Maths

Curriculum Implementation

As a minimum, Green Ridge seeks to provide children with the following knowledge, skills and understanding as outlined in the National Curriculum (2014):

Aims

The national curriculum for mathematics aims to ensure that all pupils:

- become fluent 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

Mathematics is an interconnected subject in which pupils need to be able to move fluently between representations of mathematical ideas. The programmes of study are, by necessity, organised into apparently distinct domains, but pupils should make rich connections across mathematical ideas to develop fluency, mathematical reasoning and competence in solving increasingly sophisticated problems. They should also apply their mathematical knowledge to science and other subjects.

The expectation is that the majority of pupils will move through the programmes of study at broadly the same pace. However, decisions about when to progress should always be based on the security of pupils' understanding and their readiness to progress to the next stage. Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Where pupils lack a depth of understanding, there will be opportunities to consolidate their understanding, including through additional practice.

Information and communication technology (ICT)

Calculators should not be used as a substitute for good written and mental arithmetic. They should therefore only be introduced near the end of key stage 2 to support pupils' conceptual understanding and exploration of more complex number problems, if written and mental arithmetic are secure. In both primary and secondary schools, teachers should use their judgement about when ICT tools should be used.

Spoken language

The national curriculum for mathematics reflects the importance of spoken language in pupils' development across the whole curriculum – cognitively, socially and linguistically. The quality and variety of language that pupils hear and speak are key factors in developing their mathematical vocabulary and presenting a mathematical justification, argument or proof. They must be assisted in making their thinking clear to themselves as well as others, and teachers should ensure that pupils build secure foundations by using discussion to probe and remedy their misconceptions.

Key stage 1

The principal focus of mathematics teaching in key stage 1 is to ensure that pupils develop confidence and mental fluency with whole numbers, counting and place value. This should involve working with numerals, words and the 4 operations, including with practical resources [for example, concrete objects and measuring tools].

At this stage, pupils should develop their ability to recognise, describe, draw, compare and sort different shapes and use the related vocabulary. Teaching should also involve using a range of measures to describe and compare different quantities such as length, mass, capacity/volume, time and money.

By the end of year 2, pupils should know the number bonds to 20 and be precise in using and understanding place value. An emphasis on practice at this early stage will aid fluency.
Pupils should read and spell mathematical vocabulary, at a level consistent with their increasing word reading and spelling knowledge at key stage 1.

Lower Key Stage 2 - years 3 and 4

The principal focus of mathematics teaching in lower key stage 2 is to ensure that pupils become increasingly fluent with whole numbers and the four operations, including number facts and the concept of place value. This should ensure that pupils develop efficient written and mental methods and perform calculations accurately with increasingly large whole numbers.

At this stage, pupils should develop their ability to solve a range of problems, including with simple fractions and decimal place value. Teaching should also ensure that pupils draw with increasing accuracy and develop mathematical reasoning so they can analyse shapes and their properties, and confidently describe the relationships between them. It should ensure that they can use measuring instruments with accuracy and make connections between measure and number.

By the end of year 4, pupils should have memorised their multiplication tables up to and including the 12 multiplication table and show precision and fluency in their work.

Pupils should read and spell mathematical vocabulary correctly and confidently, using their growing word reading knowledge and their knowledge of spelling.

Upper Key Stage 2 - years 5 and 6

The principal focus of mathematics teaching in upper key stage 2 is to ensure that pupils extend their understanding of the number system and place value to include larger integers. Another key aspect of upper KS2 is developing the connections that pupils make between multiplication and division with fractions, decimals, percentages and ratio.

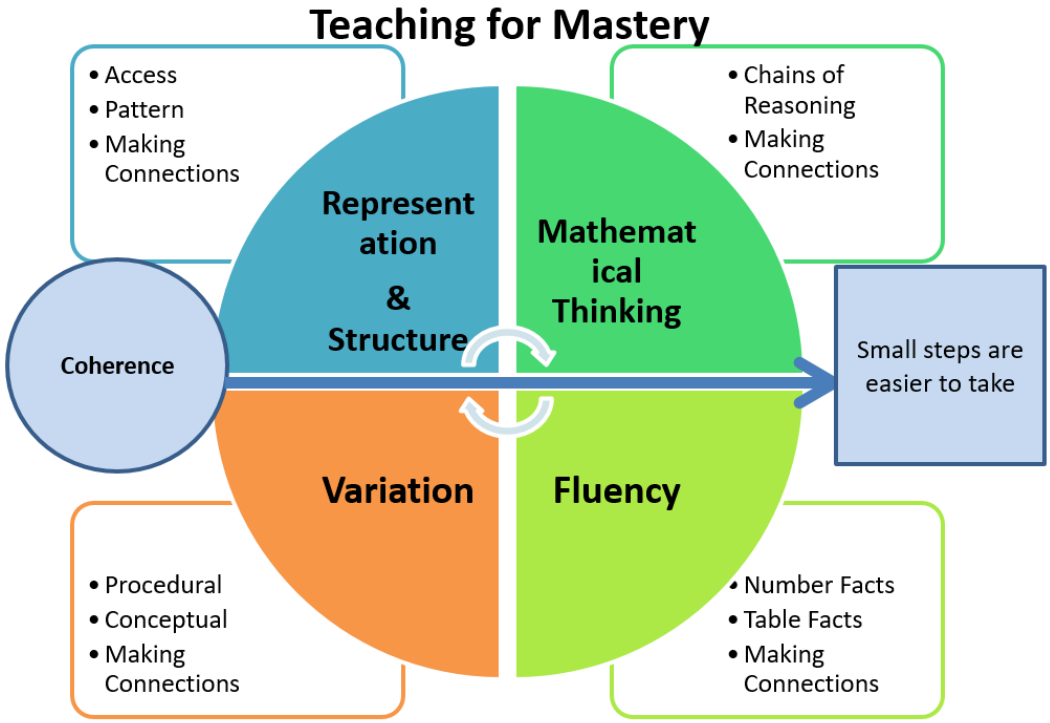
At this stage, pupils should develop their ability to solve a wider range of problems, including increasingly complex properties of numbers and arithmetic, and problems demanding efficient written and mental methods of calculation. With this foundation in arithmetic, pupils are introduced to the language of algebra as a means for solving a variety of problems. Teaching in geometry and measures should consolidate and extend knowledge developed in number. Teaching should also ensure that pupils classify shapes with increasingly complex geometric properties and that they learn the vocabulary they need to describe them.

By the end of year 6, pupils should be fluent in written methods for all 4 operations and in working with fractions, decimals and percentages. Pupils should read, spell and pronounce mathematical vocabulary correctly.

Programme of study

At Green Ridge, we use the National Curriculum as a basis for our programme of study for Key Stage One and Key Stage Two. We take a mastery approach to the way we teach maths, using the White Rose maths resource to map out our curriculum. In addition to this, teachers may also use a variety of resources including those from the NCETM to ensure that the children have a depth of mathematical understanding.

Our understanding of maths mastery includes the 5 big ideas shown below.



This structure of teaching allows the children to develop a depth of understanding of mathematical concepts that links to and build upon their previous learning. To ensure we are 'teaching for mastery, each lesson should include some of the above ideas.

Shanghai Lesson Design

Our approach to mastery teaching is largely based on the way maths has been successfully taught in East Asia, most notably, but not exclusively, Shanghai, China. This is based around NCETMs exchange programme between English and Shanghai teachers, which has informed effective pedagogic strategies for achieving mastery of mathematics. The striking performances of Shanghai, and other East Asian countries in maths has become well-established in successive international tests such as TIMSS and PISA. Successful Shanghai lessons are characterised through the inclusion of these features:

- Identify what students already know
- Identify the key points – the new knowledge
- Identify the difficult points
- Step by step approach – journey through the mathematics
- Presuppose the mistakes that students might make
- Questions to challenge thinking
- Develop reasoning and deep understanding (contexts and representations of mathematics)
- Using discussion and feedback from students

When following a teaching structure, such as the one set out above teachers should also consider the following within their planning:

- Scaffolding
- Repetition
- Challenge
- Mathematical language
- Representation and structure
- Small steps
- The connection between concrete and abstract

Using the features set out above we have highlighted the following features which we regularly aim to include.

- Revisit the previous learning.
- Introduce a new concept which is rehearsed with the children through main teaching.
- Give the children an opportunity to rehearse the new skill or concept. This would also be the point where understanding can be challenged through variation e.g. the question presented as a worded question.
- The children rehearse the new learning independently.

Mastery Elements

Mathematical representations

When planning teacher input you must consider the different presentations and structures which are being taught to the children. This will include suitable mathematical representations. Children who are taught the abstract before any concrete or pictorial elements within maths may struggle to understand more complex concepts as they do not have the depth of understanding required.

 1 × 2 = 2	*'One two is two.'*
 2 × 2 = 4	*'Two twos are four.'*
 3 × 2 = 6	*'Three twos are six.'*

The above picture shows an approach that could be used when teaching the two times tables within Year Two. This lesson would have been part of a sequence where the children would have been introduced to verbalising their understanding of the two times tables, writing them out put also linking this to grouping through the use of pictures.

Speaking Frames

Evidence of the children's understanding of new concepts will require the children to be able to verbally explain what they are doing. For this, it is essential that children use the correct language. To achieve this, we must ensure that we teach the children a broad range of vocabulary and give them opportunities to practise it in context.

For this to be achieved, children will have opportunities to use speaking frames. A speaking frame scaffolds a structure for the children to verbalise their understanding or explain what they are doing. The frame below shows what would be using within a lesson where the children would be bridging through ten using partitioning.

A speaking frame may be revisited throughout a lesson or be used for specific contexts within lessons.

Example:

Bridge through 10
Partition ___into _____and _____ Take away _____ and then take away _____

Images

The use of images allow the children to notice patterns and make links to their mathematical understanding. They are also excellent at introducing a new topic as it allows the children to quickly make real world links to their learning.

Variation

Variation can also be included within the independent learning; however, this does not mean just including a range of different questions. Variation elements should not require new teaching. The questions should challenge the children's understanding using different models, which they are familiar with. This could include worded questions, open questions, challenges where the children have to identify whether or not a concept is true or false. Variation could also be evident in pupils responses (i.e recording their working out in a variety of ways).

Reasoning through Questioning

Questioning within the lessons should be suitable for the child which is being asked but also should give the children opportunities to explain and verbalise their responses. Below are a list of different reasoning questions, which could be included within lessons.

- Spot the mistake
- What's the same? What's different?
- Odd one out
- Which is correct?
- True or false?
- Agree or disagree?
- What comes next?
- Do, then explain
- Possible answers?
- What do you notice?
- Continue the pattern
- Missing numbers/symbols/information
- Corrected calculations
- What else do you know?
- Convince me / prove it
- Make an estimate
- What's the rule?
- Always, sometimes, never

Curriculum Overview

Following on from school closures during both the 19-20 and 20-21 academic years, our long-term plans have been tweaked to include opportunities to recap on key areas from the previous year group. Long term plans can be found in: S:\Maths\09 Curriculum Coverage & Progression

	Autumn		Spring		Summer	
Reception	Getting to know you - Baseline/ Transition Just like me – Matching & Sorting and Comparing amounts Comparing size, mass and capacity	1,2,3 – Representing and comparing Numbers up to 5 – Representing; 1 more & 1 less Circles and Triangles Positional Language Shapes with 4 sides Time	Numbers to 5 – comparing 6, 7, 8 – making pairs, combining groups Compare mass/capacity Length/Height Time	9 & 10 – Comparing numbers to 10 Patterns 3D Shapes Consolidation	To 20 and Beyond – Building/ counting numbers beyond 10 Addition/ Subtraction Spatial reasoning – combining shapes	Doubling & Sharing/Grouping Odd/Even Patterns Mapping
Year One	Number: Place Value (within 10) Number: Addition and	Number: Addition and Subtraction (within 10) Geometry: Shape	Number: Addition and Subtraction (within 20)	Measurement: Length and Height Measurement: Weight and Volume	Number: Multiplication and Division (multiples of 2, 5 and 10) Number: Fractions	Geometry: Position and Direction Number: Place value to 100

	Subtraction (within 10)	Number: Place value (within 20)	Number: Place Value (within 50) (Multiples of 2, 5 and 10 to be included)			Measurement: Money Time
Year Two	Number: Place value Number: Addition and Subtraction	Number: Addition and Subtraction Measurement: Money Number: Multiplication and Division	Number: Multiplication and Division Statistics Geometry: Properties of Shape	Number: Fractions Measurement: length and height	Geometry: Position and Direction Measurement: Time	Measurement: Mass, Capacity and Temperature Consolidation following SATs
Year Three	Number and place value Addition and Subtraction	Addition and Subtraction Statistics Multiplication and Division	Multiplication and Division Measurement: Money Measurement: Length and Perimeter	Measurement: length and perimeter Number - Fractions	Number – fractions Measurement: Time Geometry: Shape	Geometry – Properties of Shapes Measurement: Mass and Capacity Introduction to 6, 7, 9, 11 and 12 times tables
Year Four	Number and place value Number- Addition and Subtraction	Measurement- Length and Perimeter Number- Multiplication and Division	Number- Multiplication and Division Measurement- Area Fractions	Fractions Decimals	Decimals Measurement- Money Time Statistics	Geometry- Properties of Shape Geometry- Position and Direction
Year Five	Number – Place Value Number – Addition and Subtraction Statistics	Number – Multiplication and Division Perimeter and Area	Number – Multiplication and Division Number – Fractions	Number – Fractions Number – Decimals & Percentages	Number – Decimals Geometry- Properties of Shapes	Geometry- Position and Direction Measurement- Converting Units Measures Volume
Year Six	Number- Place Value Number- Addition, Subtraction, Multiplication and Division	Fractions Geometry- Position and Direction Number: Decimals	Number- Percentages Number- Algebra Measurement Converting units	Measurement Perimeter, Area and Volume Number- Ratio Statistics Geometry- Properties of Shapes	Geometry- Properties of Shapes Consolidation following SATs	Consolidation following SATs

Sequencing

Lessons are sequenced using the 'White Rose' scheme of learning. This scheme breaks down each year group's national curriculum into units which are taught across the year. These are arranged sequentially across the year to support pupils to be able to perform simpler tasks so they can then move on to perform more complex tasks. For example, we cannot expect pupils to add two numbers together before they understand what each individual number represents.

For this reason, most year groups begin with a unit on place value to develop their number sense. However, we also try to avoid one topic always being at the end of Summer term, or similar, to minimise the chance of something not being covered.

Within each of these units we then have 'small steps' which are again sequenced in order of difficulty and dependency. Each step builds carefully from the previous step, building on pupils' prior knowledge to develop new skills.

Our curriculum is also a 'spiral curriculum'. This means that pupils see concepts again and again in different contexts and in different years to help them truly develop their understanding.

Structure of a Lesson

Timing

Timing is an essential part to all lessons as the pace of learning directly impacts how well the children can move on and make progress. As such the table below outlines what the typical times for each section. It should be noted that this is only a guide and may be adapted to suit the needs of the pupils in the class.

5 Minutes	Recap Questions
5 Minutes	Next Steps/Revisit
15 Minutes	Teaching Input
10 Minutes	Pupil practice
20 Minutes	Independent learning
5 Minutes	Plenary

Recap questions

To ensure that previous learning is constantly being revisited, it is expected that each lesson starts with some recap questions. Typically, there will be up to 3 questions from previously covered units. These should be displayed on the board at the beginning of the lesson and pupils can solve them on a whiteboard.

Next Steps/Revisit

These can be presented to the children on the SMART TV, through written responses or through printed questions. All next steps will need to be completed by the children using blue pencil (KS1) or blue pen (KS2)

The aim of the next step is to allow the children to revisit and correct any misconceptions form the previous day and consolidate their previous learning. The teaching of Maths Mastery means that lessons should follow a sequence and should therefore link to previous lessons e.g. Multiplication lesson may have a next step linked to grouping.

Next steps can range in their content. But may include the following:

- Common misconceptions from the previous day for pupils to correct.
- Questions from the previous lesson to rehearse and consolidate a skill.
- Variation questions where the concept or skill stays the same but the question is presented in an unfamiliar way, like a worded question.
- Open questions linked to the previous learning.
- NCETM mastery or greater depth questions.

Example:

Maths

Misconceptions	Fluency	Deepen and Stretch
When you multiply by 10, each digit is multiplied by ten e.g. 3.7 x 10 = 37 The ones have increased to tens and the tenths has increased to the ones.	Solve the following questions with a mental strategy 7x3 7x30 7x300	Gary says that when you multiply by 10, you just add zero. Is he correct? Explain your answer.

Teacher input

This part of the lesson is where the teacher will focus on teaching the children a new skill or strategy. Pupil involvement within this part of the lesson will be achieved through questioning, using concrete resources or through the use of the children's whiteboards. Children should remain actively involved within the lesson through rehearsing the skill with the teacher or through the use of targeted questioning.

Pupil practice

Following on from the teacher's input, the children then need time to rehearse and practise the skills which have been taught. These questions can include questions from the independent learning section as these are the skills the children will need to practise before moving on.

During this time the teacher should allow the children to complete these questions on whiteboards and will give the teacher an opportunity for assessment before the children start to complete their learning independently.

Independent learning/ focus group teaching

Once the children have rehearsed the skills required for the lesson, they will then be given an independent task to complete. Typically, there will be a main challenge that all pupils are expected to complete. However, additional support will be provided to those who require it. Support will vary depending on the lesson and the children that it's aimed at but may include:

- Scaffolds/recording frames
- Practical tasks linked to the learning intention
- Manipulatives
- Peer support
- Teacher/teaching assistant focus groups
- Individualised adult support

For those who are more confident with a concept, there will be opportunities to challenge/stretch themselves. The way in which pupils are stretched will vary depending on the lesson and children but may include:

- Showing their working out in a variety of ways
- Proving/Explaining their response
- Creating their own challenges
- Challenge X (extension challenge)

Challenges (including Ch X) should use the skills taught within the lesson.

Plenary

The plenary should be a review of the learning completed in this lesson. This could include (but is not limited to):

- Providing answers or solutions to challenges for pupils to self-assess or peer-assess
- Going through any Ch X problems
- Highlighting any misconceptions from the lesson
- Providing pupils with an additional question to solve or discuss as an 'exit ticket'
- Where additional time is available, it could be spent recapping on the four operations or other previously covered units that may need further consolidation

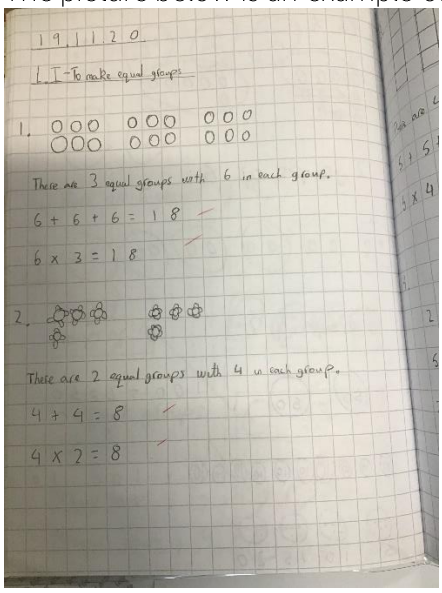
How to set it out in books

To ensure there is consistency between year groups the following would be expected within books:

- Children to write using a pencil in all year groups
- Date and learning intention will be written at the top of the page (a space will be left after both)
- Numbers should be written in the squares provided.
- Work will be completed against the left hand side of the page.
- Any sheets will be stuck in neatly.

To achieve this, you should ensure that you spend time with the children, highlighting the expectation for presentation within books. As a minimum, this should be done at the start of the academic year, but frequent reminders or revisits would be recommended.

The picture below is an example of a Year Three child's book.



Fluency

Morning Fluency

At Green Ridge, we understand that developing fluency within Maths reduces cognitive load and allows children focus on new concepts. With this in mind, we have timetabled a morning fluency session for all year groups (Year 1 – Year 6). This time allows the children to revisit previous learning with a focus on the 4 operations (in Year 2 – Year 6) and a focus on counting, place value, addition and subtraction in Year 1 (and early Year 2). However, teachers may choose to include problems relating different areas of learning if it is recognised that pupils need additional practice in that area. This takes the form of a range of different questions that the children can

choose to answer. The children will be encouraged to answer these questions mentally but can also choose preferred written methods to solve the problems. All year groups' morning fluency sessions will link to children's previous learning. Therefore, when children have only recently started a new year group, they may revisit calculations like those completed in a previous year group. This allows them to not only become more fluent but to also consolidate previous learning.

Cracking Number Bonds

From Spring Term, pupils in Year One will complete Cracking number bonds assessments once every two weeks during their early morning learning as a way to track their understanding of number bonds. They will have 3 minutes to complete this and, if they get all questions correct for their level, they will receive a certificate in the subsequent celebration assembly and move to the next level. For pupils in Year 2 (or higher) who still are yet to secure their number bonds, teachers may continue to use them as part of early morning learning to develop pupils' recall of these.

Times Table Rockstars/Numbots

In addition to the morning activities, the children within Year 2 - Year 6 will also have access to Times Table Rockstars. This online resource allows the children to practise their timetables, using a system that allows them to practise with suitably challenging times tables. This is determined through an initial baseline and then developed as the children gain more success within different timescales. Like Cracking Number Bonds, pupils will receive certificates relating to this once every two weeks. There will be two certificates per class, one for the pupil whose speed of recall has improved the most in the last two weeks and one effort-based certificate which could be based on a number of factors, such as number of questions answered, number of correct responses number of coins gained, improving their level, etc. This certificate will be decided by the class teacher.

In Year One, pupils will instead have access to Numbots to secure their fluency of addition and subtraction and to improve their recognition of a range of concepts. It should be noted, that all pupils throughout the school can access Numbots if they need to further develop their addition/subtraction fluency.

Assessment

Marking – Daily marking will provide a vital opportunity to assess the children's progress within a lesson. It is vital that this is done daily as this marking will also inform the next steps for the following lesson. Where appropriate pupils may mark their own learning or peer assessments could take place.

Hot tasks – This will provide an end of unit assessment. These hot tasks will be printed on red (hot) paper. The aim for these tasks is to show the progress a pupil had made throughout a unit. It will also highlight areas that may need to be consolidated in early morning learning or during consolidation lessons. These tasks are generated by the class teacher themselves and should include a range of arithmetic and reasoning questions. To support the development of these tasks, the teachers can use White Rose teaching resources and NCETM mastery guides for their year groups, which have example questions on. These should be no more than two A4 sheets long.

Formative assessment – Teachers should conduct regularly informal assessments throughout their lessons (e.g. through questioning, looking at pupils independent learning, etc.) to gauge how well the pupils are accessing the learning. This will enable the teacher to adapt the lessons (or subsequent lessons) to ensure they meet the needs of all children within the class.

Teacher Assessment judgements – These are based on the work the children have produced throughout the term and teachers' formative assessment. To support with this, teachers will need to use the KPI for Maths. This document outlines key aspects of learning that a child will need to secure by the end of the academic year. Use this document alongside the units which have been taught and use the children's books to verify your judgement

PUMA – Puma assessments are completed as an end of year assessment. These help verify the termly assessments conducted by teachers and ensure remaining gaps in learning are identified and can be consolidated at the end of the year and communicated to subsequent class teachers. They may also be used to provide a baseline assessment for any new pupils who join mid-year.

SATs – SATs are administered in the Summer term for Year Two and Year Six children. These are national assessments and measure the attainment and progress of the children who take them.

Diversity and Equality Within the Maths Curriculum

At Green Ridge, we are committed to promoting diversity and equality throughout all subject areas, including Maths. Our strategies for doing so may include:

- Including same sex couples within word problems.
- Highlighting the work of female mathematicians, where appropriate
- Mixing up the names and pronouns in questions to challenge gender stereotypical ideas about roles and careers e.g. Max goes to the shop with their dad. They spend £7, how much change would they get from a £10 note?
- In word problems, include characters from a range of races and ethnic groups.
- Consider using physical disabilities to provide context for word problems (e.g. wheelchair ramps and angles).