SCAMBLESBY CHURCH OF ENGLAND PRIMARY SCHOOL

Mathematics Policy

'Mathematics is not about numbers, equations, computations, or algorithms: it is about understanding.'

William Thurston

At Scamblesby CE Primary School, our aim is to equip all pupils with the skills and confidence to solve a range of problems through fluency with numbers and mathematical reasoning. Children are encouraged to see the mathematics that surrounds them every day and enjoy developing vital life skills in this subject. We aim to foster a love of mathematics and to develop children's confidence in maths through a growth mind-set.

The language of mathematics is international. The basic skills of mathematics are vital for the life opportunities of our children. Our aim is for all children to think mathematically, enabling them to reason, solve problems and assess risk in a range of contexts.

The National Curriculum:

The three aims of the NC should be addressed every day. We want to ensure that all pupils:

- *become fluent and efficient in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.*
- *reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language.*
- *can solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.*

At Scamblesby CE Primary School, our Mathematics Mastery curriculum has been developed to ensure every child can achieve excellence in mathematics. Our aim for modifying our teaching and learning is to improve attainment and progress in mathematics for our children, and to provide sufficient opportunities to deepen their understanding further. Children can experience a sense of awe and wonder as they solve a problem for the first time, discover different solutions and make links between different areas of mathematics. It provides pupils with a deep understanding of the subject through a concrete, pictorial and abstract approach. This ensures pupils fully understand what they are learning. To help us embed a mastery approach in our school, we are continuing to be part of a 'Teaching for mastery work group' with the local maths hub.

Planning:

Whole class together – we teach mathematics to whole classes. Lessons are planned based on formative assessment of what students already know and we include all children in learning mathematical concepts. At the planning stage, teachers consider the scaffolding that may be required for children struggling to grasp concepts in the lesson and suitable challenge questions for those who may grasp the concepts rapidly.

Longer but deeper – in order to ensure children to have a secure and deep understanding of the content taught, our plans have been adjusted to allow longer on topics and we move more slowly through the curriculum. We use the White Rose Mathematics Programme to structure our long and medium term planning and to ensure clear and logical progression of knowledge and skills. We supplement its resources

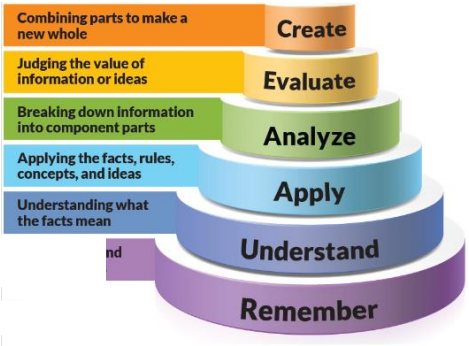
at the implementation stage with a range of strategies, practical experiences and reasoning challenges. Teachers adapt each lesson to meet the needs of their children and add extra questioning/tasks which will allow children to learn the content more deeply. The learning will focus on one key conceptual idea and connections are made across mathematical topics. Our Maths Progression Documents chart the progress in skills and concepts across the 3 Milestones of the Primary Curriculum, as detailed in Chris Quigley's Essential Curriculum (see Appendix) Our Long Term Overviews, from the White Rose mixed age planning, map out the units to be covered each term across the school.

Y1/2 MIXED AGE LONG TERM PLANNING:

Y3/4 MIXED AGE LONG TERM PLANNING:

Y5/6 MIXED AGE LONG TERM PLANNING:

To outsiders it may appear that the pace of the lesson is slower, but progress and understanding is enhanced. Mastery questions are developed from Bloom's Taxonomy in terms of offering **low threshold, high ceiling** tasks which are designed to be mathematically accessible, and to have built-in extension opportunities.

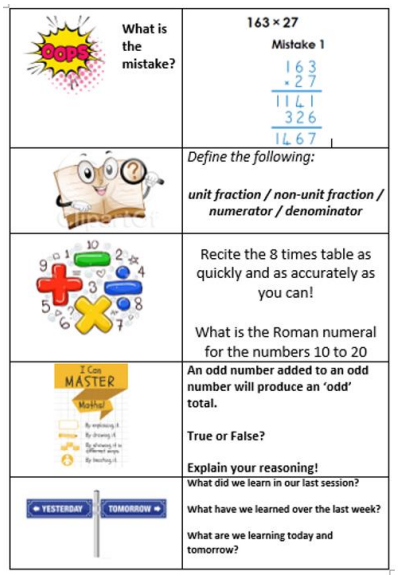


Key learning points are identified during planning and a clear journey through the maths should be shown on the use of Powerpoints which structure each mathematics session (and which is also reflected on classroom working walls). Learning points may appear to be very small but this is deliberate. The expectation is that every child will master the concept and some children will work more deeply on the same concept using variation theory and challenge tasks.

Questions will probe pupil understanding throughout, taking some children's learning deeper. Responses are expected in full sentences, using precise mathematical vocabulary. Stem sentences are used in lessons to encourage children to think and talk mathematically and to help explain their answers clearly (modelled by the teacher).

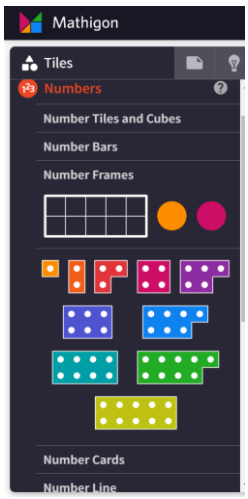
Fluency – We recognise that being fluent in maths is not just about remembering facts, and we develop all aspects of fluency through lessons. There is a whole school focus on developing an instant recall of key facts, such as number bonds, times tables, division facts, addition and subtraction facts which is built on from developing a secure early number sense in our Early Years. We explicitly teach children to recognise the importance of efficiency, so that they have a range of mental methods as a tool for becoming fluent.

Lesson Structure:



- **Fluency in Five –** at the start of each maths lesson, a Powerpoint slide is shared with the children which gives them the opportunity to use retrieval skills from previously taught concepts or a range of mastery maths skills. These may, on occasion, be used as a 'pre-teach' to introduce a new concept, and they will include the discrete use of mathematical vocabulary and the opportunity to place the day's learning in context with previous and future learning.
- **Online Supporting Resources** – Mathigon and nrich provide learning resources and activities to supplement objectives and provide a range of visual, auditory and kinaesthetic representations and variations.

Y5/6 example:



https://mathigon.org/polypad
https://nrich.maths.org/

- ***Exploration and discovery*** – instead of always giving a learning objective or 'Let me teach you…' as a starting point, children are encouraged to explore a problem themselves to see what they already know. During this time, teachers/TAs will observe the children, listen to dialogue about the problem, and may be probed further using questions based around variation theory.
- ***Develop reasoning and deep understanding (contexts and representations of mathematics)*** – problems are often set in real life contexts – carefully chosen practical resources and pictorial representations are used to explore concepts. These pictorial representations may appear in books as children show their understanding, rather than answers to a series of calculations.
- ***Sharing*** – the teacher will organise the findings of the exploration, compare/contrast strategies and guide toward the most efficient strategy (or the one being learnt that day).
- ***Thinking together (a step by step approach)*** – journey through the mathematics. These steps may appear small (especially at the beginning of a lesson), but there are points when suddenly a jump appears to have been made, or an extra challenge appears – this is normal.
- ***Questions to challenge thinking*** – teachers use questioning throughout every lesson to check understanding – a variety of questions are used, but you will hear the same ones being repeated:

How do you know? Can you prove it? Are you sure? Can you represent it another way? What's the value? What's the same/different about? Can you explain that? What does your partner think? Can you imagine? Throughout the lesson, pupils have opportunities to talk to their partners and explain/clarify their thinking. Sentence stems are modelled and used to support this.

NB: Due to the style of the lessons with frequent questioning, lessons may appear to move slower than in the past. There will be more dialogue between teacher and child, and between children, and less recording in books.

- ***Recording the learning – not just pages of similar calculations –*** In books you will see a range of activities including those requiring written explanations of the children's understanding. Sometimes learning is recorded by photos and videos, which are often put onto Tapestry. Observations may also be made by the teacher, for example in the Early Years class and in Y1, to record learning. Books are also used to record jottings and fluency work.

- ***Practising*** – this is characterised by variation, which provides children with carefully chosen questions that are essential in assessing how the children have understood the concept taught. Children's maths exercise books will demonstrate aspects of differentiation within books; some children rapidly grasp the concepts and therefore complete the activities quickly and move onto questions or activities where their understanding can be developed to a greater depth. Some children will work very hard in the lesson to complete the tasks independently, some children will need additional support to complete the pages and some children will sometimes be provided with different tasks and questions appropriate to their understanding of a concept.

Mathematical dialogue / 'Talk for Maths':

Encouraging children to engage in mathematical dialogue is crucial to thinking mathematically, and this is modelled by all staff within the classroom by thinking out loud. Children have time within all lessons to practise talking mathematically and are encouraged to develop the articulation of maths reasoning by the use of stem sentences given and key vocabulary displayed.

We can 'talk maths' in full sentences.	**We know we are great mathematicians when...**	We can 'talk maths' so that our whole audience can hear us.
We can 'talk maths' so that our whole audience understands us.		We can listen to all speakers and expect to understand.
We can explain our own thinking.	We can ask questions to help make our thinking clearer and stronger.	We can repeat and rephrase explanations.

The promotion of specific and accurate mathematical vocabulary and language is grounded in our approach to the teaching of reading across the school, specifically in the refinement of four main areas – prediction, clarifying, questioning and summarising. By developing cross-curricular skills across the subject areas gives both English and Mathematics added value and kudos and helps children's understanding of what is being

asked of them in a particular context and which skills, processes and concepts are needed for a successful response.

Rapid intervention:

In mathematics, new learning is built upon previous understanding, so in order for learning to progress and to keep the class together pupils need to be supported to keep up and areas of difficulty must be dealt with as and when they occur. Ideally this would happen on the same day but this is not always possible so it may be the following day, but will be before new learning is introduced. This has an implication on our approach to marking: teachers and Teaching Assistant teachers will review the day's work with the children and aim to speak directly with the children about successes or misconceptions. Accordingly, the amount of written feedback in children's books will be less, while the quality of the direct interaction with the children will be increased and has proved to be much more effective in ensuring progress and future success.

We do not label our children. We have high expectations of all children and strongly believe that all children are equally able in mathematics. Some may take longer to grasp concepts and may need careful scaffolding or extra time/support (guided groups, same day catch-up, additional homework, pre-teaching, intervention group, specific parental support).

Maths in the Early Years and Year 1:

Mathematics is introduced into all elements of play in the early years and this ensures the children are learning, rehearsing and developing in a non-threatening, non-stressful way. Children are encouraged to see and develop a love of using maths in everything they do. During each morning session, the children have an adult-led input with the teacher, using practical, real-life resources. While there is sequential teaching of mathematical concepts and skills as set out in Development Matters, it is important to recognise that adults support children through skilled interaction during play and seize any opportunity to develop children's mathematical skills and vocabulary. The indoor and outdoor environment is carefully planned to enable all children to explore, practise and apply mathematical skills through high-quality play. The characteristics of effective teaching and learning are fundamental in building a solid foundation of mathematical inquiry and understanding. Practitioners maximise opportunities to support children in:

- playing and exploring – children investigate and experience things, and 'have a go'
- active learning – children concentrate and keep on trying if they encounter difficulties, and enjoy achievements
- creating and thinking critically – children have and develop their own ideas, make links between ideas, and develop strategies for doing things

Teaching for mastery is evident in the class with the different representations used to support understanding and teachers model the appropriate vocabulary when exploring a concept. Maths in the early years provides children with a solid foundation that will enable them to develop skills as they progress through their schooling and ensures children are ready for the National Curriculum.

In Year 1, children continue to develop their understanding of mathematics through rehearsal with practical resources which are readily available in the provision. The classroom has a child-led ethos and the children are skilled, from their time in Early Years, at demonstrating and developing their understanding using the resources available to them. The teacher challenges and extends the children's mathematical ideas and vocabulary in a personalised way throughout the school day rather than purely within a 'lesson'.

Maths Across Scamblesby CE Primary School:

The teacher plans a daily whole class session which follows the small steps approach taken within school. The session includes counting and application of fluency for efficiency. The whole class sessions are informed by observations of previous learning, children who require more support have access to concrete resources

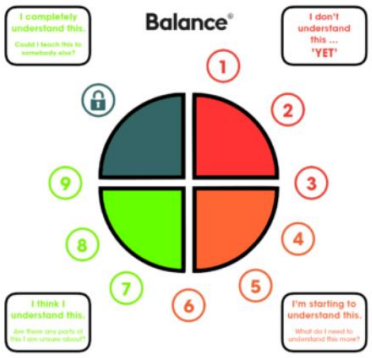
and those who are working at greater depth have more challenging questioning or tasks provided. Some children benefit from continuing their work with the White Rose resources; however, children often demonstrate a greater level of skill with mathematical concepts when working in a more individual and personalised way. The provision allows children to demonstrate their understanding of the taught concept using a range of resources. Often, adult initiated tasks are provided in the provision with an expectation of completion to ensure support and challenge can be implemented.

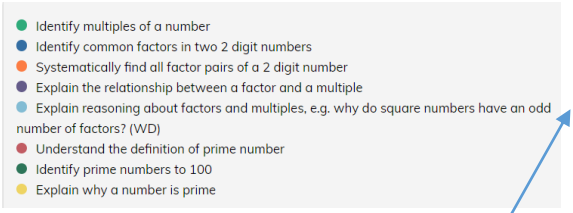
Retrieval:

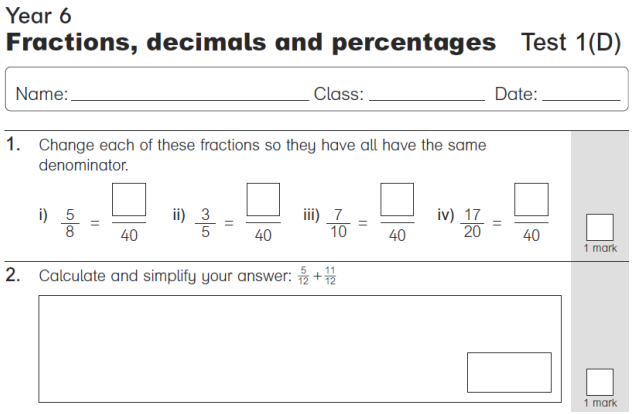
Using guidance from White Rose, we plan very carefully to ensure we are building on prior learning and to support children to make links between learning. Additionally, we also build in retrieval activities that are short tasks to revisit prior learning. This may link to fluency tasks.

Assessment:

The staff assess the children against learning objectives using the Balance Assessment Tool. This records their performance against a specific set of objectives which is then used to develop a picture of their progress and whether they are working below, at or above Age Related Expectations. PUMA tests and Rising Stars Diagnostics are also used regularly through the school year to record children's performances and inform teachers of future planning implications and the need for spaced learning which revisits skills, knowledge and concepts and gives opportunities for a deeper, more secure level of understanding.






Year 6
Fractions, decimals and percentages Test 1(D)

Name: _____ Class: _____ Date: _____

1. Change each of these fractions so they have all have the same denominator.

i) $\frac{5}{8} = \frac{\square}{40}$ ii) $\frac{3}{5} = \frac{\square}{40}$ iii) $\frac{7}{10} = \frac{\square}{40}$ iv) $\frac{17}{20} = \frac{\square}{40}$ 1 mark

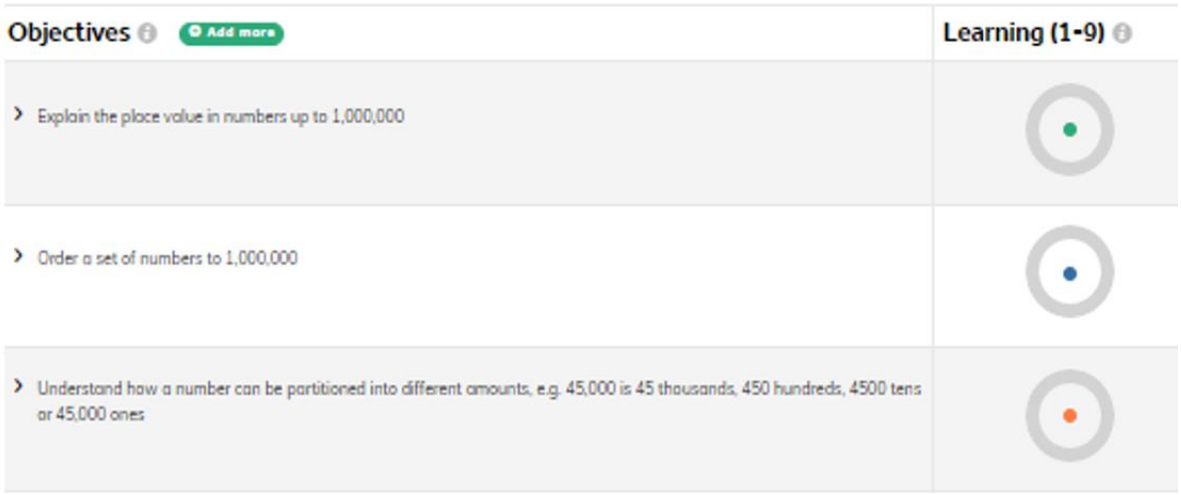
2. Calculate and simplify your answer: $\frac{5}{12} + \frac{11}{12}$ 1 mark

A sample of Rising Stars Mathematics Diagnostic tests (used at the start and end of units of work to reflect on common misconceptions and to record progress in these areas during the course of the unit).

Children's Self-Assessment:

Children have regular opportunities to assess their own work, through their responses to Learning Objectives. They use the number system from Balance and this is considered by teachers when making judgements.

BALANCE SELF-ASSESSMENT: NUMBER AND PLACE VALUE, SEPT. 2022

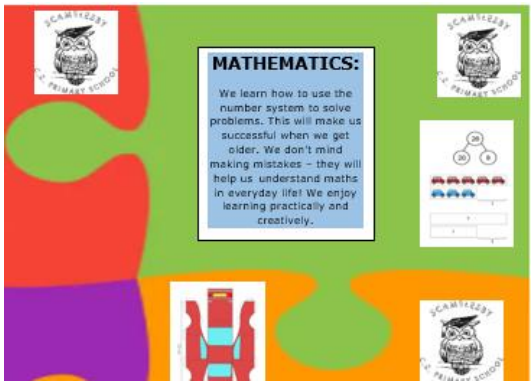


Pupil Voice / Pupil Subject Champions:

At Scamblesby CE Primary School, we take the voice and views of the children very seriously and strive to involve them in the teaching and learning process to aid understanding and develop a sense of ownership of their learning. Mathematics, in common with the other curriculum subjects across the school, is represented by two Y5/6 subject champions, whose responsibilities include joining the mathematics subject leader with learning walks, discussing the subject with children across the school and ensuring that the opinions of the children are represented and discussed. The Mathematics Subject Champions are given details of how the subject looks in our school, taken from Chris Quigley's Essential Curriculum, and contributed a 'pupil vision statement for our curriculum jigsaw.

Mathematics

Essential Characteristics...	The Mathematical Strands...
• An understanding of the important concepts and an ability to make connections within mathematics. • A broad range of skills in using and applying mathematics. • Fluent knowledge and recall of number facts and the number system. • The ability to show initiative in solving problems in a wide range of contexts, including the new or unusual. • The ability to think independently and to persevere when faced with challenges, showing a confidence of success. • The ability to embrace the value of learning from mistakes and false starts. • The ability to reason, generalise and make sense of solutions. • Fluency in performing written and mental calculations and mathematical techniques. • A wide range of mathematical vocabulary. • A commitment to and passion for the subject.	**Know and use numbers** This concept involves understanding the number system and how they are used in a wide variety of mathematical ways. **Add and subtract** This concept involves understanding both the concepts and processes of addition and subtraction. **Multiply and divide** This concept involves understanding both the concepts and processes of multiplication and division. **Use fractions** This concept involves understanding the concept of part and whole and ways of calculating using it. **Understand the properties of shapes** This concept involves recognising the names and properties of geometric shapes and angles. **Describe position, direction and movement** This concept involves recognising various types of mathematical movements. **Use measures** This concept involves becoming familiar with a range of measures, devices used for measuring and calculations. **Use statistics** This concept involves interpreting, manipulating and presenting data in various ways. **Use algebra** This concept involves recognising mathematical properties and relationships using symbolic representations



Monitoring:

The Mathematics subject leader plays a central role in the monitoring and evaluation of the quality of teaching and learning of mathematics in the school.

The monitoring strategy:

- Children's work and medium-term planning scrutinies are conducted termly;
- Pupil progress meetings are held termly.
- Learning Support Assistants participate in regular Continued Professional Development, which is led by the Mathematics Subject Leader;
- Lesson 'drop ins' and learning walks and observations take place in all classes throughout the year;
- Pupil conferencing takes place termly.

The subject leader is responsible for monitoring attainment and progress, the outcomes of which are collated and fed back to staff at an appropriate time. Teaching and learning is monitored at a time indicated in the Monitoring and Evaluation timetable. In addition, the work of the maths subject leader involves supporting colleagues in the teaching of mathematics and informing teachers about current developments in the subject.

ACTION PLAN (2021 – 2023):

Vision Statement

The language of mathematics is international. The basic skills of mathematics are vital for the life opportunities of our children. Our aim is for all children to think mathematically, enabling them to reason, solve problems and assess risk in a range of contexts. At Scamblesby CE Primary School, our Mathematics Mastery curriculum has been developed to ensure every child can achieve excellence in mathematics. Children can experience a sense of awe and wonder as they solve a problem for the first time, discover different solutions and make links between different areas of mathematics. It provides pupils with a deep understanding of the subject through a concrete, pictorial and abstract approach. This ensures pupils fully understand what they are learning.

Key features of our Maths Mastery curriculum: high expectations for every child; fewer topics, greater depth; number sense and place value come first; focus on mathematical thinking and language; resources to support; problem solving is central; calculate with confidence– understand how and why the number system works.

Mathematics Mastery places emphasis on the cumulative mastery of essential knowledge and skills in mathematics. It embeds a deeper understanding of maths by utilising a concrete, pictorial, abstract approach so that pupils understand what they are doing rather than just learning to repeat routines without grasping what is happening.

Aims:

- To implement the current legal requirements of the Foundation Stage (FS) and the National Curriculum (NC).
- To foster positive attitudes, fascination and excitement of discovery through the teaching and learning of mathematical concepts.
- To ensure pupils become fluent in the fundamentals of mathematics, developing conceptual knowledge and an ability to recall and apply knowledge rapidly and accurately
- To ensure that pupils can reason mathematically and solve problems
- For our children to develop a 'can do' attitude and perceive themselves as mathematicians.
- To broaden children's knowledge and understanding of how mathematics is used in the wider world.
- For our children to use and understand mathematical language and recognise its importance as a language for communication and thinking.

Intended outcomes: 'Over' Outcomes

In the focused areas of the maths curriculum addressed by the Work Group during the year, pupils will:

- **have high expectations of themselves as mathematicians; they continue to show a positive attitude towards the subject**
- **experience coherent, well-designed lessons**

Which leads to:

- **fewer pupils failing to meet ARE and an increased depth of understanding in the focused areas addressed by the Work Group.**

What will change?	What are the incentives?	What skills will need developing?	What will be the evidence of success?	What action(s) will promote this change?	What resources are needed for implementation?	How will you start to share this with colleagues?
The confidence of teachers and children to demonstrate and develop reasoning using precise mathematical vocabulary and stem sentences. Participation on the reasoning work group will enable teachers to explicitly teach children how to reason so they can answer questions such as: Which skills do I need to complete the task? How can I explain my thinking? What vocabulary do I need to use? The ability to articulate their reasoning skills to unpick word problems is vital to ensure depth of understanding which is reflected in Y2 and Y6 SATs results.	Success in reasoning challenges and the ability to be 'Talk for Maths' Champions, explaining concepts, processes and strategies to other children and adults.	• Reading for meaning; • The ability to extract the maths concepts, operations and context for success; • Basic skills of number bonds, multiplication tables to enable quick and efficient strategies; • The understanding that efficient mathematicians "work smarter, not harder!"	• Response to Rising Stars assessments, before and after a maths topic has been explored; • A readiness, willingness and excitement when facing reasoning opportunities and 'Using and Applying Mathematics' challenges; • More precise, refined application and use of mathematical vocabulary and terminology, without being prompted.	Well planned and appropriate use of reasoning activities to delve deeper into appropriate use and application of language and strategy.	• White Rose activities – to be adapted accordingly. • 'Maths Mastery Reasoning: Photocopiable Resources KS2: Everything you need to teach mathematical reasoning through mastery' resource • Range of manipulatives to reinforce learning and provide CPA visualisation.	Demonstrations, recording on ~~DVD~~ and including on Tapestry to show teaching and learning and use of language More able Y6 mathematicians to do a peer tutoring session with Y3/4 on suitable activities

Intended outcome: **2. Whole school/departmental policies and approaches**

Leaders will:

- continue to refine school structures and systems to ensure that all teachers can be supported to embed and sustain teaching for mastery across school
- continue to ensure a sustainable model for collaborative planning and ongoing specialist subject knowledge development for all teachers, and have systems in place to identify and support teachers who require more input than others with regards to teaching for mastery

ensure that good practice is shared beyond the participant schools.

What will change?	What are the incentives?	What skills will need developing?	What will be the evidence of success?	What action(s) will promote this change?	What resources are needed for implementation?	How will you start to share this with colleagues?
• Discussions about differentiation to be had to establish the disconnect between maths mastery and established, proven practice, to establish a compromise that suits the current teaching and learning successes and challenges at Scamblesby CE Primary School. • Appropriate inclusion into weekly planning to reflect focus on reasoning skills, which are different to 'word problems' which simply require extraction of key operations.	To know that maths for mastery, with a 'reasoning' focus, is applied consistently across the school, and the knowledge that, following our very successful Mathematics Ofsted Deep Dive in March 2022, that we are continuing to evolve and build on such strong foundations.	• A clear understanding of the need, methods and intent behind ensuring all children make appropriate progress in their reasoning skills; • The appropriate use of Balance to reflect the 'reasoning' component and focus in mathematical teaching and learning • An understanding of what 'reasoning' is and what it isn't.	• Planning shows appropriate focus on reasoning skills and vocabulary; • Classroom Working Walls reflect the processes of Problem Solving and effective reasoning skills; • All teachers and TAs are using appropriate mathematical language, based on Bloom's taxonomy development. 	• Investment in 'Maths Mastery Reasoning: Photocopiable Resources KS2, and the KS1 companion • Effective discussions about maths mastery, its aims and effective application, particularly with the balance of the 5 Big Ideas and the move away from differentiated groupings.	• Investment in 'Maths Mastery Reasoning: Photocopiable Resources KS2, and the KS1 companion • Range of manipulatives to reinforce learning and provide CPA visualisation.	Staff meeting in Term 2, to clarify and explain the Sustaining Mastery Maths Programme and its emphasis on Reasoning.

Intended Outcome: **3. Practice development**

- All teachers will plan, teach and reflect collaboratively, within school and across other settings, drawing on their deeper subject knowledge in order to provide a coherent mastery curriculum

All teachers will demonstrate their understanding of the teaching for mastery Five Big Ideas in their normal practice.

What will change?	What are the incentives?	What skills will need developing?	What will be the evidence of success?	What action(s) will promote this change?	What resources are needed for implementation?	How will you start to share this with colleagues?
Teachers and Teaching Assistants to work within a termly timetable that gives them time for classroom swaps and joint observations, to observe teaching across different phases and approaches, and to reference teaching and learning against the principles of the 5 Big Ideas of Maths Mastery. Fortnightly 'catch up's to discuss planning and effective use of the 5 Big Ideas, focusing on mathematical thinking.	Effective CPD and better understanding of 'where the children are coming from and where they are going to'	Clear understanding of the 5 Big Ideas and Bloom's Taxonomy Ability to share knowledge and apply it to own practice Professional and non-threatening / judgemental observations and professional discussion	Consistency of approach across the school, and clarity about what effective 'reasoning' is and what it isn't, and how opportunities for reasoning can be explored across the maths curriculum (and transferable skills into different areas of the curriculum)	Well-structured and SMART target –led timetable of swaps and paired observation / lesson study	Flexibility of staff, and possibly some supply cover to enable staff to be released to observe and participate in team teaching	As maths leader, model some using and applying / reasoning skills to all TAs and teachers – implication for cover for the rest of the school during this period – to be discussed with head teacher and locality lead.
Review: How's it going?				**Review: How do you know you're ready to move on?**		
What will change?	**What are the incentives?**	**What skills will need developing?**	**What will be the evidence of success?**	**What action(s) will promote this change?**	**What resources are needed for implementation?**	**How will you start to share this with colleagues?**
Maths Working Walls to reflect school's focus on spaced learning and memorisation, referencing previous, current and future learning. All classes will have a consistent approach to this, which will become the centre of each class's maths working walls	Consistency of approach and reinforcement of understanding of sequence of knowledge and skills	Clear understanding of teaching sequence	Consistency of approach across classes, and children able to articulate their understanding of the chronology of learning	Consistency of approach across classes, and children able to articulate their understanding of the chronology of learning	Wood, hooks, bulldog clips and A3 paper templates!	Discuss with staff and model in KS2.

Annually, the governor with responsibility for mathematics will visit each class and discuss current issues with the Maths subject leader and submit a report for the governing body to summarise the visit and discussions, making them aware of any actions or issues which have been identified by the SLT.

This policy will be reviewed annually.

…… – Head Teacher

……- Date

…… - Chair of Governors

…….. – Date

APPENDIX: ESSENTIAL CURRICULUM LONG TERM OVERVIEW, SHOWING COVERAGE AND PROGRESSION OF KEY MATHEMATICAL KNOWLEDGE AND SKILLS ACROSS THE SCHOOL. MILESTONE ONE REFERS TO Y1 AND 2, MILESTONE TWO REFERS TO Y3 AND 4 AND MILESTONE THREE REFERS TO Y5 AND 6.

SCAMBLESBY CE PRIMARY SCHOOL: MATHEMATICS PROGRESSION – Y1 – Y6
(adapted from Chris Quigley Curriculum)

Essential Characteristics:

- **An understanding of the important concepts and an ability to make connections within mathematics.**
- **A broad range of skills in using and applying mathematics.**
- **Fluent knowledge and recall of number facts and the number system.**
- **The ability to show initiative in solving problems in a wide range of contexts, including the new or unusual.**
- **The ability to think independently and to persevere when faced with challenges, showing a confidence of success.**
- **The ability to embrace the value of learning from mistakes and false starts.**
- **The ability to reason, generalise and make sense of solutions.**
- **Fluency in performing written and mental calculations and mathematical techniques.**
- **A wide range of mathematical vocabulary.**
- **A commitment to and passion for the subject.**

***BREADTH OF STUDY: KS1*:**

- Count and calculate in a range of practical contexts.
- Use and apply mathematics in everyday activities and across the curriculum.
- Repeat key concepts in many different practical ways to secure retention.
- Explore numbers and place value up to at least 100.
- Add and subtract using mental and formal written methods in practical contexts.
- Multiply and divide using mental and formal written methods in practical contexts.
- Explore the properties of shapes.
- Use language to describe position, direction and movement.
- Use and apply in practical contexts a range of measures, including time.
- Handle data in practical contexts.

BREADTH OF STUDY: KS2:

- Count and calculate in increasingly complex contexts, including those that cannot be experienced first-hand.
- Rigorously apply mathematical knowledge across the curriculum, in particular in science, technology and computing.
- Deepen conceptual understanding of mathematics by frequent repetition and extension of key concepts in a range of engaging and purposeful contexts.
- Explore numbers and place value so as to read and understand the value of all numbers.
- Add and subtract using efficient mental and formal written methods.
- Multiply and divide using efficient mental and formal written methods.
- Use the properties of shapes and angles in increasingly complex and practical contexts, including in construction and engineering contexts.
- Describe position, direction and movement in increasingly precise ways.
- Use and apply measures to increasingly complex contexts.
- Gather, organise and interrogate data.
- Understand the practical value of using algebra.
-

		Milestone 1	Milestone 2	Milestone 3
Threshold Concept				
Know and use numbers This concept involves understanding the number system and how they are used in a wide variety of mathematical ways.	**Counting**	Count to and across 100, forwards and backwards, beginning with 0 or 1, or from any given number. Count, read and write numbers to 100 in numerals. Given a number, identify one more and one less. Count in steps of 2, 3, 5 and 10 from 0 or 1 and in tens from any number, forward and backward.	Count in multiples of 2 to 9, 25, 50, 100 and 1000. Find 1000 more or less than a given number. Count backwards through zero to include negative numbers.	Read numbers up to 10 000 000. Use negative numbers in context and calculate intervals across zero.
	Representing	Identify, represent and estimate numbers using different representations, including the number line. Read and write numbers initially from 1 to 20 and then to at least 100 in numerals and in words.	Identify, represent and estimate numbers using different representations. Read Roman numerals to 100 (I to C) and know that over time, the numeral system changed to include the concept of zero and place value.	Write numbers up to 10 000 000 Read Roman numerals to 1000 (M) and recognise years written in Roman numerals.
	Comparing	Use the language of: equal to, more than, less than (fewer), most and least. Compare and order numbers from 0 up to 100; use <, > and = signs.	Order and compare numbers beyond 1000.	Order and compare numbers up to 10 000 000.
	Place Value	Recognise the place value of each digit in a two-digit number (tens, ones).	Recognise the place value of each digit in a four-digit number. (thousands, hundreds, tens, and ones) Round any number to the nearest 10, 100 or 1000.	Round any whole number to a required degree of accuracy. Determine the value of each digit in any number.
	Solving Problems	Use place value and number facts to solve problems.	Solve number and practical problems with increasingly large positive numbers	Solve number and practical problems.

Add and subtract **This concept involves understanding both the concepts and processes of addition and subtraction.**	**Complexity**	Solve one-step (two-step at greater depth) problems involving multiplication and division.	Solve problems involving multiplying and dividing, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems (such as n objects are connected to m objects).	Solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign. Solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates. Use knowledge of the order of operations to carry out calculations involving the four operations.
	Methods	Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (x), division (÷) and equals (=) signs. Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot. Solve problems involving multiplication and division using mental methods.	Multiply two-digit and three-digit numbers by a one-digit number using formal written layout. Use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers. Recognise and use factor pairs and commutativity in mental calculations.	Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication. Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context. Divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context. Perform mental calculations, including with mixed operations and large numbers.
	Checking	Use known multiplication facts to check the accuracy of calculations.	Recognise and use the inverse relationship between multiplication and division and use this to check calculations and solve missing number problems.	Estimate and use inverse operations and rounding to check answers to a calculation.
	Using Number Facts	Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables. Recognise odd and even numbers. Use multiplication and division facts to solve problems.	Recall multiplication and division facts for multiplication tables up to 12 × 12.	Identify common factors, common multiples and prime numbers Establish whether a number up to 100 is prime and recall prime numbers up to 19. Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000. Recognise and use square numbers and cube numbers, and the notation for squared (2) and cubed (3). Solve problems involving multiplication and division including using knowledge of factors and multiples, squares and cubes.
Fractions **This concept involves understanding the concept of part and whole and ways of calculating using it.**	**Recognising Fractions**	Recognise, find and name a half as one of two equal parts of an object, shape or quantity. Recognise, find and name a quarter as one of four equal parts of an object, shape or quantity. Recognise, find, name and write fractions 1/2, 1/4, 2/4 and 3/4 of a length, shape, set of objects or quantity.	Recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators. Recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators. Round decimals with one decimal place to the nearest whole number. Compare numbers with the same number of decimal places up to two decimal places. Count up and down in tenths; recognise that tenths arise from dividing an object into 10 equal parts and in dividing one-digit numbers or quantities by 10. Count up and down in hundredths; recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten. Compare and order unit fractions and fractions with the same denominators.	Compare and order fractions whose denominators are all multiples of the same number. Compare and order fractions, including fractions > 1. Recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements > 1 as a mixed number. Round decimals with two decimal places to the nearest whole number and to one decimal place. Read, write, order and compare numbers with up to three decimal places. Identify the value of each digit in numbers given to three decimal places. Solve problems involving number up to three decimal places. Recognise the percent symbol (%) and understand that percent relates to 'number of parts per hundred', and write percentages as a fraction with denominator 100, and as a decimal.
	Equivalence	Recognise the equivalence of 2/4 and 1/2.	Recognise and show, using diagrams, families of common equivalent fractions. Recognise and write decimal equivalents of any number of tenths or hundredths. Recognise and write decimal equivalents to 1/4, 1/2, 3/4.	Identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths. Read and write decimal numbers as fractions. Recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents. Use common factors to simplify fractions; use common multiples to express fractions in the same denomination. Associate a fraction with division and calculate decimal fraction equivalents. Recall and use equivalences between simple fractions, decimals and percentages, including in different contexts.

	Solving Problems	Write simple fractions for example, 1/2 of 6 = 3.	Add and subtract fractions with the same denominator within one whole. Solve problems involving increasingly harder fractions. Calculate quantities and fractions to divide quantities (including non-unit fractions where the answer is a whole number). Add and subtract fractions with the same denominator. Find the effect of dividing a one- or two-digit number by 10 and 100, identifying the value of the digits in the answer as ones, tenths and hundredths. Solve simple measure and money problems involving fractions and decimals to two decimal places.	Add and subtract fractions with the same denominator and denominators that are multiples of the same number. Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions. Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams. Multiply simple pairs of proper fractions, writing the answer in its simplest form. Solve problems which require knowing percentage and decimal equivalents of, 1/2, 1/4, 1/5, 2/5, 4/5 and those fractions with a denominator of a multiple of 10 or 25. Divide proper fractions by whole numbers. Multiply and divide numbers by 10, 100 and 1000 giving answers up to three decimal places. **Ratio and proportion** Solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts. Solve problems involving the calculation of percentages and the use of percentages for comparison. Solve problems involving similar shapes where the scale factor is known or can be found. Solve problems involving unequal sharing and grouping using knowledge of fractions and multiples.
Understand the properties of shapes **This concept involves recognising the names and properties of geometric shapes and angles.**		Recognise and name common 2D and 3D shapes. Identify and describe the properties of 2-D shapes, including the number of sides and line symmetry in a vertical line. Identify and describe the properties of 3-D shapes, including the number of edges, vertices and faces. Identify 2-D shapes on the surface of 3-D shapes. Compare and sort common 2-D and 3-D shapes and everyday objects.	Draw 2-D shapes and make 3-D shapes using modelling materials; recognise 3-D shapes in different orientations and describe them. Recognise angles as a property of shape or a description of a turn. Identify right angles, recognise that two right angles make a half-turn, three make three quarters of a turn and four a complete turn; identify whether angles are greater than or less than a right angle. Identify horizontal and vertical lines and pairs of perpendicular and parallel lines. Compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes. Identify acute and obtuse angles and compare and order angles up to two right angles by size. Identify lines of symmetry in 2-D shapes presented in different orientations. Complete a simple symmetric figure with respect to a specific line of symmetry.	Identify 3-D shapes, including cubes and other cuboids, from 2-D representations. Know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles. Draw given angles, and measure them in degrees (°). Identify: Angles at a point and one whole turn (total 360°). Angles at a point on a straight line and a turn (total 180°). Other multiples of 90°. Use the properties of rectangles to deduce related facts and find missing lengths and angles. Distinguish between regular and irregular polygons based on reasoning about equal sides and angles. Draw 2-D shapes using given dimensions and angles. Recognise, describe and build simple 3-D shapes, including making nets. Compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals, and regular polygons. Illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius. Recognise angles where they meet at a point, are on a straight line, or are vertically opposite and find missing angles.
Describe position, direction and movement **This concept involves recognising various types of mathematical movements.**		Describe position, direction and movement, including whole, half, quarter and three-quarter turns. Order and arrange combinations of mathematical objects in patterns and sequences. Use mathematical vocabulary to describe position, direction and movement, including movement in a straight line and distinguishing between rotation as a turn and in terms of right angles for quarter, half and three-quarter turns (clockwise and anti-clockwise).	Recognise angles as a property of shape and as an amount of rotation. Identify right angles, recognise that 2 right angles make a half turn and 4 make a whole turn. Identify angles that are greater than a right angle. Describe positions on a 2-D grid as coordinates in the first quadrant. Describe movements between positions as translations of a given unit to the left/right and up/down. Plot specified points and draw sides to complete a given polygon.	Identify, describe and represent the position of a shape following a reflection or translation, using the appropriate language, and know that the shape has not changed. Describe positions on the full coordinate grid. (all four quadrants) Draw and translate simple shapes on the coordinate plane, and reflect them in the axes.

Use measures **This concept involves becoming familiar with a range of measures, devices used for measuring and calculations.**		Compare, describe and solve practical problems for: lengths and heights mass/weight capacity and volume time. Measure and begin to record: lengths and heights mass/weight capacity and volume time (hours, minutes, seconds). Recognise and know the value of different denominations of coins and notes. Sequence events in chronological order using language. Recognise and use language relating to dates, including days of the week, weeks, months and years. Tell the time to the hour and half past the hour and draw the hands on a clock face to show these times. Use standard units to estimate and measure length/height (m/cm); mass (kg/g); temperature (°C); capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels. Compare and order lengths, mass, volume/capacity and record the results using >, < and =. Recognise and use symbols for pounds (£) and pence (p); combine amounts to make a particular value. Find different combinations of coins that equal the same amounts of money. Solve simple problems in a practical context involving addition and subtraction of money of the same unit, including giving change. Compare and sequence intervals of time. Tell and write the time to five minutes, including quarter past/to the hour and draw the hands on a clock face to show these times. Know the number of minutes in an hour and the number of hours in a day.	Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml). Measure the perimeter of simple 2-D shapes. Add and subtract amounts of money to give change. (£ and p) Tell and write the time from an analogue clock, including using Roman numerals from I to XII, and 12-hour and 24-hour clocks. Estimate and read time with increasing accuracy to the nearest minute; record and compare time in terms of seconds, minutes and hours; use appropriate vocabulary. Know the number of seconds in a minute and the number of days in each month, year and leap year. Compare durations of events. Convert between different units of measure. (for example, kilometre to metre; hour to minute) Measure and calculate the perimeter of a rectilinear figure (including squares) in centimetres and metres. Find the area of rectilinear shapes by counting squares. Estimate, compare and calculate different measures, including money in pounds and pence. Read, write and convert time between analogue and digital 12- and 24-hour clocks. Solve problems involving converting from hours to minutes; minutes to seconds; years to months; weeks to days.	Convert between different units of metric measure. Understand and use approximate equivalences between metric units and common imperial units such as inches, pounds and pints. Measure and calculate the perimeter of composite rectilinear shapes in centimetres and metres. Calculate and compare the area of rectangles (including squares), and including using standard units, square centimetres (cm2) and square metres (m2) and estimate the area of irregular shapes. Estimate volume and capacity. Solve problems involving converting between units of time. Use all four operations to solve problems involving measure (for example, length, mass, volume, money) using decimal notation, including scaling. Solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate. Use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation up to three decimal places. Convert between miles and kilometres. Recognise that shapes with the same areas can have different perimeters and vice versa. Recognise when it is possible to use formulae for area and volume of shapes. Calculate the area of parallelograms and triangles. Calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm3) and cubic metres (m3), and extending to other units.
Use statistics **This concept involves interpreting, manipulating and presenting data in various ways.**		Interpret and construct simple pictograms, tally charts, block diagrams and simple tables. Ask and answer simple questions by counting the number of objects in each category and sorting the categories by quantity. Ask and answer questions about totalling and comparing categorical data.	Interpret and present data using bar charts, pictograms and tables. Solve one-step and two-step questions (for example, 'How many more?' and 'How many fewer?') using information presented in scaled bar charts, pictograms and tables. Interpret and present discrete and continuous data using appropriate graphical methods, including bar charts and time graphs. Solve comparison, sum and difference problems using information presented in bar charts, pictograms, tables and other graphs.	Solve comparison, sum and difference problems using information presented in a line graph. Complete, read and interpret information in tables, including timetables. Interpret and construct pie charts and line graphs and use these to solve problems. Calculate and interpret the mean as an average.
Use algebra **This concept involves recognising mathematical properties and relationships using symbolic representations.**		Solve addition and subtraction problems involving missing numbers.	Solve addition and subtraction, multiplication and division problems that involve missing numbers.	Use simple formulae. Generate and describe linear number sequences. Express missing number problems algebraically. Find pairs of numbers that satisfy an equation with two unknowns. Enumerate possibilities of combinations of two variables.

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IMPROVING MATHEMATICS IN THE EARLY YEARS AND KEY STAGE 1

Summary of recommendations

1
Develop practitioners'understanding of how children learn mathematics

- Professional development should be used to raise the quality of practitioner' knowledge of mathematics, of children's mathematical development and of effective mathematical pedagogy.
- Developmental progressions show us how children typically learn mathematical concepts and can inform teaching.
- Practitioners should be aware that developing a secure grasp of early mathematical ideas takes time, and specific skills may emerge in different orders.
- The development of self-regulation and metacognitive skills are linked to successful learning in early mathematics.

2
Dedicate time for children to learn mathematics and integrate mathematics throughout the day

- Dedicate time to focus on mathematics each day.
- Explore mathematics through different contexts, including storybooks, puzzles, songs, rhymes, puppet play, and games.
- Make the most of moments throughout the day to highlight and use mathematics, for example, in daily routines, play activities, and other curriculum areas.
- Seize chances to reinforce mathematical vocabulary.
- Create opportunities for extended discussion of mathematical ideas with children.

3
Use manipulatives and representations to develop understanding

- Manipulatives and representations can be powerful tools for supporting young children to engage with mathematical ideas.
- Ensure that children understand the links between the manipulatives and the mathematical ideas they represent.
- Ensure that there is a clear rationale for using a particular manipulative or representation to teach a specific mathematical concept.
- Encourage children to represent problems in their own way, for example with drawings and marks.
- Use manipulatives and representations to encourage discussion about mathematics.
- Encourage children to use their fingers—an important manipulative for children.

4
Ensure that teaching builds on what children already know

- It is important to assess what children do, and do not, know in order to extend learning for all children.
- A variety of methods should be used to assess children's mathematical understanding, and practitioners should check what children know in a variety of contexts
- Carefully listen to children's responses and consider the right questions to ask to reveal understanding.
- Information collected should be used to inform next steps for teaching. Developmental progressions can be useful in informing decisions around what a child should learn next.

5
Use high quality targeted support to help all children learn mathematics

- High quality targeted support can provide effective extra support for children.
- Small-group support is more likely to be effective when:
- children with the greatest needs are supported by the most experienced staff;
- training, support and resources are provided for staff using targeted activities;
- sessions are brief and regular; and
- explicit connections are made between targeted support and everyday activities or teaching.
- Using an approach or programme that is evidence-based and has been independently evaluated is a good starting point.

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IMPROVING MATHEMATICS IN KEY STAGES 2 AND 3

Summary of recommendations

1 Use assessment to build upon pupils' existing knowledge and understanding

- Assessment should be used not only to track pupils' learning but also to provide teachers with information about what pupils do and do not know.
- This should inform the planning of future lessons and the focus of targeted support.
- Effective feedback will be an important element of teachers' response to assessment.
- Feedback should be specific and clear, encourage and support further effort, and be given sparingly.
- Teachers not only have to address misconceptions but also understand why pupils may persist with errors.
- Knowledge of common misconceptions can be invaluable in planning lessons to address errors before they arise.

2 Use manipulatives and representations

- Manipulatives (physical objects used to teach maths) and representations (such as number lines and graphs) can help pupils engage with mathematical ideas.
- However, manipulatives and representations are just tools: how they are used is essential.
- They need to be used purposefully and appropriately to have an impact.
- There must be a clear rationale for using a particular manipulative or representation to teach a specific mathematical concept.
- Manipulatives should be temporary; they should act as a 'scaffold' that can be removed once independence is achieved.

3 Teach strategies for solving problems

- If pupils lack a well-rehearsed and readily available method to solve a problem they need to draw on problem solving strategies to make sense of the unfamiliar situation.
- Select problem solving tasks for which pupils do not have ready-made solutions.
- Teach them to use and compare different approaches.
- Show them how to interrogate and use their existing knowledge to solve problems.
- Use worked examples to enable them to analyse the use of different strategies.
- Require pupils to monitor, reflect on, and communicate their problem solving.

4 Enable pupils to develop a rich network of mathematical knowledge

- Emphasise the many connections between mathematical facts, procedures, and concepts.
- Ensure that pupils develop fluent recall of facts.
- Teach pupils to understand procedures.
- Teach pupils to consciously choose between mathematical strategies.
- Build on pupils' informal understanding of sharing and proportionality to introduce procedures.
- Teach pupils that fractions and decimals extend the number system beyond whole numbers.
- Teach pupils to recognise and use mathematical structure.

5 Develop pupils' independence and motivation

- Encourage pupils to take responsibility for, and play an active role in, their own learning
- This requires pupils to develop metacognition—the ability to independently plan, monitor and evaluate their thinking and learning
- Initially, teachers may have to model metacognition by describing their own thinking.
- Provide regular opportunities for pupils to develop metacognition by encouraging them to explain their thinking to themselves and others.
- Avoid doing too much too early.
- Positive attitudes are important, but there is scant evidence on the most effective ways to foster them.
- School leaders should ensure that all staff, including non-teaching staff, encourage enjoyment in maths for all children.

6 Use tasks and resources to challenge and support pupils' mathematics

- Tasks and resources are just tools—they will not be effective if they are used inappropriately by the teacher.
- Use assessment of pupils' strengths and weaknesses to inform your choice of task.
- Use tasks to address pupil misconceptions.
- Provide examples and non-examples of concepts.
- Use stories and problems to help pupils understand mathematics.
- Use tasks to build conceptual knowledge in tandem with procedural knowledge.
- Technology is not a silver bullet—it has to be used judiciously and less costly resources may be just as effective.

7 Use structured interventions to provide additional support

- Selection should be guided by pupil assessment.
- Interventions should start early, be evidence-based and be carefully planned.
- Interventions should include explicit and systematic instruction.
- Even the best designed intervention will not work if implementation is poor.
- Support pupils to understand how interventions are connected to whole-class instruction.
- Interventions should motivate pupils—not bore them or cause them to be anxious.
- If interventions cause pupils to miss activities they enjoy, or content they need to learn, teachers should ask if the interventions are really necessary.
- Avoid 'intervention fatigue'. Interventions do not always need to be time-consuming or intensive to be effective.

8 Support pupils to make a successful transition between primary and secondary school

- There is a large dip in mathematical attainment and attitudes towards maths as children move from primary to secondary school.
- Primary and secondary schools should develop shared understandings of curriculum, teaching and learning.
- When pupils arrive in Year 7, quickly attain a good understanding of their strengths and weaknesses.
- Structured intervention support may be required for Year 7 pupils who are struggling to make progress.
- Carefully consider how pupils are allocated to maths classes.
- Setting is likely to lead to a widening of the attainment gap between disadvantaged pupils and their peers, because the former are more likely to be assigned to lower group.