



# MATHEMATICS POLICY



## **Our Vision for Mathematics:**

For all children to become fluent mathematicians, with the self-belief they can achieve this goal, having a deep and secure understanding of concepts to enable reasoning and problem solving in a range of contexts.

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**Contents:**

	Page
Curriculum intent, implementation and impact statements.....	3, 4
EYFS Curriculum implementation in depth.....	4
KS1 and KS2 Curriculum implementation in depth.....	5
Lesson Structure.....	6
Key Instant Recall Facts.....	8
Assessment.....	9
Cross-curricular Opportunities.....	10
Adaptive Teaching and Inclusion.....	10
Parents/Carers and Home Learning.....	11
Role of the Maths Lead.....	12
Other linked documents.....	12



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## Our curriculum intent

The language of mathematics is international. Mathematical skills are vital for the life opportunities of our children; are essential to everyday life; critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically and problem solve, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity about the subject. The National Curriculum for mathematics aims to ensure that all pupils:

- become fluent in the fundamentals of mathematics;
- reason mathematically;
- can solve problems by applying their mathematics (National Curriculum 2014)

Our vision and curriculum intent at Lickey Hills Primary School and Nursery is for all children to become fluent mathematicians, with the self-belief they can achieve this goal, having a deep and secure understanding of concepts to enable reasoning and problem solving in a range of contexts.

## Our curriculum implementation

To achieve our vision, we have adopted a Teaching for Mastery approach to our mathematics curriculum. Children are guided along a coherent, small step journey together, using concrete, pictorial and abstract representations to explore concepts and build connections, with opportunities to both support and challenge thinking and reasoning. This approach ensures a deep, secure understanding for all.

The content and principles underpinning the 2014 mathematics curriculum and the maths curriculum at Lickey Hills Primary School and Nursery reflect those found in high-performing education systems internationally, particularly those of east and south-east Asian countries such as Singapore, Japan, South Korea and China. The OECD<sup>1</sup> suggests that by age 15 students from these countries are on average up to three years ahead in maths compared to 15 years in England. Consequently, adopting a 'mastery approach' to teaching commonly followed in these countries is hoped by the DfE (NCETM) to improve outcomes. The following principles and features characterise our approach, where teachers reinforce an expectation that all pupils can achieve high standards in mathematics:

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<sup>1</sup> The Organization for Economic Cooperation and Development



- The large majority of pupils progress through the curriculum content at the same pace. Differentiation is achieved by emphasising deep knowledge and through individual support and intervention.
- Teaching is underpinned by methodical curriculum design and supported by carefully crafted lessons and resources to foster deep conceptual and procedural knowledge.
- Practice and consolidation play a central role. Carefully designed variation within this builds fluency and understanding of underlying mathematical concepts.
- Teachers use precise questioning in class to test conceptual and procedural knowledge and assess pupils regularly to identify those requiring intervention so that all pupils keep up.

These approaches provide all children with full access to the curriculum, enabling them to achieve confidence and competence - 'mastery' - in mathematics. Approaches used and sequences of learning are consistent and progressive from Nursery up to Year 6 to aid coherence and the building of connections. These are detailed in the curriculum implementation in depth section of this policy below.

## Our curriculum impact

To achieve our vision: for all children to become fluent mathematicians, with the self-belief they can achieve this goal, having a deep and secure understanding of concepts to enable reasoning and problem solving in a range of contexts. This will be evidenced in both quantitative assessments (statutory and internal data) and pupil voice.

## The Foundation Stage - implementation in depth

In the Early Years Foundation Stage (EYFS), we relate the mathematical aspects of the children's work to the Development Matters statements and the Early Learning Goals (ELG), as set out in the EYFS profile document. Mathematics development involves providing children with opportunities to practise and improve their skills in Number and Numerical Patterns (ELGs). In addition, our curriculum includes rich opportunities for children to develop their spatial reasoning skills. We continually observe and assess children against these areas using their age-related objectives, and plan the next steps in their mathematical development through a topic-based curriculum.



The main driver for our curriculum in EYFS is NCETM's Mastering Number programme. This project aims to secure firm foundations in the development of good number sense for all children from Reception through to Year 1 and Year 2. The aim over time is that children will leave KS1 with fluency in calculation and a confidence and flexibility with number. Attention will be given to key knowledge and understanding needed in Reception classes, and progression through KS1 to support success in the future.

Children visit early concepts from this programme in Nursery with supporting planning and lesson sequencing from Master the Curriculum, before following the 31-week Mastering Number project fully in Reception. The focus is on subitising (recognising an amount without counting) and developing a deep understanding of numbers to 10 using a variety of representations, including Numberblocks, tens frames and Hungarian number frames and rekenreks. Children continue with the Year 1 and 2 parts to the programme as they move up the school, as part of their maths fluency learning.

There are opportunities for children to "bump" into Maths throughout the EYFS (both inside and outside) - through both planned activities and the self-selection of easily accessible quality maths resources in the learning environment. The Mastering Number programme, supplemented with resources from other sources, such as White Rose Maths and I See Maths are used to develop ideas consistent with teacher input for continuous provision. Whenever possible children's interests are used as a vehicle for delivering the curriculum. For instance, an interest in dinosaurs may give rise to sorting, counting and recording the number of dinosaurs in small world play. Staff will support children's learning through planned activities but also value and support self-initiated mathematical learning.

Towards the end of Reception, teachers aim to draw the elements of a daily mathematics lesson together so that by the time children move into Year 1 they are familiar with features of a structured lesson / activity.

## Years 1 - 6

Through Years 1 to 6 we use Maths - No Problem, a coherent programme of high-quality materials and exercises, which are structured with great care to build deep conceptual knowledge alongside developing procedural fluency.

Our KS1 and KS2 teachers use textbooks and workbooks from the 'Maths - No Problem!' series, which is based on the approach taken in Singapore, and aligned with the National Curriculum 2014, to support their planning and delivery of Mathematics teaching.

The 'Maths - No Problem!' textbooks and workbooks are arranged in chapters and, over the course of the academic year, all units of the National Curriculum 2014 are covered.



The short-term planning is done weekly, with teachers planning learning intentions, identifying possible misconceptions, key vocabulary and ways to challenge pupils in 'Deepen it' tasks. A range of resources are used to support the latter, to provide opportunities for further depth for all, including White Rose Maths, I See Maths, nRich and NCETM Mastery materials.

## A Typical Lesson - Maths - No Problem!

Lessons last approximately 1 hour and are taught daily. Pupils start the lesson with fluency/arithmetic activity - a short, structured activity to keep maths skills and knowledge on track - such as addition and multiplication calculations. This is written in Year 2 to 6, but oral in Year 1. A short KIRF activity is included (see further detail below).

Lesson design through Maths - No Problem!, follows a mastery approach, also coined by Barak Rosenshine's Principles of Instruction<sup>1</sup>, in which practitioners lead and model (I), then pupils are guided through examples (we), before children explore independent practice (you). The main lesson begins with a hook called, 'Explore'. This is a problem-solving activity, which pupils discuss in partners to prompt mathematical thinking, recalling and applying previous learning and deeper reasoning. In Key Stage One, these problems are almost always presented with objects (concrete manipulatives) for children to use. Pupils are encouraged to use manipulatives in Key Stage Two. Teachers use careful questions to draw out pupils' discussions and their reasoning.

The class teacher then leads pupils through strategies for solving the problem in the 'Master' section of Maths - No Problem!, including those already discussed. At this part of the lesson, the children might need to write down their strategy in their 'Maths Journal'. The strategies may be displayed on sheets of paper in the classroom, added onto an interactive and functional working wall. Further similar and extended challenges are then explored. The class then, in journals, try some questions in 'Guided Practice'. Carefully designed variation in these questions builds fluency and deep understanding. When they are ready to apply their learning independently, the children answer questions in their own workbooks. If some children are not ready by this point, they will continue 'Guided Practice' with the teacher in a small group. If some pupils rapidly grasp this new learning and have completed the questions independently, they will be given extra 'Deepen It' tasks (as described above) to secure, consolidate and deepen their thinking and application of new learning, which they will complete in their 'Maths Journal'.

<sup>1</sup>Principles of Instruction, Rosenshine, B. (Spring 2012), American Educator p12-39.

These guidelines demonstrate what we expect from our teachers and pupils in mathematics:

Key Aspects	Teacher	Pupils
High expectations of engagement and attainment for every child	Conveys the message that progress is made through engagement and effort. Expects every pupils to succeed. Is enthusiastic about the learning expected. Gives <b>every</b> pupil the opportunity to experience or master key ideas.	Have high aspirations, believe they can achieve and work hard in order to do so. Want to learn and enjoy learning.
	Follows a mastery curriculum. Differentiates through scaffolding, questioning and use of concrete and pictorial representations – instead of offering pupils different tasks. Uses speaking and listening activities, engaging resources and novel ‘ways in’ to a concept. Extends through further developing depth of language, conceptual understanding or mathematical thinking. Immediately acts on assessment from questioning and observation	Explore mathematics and ask questions to deepen their appreciation of the subject. Are challenging by solving less routine problems, demonstrating using concrete manipulatives/drawing diagrams, explaining in full sentences or asking their own questions.
Fewer topics, greater depth  Depth of mastery for all	<b>Develops conceptual understanding</b> through multiple representations and connections. Has a full understanding where and why this lesson falls in the sequence and in the longer term development of pupils’ mathematical understanding. Anticipates and incorporates misconceptions and inaccuracies.	Have access to concrete manipulatives. Manipulate objects or use pictorial representations to deepen their understanding. Make links between concrete, pictorial and abstract representations Link new learning to previous learning in mathematics, other subjects and beyond school. Demonstrate conceptual understanding through tackling new problems.
	<b>Develops communication of mathematical ideas, justifications and proofs</b> Uses modelling to support pupils in developing independence in their mathematical recording. Considers own language and models expected language use clearly and accurately.	Participate in pair/group discussion tasks. Are ready to answer in class questioning/discussion. Speak in full sentences. Use correct mathematical words and symbols. Use the key words.
	<b>Develops mathematical thinking and ability to generalise</b> Ensures every pupil participates in active thinking through a variety of questioning techniques. Encourages use of independent learning strategies, such as journaling. Involves pupils in <i>generalising</i> by comparing and classifying mathematical objects or talking about what might be sometimes, always or never true.	Do as much of the cognitive work – the writing, thinking, analysing and talking – as possible. Seek general patterns and create examples.

## Resources

The use of Mathematics resources is integral to the concrete - pictorial - abstract (CPA) approach and thus planned into our learning and teaching. We have a wide variety of good quality equipment and resources, both tangible and ICT based, to support our learning and teaching, to use within and to complement our Maths - No Problem! programme. These resources are used by our teachers and children in a number of ways including:

- Demonstrating or modelling an idea, an operation or method of calculation, e.g. with a number line; place value cards; Dienes; money or coins; measuring equipment for capacity, mass and length; bead strings; the interactive



whiteboards and related software; 3D shapes and/or nets; Numicon and related resources and software; multilink cubes; clocks; protractors; calculators; dice; number and fractions' fans; individual whiteboards and pens; and 2D shapes and pattern blocks, amongst other things;

- Enabling children to use a calculation strategy or method that they couldn't do without help, by using any of the above or other resources as required standard resources, such as number lines, multi-link cubes, Dienes, hundred squares, shapes, etc. are located within individual classrooms.

*Resources within individual classes are accessible to all pupils who should be encouraged to be responsible for their use.*

A range of Mathematics related software is also available and this is accessible via the shared server, which children can access when projected onto the Interactive Whiteboards in each classroom; or by using individual iPads. Teachers are encouraged to use the school playgrounds as an outdoor classroom when possible, for example, when teaching length, area or perimeter.

The CPA approach is an essential process to demonstrate mathematical structure and build conceptual and procedural understanding. However, we acknowledge it is a temporary resource to enable children to establish an abstract mental model which they can use. Concrete materials are withdrawn once these models are secured.

## Key Instant Recall Facts (KIRFs)

To support and celebrate development in their speed of number fact recall, and reduce cognitive load when calculating, we have established daily **Key Instant Recall Facts (or KIRFs)** practice. By the end of an academic year, pupils should be able to recall the KIRFs for their year group quickly (within 5 seconds) and complete counting activities confidently and fluently. Children should also be able to recall the **KIRFs** for all **previous** year groups within the same amount of time. Arithmetic/Fluency sessions are used to explicitly teach and/or practise these, with home learning used as an opportunity for reinforcement. Learning KIRFs to automaticity is an essential prerequisite to learning new and more complex concepts and procedures in mathematics, reducing the cognitive load required to do so. However, it is also important to note, that children should be taught the conceptual understanding behind these facts, and how they can be quickly derived from other known facts, rather than simply being learned by rote.





Pupils are given 20 questions to answer in 2 minutes, which are then self-marked in a chant to further reinforce number fact knowledge. Teachers regularly check pupils' individual progress. Half-termly KIRF KLUB assessments review this further and can be used to identify children who need further intervention.

Year 4 children must have a secure knowledge and quick recall of all times tables facts up to and including  $12 \times 12$ . This is tested in the DfE's Multiplication Tables Check from June 2020. Pupils practise timed electronic tests that mimic the statutory test format. Year 4 and 5 children will embark on the NCETM's new KS2 Mastering Number programme in September 2023, which aims to support children's understanding of multiplicative relationships in number. This daily activity will support Year 4 to achieve in their MTC and consolidate/extend application of this in Year 5.

## Assessment

Assessment processes are implemented at all stages of learning: during lessons, at the end of units and also at key points in the year for summative assessment (to analyse pupil progress), and to identify possible persistent gaps in understanding.

- 1) **During lessons:** carefully crafted questions given during the episodic teaching elements at the start of the lesson, in addition to 'Guided Practice' enable quick identification of children who will need further scaffolding or adult support during independent tasks.
- 2) **After lessons:** assessment of independent tasks (highlighted green for successful, pink for unsuccessful) identifies children for same / near-same day intervention for learning to be revisited before the next lesson so that misconceptions etc are addressed. Persistent misconceptions are addressed with targeted interventions.
- 3) **End of unit reviews:** these are part of the Maths - No Problem! structure to allow teachers to assess which children have achieved a deep and secure understanding of the math focus and provide support for those who need it.
- 4) **Termly NFERs:** these assessment papers mirror SATs' structure and provide an opportunity for analysis of longer-term recall of concepts and procedures. They allow progress to be tracked through the year; opportunity for teachers to share this with the Maths Subject Lead to ensure appropriate support is in place for those children who haven't grasped specific skills and/or knowledge.
- 5) **Fluency checks:** Daily arithmetic and KIRF mini-quizzes allow not only for skills to be kept 'on-track' but also for class teachers to spot any persistent errors or misconceptions. Year group specific KIRFs are also checked in half-termly 'KIRFs Klub' timed tests to check for quick accurate recall of these facts.



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## Cross curricular opportunities

Cross Curricular Opportunities are used to draw mathematical experiences out of a range of activities in other subjects, such as in History, Geography, PE, Science and Design and Technology, to enable children to apply and use mathematics in both real life and academic contexts. Each summer, children take part in 'Enterprise Week' in which they plan and budget for a year group stall at our Summer Fete.

In addition to this, all children take part in a celebratory maths day, the NSPCC's Number Day. Children take part in creative maths themed activities across the curriculum, while fundraising for a worthy cause.

## Pupil support and adaptive teaching

Taking a mastery approach, adaptive teaching occurs in the support, intervention and challenge provided to different pupils, not in the topics taught, particularly at earlier stages. This approach can be thought of as children doing tasks differently, rather than children doing different tasks. The National Curriculum states: 'Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice, before moving on.' There is often little differentiation in the content taught but the questioning and scaffolding individual pupils receive in class as they work through problems will differ, with rapid graspers challenged through more demanding problems which deepen their knowledge of the same content. Pupils' difficulties and misconceptions are identified through immediate formative assessment and addressed with rapid intervention - commonly through individual or small group support later that day or the following day before the next lesson. Pre-teaching may be used where appropriate to give identified pupils support and confidence before the main lesson. Opportunities for depth are routinely offered in guided tasks to all children to ensure all children have the opportunity to develop reasoning and problem-solving skills.

## Inclusion

Inclusion is about every child having educational needs that are special and the school meeting these diverse needs in order to ensure the active participation and progress of all children in their learning. Inclusive practice in mathematics should enable all children to achieve their best possible standard; irrespective of gender, ethnic, social or cultural background, home language or any other aspect that could affect their participation in, or progress in their learning. Where children are working at a level significantly below



their year group expectations, learning provided should mirror the topic being covered by the whole class to ensure inclusivity.

Language base children are routinely assessed for their maths abilities and complete learning appropriate to their maths abilities. This can be carried out both in LB or mainstream classes, depending on each individual child's needs.

## Parents/Carers

The school aims to involve parents/carers in their children's learning as much as possible and to inform them regularly of their child's progress in mathematics. Parents/carers have the opportunity to meet with their child's class teacher and receive written reports. Information about their child's standards, achievements and future targets in mathematics is shared with parents/carers at these times and also ways that parents/carers may be able to assist with their child's learning. Parents/carers are encouraged to support their children with homework (refer to homework policy). School also provides a number of opportunities for parents/carers to learn about what their child is learning and the way their child is being taught through parent workshops.

## Home Learning

Weekly tasks are given to all children from Y1 to Y6. These consist of quick KIRF recall questions, a problem-solving question and a more open-ended task (low threshold, high ceiling) that may have multiple solutions. This is sent home every Wednesday, for return the following Monday. If home learning is not completed at home, children must be given the opportunity to complete the tasks during the school day. A record of children who do not complete their home learning at home is maintained, so that parents/carers of pupils who regularly do not meet these requirements can be contacted and encouraged to support their children.

## Subject Leader

The role of the Subject Leader is to provide professional leadership and management in mathematics in order to secure high quality teaching, effective use of resources and high standards of learning and achievement for all pupils. They will achieve this by affecting the following key areas: strategic direction and development:



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- Learning and teaching (including planning and marking and presentation)
  - Leading and managing staff
  - Leading CPD
  - Monitoring
  - Efficient and effective deployment of staff and resources.

The Subject Leader has regular discussions with the Senior Leadership Team and link governor about mathematics, and areas for future development. The school also has an ongoing relationship with The GLOW MathsHub with whom maths teaching and learning can evolve with new thinking and approaches. The school partakes in many CPD opportunities through the Sustaining Teaching for Mastery Programme, and the maths lead is a Local Leader in Maths Education for the hub.

## Related Documents

Accompanying this policy are:

- Lesson structure model
- Written calculation policy
- KIRF coverage
- Vision statement
- Maths progression - steps by year group for each skill (aligned with the National Curriculum).