Introducing Numicon 6
Build a secure future in mathematics for every child
Award-winning whole-curriculum maths resources

With resources and Professional Development for nursery to Year 6/P7, plus support for intervention and inclusion, Numicon provides all you need to create confident mathematicians throughout your whole school.

- Embodies the aims of the 2014 National Curriculum by developing fluency, mathematical reasoning and problem-solving
- Structured apparatus and imagery ensures children master the skills needed to gain deep understanding
- Ensures every child meets end-of-year expectations with robust and reliable assessment tracking
- Supported by NCETM-accredited professional development, delivered by UK educational specialists, for sustained school improvement

Supporting you with the 2014 National Curriculum and 2016 SATs

With resources for Number, Pattern and Calculating, and Geometry, Measurement and Statistics you can teach right across the 2014 Year 6 maths Programme of Study with confidence. Numicon 6 introduces two additional strands to support you in facing the increased demands and raised expectations of the 2014 National Curriculum:

- **Preparation for Formal Testing**: self-assessment, fluency and problem-solving strategies
- **Investigations**: inspiring mathematical investigations to deepen understanding and stretch your highest achievers
Numicon 6

Covering key topics such as algebra, ratio and proportion, calculating with fractions, long division, coordinates in four quadrants, finding the mean and pie charts, the Activity Groups have careful progression and adaptable, easy-to-follow steps built in.

For assessment, the Explorer Progress Books allow you to gather evidence of each child’s understanding, and the regular Milestones enable you to track their progress throughout the year. The Explore More Copymasters provide fun activities for children to practise and discuss maths at home.

All you need for Numicon 6:

Number, Pattern and Calculating 6 Easy Buy Pack

Contains:
- Number, Pattern and Calculating 6 Teaching Resource Handbook and Implementation Guide
- Number, Pattern and Calculating 6 Explorer Progress Books A, B and C (30 copies of each)
- Number, Pattern and Calculating 6 Explore More Copymasters

Geometry, Measurement and Statistics 6 Easy Buy Pack

Contains:
- Geometry, Measurement and Statistics 6 Teaching Resource Handbook (includes Explore More Copymasters) and Implementation Guide
- Geometry, Measurement and Statistics 6 Explorer Progress Book (Pack of 30)

Starter Apparatus Pack C

Contains a new selection of apparatus ready for every element of the Year 6 curriculum.

Numicon Online

Online support to introduce and implement Numicon in your school. Find editable planning documents, assessment tracking and video guidance on implementation.
# Numicon overview chart

<table>
<thead>
<tr>
<th>Teaching Support</th>
<th>NURSERY</th>
<th>FOUNDATION</th>
<th>AGE 5–6</th>
<th>AGE 6–7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ST STEPS WITH NUMICON IN THE NURSERY KIT</td>
<td>NUMICON FIRM FOUNDATIONS KIT</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Apparatus</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>STARTER APPARATUS PACK A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activities for Home</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1ST STEPS WITH NUMICON AT HOME KIT</td>
<td></td>
</tr>
</tbody>
</table>


*Explorer Progress Books (Three Explorer Progress Books for Number, Pattern and Calculating, one for Geometry, Measurement and Statistics)

*Explore More Copymasters
This book is designed to be used alongside the Geometry, Measurement and Statistics 6 Teaching Resource Handbook and Implementation Guide, Explorer Progress Book and the Planning and Assessment Support.

Your book contains:

- Step-by-step activities with specific learning and assessment.
- Assessment milestones that clearly signpost where children are and what they need to do next and allow you to monitor children's progress.
- Helpful illustrations that demonstrate how apparatus can be used to illustrate children's reasoning.
- Easy-to-follow long- and medium-term planning, that helps you to scaffold children's learning.
- Relevant contexts that develop children's ability to think and talk mathematically and apply their understanding.
- Enjoyable games and activities to be sent home that will actively involve parents and carers in their child's maths.
- Suggested next steps to develop the learning from activities.

How to get in touch:

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NUMICON ONLINE
ONLINE PLANNING AND ASSESSMENT SUPPORT

ALSO AVAILABLE
Investigations with Numicon: a supplementary teaching manual and apparatus pack to stretch able children in Key Stage 2.

ALSO AVAILABLE
Breaking Barriers designed specifically for pupils with SEND or those experiencing learning difficulties with maths.
Using symbols and letters for variables and unknowns

Educational context
In this activity group, children continue to explore how to describe general situations and rules mathematically. They are supported to express patterns numerically, e.g. as sequences and functions, and to identify and describe relationships between numbers, e.g. as formulas. This links to children’s work in the Geometry, Measurement and Statistics 6 Teaching Resource Handbook, Measurement 3. This leads into describing general rules which apply in any instance of the same type of situation, and, building on their work in Pattern and Algebra 3, to expressing these rules concisely using algebra, with letters standing for unknown values and variables. For example, in Activity 6 they work out how to describe the commutative property of adding two numbers – the property that the order in which the numbers are added doesn’t matter – more succinctly, as \(a + b = b + a\).

Connecting with the work of Pattern and Algebra 2, we explore general rules of divisibility for help in finding factors.

Learning opportunities
- To describe a numerical pattern or general relationship in words and algebraically, as a formula.
- To recall and use tests of divisibility by 2, 3, 5, 9 and 10.
- To describe and explain the commutative property of adding and multiplying.

Words and terms for use in conversation
- Algebra, algebraic notation, symbol, generalize, reasoning, logic, systematic, show, prove, pattern, sequence, constant difference, term, first term, term-to-term rule, predict, relationship, general rule, general term, with term, unknown, variable, value, expression, equation, equivalent, inverse, function, function machine, input, output, divisibility, last of divisibility, factor, multiple, prime, composite, commutative property, associative property, number trio, part-whole relationship.

Assessment opportunities
Look and listen for children who:
- Use the words and terms for use in conversation effectively.
- Can identify the term-to-term rule in a linear sequence and express this with an algebraic expression, e.g. \(5n + 33\) in Activity 1.
- Can explain why adding and multiplying are commutative, e.g. \(a \times b = b \times a\).
- Can explain algebraically how ‘think of a number’ problems work.
- Can explain the general relationship between an ‘input’ (\(x\)) and an ‘output’ (\(y\)) for a particular function, e.g. a function described by \(y = 3x\), \(y\) is always three times \(x\); \(x\) is always one third of \(y\).
- Can identify a missing input or output for a given function machine, and a missing instruction, e.g. ‘\(\times 3\)’ for a given set of inputs and outputs.
- Can write an equation to show the general relationship between input and output for a given function, represented as \(x\) and \(y\) respectively, e.g. \(y = 3x\).
- Use tests of divisibility to sort numbers.
- Describe the commutative properties of adding and of multiplying in general terms, including algebraically, e.g. \(a + b = b + a\), \(ab = ba\).
- Can explain why adding and multiplying are commutative, while subtracting and dividing are not.

**Explorer Progress Book 6b, 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 4: Secret Function Machine**

After completing work on Activity 4, give children Explore More Copymaster 4: Secret Function Machine to take home.

**Explore More Copymasters** give children a further opportunity to practise at home what they have been learning in class.

Clear assessment opportunities for every activity group.
Focus activities

Activity 1: Investigating rules and generalizing with algebra
Have ready: Numicon Shapes, 100 square, photocopiable and reproducible material for the 100 square (optional), number rods
Step 1
Show a 100 square and choose a ‘starting number’, e.g. 1. Give a starting rule, e.g. ‘Find the odd numbers on the two numbers above and below the number you have chosen’. Ask children to use their rule to find the next odd number. Agree that the next number is 16, and that 16 is 1 less than 17, 17 is 1 more than 16, and so on. Agree that the term is 1 more each time; since it is added into the total 15 times, each number in the list, and the numbers being totalled, allow plenty of time for them to experiment and explore.
Step 2
Ask children whether there is a way to predict the 22nd term in the sequence without simply repeatedly adding 5. Some may suggest using symbols, e.g. identifying that the units digit for the 22nd term will be 5, since 22 is an even number greater than 10. Some may suggest using the rule, e.g. identifying that the number of the term and the numbers being totalled are always 1 more and 2 more than the starting number. Encourage children to come up with ways to illustrate this visually (e.g. see below).
 Invite children to use their illustrations to explain why the terms in the sequence are odd. Look and listen for children who can explain, e.g. the only number that changes, when adding to find a new term is the starting number, which is 1 more each time, since it is added into the total 5 times, each time it is added to the previous term.

Focus activities are broken down into easy-to-follow steps.
## Sample activity group

**Educational context**

This activity group involves children working with data to calculate the mean, or average, of a set. This allows them to compare different data within the same context, for example growing green beans. They move on to looking at estimated values in the context of packaging food, and how the mean is affected by different values in the set. They also consider "outliers" and how they can skew an average to be higher or lower.

This activity group builds on the work on charts and graphs in the *Geometry, Measurement and Statistics 5 Teaching Resource Handbook, Measurement 2*. Later in the activity group, they consider average speed and how to plot distance-time graphs to show speed. They extend this to plotting more data points for distance and time, and discuss how the gradient of the graph shows the speed. These activities develop work in the *Number, Pattern and Calculating & Teaching Resource Handbook, Pattern and Algebra 2*, where children plot graphs showing fuel used and distance travelled, and discuss how this relates to speed.

**Learning opportunities**

- To become familiar with the mean as an average of a set of data.
- To know how to calculate the mean (sum of all data divided by the number of data points).
- To work with different units for speed and convert between them (e.g., m/s to km/h).
- To convert between metric and imperial units (kilometres and miles).
- To plot distance-time graphs and understand how they can be used to work out speed.

**Words and terms for use in conversation**

- data, data set, survey, sample, sample size, value, maximum, minimum, range, spread, statistic, statistician, average, mean, outlier, skewing, central, rate, conversion, rate, speed, metre, kilometre, mile, second, minute, hour

**Assessment opportunities**

- Look and listen for children who:
  - Use the words and terms for use in conversation effectively.
  - Calculate the mean from a given data set.
  - Explain that an outlier can skew a data set.
  - Present, interpret and read data on distance-time graphs.
  - Use distance-time graphs to calculate average speed.

**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 4: Finding The Mean**

After completing work on Activity 2, give children Explore More Copymaster 4: Finding The Mean to take home.

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**Key mathematical ideas**

Representing and interpreting data, Speed and Distance

<table>
<thead>
<tr>
<th>Statistics and graphs</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
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**Topics are introduced through real-life scenarios.** In this activity group, children learn about fractions, e.g. finding the mean size of a set of beans.

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**The learning opportunities come from real classroom experiences and are designed to help children develop their understanding of the key ideas in each activity group.**
A clear list of the apparatus used to support learning is provided at the start of every focus activity.

Opportunities for whole-class, paired and individual practice activities are included in every activity group to give children the opportunity to build on their knowledge, deepen their thinking and develop their mathematical conversations with others.

Support children to choose suitable scales to work out equations in order to plot points (0km = 0 miles) followed by 1km = 0 miles of the points with a straight line.

Using and applying is supported through the use of real-life contexts.

Careful progression is built into every activity group, and across the whole teaching programme, helping children to become fluent through understanding.

Activity 4: Converting between units of speed

How many: graph paper, ruler, number rods

Step 1: Talk with children about how fast humans can run. 

Establish time that very fast sprinters run 100m in approximately 10-15 seconds.

Ask children how they can use this information to calculate a top sprinter's approximate speed. Look and note: for children who suggest dividing 100 by 10, and for those who stress links with their work in Activity 3, recognize that this will give an average speed. Encourage children to recognize that the calculation gives the average number of metres traveled in 10 seconds, so the units are metres per second and write the result as "m/s".

Step 2: Talk with children about it is quite difficult to appreciate how fast 100m might be, since we don't often talk about speeds measured in metres per second. Agree that many people are likely to be more used to thinking in kilometres per hour or miles per hour. 

Recall with children that kilometres are a "metric" unit of distance while miles are imperial. Discuss why this matters, and establish that units of both scales are commonly used.

Activity 1: Introducing the mean

How many: picture of edible bean pods (e.g. green beans), number rods

Step 1: Show children a picture of some edible bean pods, e.g. green beans. 

Set the scene: Fafi and Jodie are both growing beans, and they want to know whose beans are growing more. They both measure the length of the ten six beans they harvest and record their lengths of six beans, see .

Ask children to talk about the total length of the beans they have each planted. Establish that for Fafi this is 54cm and for Jodie it’s 50cm, so Jodie’s are longer overall.

Step 2: Set the scene again. Jemima is also growing beans, but has only harvested five so far. Show children their lengths. 

Establish that the combined length of Jemima’s beans is 32cm, but she has only managed five of its. Ask children how they could tell whether or not Jemima’s beans are generally growing longer than Jodie’s or Fafi’s.

Some children may suggest discussing one measurement for each for and Jodie. Guide children to appreciate that this means "averaging" one of the sets, and it would also be difficult to decide which measurements to discard (e.g. longer, shorter).

Some children may have mentioned finding an "average" length for each group of beans. Encourage children to talk about where they have been seen or heard the word "average" before. Suggestions might include news reports, sports analytics, descriptions of people (e.g. being of "average" height) or average contents volumes in packaging.

Talk about what they understand by this term. Guide children to appreciate that an average is a "typical" or central value. Explain that is a single value, which can be used to summarise and represent a set of data with a spread of values.

Step 4: Invite children to share their ideas and findings. Work with them to reason through the steps of one possible method:

1. To convert from metres to kilometres we divide by 1000, so 30km is 30000m is 0.03 km.

2. Fafi’s beans are recorded as 100m, 150m, 100m, 120m, 100m, 110m, 120m, 150m, 120m, 100m.

3. Jodie’s beans are recorded as 100m, 100m, 100m, 100m, 100m, 100m.

4. Jemima’s beans are recorded as 32cm, 32cm, 32cm, 32cm, 32cm.

Using and applying is supported through use of real-life contexts.
**Function Machines**

Leo made a function machine that gave the following input and output:

\[
\begin{align*}
5 & \rightarrow ? & 20 \\
6 & \rightarrow ? \\
7 & \rightarrow ?
\end{align*}
\]

What are the different functions that might have been in the machine?

What if it was a two-step function? What could those functions have been?

What if Leo’s machine also did:

What do you think the function was? Was it a one-step or a two-step function?

**Mini-Marathon**

Freya is training for a mini-marathon. She wants to calculate how many calories to eat to replace all the energy she will use as she runs. She knows that someone her age uses 10 calories per hour for every kilogram of their weight, running at a steady pace.

Freya weighs 36 kg and she runs for half an hour every day after school. How many calories will she use in a week?

Freya’s friends would like to do the run too, and want to know how to make this calculation for each of their weights. How could Freya write her calculation for them, if \(A = \) calories burned per hour and \(B = \) weight in kg?

Children have the freedom to record their answers in their own way, allowing you to see their thinking.
Secret Function Machine

How this will help your child
- This activity will help your child to look for relationships between numbers.
- It will also help them to express those relationships in words and letters (algebraically).
- It will also help them to find the ‘missing rule’ using inputs and outputs of function machines.

Words and phrases to use
- relationship, general rule, function, function machine, input, output

You will need
- 5cm
- 2 pencils
- A paper clip
- Card Numicon Shapes 1–10 (optional)

During the activity, look at what your child can do
- Identify a missing function to explain how two numbers are linked (e.g., the missing function between 10 and 11 might be × 1).
- Write an equation to show how two numbers are linked.

What to do
- Use a paper clip and pencil to make the spinner from the Secret Function Machine sheet.
- Cut out the function cards from the sheet. Place them face down in a pile.
- Ask your child to spin the spinner. The number spun is the “input,” e.g., 3.
- Pick up a function card from the pile, without showing your child. Write the “input” on the left-hand side of the function machine.
- Tell the child the “output.” E.g., if you pick up “× 5,” “– 7,” multiply their number by 5 and subtract 7, so if 3 is spun, the output is (3 × 5) – 7, which is 13 – 7 = 6. Record the output on the right-hand side of the function machine.
- Explain to your child that they have to work out the function of the machine (what is written on the card) and that this could involve two instructions. They could use Numicon Shapes to help them.
- Ask your child to spin the spinner again. Say the output using the same function. Record the input and output on the function machine.
- Keep going until your child can work out what the second function is.

Encourage your child to describe how the input and output are related using the function card. E.g., if 3 is spun, the output is 3 times (with 3 then subtracted, y = 3 × 3 – 3).

Repeat with different function cards.

Next steps…
- Make up your own function using the blank function cards and complete the activity again.
- Ask your child to find the missing function when converting pounds to pence (x 100), kilograms to grams, or kilometres to metres (x 1000).

Practical links to real life help children think about how maths can be used and applied.

Simple illustrations help to explain the purpose of activities.
Your next steps . . .

To find out how *Numicon* can make a difference in your school, book an appointment with your local Educational Consultant:

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