use of decimals in measurement](#)
2. [Making connections between fractions and decimals – tenths](#)
3. [Making connections between fractions and decimals – hundredths](#)
4. [Representing decimals with base-ten apparatus](#)
5. [Decimal number lines](#)
6. [Introducing thousandths](#)
7. [Comparing decimals](#)
8. [Ordering decimals in a list](#)



# Geometry 1: Measuring angles

**Key mathematical ideas** Angles, Rotation, Equivalence, Invariance, Ordering, Being logical

## Educational context

In the *Geometry, Measurement and Statistics 5 Teaching Resource Handbook*, Geometry 3, children encountered both the 'static' and the 'dynamic' aspects of angles – that is, angles as fixed properties of shapes and angles as amounts of turn or change in direction. *Geometry, Measurement and Statistics 5* builds on this experience, providing children with an opportunity to refine and develop their understanding of this learning through practical exploration and discussion.

In this activity group children are introduced to the measurement of angles in degrees, and have the opportunity to practise classifying, estimating, measuring and drawing angles accurately, using a protractor, in a variety of meaningful contexts. They also begin to consider relationships between angles, in particular angles which meet at a point or on a straight line, and to use this understanding to work out missing angles. This work lays the foundations for Geometry 3, in which children will explore more general ideas relating to angles in 2D shapes, and encounter geometric proof.

Throughout the activity group, support children to investigate for themselves and in practical ways. Provide resources and time to allow them to explore, in particular, the relationship between different illustrations of angles, and between angles as turns and describing directions as 'fixed' quantities.

## Learning opportunities

- To understand that an angle is an amount of turn and is measured in degrees ( $^{\circ}$ ).
- To understand that a full turn is  $360^{\circ}$ .
- To identify acute, obtuse and reflex angles and estimate their size, in degrees.
- To measure and draw angles, in degrees, using a protractor.
- To find missing angles at a point or at a point on a straight line.

## Terms for children to use

angle, turn, rotation, rotate, clockwise, anticlockwise, vertex, degrees, acute angle, right angle, obtuse angle, straight angle, reflex angle, quarter turn, half turn, three-quarter turn, full turn, circle, semicircle, direction, distance, points of the compass, estimate, measure, protractor, accurate, precise, rounding

## Assessment opportunities

Look and listen for children who:

- Use the terms for children to use effectively.
- Explain that an angle is an amount of turn or a measure of change in direction and is measured in degrees.
- Know that a full turn or full circle is  $360^{\circ}$ , and know or can work out the size of other fractions of a full turn or circle, e.g. that a quarter turn or right angle is  $90^{\circ}$ .
- Classify an angle as acute, right, obtuse, straight or reflex, and use this understanding to give a reasonable estimate of its size.
- Use a protractor to measure and draw angles.
- Calculate missing angles at a point and at a point on a straight line.
- Understand the types of shapes that belong in each part of a sorting diagram, e.g. in the intersection of sets on a Venn diagram.

## GMS Milestone 1

- Estimate and classify angles between  $0^{\circ}$  and  $360^{\circ}$  (GMS 5:1a)
- Measure angles using a protractor, correct to the nearest degree (GMS 5:1b)
- Find missing angles at a point and in one full turn, or at a point on a straight line and in a half turn, using knowledge that the total angle is  $360^{\circ}$  or  $180^{\circ}$ , respectively (GMS 5:1c)

## Explorer Progress Book 5, pp. 2–3

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 1: Open Book

After completing work on Activity 2, give children Explore More Copymaster 1: Open Book to take home.

## Pupil Book 5, pp. 14–17

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Introducing degrees](#)
2. [Measuring angles with a protractor](#)
3. [Measuring angles and planning a route](#)
4. [Drawing angles and plotting a route](#)
5. [Finding missing angles at a point and on a straight line](#)

# Calculating 1: Developing fluency with adding and subtracting calculations and understanding inverse relationships

**Key mathematical ideas** Adding, Subtracting, Inverse, Pattern, Mathematical thinking and reasoning

## Educational context

The activities in this group are designed to develop children's fluency with adding and subtracting calculations involving whole numbers, fractions and decimals, with the aim of encouraging children increasingly to calculate mentally.

Discussion and illustration of strategies is used throughout to support this aim.

There is much non-computational thinking to be done in this activity group, as children convert calculations from one form into another. Inverse relationships are useful – subtracting can sometimes helpfully be turned into adding (and vice versa) – as are rounding and compensating. The usefulness of multiples of 10 is also emphasized.

Calculations are presented within a variety of problem contexts, including money, measurement and statistics, as well as in the form of number puzzles.

Throughout the activity group encourage children to explore different ways of approaching calculations and ensure there is plenty of discussion and illustration.

Vary the numbers involved as needed – use, e.g. larger numbers, more decimal places, more complex fractions or mixed numbers – in order to ensure children are challenged to consider carefully how to find the answer.

The major aim of the work is to encourage children to think flexibly about calculating, and always to seek a variety of ways to carry out any calculation.

## Learning opportunities

- To add and subtract increasingly large whole numbers mentally.
- To convert adding problems into subtracting problems, and vice versa.
- To add and subtract numbers with up to two decimal places.
- To add and subtract fractions and mixed numbers with the same denominator.

## Terms for children to use

add, sum, total, subtract, difference, equals, number trio, adjust, integers, decimals, common fractions, inverse relationship, mental methods, complements, number bonds, number facts

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Use fluent recall of adding and subtracting facts to solve problems.
- Adjust numbers in a calculation to find equivalent solutions.
- Use the inverse relationship between adding and subtracting to convert a subtracting problem into an adding one and vice versa.
- Solve adding and subtracting problems in the context of money.
- Solve adding and subtracting problems in the context of measures.
- Use adding and subtracting facts to find missing numbers in fraction problems, where fractions have the same denominator.
- Add and subtract numbers with up to two decimal places.

## NPC Milestone 1

- Choose appropriate and effective mental or written methods to solve adding and subtracting number problems involving whole numbers up to 1000 (NPC 5:1g)
- Solve adding and subtracting problems involving fractions and decimal fractions efficiently (NPC 5:1h)

## Explorer Progress Book 5a, pp. 10–11

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 15: Days Out

After completing work on Activity 3, give children Explore More Copymaster 15: Days Out to take home.

## Pupil Book 5, pp. 18–21

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Using adding and subtracting facts to solve problems](#)
2. [Using adding and subtracting facts to solve money problems](#)
3. [Using adding and subtracting facts to solve missing measurement problems](#)
4. [Using adding and subtracting facts to solve missing number problems involving fractions](#)
5. [Using adding and subtracting facts to solve problems involving decimals](#)
6. [Using adding and subtracting facts to solve puzzles involving decimals](#)
7. [Using adding and subtracting facts to find numbers in a Venn diagram](#)

# Calculating 2: Strategies for bridging when adding and subtracting mentally

**Key mathematical ideas** Adding, Subtracting, Fractions, Bridging, Mathematical thinking and reasoning

## Educational context

The activities in this group are designed to help children generalize their use of 'bridging' strategies, moving on from bridging through multiples of 10 to bridging through multiples of 100 and 1000, and, in appropriate contexts, bridging through different kinds of 'whole'. For example, with fractions and decimal fractions it can be helpful to bridge through an appropriate whole number, while in particular contexts, such as measuring, whole units are useful, e.g. 'whole hours' (such as 5 p.m.), whole pounds, whole centimetres, and so on. The overall aim of this work is to develop children's fluency in mental calculating. Vary the numbers involved as needed – use, e.g. larger numbers, more decimal places, more complex fractions or mixed numbers – in order to ensure children are challenged to consider carefully how to find the answer. For this reason providing visual imagery is crucial: encourage plenty of discussion with illustration, so that children literally share different ways of looking at calculations, enabling them to develop important flexibility in their calculating.

## Learning opportunities

- To add and subtract larger whole numbers mentally using bridging.
- To add and subtract decimals mentally using bridging.
- To add and subtract clock times and durations mentally using bridging.
- To add and subtract fractions with the same denominator mentally using bridging.
- To add and subtract money amounts mentally using bridging.

## Terms for children to use

estimate, add, subtract, balancing calculations, adjusting, bridging strategy, bridging a multiple of 10/100/1000, partition, fluency, duration, fractions, whole numbers, denominations, decimals, equivalence, units, ones, tenths, hundredths, fraction, improper fraction, mixed number

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Make connections with bridging through multiples of 10 to bridge through multiples of 100 and 1000 when adding or subtracting.
- Have fluent recall of adding and subtracting facts to 10 and 100 and use this to partition numbers in different ways.
- Use the inverse relationship between adding and subtracting to calculate efficiently.
- Explain and illustrate how they use whole hours as a bridge to solve problems involving time.
- Illustrate with apparatus using whole numbers as a bridge when solving adding and subtracting problems involving fractions.
- Explain and illustrate how they use whole numbers as a bridge when solving adding and subtracting problems involving decimals.
- Explain and illustrate how they use bridging when solving adding and subtracting problems involving money.

## NPC Milestone 1

- Choose appropriate and effective mental or written methods to solve adding and subtracting number problems involving whole numbers up to 1000 (NPC 5:1g)
- Solve adding and subtracting problems involving fractions and decimal fractions efficiently (NPC 5:1h)

## Explorer Progress Book 5a, pp. 12–13

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 16: Don't Burn the Dinner!

After completing work on Activity 3, give children Explore More Copymaster 16: Don't Burn the Dinner! to take home.

## Pupil Book 5, pp. 22–25

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Bridging through hundreds and thousands when adding](#)
2. [Bridging through hundreds and thousands when subtracting](#)
3. [Using a bridging strategy to solve problems involving time](#)
4. [Using a bridging strategy to solve problems involving fractions](#)
5. [Using a bridging strategy to solve problems involving adding decimal measures](#)
6. [Using a bridging strategy to solve problems involving subtracting decimals](#)

# Numbers and the Number System 4: Estimating and rounding

**Key mathematical ideas** Counting, Place value, Ordering, Mathematical thinking and reasoning

## Educational context

Using a variety of contexts, these activities invite children to estimate and round numbers, for example estimating masses, perimeters and areas, total cost and change.

They round numbers, including larger numbers, to the nearest multiple of 10, 100, 1000, 10 000 and 100 000, and numbers with two decimal places to the nearest tenth or whole number.

This work is important not just for use in everyday measurement contexts, where an approximate answer is often the most useful answer, but also more generally in mathematics. Rounding and estimating are skills that allow children to judge whether an answer they have calculated precisely (in any context) seems reasonable.

Being able to estimate an answer to a calculation not only guards against errors, but can also be helpful with carrying out the calculation, particularly when dividing.

Encouraging children to get into the habit of estimating an answer to a calculation in advance thus serves many useful purposes, as well as contributing to their overall 'number sense' and fluency.

## Learning opportunities

- To round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000.
- To use rounding to check answers to calculations and determine, in the context of a problem, levels of required accuracy.
- To round decimals with two decimal places to the nearest whole number and to one decimal place.

## Terms for children to use

rounding, round amounts, round numbers, roughly, nearest multiple of ... , closer to, nearer to, nearly, approximately, estimate, estimation

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Use appropriate strategies for estimating in different situations and explain their reasoning.
- Round 4- and 5-digit numbers to the nearest multiple of 10.
- Round 4- and 5-digit numbers to the nearest multiple of 100.
- Round 6-digit numbers to the nearest 1000, 10 000 or 100 000.
- Make connections between rounding whole numbers and rounding decimal numbers.
- Round numbers with two decimal places to the nearest whole number or tenth.
- Use estimating and rounding skills to get an approximate answer when calculating.
- Use the problem context to decide the level of accuracy required when calculating, also whether to round numbers up or down.

## NPC Milestone 2

- Round whole numbers to the nearest multiple of 10, 100, 1000, 10 000, or 100 000 (NPC 5:2a)
- Round numbers with up to two decimal places to the nearest whole number and to one decimal place (NPC 5:2b)

## Explorer Progress Book 5a, pp. 14–15

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 11: Rounding Up World Records

After completing work on Activity 4, give children Explore More Copymaster 11: Rounding Up World Records to take home.

## Pupil Book 5, pp. 26–29

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Estimating](#)
2. [Rounding to the nearest 10](#)
3. [Rounding to the nearest 100](#)
4. [Rounding to the nearest 1000, 10 000 or 100 000](#)
5. [Rounding numbers with one decimal place to the nearest whole number](#)
6. [Rounding numbers with two decimal places to the nearest whole number or tenth](#)
7. [An estimating game](#)
8. [Estimating calculations](#)

# Calculating 3: Further strategies for adding and subtracting

**Key mathematical ideas** Adding, Subtracting, Place value, Pattern, Mathematical thinking and reasoning

## Educational context

The general theme of these activities is the role of multiples of 10 in calculating. Multiples of 10 can feature in many different ways as we calculate: rounding, bridging, and partitioning all focus on these helpful 'round' numbers.

In this activity group the aim is again to explore different approaches to calculating. With this in mind, encourage plenty of discussion and illustrating so that children further develop their flexibility. Fluency in calculating is very much based upon flexibility – that is, on being able to see different ways of doing any calculation, and choosing the most effective approach. This flexibility is also encouraged through work on

non-computational thinking: ways of reorganizing a calculation into a different, more manageable form.

Vary the numbers involved as needed – use, e.g. larger numbers, more decimal places, more complex fractions or mixed numbers – in order to ensure children are challenged to consider carefully how to find the answer.

The activities conclude with some revision of the written column methods of adding and subtracting.

## Learning opportunities

- Mentally add and subtract increasingly large whole numbers.
- Mentally add and subtract tenths and 1-digit whole numbers and tenths.
- Use the written column method to add increasingly large numbers.
- Use the written column method to subtract increasingly large numbers.

## Terms for children to use

strategy, multiples of 10, compare, hundreds, tens, ones, tenths, partition, balancing calculation, bridging, rounding, adjusting, compensating, is equal to, is not equal to, add, subtract, inverse, difference, take away, total, number facts, increase, estimate, sum, column method, column value, grouping, regrouping, carrying, mental strategies, complements, partitioning, combining, exchanging, redistributing

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Have fluent recall of adding and subtracting facts to 10 and 100 and can use these flexibly when calculating mentally.
- Confidently explain their strategy for adding and subtracting.
- Recognize when to use rounding and adjusting as a calculating strategy and do this confidently.
- Recognize when to use their understanding of place value and partitioning as a calculating strategy and do this confidently, including with decimals.
- Recognize when to use the strategy of creating equivalent alternatives by adjusting and compensating and do this confidently.
- Recognize when to use a column method for adding and subtracting and do this confidently.

## NPC Milestone 2

- Convert an adding or subtracting calculation to an easier equivalent calculation (NPC 5:2c)

## Explorer Progress Book 5a, pp. 16–17

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 17: How Far?

After completing work on Activity 4, give children Explore More Copymaster 17: How Far? to take home.

## Pupil Book 5, pp. 30–33

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Calculating mentally with large numbers using place value](#)
2. [Adding and subtracting by rounding and adjusting](#)
3. [Adjusting adding and subtracting sentences – using non-computational reasoning](#)
4. [Adding decimals using a partitioning strategy](#)
5. [Using a column method for adding](#)
6. [Using a column method for subtracting](#)



# Pattern and Algebra 1: Exploring sequences and number patterns

**Key mathematical ideas** Generalizing, Pattern, Mathematical thinking and reasoning

## Educational context

The activities in this group are devoted to exploring linear sequences – sequences of numbers with a constant difference between successive terms. This builds on work in Numbers and the Number System 1, which uses and applies place value, and the *Number, Pattern and Calculating 4 Teaching Resource Handbook*, Pattern and Algebra 1.

The key to understanding a linear sequence is to work out the ‘term-to-term rule’, e.g. the number that needs to be added to a term to arrive at the next. Time sequences involving regular cycles (e.g. sporting events) are used to illustrate the relevance of such sequences.

In common with much of the work in Number, Pattern and Calculating 5, the numbers used are extended beyond whole numbers to decimal and common fractions. An important connection is made between linear sequences and the patterns evident in the numerators and denominators of families of equivalent fractions.

Children also work with sequences involving constant steps of powers of 10, but are not expected to use the language of ‘powers’ until later in their mathematics learning; they instead consider, e.g. steps of 10, 100 and 1000.

The mathematical significance of this work for children is that linear sequences provide a clear example of how finding a rule – a generalization – enables us to predict what will come next. As children progress, they will learn many more ways in which mathematics enables us to make predictions by generalizing.

## Learning opportunities

- To recognize and describe linear sequences involving larger whole numbers.
- To recognize and describe linear sequences involving decimals to two decimal places.
- To recognize and describe linear sequences involving fractions and equivalent fractions.
- To solve problems in context using linear sequences.

## Terms for children to use

term, ordinal number words (e.g. first, second, third), interval, steps of, constant difference, sequence, increasing, decreasing, term-to-term rule, hundred thousands, ten thousands, thousands, hundreds, tens, ones, tenths, hundredths, pattern, rule, repeat, equivalent

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Relate the idea of a sequence to familiar recurring events.
- Find the difference between a pair of numbers in a linear sequence to help them find the term-to-term rule and work out missing terms.
- Illustrate with structured apparatus and explain the term-to-term rule for increasing and decreasing linear sequences.
- Recognize which digits are significant when finding differences between terms in a linear sequence of larger numbers.
- Make sequences of larger numbers that increase or decrease in powers of 10, changing digits appropriately when place value boundaries are crossed.
- Make sequences of numbers with up to three decimal places, changing digits appropriately when place value boundaries are crossed.
- Use number rods to find the term-to-term rule in increasing and decreasing decimal sequences.

## NPC Milestone 2

- Find the term-to-term rule for a linear sequence involving whole numbers, fractions or decimals, and work out missing terms (NPC 5:2d)

## Explorer Progress Book 5a, pp. 18–19

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 2: Power Sequences

After completing work on Activity 3, give children Explore More Copymaster 2: Power Sequences to take home.

## Pupil Book 5, pp. 34–37

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Exploring patterns in linear sequences](#)
2. [Using number rods to find missing information in sequences with constant differences](#)
3. [Making sequences that increase or decrease in powers of 10](#)
4. [Making decimal sequences that increase or decrease in tenths and hundredths](#)
5. [Exploring decimal sequences with number rods](#)
6. [Exploring fraction sequences](#)
7. [Making connections between sequences and equivalent fractions](#)



# Geometry 2: Transformations

**Key mathematical ideas** Translation, Reflection, Equivalence, Invariance, Being logical

## Educational context

In *the Geometry, Measurement and Statistics 5 Teaching Resource Handbook*, Geometry 4, children were introduced to using coordinates as a way of describing and recording position, as well as to the term 'translation' and the idea of using coordinates to define precisely the start and end points of a translation. This activity group builds on this work and the work in the *Geometry, Measurement and Statistics 4 Teaching Resource Handbook*, Geometry 2, on reflective symmetry.

Children continue to develop their mathematical language to describe transformations with precision, and will be able to describe the precise position of points using coordinates in the first quadrant (that is, with coordinates which are positive numbers). They draw shapes and their images under given reflections or translations, and identify reflections and translations from given shapes. They consider why neither reflection nor translation affects the size of a 2D shape through discussing what changes and what stays the same.

Children develop these ideas in the context of making designs and patterns by translating and reflecting points and shapes on a coordinate grid. Provide a range of resources, such as Numicon Baseboard Laminates and geo boards, and allow plenty of time, to help children explore and extend this work. Throughout, emphasize the connection between the transformations children are making and the coordinates of transformed points or vertices.

## Learning opportunities

- To use coordinates to identify and plot points in the first quadrant.
- To read and write coordinates in the conventional form  $(x,y)$ .
- To identify, describe and represent the position of a shape following a reflection or translation.
- To understand what changes and what stays the same about a shape following a reflection or translation.

## Terms for children to use

shape, transform, transformation, translate, translation, reflect, reflection, axis, axes, coordinates, origin, point, plot, left, right, up, down, horizontal, vertical, area, length, size, angle, turn, units, slide,  $x$ -axis,  $y$ -axis,  $x$ -coordinate,  $y$ -coordinate, mirror, across, image, map, asymmetry, asymmetric, line of symmetry, corresponding, equidistant,  $x$ -direction,  $y$ -direction

## Assessment opportunities

Look and listen for children who:

- Use the terms for children to use effectively.
- Locate the mirror line accurately.
- Make or draw a symmetrical pattern or shape with a vertical, horizontal or sloping line of symmetry.
- Accurately plot points using coordinates in the first quadrant.
- Give the coordinates of a point or points on a grid.
- Locate the image of a shape under a translation or reflection.
- Explain a translation or reflection of a point on a coordinate grid in terms of the changes in its  $x$ - and  $y$ -coordinates.
- Identify the transformation that maps one shape to another.

## GMS Milestone 1

- Identify lines of symmetry in given figures (GMS 5:1d)
- Find or show images of points and polygons under translation or reflection in the first quadrant (with lines of symmetry parallel to the  $x$ - and  $y$ -axes), describing the transformation and how the position and coordinates of the point or polygon have changed (GMS 5:1e)
- Explain that more than one transformation can map one shape onto another (GMS 5:1f)

## Explorer Progress Book 5, pp. 4–5

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 2: Reflected Designs

After completing work on Activity 2, give children Explore More Copymaster 2: Reflected Designs to take home.

## Pupil Book 5, pp. 38–41

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Exploring reflective symmetry](#)
2. [Exploring reflections on a coordinate grid](#)
3. [Describing translations using coordinates](#)
4. [Exploring translations on a coordinate grid](#)

# Numbers and the Number System 5: Working with negative numbers

**Key mathematical ideas** Fractions, Equivalence, Mathematical thinking and reasoning

## Educational context

Building on the introductory work in the *Number, Pattern and Calculating 4 Teaching Resource Handbook*, Numbers and the Number System 4, these activities explore the use of negative numbers in a variety of everyday contexts emphasizing the reasonableness of such numbers. The essential idea for children to understand mathematically is that numbers can have a 'direction' as well as a size ('magnitude'). Children use the number line to support and illustrate their early calculating with 'directed numbers' in particular the calculation of differences between these numbers, or what we would otherwise call subtraction. Importantly, children are also asked explicitly to order directed numbers both in the context of temperature and on a number line. This raises important discussion points about whether  $-18$  is 'bigger' or 'smaller' than  $-23$ . At this stage it is probably best to focus simply on direction and agree with children that  $-18$  is 'to the right of'  $-23$ , or, in the context of temperature,  $-18^{\circ}\text{C}$  is 'warmer' than  $-23^{\circ}\text{C}$ .

## Learning opportunities

- To interpret negative numbers in context.
- To count forward and back through zero with positive and negative whole numbers.
- To order negative numbers using  $<$  and  $>$  symbols.
- To calculate differences between positive and negative numbers.

## Terms for children to use

negative, positive, minus, plus, thermometer, temperature, levels, horizontal, vertical, increasing, decreasing, direction, magnitude

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Read and write negative numbers.
- Recognize and interpret positive and negative numbers on a scale.
- Notice the symmetry in the negative number line.
- Explain that the magnitude of negative numbers increases the further their distance from 0.
- Order positive and negative numbers.
- Make connections with adding and subtracting and movements forwards and backwards on the negative number line, noticing how inverse operations affect each other.
- Compare numbers, including negative numbers, using  $<$  and  $>$  symbols in the context of temperature.
- Explain that calculating the difference between a positive and a negative number involves adding the amount from 0 to the positive number to the amount from 0 to the negative number.
- Recognize movement to the right (or forwards) on the number line as the positive direction and movement to the left (or backwards) as the negative direction.

## NPC Milestone 2

- Read, write and order positive and negative numbers (NPC 5:2e)
- Calculate the difference between a positive and a negative number (NPC 5:2f)

## Explorer Progress Book 5a, pp. 20–23

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

Children will also have the opportunity to complete their Learning Log (pp. 22–23) where they can reflect on the mathematics they have done so far.

## Explore More Copymaster 12: Cold Places

After completing work on Activity 3, give children Explore More Copymaster 12: Cold Places to take home.

## Pupil Book 5, pp. 42–45

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Understanding negative numbers](#)
2. [Exploring negative numbers in the context of temperature](#)
3. [Drawing negative number lines horizontally](#)
4. [Comparing temperatures](#)
5. [Calculating differences between positive and negative numbers](#)
6. [Negative numbers and direction](#)

# Calculating 4: Developing fluency with multiplying and dividing

**Key mathematical ideas** Multiplying, Dividing, Pattern, Fractions, Decimals, Mathematical thinking and reasoning

## Educational context

The activities in this group focus firstly on developing children's fluency with recognizing and recalling basic multiplying and dividing facts, rehearsing use of the terms 'factor' and 'multiple'. Later the focus is on practising the short written methods of multiplying and dividing introduced in e.g. the *Number, Pattern and Calculating 3 Teaching Resource Handbook*, Calculating 15 and the *Number, Pattern and Calculating 4 Teaching Resource Handbook*, Calculating 10, 11, 12 and 13.

In all of this work children should be encouraged to discuss, explain and communicate their thinking using plenty of illustration. In Activities 2 and 3, much emphasis is placed upon children thinking through possibilities systematically. The activity group concludes by asking children to connect multiplying and dividing with proportions of a given whole, thus making explicit connections between fractions and multiplying and dividing, which are crucial to developing children's 'multiplicative thinking'. Activities 8 and 9 give children who are confident with multiplying and dividing facts and with place value opportunities to apply their understanding to multiply and divide with decimals.

## Learning opportunities

- To multiply and divide numbers mentally drawing upon known facts.
- To solve missing number problems involving multiplying.
- To estimate to check short written multiplying calculations.
- To estimate to check short written dividing calculations.
- To find fractions of amounts using multiplying and dividing facts.
- To multiply and divide decimals to one decimal place

## Terms for children to use

multiply, times, product, multiplying, dividing, divisor, quotient, multiplication tables, times tables, times tables square, commutative property, multiplying and dividing facts, symmetry, multiples, factor, relationships, place value, digits, scale, balancing calculations, equals, equivalent, equivalence statements, decimal, short written dividing, short written multiplying, approximate, estimate

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Explain that the commutative property of multiplying reduces the number of facts they have to learn.
- Recognize patterns in multiplication tables and use these to make general rules for tables they are learning.
- Are developing fluency with a growing number of multiplying facts.
- Have strategies for working out multiplying facts they cannot yet recall.
- Recognize when to use their knowledge of times tables facts, factors and multiples to solve problems.
- Use knowledge of multiples and related dividing facts to identify common factors.
- Show understanding of the associative property of multiplying by explaining that they can change the order of numbers in multiplication calculations and the product will be the same.
- Use knowledge of factors to work out missing numbers in multiplying calculations and to find equivalent multiplying expressions.

## NPC Milestone 2

- Use multiplying and dividing facts and knowledge of factors and multiples to solve problems (NPC 5:2g)
- Solve problems effectively by finding fractions of amounts, making use of multiplying and dividing facts (NPC 5:2h)
- Multiply and divide decimals to one decimal place (NPC 5:2i)

## Explorer Progress Book 5b, pp. 2–3

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 18: Multiplying Match

After completing work on Activity 4, give children Explore More Copymaster 18: Multiplying Match to take home.

## Pupil Book 5, pp. 46–49

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Revising multiplying facts](#)
2. [Using multiplying facts](#)
3. [Solving problems with multiplying and dividing facts](#)
4. [Using factors to solve empty box balancing problems involving multiplying](#)
5. [Revising the short written method of multiplying](#)
6. [Revising the short written method of dividing](#)
7. [Revising finding fractions of amounts using multiplying and dividing facts](#)
8. [Multiplying decimals](#)
9. [Dividing decimals](#)

# Numbers and the Number System 6: Comparing and ordering fractions

**Key mathematical ideas** Fractions, Equivalence, Ordering, Mathematical thinking and reasoning

## Educational context

This activity group develops work from Numbers and the Number System 2 and from the *Number, Pattern and Calculating 4 Teaching Resource Handbook*. Essentially, the activities are about using fractions to describe proportions, recognizing that a variety of equivalent fractions can be used to describe the same proportion, and that proportions expressed as fractions can be ordered. Children are thus using fractions to develop their communicating about proportions, both within specific contexts and more generally. Later, in Calculating 10, children will explore similar activities to help them make connections between proportion and ratio.

At the heart of this work, children are developing ways of recognizing and finding equivalent fractions. They then use these to compare fractions and order them by size. These ideas are both important and challenging. Give children plenty of time and encourage discussion and illustration to help them develop their communicating about fractions and proportions.

## Learning opportunities

- To compare and order fractions whose denominators are all multiples of the same number.
- To use  $<$  and  $>$  signs to record the ordering of fractions.
- To simplify fractions to their lowest terms by finding common factors.
- To use equivalent fractions to scale up or down in context.

## Terms for children to use

part-whole relationship, comparing, equivalence, equivalent fractions, denominator, numerator, proportion, 'in every', 'for every', unit fraction, proper fraction, improper fraction, mixed number, factor, common factor, divisible by, multiple, times, divide, scale down, scale up, simplest form, common denominator

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Compare fractions whose denominators are multiples of the same number.
- Use knowledge of multiples to find equivalent fractions and illustrate this with structured apparatus.
- Compare fractions and order them using  $<$  and  $>$  symbols.
- Make connections between scaling up and multiplying, and scaling down and dividing, as inverses.
- Use knowledge of multiples and factors to simplify fractions to their lowest terms.

## NPC Milestone 3

- Use knowledge of factors and multiples to find equivalent fractions and to simplify fractions to their lowest terms (NPC 5:3a)
- Compare and order fractions with denominators which are multiples of the same number (NPC 5:3b)

## Explorer Progress Book 5b, pp. 4–5

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 13: Who Gets More?

After completing work on Activity 3, give children Explore More Copymaster 13: Who Gets More?

## Pupil Book 5, pp. 50–53

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Comparing and ordering proper fractions whose denominators are multiples of the same number](#)
2. [Comparing and ordering proper fractions by finding a common denominator](#)
3. [Using greater than and less than signs to record comparisons of fractions](#)
4. [Simplifying fractions by finding common factors](#)
5. [Simplifying fractions to their lowest terms](#)

# Pattern and Algebra 2: Using inverse relationships to solve problems

**Key mathematical ideas** Inverse, Adding, Subtracting, Multiplying, Dividing, Pattern, Mathematical thinking and reasoning

## Educational context

The key theme of this activity group is that of inverse relationships. Doing mathematics is essentially about studying relationships, and so ‘making connections’ of every kind is always very important for children. The work here builds on the *Number, Pattern and Calculating 4 Teaching Resource Handbook*, Pattern and Algebra 2.

Inverses are essentially about ‘doing and undoing’ and so here children are invited to work on adding and subtracting and on multiplying and dividing as pairs of operations that ‘undo’ each other. Sometimes this will feel like ‘working backwards’ through a problem.

This lays the foundations for later work in which children will be introduced to pairs of inverse functions, e.g. converting from metric to imperial units and then back again (e.g. in the *Geometry, Measurement and Statistics Teaching Resource Handbook*, Measurement 1). Importantly, children will also discover that some actions are irreversible – they are impossible to undo exactly – and that it is important to know which actions these are.

Throughout, encourage children to use plenty of time, experimentation and discussion to think out how to ‘work backwards’. It can feel very strange, but also like a good puzzle if the classroom atmosphere is right. Encourage children to use apparatus and imagery to support their reasoning as they work.

## Learning opportunities

- To multiply and divide numbers mentally, drawing upon known facts.
- To solve missing number problems by using the inverse relationship between adding and subtracting.
- To solve missing number problems by using the inverse relationship between multiplying and dividing.
- To solve problems involving ???

## Terms for children to use

inverse facts/relationships/calculations/operations, arithmagon, factor, multiple, common factors, working backwards, compare, adding, subtracting, multiplying, dividing, double, halve, solution, trial and improvement, column method, number trio

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Use adding and subtracting and the inverse relationship between them flexibly and fluently to solve number puzzles and check solutions.
- Use multiplying and dividing and the inverse relationship between them flexibly and fluently to find solutions to number puzzles and check solutions.
- Recall number facts fluently and use the inverse relationships between adding and subtracting and between multiplying and dividing to complete calculations with missing numbers.
- Use recalled number facts flexibly to solve problems by working backwards.
- Identify inverse operations in number ‘tricks’ and explain that these will cancel each other out.
- Create number tricks using inverse operations.

## NPC Milestone 3

- Use the inverse relationships between adding and subtracting, and multiplying and dividing, to complete calculations with missing numbers (NPC 5:3c)

## Explorer Progress Book 5b, pp. 6–7

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 3: Missing Number Game!

After completing work on Activity 3, give children Explore More Copymaster 3: Missing Number Game! to take home.

## Pupil Book 5, pp. 54–57

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Exploring arithmagons](#)
2. [Using inverse facts to complete arithmagons](#)
3. [Completing calculations with missing numbers](#)
4. [Finding missing digits in written calculations](#)
5. [Solving problems by working backwards](#)
6. [Using number loops](#)
7. [Think of a number](#)



# Calculating 5: Written methods of adding

**Key mathematical ideas** Adding, Place value, Mathematical thinking and reasoning

## Educational context

This activity group builds on the methods explored in the *Number, Pattern and Calculating 4 Teaching Resource Handbook*, Calculating 8. In order to work through these activities successfully, children will need a secure understanding of place value and recall of adding facts. They will work with up to 4-digit whole numbers as well as with numbers with up to three decimal places in the contexts of measures and money. Following on from their work on decimal numbers, children are introduced to a different approach to calculating with money, in which pence amounts are viewed as decimal rather than whole numbers.

It is important to ensure that children review the numbers involved in a calculation to determine whether a mental or a written method is most appropriate, also that they appreciate that larger numbers and decimals do not automatically make an adding calculation more complicated. Vary the numbers involved, as appropriate – increasing or reducing the number of digits and the amount of regrouping involved – to help ensure a focus on choosing an appropriate calculating strategy. As children work, encourage them to look for equivalent calculations that are easier to carry out and to estimate their answers before calculating. They should be able to explain how they have arrived at their estimates. Provide children with regular opportunities to practise their adding skills in all areas of the mathematics curriculum as well as in cross-curricular contexts. This ensures that they continue to develop and refine their skills. Once working with larger numbers, the use of base-ten materials becomes less efficient. However, it is still important that, where a child shows a gap in their understanding, images and apparatus are used to explain. This may mean working with smaller numbers.

## Learning opportunities

- To understand that larger numbers and decimals do not necessarily make an adding calculation more difficult.
- To appreciate that a column method is efficient when an adding calculation involves several steps.
- To estimate the answer to an adding calculation before calculating.
- To change an adding calculation to an equivalent calculation that is easier to carry out mentally.
- To understand that columns are added from right to left to allow for regrouping where necessary.
- To use the column method of adding with decimal numbers.

## Terms for children to use

estimate, add, adding, more, plus, written calculation, column calculation, column addition, column method, total, sum, altogether, grouping, regrouping, carrying, zero as a placeholder, mental strategies, bridging, complements, compensating, partition, decimal point, column value, quantity value

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Review numbers in a calculation to make a sensible estimate and to determine an appropriate calculation method.
- Explain why columns are added from right to left.
- Explain the processes of grouping and regrouping, recognizing when regrouping is necessary and relating it to bridging.
- Record the carrying digit in the correct column and refer accurately to its value.
- Change an adding calculation to an equivalent calculation that is easier to solve mentally.
- Use money notation when carrying out column adding calculations.
- Can talk about tenths, hundredths and thousandths when adding decimals.

## NPC Milestone 3

- Use efficient written column methods for adding and subtracting whole numbers up to 10 000 and decimals with up to 3 decimal places (NPC 5:3d)

## Explorer Progress Book 5b, pp. 8–9

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 19: Cafe Calculation

After completing work on Activity 4, give children Explore More Copymaster 19: Cafe Calculation to take home.

## Pupil Book 5, pp. 58–61

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Knowing when to use a written method for adding](#)
2. [Adding 4-digit whole numbers using a column method](#)
3. [Developing fluency and accuracy with column adding](#)
4. [Using the column method for adding money](#)
5. [Solving measuring problems involving adding](#)



# Calculating 6: Written methods of subtracting

**Key mathematical ideas** Subtracting, Place value, Mathematical thinking and reasoning

## Educational context

This activity group builds on the methods explored in the *Number, Pattern and Calculating 4 Teaching Resource Handbook*, Calculating 9. In order to work through these activities successfully, children will need a secure understanding of place value and good recall of subtracting facts. Children will work with up to 4-digit whole numbers as well as numbers with up to three decimal places in the contexts of measures and money, to refine their understanding of a column method for subtracting. As emphasized in Calculating 5, it is important to ensure that children review the numbers they are dealing with to determine whether a mental or written method is most appropriate and to understand that larger numbers and decimals do not automatically make a subtracting calculation more complicated. Encourage them to look for balancing calculations, e.g.  $4340 - 2280 = 4360 - 2300$  and explain how this makes the calculation easier to solve. Encourage children to estimate before calculating and explain their estimations. Provide regular opportunities to practise their subtracting skills in all areas of the mathematics curriculum as well as in cross-curricular contexts. This will enable them to keep their skills sharp.

Vary the numbers involved, as appropriate – increasing or reducing the number of digits and the amount of regrouping involved – to help ensure a focus on choosing an appropriate calculating strategy. Once working with larger numbers, the use of base-ten apparatus becomes less efficient. It is important however, that where a child shows a gap in their understanding, images and apparatus are used to explain. This may mean working with smaller numbers.

## Learning opportunities

- To understand that larger numbers and decimals do not necessarily make a subtracting calculation more difficult.
- To appreciate that a column method is efficient when a subtracting calculation involves several steps.
- To estimate their answer before subtracting and be able to say how they arrived at the estimate.
- To change a calculation to give an equivalent that is easier to solve mentally.
- To understand that numbers can be subtracted by partitioning, then redistributing across columns, to the right.
- To use the written column method for subtracting with decimals.
- To know that the inverse relationship between adding and subtracting is useful when checking calculations.

## Terms for children to use

estimate, subtract, subtracting, less, fewer, minus, column method, difference, inverse, exchanging, redistributing, regrouping, zero as a placeholder, mental strategy, bridging, partition

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Recognize from the numbers in a subtracting calculation when redistribution is necessary and relate this to bridging.
- Review numbers in a calculation to make a sensible estimate and choose an appropriate calculating method.
- Can redistribute thousands, hundreds and tens and explain in terms of place value why they are shifted to the right.
- To understand that numbers can be subtracted by partitioning, then redistributing across columns, to the right.
- Record a redistributed digit in the correct column and refer to it correctly.
- Change a calculation to give an equivalent that is easier to solve mentally.
- Use money notation accurately when carrying out column subtracting with amounts of money.

## NPC Milestone 3

- Use efficient written column methods for adding and subtracting whole numbers up to 10 000 and decimals with up to 3 decimal places (NPC 5:3d)

## Explorer Progress Book 5b, pp. 10–11

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 20: Down the River

After completing work on Activity 2, give children Explore More Copymaster 20: Down the River to take home.

## Pupil Book 5, pp. 62–65

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Knowing when to use a written method for subtracting](#)
2. [Developing fluency and accuracy with column subtracting](#)
3. [Exploring column subtracting with money](#)
4. [Solving measure subtracting problems](#)
5. [Developing further fluency with subtracting decimal calculations](#)

# Calculating 7: Mental strategies for multiplying and dividing by 10, 100 and 1000

**Key mathematical ideas** Multiplying, Dividing, Pattern, Place value, Decimals, Mathematical thinking and reasoning

## Educational context

The activities in this group draw on children's previous work on multiplying and dividing, in particular in Calculating 4, and their understanding of place value to explore situations using the scaling structure of multiplying and the ratio structure of dividing.

The activities provide opportunities for children to consolidate their use of the mathematical language associated with these structures and to consider how to represent calculations with structured apparatus.

Children are given time to revisit the skills they already have and to apply them in solving multiplying and dividing problems. As children multiply and divide by 10, 100 or 1000, they apply familiar patterns to work with a wider range of numbers, including decimals. Children use these ideas to convert between different units of measure and to solve problems.

## Learning opportunities

- To use patterns and generalize about multiplying or dividing by 10, 100 and 1000.
- To relate multiplying or dividing by 10 to multiplying or dividing by 100 or 1000.
- To use knowledge of multiplying facts to multiply whole tens, hundreds and thousands.

## Terms for children to use

ten/one hundred/one thousand times larger/smaller, scaling up/down, ... times larger/smaller, scaled up/down by, general rule, commutative, multiplying sentences, dividing sentences, multiples of 10/100/1000, place value, ones, tens, hundreds, thousands, ten thousands, hundred thousands, tenths, hundredths, thousandths, decimal point, inverse

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Notice patterns when multiplying or dividing by 10, 100 or 1000.
- Explain what always happens when multiplying or dividing by 10, 100 or 1000.
- Use known multiplying facts to derive facts for multiplying with whole tens, hundreds or thousands or decimal numbers, e.g. use  $3 \times 5$  to derive  $3 \times 50$ ,  $3 \times 500$ ,  $3 \times 5000$ ,  $3 \times 0.5$ ,  $3 \times 0.05$  and  $3 \times 0.005$ .

## NPC Milestone 3

- Use known multiplying facts to multiply and divide whole numbers and decimals by 10, 100, and 1000 (NPC 5:3e)

## Explorer Progress Book 5b, pp. 12–13

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 21: Number Board $\times$ and $\div$

After completing work on Activity 4, give children Explore More Copymaster 21: Number Board  $\times$  and  $\div$  to take home.

## Pupil Book 5, pp. 66–69

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Consolidating understanding of multiplying by 10](#)
2. [Consolidating understanding of dividing by 10](#)
3. [Multiplying and dividing by 100 and 1000](#)
4. [Multiplying and dividing by 10 with numbers to one decimal place](#)
5. [Multiplying and dividing by 10 with numbers with more than one decimal place](#)
6. [Multiplying and dividing by 10, 100 and 1000 with decimals](#)

# Measurement 1: Metric and imperial units

**Key mathematical ideas** Equivalence, Length and distance, Volume and capacity, Mass, Standard units, Ratio

## Educational context

In this activity group children build on previous measurement work, first consolidating their knowledge of different metric units of length before being introduced to common imperial units for length, mass and volume.

They learn about the similarities and differences between the two measurement systems and explore approximate equivalences between units. Encourage children to use the language of approximation, comparison and ratio, e.g. '1 metre for every 0.9 yards'. Children will be formally introduced to ratio in the *Number, Pattern and Calculating 5 Teaching Resource Handbook*, Calculating 10.

Wherever possible, measuring activities should have realistic contexts, to reinforce that measuring in everyday life is always done for a specific purpose. This activity group uses the context of Isaac and his grandma, who are involved as volunteers in planning and building a new playpark – Isaac is more familiar with metric units, while his grandma prefers imperial. As children consider the different units, take the opportunity to emphasize that standard units of any kind are standardized only for the purposes of communication – that is, so that we are all talking the same 'language' – and that no one system is more or less accurate than another. Encourage them, too, to estimate measurements in order to develop a personal sense of the units used and the relationships between them.

## Learning opportunities

- To convert between different metric units of length, e.g. between millimetres, centimetres, metres and kilometres.
- To explore different imperial units of measure, e.g. inches, pounds, imperial gallons.
- To estimate measurements effectively.
- To understand and use approximate equivalences between metric units and common imperial units.
- To solve problems involving measures.

## Terms for children to use

length, distance, width, height, area, millimetre, centimetre, metre, kilometre, inch, foot, yard, mile, gram, kilogram, tonne, ounce, pound, stone, ton, millilitre, litre, pint, imperial gallon, scale, approximation, estimate, error, ... for every ...

## Assessment opportunities

Look and listen for children who:

- Use the terms for children to use effectively.
- Understand that there are different scales of measurement, e.g. millimetre, centimetre, metre, kilometre.
- Understand that there are different systems of measurement, e.g. that an object can be measured accurately in either metric or imperial units.
- Know that the metric system is more recent than the imperial system.
- Appreciate that while the units of the metric system are all based upon multiples of ten, the units of the imperial system use a variety of multiples.
- Give reasonable estimates of length using both metric and imperial units.
- Carry out approximate conversions between common metric and imperial units of length, mass and volume.

## GMS Milestone 1

- Convert between metric units of measure, e.g. between metres and kilometres (GMS 5:1g)
- Recognize and use common imperial measures, e.g. miles, feet, inches, pints (GMS 5:1h)
- Understand and use approximate equivalences between metric units and common imperial units (GMS 5:1i)

## Explorer Progress Book 5, pp. 6–7

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 4: Which Units Fit Best?

After completing work on Activity 2, give children Explore More Copymaster 4: Which Units Fit Best? to take home.

## Pupil Book 5, pp. 70–73

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Converting between metric units of length and distance](#)
2. [Exploring metric and imperial units of measure](#)
3. [Exploring metres and yards](#)
4. [Converting between miles and kilometres](#)
5. [Converting between imperial and metric units of mass and volume](#)

# Pattern and Algebra 3: Properties of number

**Key mathematical ideas** Generalizing, Pattern, Mathematical thinking and reasoning

## Educational context

These activities rehearse children's knowledge of tables facts through focusing on multiples, factors, and prime and composite numbers. They further build children's multiplicative 'number sense', and also support fluent calculating with fractions, since finding 'lowest common multiples' and 'highest common factors' depends upon being able to recognize factors and multiples quickly. Working systematically is also crucial to this work: it is often important to be able to consider all factor or multiple possibilities in a situation, and knowing that one has 'found all the possibilities' requires a systematic approach. Finally the important distinction between prime and composite (i.e. non-prime) numbers is introduced formally, with a traditional approach to finding all prime numbers less than 100. Overall, the aim should be to develop an easy familiarity with factors and multiples of numbers, and to encourage systematic thinking.

## Learning opportunities

- To identify multiples and factors, including finding all factor pairs and all the factors for a given number.
- To find the lowest common multiple (LCM) of two or more numbers.
- To find the highest common factor (HCF) of two or more numbers.
- To establish whether a number up to 100 is prime.
- To recall all prime numbers up to 20.

## Terms for children to use

multiples, odd, even, digits, divided into equal groups, divided equally, discounted, eliminated, all possibilities, systematic, combinations, strategies, generalize, most, least, common multiples, lowest common multiple, multiply, divides by, divisible, remainders, factors, factor pair, common factor, highest common factor, prime numbers, composite numbers, prime factor, whole number

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Explain that a number is a multiple of another if it divides by that number without a remainder.
- Use knowledge of multiples and times table facts flexibly and fluently.
- Work systematically and logically to narrow possibilities and find solutions to a range of problems involving combinations of multiples.
- Use knowledge of multiples and number facts to find the lowest common multiple of two or more numbers.
- Use knowledge of multiples and times table facts flexibly to develop efficient strategies for finding common multiples and record these in different ways.
- Work systematically to find common factors and identify the highest common factor.
- Work systematically to find all the factors of a given number.
- Work systematically to find prime numbers to 100.
- Explain that numbers that have only 1 and themselves as factors are called prime numbers.
- Explain that numbers that have factors other than 1 and themselves are called composite numbers.

## NPC Milestone 4

- Find the lowest common multiple of two or more numbers (NPC 5:4a)
- Find the highest common factor of two or more numbers (NPC 5:4b)
- Explain the difference between prime and composite numbers and identify them by testing accordingly (NPC 5:4c)

## Explorer Progress Book 5b, pp. 14–15

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 4: Finding Factors

After completing work on Activity 4, give children Explore More Copymaster 4: Finding Factors to take home.

## Pupil Book 5, pp. 74–77

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Guess the multiple](#)
2. [Solving problems with combinations of multiples](#)
3. [Finding the lowest common multiple of two or more numbers](#)
4. [Finding all the factors of a given number](#)
5. [Finding common factors, including the highest common factor](#)
6. [Prime and composite numbers](#)
7. [Finding all prime numbers to 100](#)

# Calculating 8: Using mental methods for multiplying and dividing

**Key mathematical ideas** Multiplying, Dividing, Distributive property, Mathematical thinking and reasoning

## Educational context

The activities in this group build on those explored in the *Number, Pattern and Calculating 4 Teaching Resource Handbook*, Calculating 10. Children develop their understanding that, when multiplying and dividing, a problem can be broken down into easier steps by partitioning a number and then multiplying or dividing the separate parts before combining the outcomes to give a final answer. This distributive property of multiplying and dividing lies behind the short written methods of multiplying and dividing that are extended in Calculating 12 and Calculating 13. Throughout these activities children will need to draw on their knowledge of multiplying facts and the division facts that can be derived from them. It is essential that children keep these skills sharp. The activities are based around the use of arrays to model the distributive property. In turn this builds on the grid method that was explored in the *Number, Pattern and Calculating 4 Teaching Resource Handbook*, Calculating 12. In order to become fluent in these strategies, children should revisit them often in a wide variety of contexts.

## Learning opportunities

- To become familiar with the distributive property of multiplying and dividing.
- To know that the total number represented by an array can be calculated by separating the array into two or more parts, multiplying to find the number for each part and adding these numbers together.
- To know that, to divide it, a number can be broken into two or more parts and each part divided separately, then the quotients added together.

## Terms for children to use

array, times, multiplied by, multiplying sentence, multiplying fact, doubling, partition, product, total, divided by, dividing sentence, dividing fact, groups of ..., grouped into, factor

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Separate arrays into two or more parts and write multiplying sentences for each part.
- Partition a number into two or more parts to make multiplying or dividing easier.
- Record the steps that they have taken using a balancing calculation, e.g.  $1.4 \times 6 = (1 \times 6) + (0.4 \times 6)$
- Demonstrate a good understanding of the relationship between multiplying and dividing.

## NPC Milestone 4

- Use the distributive property of multiplying and dividing to break down calculations into parts and complete them using mental or informal methods (NPC 5:4d)

## Explorer Progress Book 5b, pp. 16–17

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 22: Swimming the Distance

After completing work on Activity 3, give children Explore More Copymaster 22: Swimming the Distance to take home.

## Pupil Book 5, pp. 78–81

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Multiplying using partitioning](#)
2. [Developing understanding of multiplying using the distributive property](#)
3. [Using the distributive property for multiplying with decimals](#)
4. [Exploring dividing using mental strategies](#)
5. [Dividing larger numbers using the distributive property in the context of money](#)

# Calculating 9: Division with remainders

**Key mathematical ideas** Dividing, Pattern, Place value, Fractions, Decimals, Mathematical thinking and reasoning

## Educational context

This activity group focuses on how to deal with remainders of dividing calculations in a range of contexts, building on work done in the *Number, Pattern and Calculating 4 Teaching Resource Handbook*, Calculating 11. Children explore the importance of giving an answer that makes sense in the context of a question, whether this means rounding up, rounding down or expressing the remainder as the number left over or as a common fraction or decimal. These activities complement the work on division in Calculating 8 and on fraction and division in Numbers and the Number System 2, and provide a basis for dealing with remainders when using written methods, as in Calculating 13. In Calculating 13 children will be introduced to extending a calculation to give an answer to two or three decimal places.

In this activity group children are also introduced to the relationship between fractions and division. Making use of a variety of imagery and contexts, they convert improper fractions to whole numbers and, where a remainder is involved, to mixed numbers, spotting factors and multiples in order to reduce fractions to their simplest terms.

## Learning opportunities

- To understand that remainders have to be dealt with in different ways depending on the context, including rounding up or rounding down, or expressing the remainder as a fraction or decimal.
- To know how to express the answer to a dividing calculation where the answer is not an integer as a fraction in its simplest form.
- To know how to express the answer to a dividing calculation where the answer is not an integer as a decimal.
- To know that a fraction, e.g.  $\frac{8}{5}$  is equivalent to a dividing calculation, e.g.  $8 \div 5$ .
- To recognize when an improper fraction will simplify to an integer and when to a mixed number.

## Terms for children to use

shared equally, equal groups of ... , dividing sentence, approximately equal, check, tables facts, multiples, factors, divide, divided by ... , divisible by ... , remainder, fraction, equivalent fraction, improper fraction, mixed number, decimal, divisor, dividend, quotient, exchanging, sharing, groups, inverse, partition

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Determine the most appropriate way for a remainder to be expressed.
- Complete a dividing calculation and express the remainder as a common fraction.
- Complete a dividing calculation and express the remainder as a decimal.
- Understand that a fraction can be expressed as a dividing calculation, for example,  $\frac{12}{5} = 12 \div 5$ .

## NPC Milestone 4

- Interpret answers to dividing calculations which are not whole numbers appropriately, in context (NPC 5:4e)

## Explorer Progress Book 5b, pp. 18–19

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 23: Equal Share

After completing work on Activity 4, give children Explore More Copymaster 23: Equal Share to take home.

## Pupil Book 5, pp. 82–85

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Understanding remainders](#)
2. [Dividing using fractions as remainders](#)
3. [Linking remainders to arrays](#)
4. [Expressing remainders as fractions in short division](#)
5. [Using equivalent fractions to express a remainder as a decimal](#)
6. [Linking improper fractions to division with no remainders \(converting improper fractions to whole numbers\)](#)
7. [Linking improper fractions to division with remainders – converting improper fractions to mixed numbers](#)



# Geometry 3: Exploring angles

**Key mathematical ideas** Angles, Rotation, Equivalence, Parts and properties, Classifying, Being logical

## Educational context

This activity group builds on work from Geometry 1 and from the *Geometry, Measurement and Statistics 5 Teaching Resource Handbook*, Geometry 1 and 3, to explore the angle properties of polygons. Children are introduced to the idea of interior and exterior angles, and have the opportunity to explore the sums of these angles to establish that, e.g. the exterior angles of any polygon add up to  $360^\circ$  and the interior angles of any triangle add up to  $180^\circ$ , using their growing understanding of angle relationships to solve 'missing angle' problems. They revisit their knowledge of the conventional classification of polygons, particularly triangles and quadrilaterals, and further develop their understanding of this in relation to angles. They work with geometric diagrams, and are introduced to the diagonal, and to the conventional 'arrow' symbols used to indicate parallel lines.

As part of this work, children encounter formal mathematical and geometric proof. This represents a crucial extension of their ability to generalize findings through abstract reasoning, and is reflected in distinctions – between reasoning and measuring, exactness and approximation, the abstract and physical, the general and particular – which are emphasized throughout the activity group. The activities are likely to be demanding in terms of children's abstract and spatial reasoning, and their investigative skills and resilience. It is important to allow them plenty of time to think about, share and discuss the ideas involved, and to encourage them to make full use of available resources and persist in their explorations.

The activities provide significant scope for extension, but the focus should be on understanding rather than fast progression; explore children's learning at each stage, encouraging them to explain in their own terms, before moving on.

## Learning opportunities

- To understand the angle properties of a variety of polygons.
- To begin to appreciate the distinction between reasoning and measuring.
- To distinguish between regular and irregular polygons.
- To appreciate how the properties of polygons can be used to find missing angles.
- To understand what a diagonal is.
- To know how to use conventional markings for parallel sides.

## Words for children to use

angle, turn, rotation, clockwise, anticlockwise, degrees, acute, right, obtuse, reflex, 2D shape names (e.g. triangle, quadrilateral, pentagon, hexagon, circle, square, oblong), side, vertex, polygon, non-polygon, regular, irregular, exterior, interior, supplementary, protractor, perimeter, parallel, perpendicular, diagonal, proof, exact, approximate, specific, general, measure, equal, equivalent

## Assessment opportunities

Look and listen for children who:

- Use the terms for children to use effectively.
- Can describe the relationship between the interior and exterior angles of any polygon.
- Use conventional symbols for parallel lines.
- Identify and draw diagonals in polygons.
- Use angle sum facts to work out missing angles.
- Reason to generalize findings.

## GMS Milestone 2

- Accurately identify and describe parallel sides in polygons, including from conventional symbols (GMS 5:2a)
- Identify the interior and exterior angles of a polygon, and explain the difference and relationship between them (GMS 5:2b)
- Explain in simple terms why the exterior angle sum of any polygon is  $360^\circ$  (GMS 5:2c)
- Identify and draw diagonals in polygons (GMS 5:2d)
- Distinguish between regular and irregular polygons (GMS 5:2e)
- Use angle sum facts and understanding of the angle properties of polygons to calculate the size of unknown angles (GMS 5:2f)
- 

## Explorer Progress Book 5, pp. 8–9

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 3: Investigating Angles

After completing work on Activity 2, give children Explore More Copymaster 3: Investigating Angles to take home.

## Pupil Book 5, pp. 86–89

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Exploring exterior angles](#)
2. [Exploring exterior and interior angles](#)
3. [Proving the sum of the interior angles of a triangle](#)
4. [Exploring angles in triangles](#)
5. [Exploring angles in quadrilaterals](#)

# Calculating 10: Proportion and ratio

**Key mathematical ideas** Fractions, Equivalence, Ratio, Multiplicative thinking, Mathematical thinking and reasoning

## Educational context

In this activity group children explore ratio and proportion, applying their knowledge of multiplying and dividing to solve problems. These activities lay the foundations for a more formal introduction to ratio in Year 6. Children explore scales, rates and conversions in a range of contexts, using numbers they are confident working with mentally. They also explore this further in the *Geometry, Measurement and Statistics 5 Teaching Resource Handbook*, Measurement 2 and 6.

Ratio is a way of comparing two or more quantities measured in the same units – the quantities may be separate entities or they may be different parts of a whole. Proportion can be defined as ‘an equality of ratios’, e.g. when reading a map, the distance between two points drawn to scale is proportional to the actual distance on the ground. The scale shows you how to compare the two distances. Often we use the same word to refer to a fractional part of a whole, e.g. the ‘proportion’ of children in a class who walk to school. This can sometimes be a source of confusion. You can encourage children to recognize the two different senses in which this term is used by discussing and working with them to illustrate the difference between finding a fraction of an amount (as they did in, e.g. Calculating 4) and using ratios in these activities to solve scaling and conversion problems.

The final activity in this group involves children converting between metric units of measurement. This will draw on the skills they explored in Calculating 7, of multiplying and dividing by 10, 100 and 1000, as well as their knowledge of units (from, e.g. the *Geometry, Measurement and Statistics 4 and 5 Teaching Resource Handbooks*).

## Learning opportunities

- To solve problems involving multiplication and division, including scaling problems.
- To solve problems involving simple rates.
- To use multiplication and division as inverses to support the later introduction of ratio, e.g. by multiplying and dividing by powers of 10 in scale drawings or by multiplying and dividing by powers of 10 to convert between units such as kilometres and metres.

## Terms for children to use

ratio, proportion, in every ... , for every ... , to every ... , scale, multiply, divide, in steps of ... , rate, scale

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Notice patterns when exploring ratios and different scales.
- Use their knowledge of multiplying and dividing by powers of 10 when converting between measurements in different metric units.
- Apply their knowledge of multiplying and dividing to create scale drawings.
- Use a ruler to draw lines to the nearest millimetre.

## NPC Milestone 4

- Use multiplying and dividing to solve problems involving scaling (NPC 5:4f)

## Explorer Progress Book 5b, pp. 20–23

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance. Children will also have the opportunity to complete their Learning Log (p22–23) where they can reflect on the mathematics they have done so far.

## Explore More Copymaster 24: Railway Stations

After completing work on Activity 2, give children Explore More Copymaster 24: Railway Stations to take home.

## Pupil Book 5, pp. 90–93

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Scaling a recipe](#)
2. [Exploring ratio in a real-life context](#)
3. [Making scale drawings](#)
4. [Solving problems involving simple rates](#)
5. [Converting units of metric measurement](#)

# Calculating 11: Percentages

**Key mathematical ideas** Percentages, Equivalence, Mathematical thinking and reasoning

## Educational context

This activity group introduces percentages. In the focus activities children develop an understanding of how percentages are used in contexts relevant to them.

Ask children in their class to look for real-life examples of percentages and bring these in to create a class collection that can be used as a stimulus for discussion. The activities are very closely linked to those focused on fractions and decimals, e.g. Numbers and the Number System 2 and 3 and it is essential that children explore these links.

Once children have a good understanding of the learning covered in this activity group, they will be able to move on to solving more complex problems involving the calculation of percentages of whole numbers or measures and using percentages for comparison; this is covered in Numbers and the Number System 7.

## Learning opportunities

- To become familiar with the per cent (%) symbol.
- To understand that 'per cent' relates to 'number of parts per hundred'.
- To find percentages of numbers other than 100.
- To realize that an understanding of fractions, e.g.  $\frac{1}{2}$ ,  $\frac{1}{4}$  and  $\frac{1}{5}$  can be applied to problems involving percentage.
- To explore the relationship between percentages, fractions and decimals.
- To order percentages, fractions and decimals on a number line.
- To realize that percentages are both proportions of quantities and operators on quantities.

## Terms for children to use

percentage, per cent, in every, for every, out of, proportion, hundredth, half, quarter, tenth, fraction, decimal

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Notice the relationships between fractions, decimals and percentages.
- Can order percentages, fractions and decimals on a number line.
- Apply their understanding of number relationships to help them solve problems involving percentages.
- Use known number facts to solve problems involving percentage, e.g.  $3 \times 25 = 75$  and  $3 \times 12 = 36$ , so if 25% is £1.20, then 75% is £3.60.

## NPC Milestone 4

- Explain percentage as the number of parts per hundred (NPC 5:4g)
- Find and explain percentage, fraction and decimal equivalents in order to solve problems in context (NPC 5:4h)

## Explorer Progress Book 5c, pp. 2–3

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 25: Mixed Materials?

After completing work on Activity 3, give children Explore More Copymaster 25: Mixed Materials? to take home.

## Pupil Book 5, pp. 94–97

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Understanding the term 'per cent'](#)
2. [Consolidating understanding of per cent as 'parts per hundred'](#)
3. [Finding percentages that total 100%](#)
4. [Visualizing 50% using knowledge of fractions](#)
5. [Using a known percentage to find other percentages](#)
6. [Exploring the relationship between percentages, fractions and decimals and placing these on a number line](#)

## Measurement 2: Interpreting charts and graphs

**Key mathematical ideas** Collecting data, Organizing data, Representing data, Temperature, Time

### Educational context

This activity group involves children collecting, reading, interpreting and presenting data in order to answer questions in a variety of contexts. The activities encourage children to think carefully about the question being asked, and to read and interpret information from a range of tables, charts and graphs. They begin making decisions about research questions, and methods of data collection, organization and presentation, that are appropriate to the type of data and are effective in answering the specific question asked. Building on their work on angles (in Geometry 1 and 3) and on percentages, ratio and proportion (from the *Number, Pattern and Calculating 5 Teaching Resource Handbook*, Calculating 10 and 11); and preparing for further work on percentages, ratio and proportion in the *Number, Pattern and Calculating 5 Teaching Resource Handbook*, Numbers and the Number System 7; they are introduced to the use and construction of pie charts. They build on their work on negative numbers (from the *Number, Pattern and Calculating 5 Teaching Resource Handbook*, Numbers and the Number System 5) by reading and recording temperatures using thermometers.

Throughout, a key point of emphasis is the purpose of data handling: activities pose specific questions and are built around answering these questions, whether the context is an archery competition, water usage, the growth of a snake, organizing a trip or car colours. The appropriateness, clarity and overall success of different ways of presenting data are evaluated in terms of the type of data and the specific question to be answered. It is important to encourage children at every stage to consider and discuss their work in relation to the question they are trying to answer.

A few of the activities in this activity group require some time and preparation to set up the resources in advance of children using them, e.g. Activity 4 needs ice cubes, water trays; Activity 5 needs local maps, leaflets and timetables to be collected; Activity 6 requires children to collect their own data on cars, which will require planning.

### Learning opportunities

- To complete, read and interpret information from tables, charts and graphs.
- To solve comparison, sum and difference problems using tables, charts and graphs.
- To choose a method of presentation appropriate to the type of data and the question to be answered.
- To relate the size of negative numbers to their position on measuring scales.
- To explain why a line graph is an appropriate way of presenting data on continuously changing measures, e.g. temperature.

### Terms for children to use

table, chart, graph, timetable, pie chart, bar chart, line graph, data, axis, scale, label, title, division, point, coordinate, continuous, discrete, interval, score, percentage, proportion, fraction, total, result, running total, conclusion, cumulative, sample, negative numbers, positive numbers, thermometer, digital, analogue, temperature, Celsius, increasing, decreasing, direction, magnitude

### Assessment opportunities

Look and listen for children who:

- Use the terms for children to use effectively.
- Understand that data can be presented in different ways.
- Read, interpret and present data in tally charts, timetables, bar charts and pie charts.
- Select a method of presenting data which is appropriate to the type of data and the question to be answered.
- Read temperature from a thermometer, in degrees Celsius ( $^{\circ}\text{C}$ ), including negative values.
- Explain that as temperature rises the magnitude of negative values decreases and that of positive values increases, and vice versa.

### GMS Milestone 2

- Complete, read and interpret information in tables, charts and graphs (GMS 5:2g)
- Read and use scales on charts and graphs in a variety of contexts, including with negative numbers (GMS 5:2h)
- Recognize that choosing which is an appropriate method for representing data depends on the type of data and the question being asked (GMS 5:2i)

### Explorer Progress Book 5, pp. 10–11

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

### Explore More Copymaster 5: Rent a Flat

After completing work on Activity 2, give children Explore More Copymaster 5: Rent a Flat to take home.

### Pupil Book 5, pp. 98–101

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

### Focus activities

1. [Analysing data presented in different ways](#)
2. [Using a line graph to present data](#)
3. [Using a line graph to compare and predict measurements](#)
4. [Measuring temperature over time](#)
5. [Reading and using information from timetables](#)
6. [Presenting and comparing data in pie charts and bar charts](#)

# Numbers and the Number System 7: Solving problems with fractions, decimals and percentages

**Key mathematical ideas** Fractions, Percentages, Equivalence, Ordering, Mathematical thinking and reasoning

## Educational context

This activity group builds on the work in Numbers and the Number System 3, where children explored equivalences between fractions and decimals, relating this understanding to percentages (introduced in Calculating 11). Children use this knowledge to find proportions of quantities, e.g. to work out that, if 40 out of 50 children are girls, then 80% are girls. They also explore equivalents of commonly used fractions, and are introduced to using a percentage as an operator, e.g. finding 20% of 160 cm.

Children will develop an understanding that percentages can be used in contexts where comparisons are important (e.g. trade, science) as a 'common fraction language', recognizing that it is easier to compare 44% with 45% than  $\frac{11}{23}$  with  $\frac{9}{20}$ .

## Learning opportunities

- To become confident at making connections between percentages, decimals and fractions.
- To be familiar with the decimal and fraction equivalents of 1%, 10%, 100%, 25% and 50%, e.g.  $25\% = 0.25 = \frac{1}{4}$ .
- To use known equivalents to determine new relationships, e.g.  $10\% = \frac{1}{10}$ , so  $40\% = \frac{4}{10}$ .
- To find fractions of amounts, including measures.
- To use percentages as proportions of quantities and as operators on quantities.

## Terms for children to use

fraction, decimal, percentage, per cent, part-whole relationship, equivalent, denominator, numerator, proportion, for every, out of, unit fraction, proper fraction, improper fraction, mixed number, factor, common factor, multiple

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Notice patterns that support their understanding and can talk about these using mathematical language.
- Explain equivalences between fractions, decimals and percentages.
- Use their knowledge of, e.g. 1% or 10% of an amount to work out other percentages of the same amount.
- Find percentages and fractions of amounts in a range of contexts such as money and measures.
- Convert fractions with denominators that are factors of 100 to percentages, e.g.  $\frac{11}{25} = \frac{44}{100} = 44\%$ .

## NPC Milestone 5

- Know percentage equivalents of commonly used fractions, e.g.  $\frac{1}{2}$ ,  $\frac{1}{4}$ ,  $\frac{3}{4}$  (NPC 5:5a)
- Use percentages to express simple proportions, e.g. 24 out of 32 as 75% (NPC 5:5b)
- Find percentages of amounts, including measures (NPC 5:5c)

## Explorer Progress Book 5c, pp. 4–5

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 14: 100% Challenge

After completing work on Activity 3, give children Explore More Copymaster 14: 100% Challenge to take home.

## Pupil Book 5, pp. 102–105

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Finding equivalents of 1% and other multiples](#)
2. [Finding percentages of amounts other than 100](#)
3. [Finding equivalents of multiples of 10% and finding percentages of amounts](#)
4. [Finding equivalents of commonly used fractions](#)
5. [Using percentages as proportions of quantities](#)
6. [Using percentages as operators](#)

# Pattern and Algebra 4: Looking for patterns and generalizing

**Key mathematical ideas** Generalizing, Pattern, Mathematical thinking and reasoning

## Educational context

These activities are essentially about generalizing, first in relation to tests of 'divisibility', e.g. 'A number is divisible by 4 if its last two digits are divisible by 4,' then through extending children's work on number sequences beyond linear sequences to sequences with more complicated term-to-term rules.

The emphasis here is on visualizing such sequences and describing their rules and patterns in visual terms: sequences are presented using apparatus or imagery and children are encouraged to 'say what you see' before using numbers to describe it.

These activities provide a foundation for children's future work on 'global generalizations', which involve writing a 'general term' (or 'formula') for a sequence. At this stage, the most important thing to focus on is visualizing and imagery.

Finally, the visual emphasis is continued in introducing the sequences of 'square' and 'cube' numbers. Here again, the focus should be on discussion and how these numbers 'look', rather than on, for example, the superscript notation (e.g.  $4^2$ ). Conventions are important, but at this stage physical action and imagery will help children grasp the 'sense' of what is going on. The understanding gained here will help children in their exploration of area and volume in *the Geometry, Measurement and Statistics 5 Teaching Resource Handbook*, Measurement 3, 4 and 5.

## Learning opportunities

- To recognize and use rules of divisibility by 2, 3, 5, and 10.
- To visualize and describe non-linear number sequences using number rods.
- To recognize and use square numbers and cube numbers, and their superscript notation.

## Terms for children to use

multiples, factors, divisible by, divided equally, divisibility rules, qualify, disqualify, odd, even, prove, general rule, general statement, generalize, digits, digit sum, systematically, investigate, relationships, term, pattern, growing patterns, relative size, area, difference, sequence, consecutive, length, width, height, area, volume, square, square number, cube, cube number

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Use knowledge of factors, multiples and divisibility flexibly and systematically to deduce general rules and explain them clearly.
- Work systematically to explore non-linear sequences to find patterns from which they deduce general rules.
- Explain that when a number is multiplied by itself the product can be called a square number.
- Use and read square number notation, e.g.  $5^2$ .
- Make connections between square numbers and area and the notation used for units of area (e.g.  $\text{cm}^2$ ).
- Explain that when a number is multiplied by itself twice we call this a cube number
- Use and read cube number notation, e.g.  $4^3$ .

## NPC Milestone 5

- Know and be able to use simple tests of divisibility (NPC 5:5d)
- Explain what square and cube numbers are (NPC 5:5e)

## Explorer Progress Book 5c, pp. 6–7

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 5: Window Patterns

After completing work on Activity 3, give children Explore More Copymaster 5: Window Patterns to take home.

## Pupil Book 5, pp. 106–109

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Testing general statements about factors, multiples and divisibility](#)
2. [Writing general rules for number rod designs](#)
3. [Writing general rules for growing number rod sequences](#)
4. [Generalizing about square numbers](#)
5. [Exploring square numbers](#)
6. [Generalizing about the factors of square numbers](#)
7. [Generalizing about cube numbers](#)



## Measurement 3: Calculating area and perimeter

**Key mathematical ideas** Area, Length and distance, Being logical

### Educational context

In this activity group children consolidate and extend the work from the *Geometry, Measurement and Statistics 4 Teaching Resource Handbook* on area and perimeter. They begin by revisiting the idea of rectangles as arrays of square units, using this context to explore the connections between rectangular area and factors and multiples, and extending this to make links to square and prime numbers. This provides an opportunity to consolidate work in the *Number, Pattern and Calculating 5 Teaching Resource Handbook*, Pattern and Algebra 3 and 4. Children also consolidate their understanding of the relationship between area and perimeter, before moving on to consider composite rectilinear shapes. They solve problems involving shapes for which the lengths of sides are given in different units or are missing, enabling them to develop their understanding to the point where they can calculate areas from given measurements.

### Learning opportunities

- To calculate the area and perimeter of rectangles and composite rectilinear shapes.
- To calculate and compare areas measured in square centimetres (cm<sup>2</sup>).
- To use known facts about squares and rectangles to find an unknown length.
- To use knowledge about the factors of prime and square numbers when finding areas.

### Terms for children to use

area, perimeter, length, space, 1D, 2D, 3D, dimensions, rectilinear, composite, compound, regular, irregular, maximum, minimum, generalize, factor, multiple, square number, prime number, square centimetre

### Assessment opportunities

Look and listen for children who:

- Use the terms for children to use effectively.
- Understand that area is an amount of surface within a shape and perimeter is the distance around a shape.
- Calculate and compare the area of rectangles based on their dimensions.
- Use factors to discover possible dimensions of a shape with a specified area.
- Use knowledge of prime numbers to determine when only one set of dimensions is possible for a specified area.
- Calculate perimeter in centimetres based on the properties of a shape, e.g. working out and adding side lengths of rectilinear shapes.
- Understand units of area, e.g. square centimetres, as squares of a given side length, e.g. 10 cm.
- Calculate the area of composite shapes, either by dividing into component rectangles and adding areas, or by subtracting a missing area from an imagined larger shape.

### GMS Milestone 2

- Describe area as a measure of flat space and perimeter as a measure of length (GMS 5:2j)
- Recognize that area is measured in square units (GMS 5:2k)
- Calculate the areas and perimeters of rectangles, in square centimetres and centimetres, respectively, given pairs of dimensions (GMS 5:2l)
- Find missing side lengths and calculate areas and perimeters of composite rectilinear shapes, in square centimetres and centimetres (GMS 5:2m)

### Explorer Progress Book 5, pp. 12–13

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

### Explore More Copymaster 6: Exploring Rectangles

After completing work on Activity 3, give children Explore More Copymaster 6: Exploring Rectangles to take home.

### Pupil Book 5, pp. 110–113

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

### Focus activities

1. [Exploring area and perimeter of rectangles](#)
2. [Using the areas of rectangles to explore factors and square and prime numbers](#)
3. [Understanding the area and perimeter of a rectangle](#)
4. [Finding the area and perimeter of composite shapes](#)

# Calculating 12: Written methods of multiplying

**Key mathematical ideas** Multiplying, Distributive property, Mathematical thinking and reasoning

## Educational context

This activity group builds on children's learning in the Number Pattern and Calculating 4 Teaching Resource Handbook, Calculating 12.

Children develop their understanding of written methods of multiplying and use them in a range of contexts, including money and measures. Throughout the activity group it is important to encourage children to estimate answers and to decide what sort of method is most appropriate for the numbers they are dealing with, building on their work with mental methods in Calculating 8. As they progress through the activities, children develop their understanding of arrays and how these relate to the more formal written methods that are introduced.

There are many opportunities for children to apply their knowledge of place value and number facts in order to gain fluency, and to develop the habit of expressing the answer in the context of the problem. When exploring the long method of multiplying, it is important to stress the need to lay out each calculation carefully and put carry digits in the right place. Activity 5 offers guidance on selecting calculations that gradually introduce the different stages of carrying to children, as they become more confident with long multiplication.

## Learning opportunities

- To understand how arrays can be broken down into different parts to make it easier to calculate a product.
- To use recall of multiplying facts and the distributive property to calculate products.
- To use the short method for written multiplying calculations (up to 3-digits  $\times$  1-digit).
- To use the long method of multiplying to multiply by a 2-digit whole number.
- To use knowledge of place value when multiplying.
- To understand when to multiply to solve problems in a range of real-life contexts, including measures.
- To multiply decimal numbers to solve problems in real-life contexts.

## Terms for children to use

multiplying, multiply, multiplied by, array, times, lots of, multiplying sentences, short method of multiplying, long method of multiplying, written method, place value, partitioning, carrying, grouping, regrouping, names of units of measure and money (e.g. litre, kilogram, pounds, pence)

## Assessment opportunities

Look and listen for children who can:

- Use the words and terms for use in conversation effectively.
- Describe the steps involved in the short method of multiplying.
- Describe the steps involved in the long method of multiplying.
- Multiply to solve problems in the context of measures.

## NPC Milestone 5

- Use efficient written methods to multiply numbers with up to 4 digits by 2-digit numbers (NPC5:5f)

## Explorer Progress Book 5c, pp. 8–9

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 26: Cycle Calculator

After completing work on Activity 3, give children Explore More Copymaster 26: Cycle Calculator to take home.

## Pupil Book 5, pp. 114–117

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Understanding the short written method of multiplying for  \$TO \times O\$  and  \$HTO \times O\$](#)
2. [Multiplying in measuring contexts \( \$HTO \times O\$ \)](#)
3. [Multiplying decimals using the short written method](#)
4. [Multiplying 2-digit numbers \( \$TO \times TO\$ \)](#)
5. [Introducing long multiplication](#)

## Measurement 4: Estimating volume and capacity

**Key mathematical ideas** Volume and capacity, Working in 2D and 3D, Equivalence, Standard units

### Educational context

This activity group builds on the work on capacity and volume from the *Geometry, Measurement and Statistics 4 Teaching Resource Handbook*. Using their understanding of liquid volumes, children explore solid volumes through building cubes and cuboids and reasoning about their dimensions.

Working practically with number rods, interlocking cubes and isometric paper, children investigate and calculate the volume and capacity of various cuboids. They build models with specific volumes, in cubic centimetres, relating this to their understanding of multiplying and building on their learning about square and cube numbers from the *Number, Pattern and Calculating 5 Teaching Resource Handbook*, Pattern and Algebra 4. They also practise drawing 2D representations of 3D cubes and cuboids on isometric paper.

In Activity 4, children explore displacement (as discovered by Archimedes) and develop an understanding of the equivalence between cubic centimetres and millilitres. They convert between millilitres or litres and cubic centimetres, preparing them for meeting cubic millimetres, metres and kilometres in the *Geometry, Measurement and Statistics 6 Teaching Resource Handbook*. Finally, they work together to design a miniature aquarium according to given specifications.

### Learning opportunities

- To calculate the volume of cuboids in cubic centimetres.
- To estimate the volume of solids in cubic centimetres.
- To recognize and draw 2D representations of 3D cubes and cuboids.
- To consolidate understanding of square and cube numbers.
- To convert between millilitres, litres and cubic centimetres.

### Terms for children to use

size, space, volume, capacity, length measurements, length, width, height, depth, dimensions, two/three dimensional, 2D, 3D, cuboid, cube, rectangle, oblong, square, displace, product, estimate, orientation, face, edge, vertex, square number, cube number, cubic centimetre

### Assessment opportunities

Look and listen for children who:

- Use the terms for children to use effectively.
- Convert between cubic centimetres and millilitres or litres.
- Estimate the volume of a solid object in cubic centimetres.
- Estimate the volume of liquids in millilitres.
- Calculate the volume of a cuboid given the length, width and height.
- Describe what a cube number is.
- Calculate and recognize cube numbers (up to 63).
- Recognize and create 2D representations of 3D cubes and cuboids.

### GMS Milestone 3

- Explain the difference between volume and capacity and the equivalence between cubic centimetres and millilitres (GMS 5:3a)
- Build cuboids of a given volume using cubes or rods (GMS 5:3b)
- Create 2D drawings of 3D shapes (GMS 5:3c)
- Give a reasonable estimate of the volume of an object, in cubic centimetres (GMS 5:3d)
- Calculate volume or capacity given the dimensions of a cuboidal shape or space (GMS 5:3e)

### Explorer Progress Book 5, pp. 14–15

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

### Explore More Copymaster 7: Drawing Cubes

After completing work on Activity 2, give children Explore More Copymaster 7: Drawing Cubes to take home.

### Pupil Book 5, pp. 118–121

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

### Focus activities

1. [Finding the volume of a cuboid](#)
2. [Drawing 2D representations of cuboids](#)
3. [Building cubes and exploring cube numbers](#)
4. [Introducing the equivalence between cubic centimetres and millilitres](#)
5. [Estimating and converting between volumes in cubic centimetres and millilitres](#)
6. [Solving problems involving solid and liquid volumes and capacities](#)

# Calculating 13: Written methods of dividing

**Key mathematical ideas** Dividing, Mathematical thinking and reasoning

## Educational context

These activities develop children's understanding of dividing, building on their learning from the *Number, Pattern and Calculating 4 Teaching Resource Handbook*, Calculating 13. The activities explore the two key dividing structures of sharing (partition) and grouping (quotition) and use these to extend children's understanding of the traditional method for written dividing to decimals. Provide children with opportunities to discuss these structures and the relationship between them, so that they can confidently carry out written dividing calculations. To help them develop fluency, understanding and accuracy in their written calculations work, they will also need to revisit, use and apply their learning regularly in as wide a variety of contexts as possible, both within mathematics and across the curriculum. Some dividing calculations may not have an exact answer, and, as explored in Calculating 9, we need to think about whether to 'leave a remainder' or to continue dividing into fractions or to an approximate answer expressed as a decimal.

When working with money, e.g. in Activity 5, children may suggest converting the amount to pence by multiplying by 100. If they do this, it is important that they know how to convert their result back to pounds and pence to give a sensible answer.

## Learning opportunities

- To use the short method of dividing.
- To extend understanding of dividing to calculations involving decimals.
- To record dividing calculations using the  $\overline{)} \quad$  and  $\div$  symbols.
- To know how to interpret remainders in different dividing situations, including as fractions and decimals.
- To use multiplying facts to check dividing calculations.
- To know when to divide to solve problems in a variety of contexts, including measures and money.

## Terms for children to use

shared equally, equal groups of, dividing sentence, tables facts, multiple, factor, divide, divided by, divisible by, remainder, fraction, decimal, dividend, divisor, quotient, exchanging, sharing, groups, inverse, partition, written method, names of units of measure and money (e.g. litre, kilogram, pounds, pence)

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Record dividing calculations using the  $\overline{)} \quad$  and  $\div$  symbols.
- Review numbers in a dividing calculation to decide whether to use a written or mental method.
- Use the short written method for dividing for whole numbers and decimals.
- Divide when necessary to solve measures and money problems.
- Use inverse multiplying calculations to check dividing calculations.

## NPC Milestone 5

- Choose appropriate and effective mental or written methods to divide numbers with up to 4 digits by single-digit numbers (NPC 5:5g)

## Explorer Progress Book 5c, pp. 10–11

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 27: Ribbon Shapes

After completing work on Activity 3, give children Explore More Copymaster 27: Ribbon Shapes to take home.

## Pupil Book 5, pp. 122–125

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Revisiting the sharing and grouping structures for dividing](#)
2. [Developing fluency with the short written method of dividing \(ThHTO  \$\div\$  O\)](#)
3. [Dividing with decimals in a measures context](#)
4. [Dividing where the answer has three or more decimal places](#)
5. [Dividing in a money context](#)
6. [Developing fluency and accuracy with the short method of dividing decimals](#)

# Calculating 14: Calculating fractions of amounts

**Key mathematical ideas** Fractions, Dividing, Equivalence, Mathematical thinking and reasoning

## Educational context

This activity group builds on children's understanding of fractions, developed in Numbers and the Number System 2, 6 and 7. It also revisits the method of using arrays introduced in the *Number, Pattern and Calculating 4 Teaching Resource Handbook*, Calculating 11. Children calculate fractions of numbers and quantities, first to find one part, e.g.  $\frac{1}{12}$  of 48, then to find several parts, e.g.  $\frac{5}{12}$  of 48. They begin their exploration with arrays before moving on to apply their understanding in real-life contexts, including money and measures. Finally, children build on the work in Calculating 9 and 13 to explore how to approach dividing calculations that produce remainders and how these remainders can be expressed

## Learning opportunities

- To use the inverse relationship between multiplying and dividing.
- To use multiplying and dividing facts to find fractions of amounts.
- To appreciate that having fluent recall of multiplying facts supports the process of calculating fractions of amounts.

## Terms for children to use

equal, fair, parts, divided into, dividing, multiplying, fraction, dividing facts, multiplying facts, factor, multiple, inverse, matching, how many ... in ... ?, dividend, divisor, quotient, remainder

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Find one part of a whole number or quantity.
- Find several parts of a whole number or quantity.
- Use multiplying facts to help with dividing.
- Describe part of an array as a fraction of the whole.
- Explain links between finding fractions and dividing.
- Express remainders in ways consistent with the context of the problem, including as remainders or fractions.

## NPC Milestone 5

- Calculate fractions of amounts in practical problem-solving contexts (NPC 5:5h)

## Explorer Progress Book 5c, pp. 12–13

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 28: Charity Funds

After completing work on Activity 3, give children Explore More Copymaster 28: Charity Funds to take home.

## Pupil Book 5, pp. 126–129

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Finding fractions of an array](#)
2. [Finding fractions of quantities](#)
3. [Finding fractions of amounts of money](#)
4. [Finding fractions of lengths](#)
5. [Finding fractions of amounts where the answer is not a whole number](#)

# Measurement 5: Working with area and perimeter

**Key mathematical ideas** Area, Length and distance, Being logical

## Educational context

This activity group consolidates and extends the work from Measurement 3 on area and perimeter. Children begin by extending their mathematical reasoning to calculate areas and perimeters for rectilinear shapes with sides in metres. They also estimate areas of irregular shapes and shapes made with non-perpendicular sides.

Finally, children consider how to find an unknown side length from a given area or perimeter. This work draws them into using algebraic notation, with letters standing for unknown number values and also providing a way of expressing generalized relationships, including giving the area of any rectangle as  $n \times b$  and its perimeter as:

$$n + b + n + b \text{ or } (2 \times n) + (2 \times b)$$

## Learning opportunities

- To calculate the area and perimeter of rectangles and composite rectilinear shapes.
- To convert between metres and centimetres.
- To use a known perimeter or area to find an unknown length on a shape.
- To calculate and compare areas measured in square centimetres ( $\text{cm}^2$ ) and square metres ( $\text{m}^2$ ).
- To estimate the area of irregular shapes and shapes with non-perpendicular sides.
- To express a missing measure problem algebraically.

## Terms for children to use

area, perimeter, length, space, dimensions, rectilinear, composite, compound, scale, regular, irregular, estimate, maximum, minimum, factor, multiple, inverse, square metre, square centimetre

## Assessment opportunities

Look and listen for children who:

- Use the terms for children to use effectively.
- Understand that perimeter is the distance around a shape and area is the amount of surface within a shape.
- Understand that shapes with the same area can have different perimeters and vice versa.
- Calculate perimeter in metres based on the properties of a shape, e.g. doubling side lengths.
- Create composite shapes (e.g. an L-shape) made from rectilinear shapes.
- Calculate the area of composite shapes.
- Estimate the area of irregular shapes and shapes with non-perpendicular sides.
- Express the area and perimeter of a rectangle algebraically.
- Use algebra with known facts to show area or perimeter of rectangles with unknown lengths
- Find unknown lengths using known facts about area or perimeter of rectangles.
- Understand units of area as squares of a given side length, e.g. square metres have a given side length of 1 m.

## GMS Milestone 3

- Find missing side lengths and calculate areas and perimeters of more complex composite rectilinear shapes, in square centimetres or metres and in centimetres or metres (GMS 5:3f)
- Estimate areas of irregular shapes (GMS 5:3g)
- Express the area or perimeter of a rectangle algebraically in order to find an unknown length, e.g.  $5 \times b = 30$  so  $b = 6$  and the unknown length is 6 cm (GMS 5:3h)

## Explorer Progress Book 5, pp. 16–17

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 8: Estimating the Area of Irregular Shapes

After completing work on Activity 2, give children Explore More Copymaster 8: Estimating the Area of Irregular Shapes to take home.

## Pupil Book 5, pp. 130–133

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Investigating shape, area and perimeter](#)
2. [Finding the area of more composite shapes](#)
3. [Calculating area and perimeter of oblongs with unknown lengths](#)
4. [Finding an unknown side length from a given area or perimeter](#)



# Measurement 6: Scale drawing

**Key mathematical ideas** Scaling, Equivalence, Ratio, Being logical

## Educational context

In this activity group children build on their work in Measurement 5 to consider how scale drawings and maps provide accurate representations of real life and how they are constructed. They begin by considering how scale works in relation to representations of some famous buildings, and the effect of different scales on our ability to compare these buildings in terms of height. They then move on to making scale drawings: measuring actual lengths, deciding on an appropriate scale factor and calculating scaled lengths. They also explore the use of scale on maps, investigating how lengths and distances on a map relate to real-world objects and places, and considering how accurate actual lengths and distances calculated from a map can be.

These activities involve children in applying their understanding of length, perimeter and area from Measurement 5, and in multiplying and dividing by powers of 10, consolidating work from the *Number, Pattern and Calculating 5 Teaching Resource Handbook*, Calculating 7. They also enable children to make important visual connections to ideas of ratio, proportion and fractions, as covered in the *Number, Pattern and Calculating 5 Teaching Resource Handbook*, Calculating 10.

The final focus and independent practice activities offer opportunities to invite children to notice that lengths and areas change at different rates in response to scaling height and width: if the dimensions of a shape are doubled, its area becomes not twice but four times as large. There is an opportunity here to explore the mathematical relationship between the scale factors for length and area; however, this is a complicated idea that will be revisited in more depth in the *Geometry, Measurement and Statistics 6 Teaching Resource Handbook*.

Children will need plenty of time to think about and discuss these ideas as they work through them

## Learning opportunities

- To understand and create scale drawings.
- To consolidate understanding of converting between different units of metric measure.
- To use scale information to find actual length from scaled length measurements, and vice versa.
- To compare actual and scaled length measurements to identify scale.
- To understand that area does not scale in the same way as length.

## Terms for children to use

scale, scale factor, enlarge, reduce, size, ratio, proportion, fraction, length, distance, dimension, measurement, square, squared, area, perimeter, scale drawing, to scale, scale of 1 to ..., grid

## Assessment opportunities

Look and listen for children who:

- Use the terms for children to use effectively.
- Measure accurately, using an appropriate degree of accuracy.
- Multiply and divide by powers of 10 in order to convert between metric units of length or distance.
- Appreciate that a scale drawing is an accurate representation of real-life proportions.
- Create scale drawings based on actual measurements.
- Estimate real measurements from scale drawings.

## GMS Milestone 4

- Explain the meaning of the term 'scale drawing' (GMS 5:4a)
- Know that the scale of a drawing is the ratio of drawn to actual lengths (GMS 5:4b)
- Identify the scale of a drawing by comparing drawn and actual lengths (GMS 5:4c)
- Select an appropriate scale for a scale drawing (GMS 5:4d)

## Explorer Progress Book 5, pp. 18–19

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 9: Scaling Furniture

After completing work on Activity 1, give children Explore More Copymaster 9: Scaling Furniture to take home.

## Pupil Book 5, pp. 134–137

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Understanding scale](#)
2. [Making a scale drawing](#)
3. [Using scale drawings to find the actual size](#)
4. [Exploring the effect of scaling](#)

# Calculating 15: Calculating with fractions

**Key mathematical ideas** Fractions, Equivalence, Adding, Subtracting, Multiplying, Dividing, Mathematical thinking and reasoning

## Educational context

This activity group builds on the work in Numbers and the Number System 2, 6 and 7 and Calculating 14, where children developed their understanding of mixed numbers, improper fractions and equivalent fractions, and extends it to calculating with fractions: children add and subtract with fractions, including fractions with different denominators, and multiply fractions and mixed numbers by whole numbers. They explore different problem contexts and calculating structures with fractions, as well as the relationship between fractions and division.

In the course of this work, children further explore the idea of fractions as mathematical objects in their own right; that is, they use fractions as ‘nouns’ (just  $\frac{3}{10}$ ) as well as ‘adjectives’ ( $\frac{3}{10}$  of a pizza). This continues to lay foundations for subsequent fractions work and, more generally, reflects the increasing levels of abstraction in children’s mathematical thinking. Number rods are used throughout the activity group to help children share and summarize ideas and solutions. To encourage them to explore and develop their understanding, however, it is important to provide them with a range of resources to choose from; ensuring children have a variety of ways of representing fractions also helps avoid conceptual errors, such as adding or subtracting both numerators and denominators when calculating. It is similarly important to emphasize an understanding of fractions as parts or proportions, e.g. to ensure that children are confident about which number rods represent fractions and which represent wholes in a given context.

Some of the activities in this group involve a number of linked steps. Approaching them over several sessions will help to ensure that children have time to understand, explore and consolidate the ideas involved.

## Learning opportunities

- To be able to add and subtract fractions with the same denominator.
- To become familiar with the way that equivalent fractions can be used to add or subtract fractions whose denominators are multiples of the same number, e.g.  $\frac{1}{2} + \frac{5}{6}$ .
- To become fluent at adding and subtracting fractions, including where the answer is a mixed number.
- To multiply proper fractions and mixed numbers by whole numbers.
- To make connections between multiplying by a fraction, using a fraction as an operator and division.

## Terms for children to use

fraction, proper fraction, improper fraction, mixed number, numerator, denominator, equivalent, reduced to, cancel, total, adding, subtracting, multiplying, dividing, common denominator, fraction *of* a number or quantity (e.g. half *of* twenty)

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Convert between improper fractions and mixed numbers, and between equivalent fractions.
- Identify what fraction of a number rod another number rod represents, and use this to help illustrate calculations involving fractions.
- Use apparatus or imagery, e.g. a number line, to show a calculation involving fractions and write the related number sentence.
- Identify an equivalent fraction to enable fractions, whose denominators are multiples of the same number, to be added or subtracted.
- Relate finding a fraction of a number or quantity to multiplying by a fraction.

## NPC Milestone 6

- Add and subtract fractions whose denominators are multiples of the same number (NPC 5:6a)
- Multiply proper fractions and mixed numbers by whole numbers (NPC 5:6b)
- Relate finding a fraction of a number or quantity to multiplying by a fraction (NPC 5:6c)

## Explorer Progress Book 5c, pp. 14–15

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 29: Fruit Fractions

After completing work on Activity 3, give children Explore More Copymaster 29: Fruit Fractions to take home.

## Pupil Book 5, pp. 138–141

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Adding fractions with the same denominator](#)
2. [Subtracting fractions with the same denominator](#)
3. [Adding and subtracting fractions on a number line](#)
4. [Adding and subtracting fractions whose denominators are multiples of the same number](#)
5. [Multiplying a proper fraction by a whole number](#)
6. [Multiplying a mixed number by a whole number](#)

# Calculating 16: Solving problems involving several steps

**Key mathematical ideas** Adding, Subtracting, Multiplying, Dividing, Mathematical thinking and reasoning

## Educational context

This activity group draws together much of children's learning from throughout the Calculating strand, as well as the understanding they have developed through their work on Numbers and the Number System, and Pattern and Algebra. There are four activities, all based on the contextual theme of a school fair and all providing problems which are solved using two or more calculating steps. If it is possible to involve children in planning a 'real-life' school fair or other fundraising event, this is a very effective way of involving them in doing mathematics 'first hand', emphasizing its relevance and providing further extension.

The problems challenge children to reason logically about the steps to be taken; to recognize the structures of the four operations, decide on a calculating strategy and choose an appropriate written or mental method; to organize their work; to check their results make sense and are correct; and to communicate their solutions effectively.

To help children develop fluency, understanding and accuracy with written and mental calculating, provide them with regular opportunities to revisit, use and apply their skills in as wide a variety of problem-solving contexts as possible. Encourage them to make decisions for themselves about the operations and calculation strategies to use and provide a variety of physical resources and imagery to choose from.

## Learning opportunities

- To be able to decide on appropriate operations, strategies and methods for calculating.
- To appreciate the need to work systematically.
- To appreciate that solving a problem often involves working through several steps.
- To understand the importance of checking that solutions make sense and are accurate.

## Terms for children to use

step, cost, estimate, calculating, method, strategy, dividing, multiplying, adding, subtracting, total, difference, more, less, double, halve, share, equal, number sentence, budget, profit, loss, overheads, takings

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Approach problem solving confidently.
- Draw on a bank of known number facts to calculate efficiently.
- Organize their work and communicate their ideas fluently.
- Choose operations, strategies and methods appropriate to the problem.

## NPC Milestone 6

- Solve a range of multi-step problems by choosing appropriate operations, strategies and methods (NPC 5:6d)
- Organize work independently and communicate ideas fluently (NPC 5:6e).

## Explorer Progress Book 5c, pp. 16–17

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 30: Cafe Trip

After completing work on Activity 2, give children Explore More Copymaster 30: Cafe Trip to take home.

## Pupil Book 5, pp. 142–145

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Problems involving multiplying and finding differences](#)
2. [Problems involving multiplying and adding](#)
3. [Problems involving subtracting and dividing](#)
4. [Problems involving adding and subtracting](#)

# Measurement 7: Solving problems involving time, money and measures

**Key mathematical ideas** Volume and capacity, Mass, Standard units, Equivalence, Time, Money, Being logical

## Educational context

In this activity group children build on their learning from throughout the Measurement strand, as well as the understanding they have developed through their work on geometry and calculating. They encounter problems in a variety of contexts which challenge them to draw on their mathematical knowledge and thinking skills, in particular in relation to mass, volume, capacity, time, money, shape and statistics.

The problems challenge children to think systematically about the steps to be taken; to identify whether they have the information they need; to organize their work; to check their results make sense and are correct; and to communicate their solutions effectively. To help children develop fluency, understanding and accuracy, encourage them to make decisions for themselves about the approach to take and provide a variety of physical resources and imagery for them to choose from.

## Learning opportunities

- To decide on an appropriate problem-solving strategy, appreciating that often several steps are involved.
- To understand the importance of working systematically and checking that solutions make sense.
- To use all four operations to solve problems involving measures.
- To read and interpret information from a variety of sources, including lists, tables and line graphs.
- To solve problems involving time, money, mass, capacity, volume and shape.
- To convert between litres and cubic centimetres.

## Terms for children to use

mass, weight, volume, share, scale, convert, conversion, exchange, exchange rate, equal, equivalent, time, duration, period, calendar, dates, second, minute, hour, day, week, month, year, currency, pound, euro, dollar, rate, line graph, cost, budget, best value, cuboid, cube, cube number, cubic centimetre (cm<sup>3</sup>), dimensions

## Assessment opportunities

Look and listen for children who:

- Use the terms for children to use effectively.
- Organize their work and communicate their ideas clearly.
- Explore and interpret information from a variety of sources and choose strategies, methods and operations appropriate to the problem.
- Identify more than one way of solving a problem, where appropriate.
- Convert between metric units of length, mass, capacity or volume.
- Know the relationship and convert between different units of time, and describe elapsed time in different ways.
- Understand that currencies are different units of money and use a line graph to convert between them.
- Understand the relationship between a cube number and the volume of a cube.

## GMS Milestone 4

- Find sensible solutions to multi-step problems involving a variety of measures, e.g. time, money or mass, choosing appropriate operations, strategies and methods (GMS 5:4e)
- Organize work independently and communicate ideas fluently (GMS 5:4f)

## Explorer Progress Book 5, pp. 20–23

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance. Children will also have the opportunity to complete their Learning Log (pp. 22–23) where they can reflect on the mathematics they have done so far.

## Explore More Copymaster 10: Planning an Airshow

After completing work on Activity 2, give children Explore More Copymaster 10: Planning an Airshow to take home.

## Pupil Book 5, pp. 146–149

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Scaling quantities](#)
2. [Converting units of time](#)
3. [Using a line graph to convert between currencies](#)
4. [Solving problems involving money, including currency conversions](#)
5. [Solving problems involving volume and capacity](#)

# Pattern and Algebra 5: Using equivalence to solve problems

**Key mathematical ideas** Equivalence, Factors, Non-computational thinking, Mathematical thinking and reasoning

## Educational context

This activity group further develops children's understanding of equivalence. They extend earlier work in Pattern and Algebra 2 and 3, where children explored missing number problems and the use of brackets. The activities are designed to encourage children to look carefully at the numbers involved in a calculation and to recognize situations in which they can use non-computational strategies, e.g. adjusting and compensating. The activities also revisit the signs used to express inequalities. Children are encouraged to use strategies for adjusting expressions in balancing number sentences involving all four operations, with some problems set in a measures context. The activity group further develops children's understanding of the use of brackets, which are used to show the order of calculation for more complex expressions that would otherwise be ambiguous.

Children apply their understanding by working with factors, multiples, and prime, square and cube numbers, using them to construct equivalence statements.

## Learning opportunities

- To describe number relationships when comparing expressions in balancing number sentences involving all four operations.
- To have a rich understanding of the equals sign (=) and relate this to understanding of other relationships, including where expressions are less than (<) or greater than (>) other expressions.
- To develop strategies for making calculations easier by adjusting and compensating numbers.
- To develop strategies for solving problems where more than one number is missing.
- To find missing numbers in balancing number sentences involving adding, subtracting and multiplying.
- To know that brackets are used to show the order in which calculations are to be carried out.
- To use a factor tree to identify the prime factors of a number.

## Terms for children to use

expressions, relative size, greater than, less than, fewer than, equal, equivalent, adjust, compensate, compensate for the difference, complements, inverse, total, brackets, balancing calculation, factors

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Use the <, > and = symbols to compare expressions in balancing number sentences and explain their reasoning.
- Adjust and compensate numbers in balancing number sentences without calculating.
- Explain that symbols can be used to stand for different missing numbers.
- Solve missing number problems using an expanding knowledge of, e.g. complements, doubles, inverses.
- Explain that brackets are used to show the order in which calculations are to be carried out.

## NPC Milestone 6

- Explain how to solve missing number problems involving both equivalence and inequality (NPC 5:6f)

## Explorer Progress Book 5c, pp. 18–19

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

## Explore More Copymaster 6: Post Office Weigh-in

After completing work on Activity 4, give children Explore More Copymaster 6: Post Office Weigh-in to take home.

## Pupil Book 5, pp. 150–153

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Using symbols to show inequalities](#)
2. [Exploring inequalities with missing numbers](#)
3. [Exploring balancing number sentences](#)
4. [Finding missing numbers in balancing number sentences](#)
5. [Solving problems where symbols stand for unknown numbers](#)
6. [Recording with brackets](#)
7. [Introducing factor trees](#)

# Pattern and Algebra 6: Logic and reasoning

**Key mathematical ideas** Generalizing, Pattern, Mathematical thinking and reasoning

## Educational context

This activity group further develops the problem-solving skills that children used in the Number, Pattern and Calculating 4 Teaching Resource Handbook, Pattern and Algebra 7. Each of the five activities encourages children to work systematically and reason logically as they seek solutions.

Each activity has a starting point that can engage all children, as well as the potential for children to persevere and come up with general rules. The activities may be developed over a sustained period of time, either during one day or over the course of several lessons. Children develop their understanding of general statements through finding examples that match statements that they are given, as well as counter-examples that mean that a statement is not always true. (It is important to make sure children understand that general statements don't have to be true, just general.) Throughout, encourage children to develop a systematic approach and to record their steps and the stages in their thinking clearly.

Encouraging children to describe and explain the patterns that they spot to help them formulate general statements is fundamental to these activities. Children can also be challenged to stretch their thinking and develop their mathematical creativity through devising problems of their own for others to solve.

## Learning opportunities

- To work logically when interpreting clues in order to solve a problem.
- To know that finding a general rule involves looking for and describing patterns and reasoning to predict what always happens.
- To use the correct language when generalizing.
- To know that having a systematic approach to recording the steps that have been taken and the thinking that has occurred helps when looking for patterns and when explaining logic and reasoning.

## Terms for children to use

general rule, general statement, sequence, strategy, logic, systematically, predict, predictions, investigate, relationships, term, step, pattern, multiple, prove, consecutive, sometimes, never, always, cancels out

## Assessment opportunities

Look and listen for children who can:

- Use the terms for children to use effectively.
- Persevere in investigating a problem.
- Are confident in trying different strategies for solving a problem.
- Notice and explain patterns and use them to come up with general rules.
- Explain their reasoning.
- Keep systematic records.
- Relate problems to similar examples they have attempted in the past.

## NPC Milestone 6

- Approach problems involving number relationships systematically, logically and effectively (NPC 5:6g)

## Explorer Progress Book 5c, pp. 20–13

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance.

Children will also have the opportunity to complete their Learning Log (pp. 22–23) where they can reflect on the mathematics they have done so far.

## Explore More Copymaster 7: Always, Sometimes or Never True

After completing work on Activity 3, give children Explore More Copymaster 7: Always, Sometimes or Never True to take home.

## Pupil Book 5, pp. 154–157

These pages in the Pupil Book provide further practice and challenging questions. You can use them to follow up the activities and deepen the learning.

## Focus activities

1. [Finding a general rule to total a sequence of consecutive numbers](#)
2. [Recognizing and testing general statements](#)
3. [Reasoning about multiples of 4](#)
4. [Using trial and improvement methods and reasoning in problem solving](#)
5. [Reasoning about numbers to solve a mathematical problem](#)



# Assessment support

The Explorer Progress Book pages will help you record and assess learning throughout the programme. Here are two additional tools to support you with assessment. Log on to your Numicon Online NZ subscription and click on the name of the resource below to open it.

## Milestone Assessment cards

Materials for children’s self-assessment: question cards, category cards, a quick guide, milestone statements, Teaching Progression and answers. NOTE: This resource is provided as a zip file. Download, right-click and click ‘Extract’ to open the files.

The question cards are also provided on the next page of this document.

**5.1 Numicon Milestone Assessment – NPC 5 Milestone 1 (Teacher)**

Answers are in bold.

<p><b>1</b></p> <p>Can you write the following number in words?</p> <p style="text-align: center;">946 053</p> <p><b>Nine hundred and forty-six thousand and fifty-three.</b></p>	<p><b>2</b></p> <p>Can you use apparatus to represent 109 821?</p> <div style="text-align: center;"> <table border="1" style="border-collapse: collapse; margin: auto;"> <tr> <th style="padding: 2px;">Millions</th> <th style="padding: 2px;">Hundred Thousands</th> <th style="padding: 2px;">Ten Thousands</th> <th style="padding: 2px;">Thousands</th> <th style="padding: 2px;">Hundreds</th> <th style="padding: 2px;">Tens</th> <th style="padding: 2px;">Ones</th> </tr> <tr> <td style="text-align: center;">○</td> <td style="text-align: center;">○○○○</td> <td style="text-align: center;">○○○○</td> <td style="text-align: center;">○○○○</td> <td style="text-align: center;">○○○○</td> <td style="text-align: center;">○○○○</td> <td style="text-align: center;">○○○○</td> </tr> </table> </div> <p><b>Other resources may also be used. The resource should enable children to show the six values, so alternatives could be six different colours of counters or multilink cubes that represent the value of each digit.</b></p>	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones	○	○○○○	○○○○	○○○○	○○○○	○○○○	○○○○
Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones									
○	○○○○	○○○○	○○○○	○○○○	○○○○	○○○○									

NPC Milestone 5:1a
NPC Milestone 5:1a

## Milestone Assessment Tracking

A detailed tracking sheet for assessing your class.

Milestone	Code	NPC / GMS	Numicon strand	AG	NC strand
<b>Number, Pattern &amp; Calculating 5 Milestone 1</b>					
By this point, children should be able to:					
• Read, write, and convert between column and quantity values of numbers up to 1 000 000	NPC5:1a	NPC	NNS	NNS1	Number & place value
• Count in steps of powers of 10 forwards and backwards from any number, and explain which digit changes when a place value boundary is crossed	NPC5:1b	NPC	NNS	NNS1	Number & place value
• Explain equivalences between improper fractions and mixed numbers	NPC5:1c	NPC	NNS	NNS2	Fractions
• Use knowledge of factors and multiples to recognize and explain equivalences between proper fractions	NPC5:1d	NPC	NNS	NNS2	Fractions
• Read, write and order numbers with up to three decimal places	NPC5:1e	NPC	NNS	NNS3	Number & place value
• Recognize and explain decimal and common fraction equivalents, e.g. $0.268 = 268/1000$ , including familiar common fraction equivalents, e.g. $1/5 = 0.2$	NPC5:1f	NPC	NNS	NNS3	Fractions
• Choose appropriate and effective mental or written methods to solve adding and subtracting number problems involving whole numbers up to 1000	NPC5:1g	NPC	C	C1 & C2	Addition & subtraction
• Solve adding and subtracting problems involving fractions and decimal fractions efficiently	NPC5:1h	NPC	C	C1 & C2	Addition & subtraction
<b>Number, Pattern &amp; Calculating 5 Milestone 2</b>					
By this point, children should be able to:					

## Milestone Assessment cards

Click on a Numicon milestone below to jump to the question cards that relate to it.

Milestone	Milestone statements	
<u>NPC Milestone 1</u>	Read, write, and convert between column and quantity values of numbers up to 1 000 000	NPC5:1a
	Count in steps of powers of 10 forwards and backwards from any number, and explain which digit changes when a place value boundary is crossed	NPC5:1b
	Explain equivalences between improper fractions and mixed numbers	NPC5:1c
	Use knowledge of factors and multiples to recognize and explain equivalences between proper fractions	NPC5:1d
	Read, write and order numbers with up to three decimal places	NPC5:1e
	Recognize and explain decimal and common fraction equivalents, e.g. $0.268 = \frac{268}{1000}$ , including familiar common fraction equivalents, e.g. $\frac{1}{5} = 0.2$	NPC5:1f
	Choose appropriate and effective mental or written methods to solve adding and subtracting number problems involving whole numbers up to 1000	NPC5:1g
	Solve adding and subtracting problems involving fractions and decimal fractions efficiently	NPC5:1h
<u>NPC Milestone 2</u>	Round whole numbers to the nearest multiple of 10, 100, 1000, 10 000, or 100 000	NPC5:2a
	Round numbers with up to two decimal places to the nearest whole number and to one decimal place	NPC5:2b
	Convert an adding or subtracting calculation to an easier equivalent calculation	NPC5:2c
	Find the term-to-term rule for a linear sequence involving whole numbers, fractions or decimals, and work out missing terms	NPC5:2d
	Read, write and order positive and negative numbers	NPC5:2e
	Calculate the difference between a positive and a negative number	NPC5:2f
	Use multiplying and dividing facts and knowledge of factors and multiples to solve problems	NPC5:2g
	Solve problems effectively by finding fractions of amounts, making use of multiplying and dividing facts	NPC5:2h
Multiply and divide decimals to one decimal place	NPC5:2i	
<u>NPC Milestone 3</u>	Use knowledge of factors and multiples to find equivalent fractions and to simplify fractions to their lowest terms	NPC5:3a
	Compare and order fractions with denominators which are multiples of the same number	NPC5:3b
	Use the inverse relationships between adding and subtracting, and multiplying and dividing, to complete calculations with missing numbers	NPC5:3c
	Use efficient written column methods for adding and subtracting whole numbers up to 10 000 and decimals with up to 3 decimal places	NPC5:3d
	Use known multiplying facts to multiply and divide whole numbers and decimals by 10, 100, and 1000	NPC5:3e
<u>GMS Milestone 1</u>	Estimate and classify angles between $0^\circ$ and $360^\circ$	GMS5:1a
	Measure angles using a protractor, correct to the nearest degree	GMS5:1b
	Find missing angles at a point and in one full turn, or at a point on a straight line and in a half turn, using knowledge that the total angle is $360^\circ$ or $180^\circ$ , respectively	GMS5:1c
	Identify lines of symmetry in given figures	GMS5:1d
	Find or show images of points and polygons under translation or reflection in the first quadrant (with lines of symmetry parallel to the x- and y-axes), describing the transformation and how the position and coordinates of the point or polygon have changed	GMS5:1e
	Explain that more than one transformation can map one shape onto another	GMS5:1f
	Convert between metric units of measure, e.g. between metres and kilometres	GMS5:1g
	Recognize and use common imperial measures, e.g. miles, feet, inches, pints	GMS5:1h
	Understand and use approximate equivalences between metric units and common imperial units	GMS5:1i

Milestone	Milestone statements	
<b><u>NPC Milestone 4</u></b>	Find the lowest common multiple of two or more numbers	NPC5:4a
	Find the highest common factor of two or more numbers	NPC5:4b
	Explain the difference between prime and composite numbers and identify them by testing accordingly	NPC5:4c
	Use the distributive property of multiplying and dividing to break down calculations into parts and complete them using mental or informal methods	NPC5:4d
	Interpret answers to dividing calculations which are not whole numbers appropriately, in context	NPC5:4e
	Use multiplying and dividing to solve problems involving scaling	NPC5:4f
	Explain percentage as the number of parts per hundred	NPC5:4g
	Find and explain percentage, fraction and decimal equivalents in order to solve problems in context	NPC5:4h
<b><u>GMS Milestone 2</u></b>	Accurately identify and describe parallel sides in polygons, including from conventional symbols	GMS5:2a
	Identify the interior and exterior angles of a polygon, and explain the difference and relationship between them	GMS5:2b
	Explain in simple terms why the exterior angle sum of any polygon is 360°	GMS5:2c
	Identify and draw diagonals in polygons	GMS5:2d
	Distinguish between regular and irregular polygons	GMS5:2e
	Use angle sum facts and understanding of the angle properties of polygons to calculate the size of unknown angles	GMS5:2f
	Complete, read and interpret information in tables, charts and graphs	GMS5:2g
	Read and use scales on charts and graphs in a variety of contexts, including with negative numbers	GMS5:2h
	Recognize that choosing which is an appropriate method for representing data depends on the type of data and the question being asked	GMS5:2i
	Describe area as a measure of flat space and perimeter as a measure of length	GMS5:2j
	Recognize that area is measured in square units	GMS5:2k
	Calculate the areas and perimeters of rectangles, in square centimetres and centimetres, respectively, given pairs of dimensions	GMS5:2l
	Find missing side lengths and calculate areas and perimeters of composite rectilinear shapes, in square centimetres and centimetres	GMS5:2m
<b><u>NPC Milestone 5</u></b>	Know percentage equivalents of commonly used fractions, e.g. $\frac{1}{2}$ , $\frac{1}{4}$ , $\frac{3}{4}$	NPC5:5a
	Use percentages to express simple proportions, e.g. 24 out of 32 as 75%	NPC5:5b
	Find percentages of amounts, including measures	NPC5:5c
	Know and be able to use simple tests of divisibility	NPC5:5d
	Explain what square and cube numbers are	NPC5:5e
	Use efficient written methods to multiply numbers with up to 4 digits by 2-digit numbers	NPC5:5f
	Choose appropriate and effective mental or written methods to divide numbers with up to 4 digits by single-digit numbers	NPC5:5g
	Calculate fractions of amounts in practical problem-solving contexts	NPC5:5h

Milestone	Milestone statements	
<b>GMS Milestone 3</b>	Explain the difference between volume and capacity and the equivalence between cubic centimetres and millilitres	GMS5:3a
	Build cuboids of a given volume using cubes or rods	GMS5:3b
	Create 2D drawings of 3D shapes	GMS5:3c
	Give a reasonable estimate of the volume of an object, in cubic centimetres	GMS5:3d
	Calculate volume or capacity given the dimensions of a cuboidal shape or space	GMS5:3e
	Find missing side lengths and calculate areas and perimeters of more complex composite rectilinear shapes, in square centimetres or metres and in centimetres or metres	GMS5:3f
	Estimate areas of irregular shapes	GMS5:3g
	Express the area or perimeter of a rectangle algebraically in order to find an unknown length, e.g. $5 \times b = 30$ so $b = 6$ and the unknown length is 6 cm	GMS5:3h
<b>GMS Milestone 4</b>	Explain the meaning of the term 'scale drawing'	GMS5:4a
	Know that the scale of a drawing is the ratio of drawn to actual lengths	GMS5:4b
	Identify the scale of a drawing by comparing drawn and actual lengths	GMS5:4c
	Select an appropriate scale for a scale drawing	GMS5:4d
	Find sensible solutions to multi-step problems involving a variety of measures, e.g. time, money or mass, choosing appropriate operations, strategies and methods	GMS5:4e
	Organize work independently and communicate ideas fluently	GMS5:4f
<b>NPC Milestone 6</b>	Add and subtract fractions whose denominators are multiples of the same number	NPC5:6a
	Multiply proper fractions and mixed numbers by whole numbers	NPC5:6b
	Relate finding a fraction of a number or quantity to multiplying by a fraction	NPC5:6c
	Solve a range of multi-step problems by choosing appropriate operations, strategies and methods	NPC5:6d
	Organize work independently and communicate ideas fluently	NPC5:6e
	Explain how to solve missing number problems involving both equivalence and inequality	NPC5:6f
	Approach problems involving number relationships systematically, logically and effectively	NPC5:6g