Subject Curriculum Maps: Mathematics

Mathematics

Declarative Knowledge (Facts)

Do plans outline the key number facts to be learned, as well as their benchmarks for automaticity? How well are mathematical vocabulary and sentence stems developed alongside key facts and methods? Are pupils equipped with rules and formulae for working with shape, distance, time, angles? Do plans ensure that pupils are familiarised with principles enabling the conversion of word problems into equations? Do pupils have a secure grasp of time, fraction and length facts?

The statutory programmes of study from the National Curriculum are taught through the school's adopted 'White Rose Hub' Scheme of Learning. Clear progression of skills and concepts is identified with the scheme across Early Years, Key Stage One and Key Stage Two. Using White Rose Hub materials, including 'Small Steps' (based on Ready to Progress Criteria), mathematics lessons at St. Michael's focus on learning facts, methods and strategies, which have been broken down into small steps. This ensures children deepen their knowledge and understanding of core concepts. The exploration of the types of mathematical knowledge (declarative/facts, procedural/methods and conditional/strategies) is made explicit to the children in teaching and learning.

TT Rockstars, Numbots and NCETM Mastering Numer (EYFS and KS1) are used to teach and embed core number and multiplication facts.

Each day starts with 15-30 minutes of mathematical knowledge revision via the use of TT Rockstars and/or CGP revision guides. Each lesson begins with daily revision, focused on building, revising and securing the foundation facts in mathematics.

Conditional Knowledge (Problem Solving)

Do plans help pupils to familiarise themselves with the conditions where combinations of facts and methods will be useful? Do plans ensure that pupils obtain automaticity in linked facts and methods, before being expect to deploy them in problem solving? Are problems chosen carefully, so that pupils are increasingly confident with seeing past the surface features and of recognising the deep structure of problems? Can pupils solve problems without resorting to unstructured trial and error approaches?

Conditional knowledge is the knowledge is the understanding of strategies which can be used to reason and solve problems. This extends to combinations of conceptual / declarative and procedural knowledge which then become strategies for particular types of problems. This type of knowledge can typically be described as 'I know when…'

At St. Michael's, our mathematics curriculum aims to ensure 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. Once secure in this area, children can reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language. Finally, children 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.

Subject Curriculum Maps: Mathematics

Procedural Knowledge (Methods)

Do curriculum plans acknowledge the most efficient and accurate methods of calculation that pupils will use in their next stage of mathematics education? Is there a balance between procedures that rely on derivation and those that train recall? Are pupils equipped with knowledge of how to lay out calculations systematically and neatly? Are all pupils given procedural knowledge that enables them to work in the abstract? Can pupils calculate with speed and accuracy?

Mathematics at St. Michael's involves practical opportunities to develop mastery in mathematics through fluency, reasoning and problem solving tasks, underpinned by the use of a CPA approach (concrete, pictorial and abstract) when teaching procedural knowledge.

The CPA approach builds on children's existing knowledge by introducing abstract concepts in a concrete and tangible way. It involves moving from concrete materials, to pictorial representations, to abstract symbols and problems.

Concrete is the "doing" stage. During this stage, students use concrete objects to model problems. Unlike traditional maths teaching methods where teachers demonstrate how to solve a problem, the CPA approach brings concepts to life by allowing children to experience and handle physical (concrete) objects.

Pictorial is the "seeing" stage. Here, visual representations of concrete objects are used to model problems. This stage encourages children to make a mental connection between the physical object they just handled and the abstract pictures, diagrams or models that represent the objects from the problem.

Abstract is the "symbolic" stage, where children use abstract symbols to model problems. Students will not progress to this stage until they have demonstrated that they have a solid understanding of the concrete and pictorial stages of the problem. The abstract stage involves the teacher introducing abstract concepts (for example, mathematical symbols). Children are introduced to the concept at a symbolic level, using only numbers, notation, and mathematical symbols (for example, +, –, x, /) to indicate addition, multiplication or division.

Teachers will go back and forth between each stage to reinforce concepts. This supports children to craft powerful mental connections between the concrete, pictorial, and abstract phases.

By ensuring that concrete representations aren't removed too early, it allows children to build a conceptual mathematical understanding that can propel them through their education.

The CPA model is a progression. By the end of KS1, children need to be able to go beyond the use of concrete equipment to access learning using either pictorial representations or abstract understanding.

Components and Sequencing

Has the content been carefully selected to ensure pupils have the building blocks they need for later work? Once key facts and methods are learned, do plans allow pupils to apply their learning to different contexts? Is progression through the curriculum a guarantee for all and not overly influenced by choice? Do plans engineer the successful opportunities to connect concepts within and between topic sequences? Do plans rule out the acquisition of common misconceptions? Are pupil errors immediately highlighted and corrected?

Progression of skills and understanding is vital in the successful implementation of our mathematics curriculum. In order for children to progress, they need to have a firm understanding of facts (declarative knowledge), before developing methods (procedural knowledge) and implementing strategies (conditional knowledge). Teachers ensure that children's understanding of facts is secure, before developing and building on understanding of methods and strategies.

Memory

Do plans ensure that consolidation and overlearning of content takes place at frequent intervals? Are pupils able to refer to work completed and content learned in previous lessons? Do plans strike a balance between rehearsal of explanations or proof of understanding and rehearsal of core facts and methods needed to complete exercises and solve problems? Do plans prioritise thinking about core content by ensuring that pupils know what to do? Do plans actively prevent the need for guessing, casting around for clues and unstructured trial and error? Can pupils recall, rather than derive, facts and formulae, without the use of memory aids?

The fundamental idea behind our curriculum design is 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.

This thinking gives rise to a typical sequence of 'blocks' of mathematics that you will see in most of our year groups.

Within each of these blocks we then have 'small steps' which are again sequenced in order of difficulty and dependency. Here are the first seven steps (of 18) in our Year 3 Addition and Subtraction block:

- Add and subtract multiples of 100
- Add and subtract 3-digit and 1-digit numbers – not crossing 10
- Add 3-digit and 1-digit numbers – crossing 10
- Subtract a 1-digit number from a 3-digit number – crossing 10
- Add and subtract 3-digit and 2-digit numbers – not crossing 100
- Add 3-digit and 2-digit numbers – crossing 100
- Subtract a 2-digit number from a 3-digit number – crossing 100

As you can see, nothing is left to chance – each step builds carefully from the previous step, building on pupils' prior knowledge to develop new skills, with nothing left out. Pupils are ready for this having covered addition with 2-digit numbers in Year 2 and Place Value up to 1,000 in the first block of Year 3.

Our curriculum is designed to use skills that have already been learnt in different contexts (sometimes called 'interleaving') whenever we can. This helps pupils to remember and to make connections between different parts of the curriculum.

Taking the Year 3 example, after the Addition and Subtraction block, pupils will revisit and practice these skills again in these blocks later in the year:

- Multiplication and Division
- Money
- Length and Perimeter
- Mass and Capacity

…and then they are built on and extended in Year 4 and beyond.

Subject Curriculum Maps: Mathematics

Memory

White Rose Maths includes this revisiting in their example questions, and also in the worksheets that accompany the small steps available via our Premium Resources subscription. The subscription also includes other useful resources to help pupils remember:

- Flashback 4 – a daily starter activity consisting of one question each from a topic covered last lesson, last week, two or three weeks ago and last term or last year
- True of False – a question for each step that can be used whenever the teacher wants to bring that topic back to the front of pupils' minds.

Our maths curriculum combines the best of both 'mastery' and 'spiral' approaches in its design. It certainly follows many of the mastery principles – spending longer on topics to help gain deeper understanding, making connections, keeping the class working together on the same topic and a fundamental belief that, through effort, all pupils are capable of understanding, doing and improving at mathematics. But we also recognise that just spending a good chunk of time on a topic doesn't mean that all pupils will 'master' it the first time they see it, and that they need to see it again and again in different contexts and in different years to help them truly develop their understanding on their journey to mastery, so this has been built in the revisiting and reinforcing features of spiral curricula too.

Fluency, reasoning and problem solving are key components of learning mathematics and they are included in all the White Rose small steps. We do not simply complete all of the fluency in a block first, then the reasoning and then the problem solving. These three key components should be integrated into classroom practice as much as possible in the order that is appropriate for the step, e.g. the process of division may be introduced by a problem about sharing or grouping for which we need to become fluent at the procedure.

Early Years

Do plans close the school entry gap in knowledge of number? Do plans allow for learning of key number facts and an efficient and accurate method of counting before pupils are expected to solve everyday problems? Are pupils given key mathematical language? Are curriculum plans equitable?

Our maths curriculum supports the ethos of the EYFS whilst at the same time enabling teachers to create a mathematically rich curriculum. Additionally, it allows for key mathematical concepts to be revisited and developed further across the year.

The White Rose Maths EYFS scheme of work is divided into ten phases and provides a variety of opportunities to develop the understanding of number, shape, measure and spatial thinking.

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14
Autumn	Getting to Know You			Just Like Me!			It's Me 1 2 3!			Light and Dark			Consolidation	
Spring	Alive in 5!			Growing 6, 7, 8			Building 9 and 10			Consolidation				
Summer	To 20 and Beyond			First Then Now			Find My Pattern			On The Move				

Staff in Reception also use the Mastering Number Programme alongside the EYFS White Rose Curriculum. This programme focuses on the key knowledge and understanding needed in Reception classes, and progression through KS1. Staff were fully trained in this programme during the 2022/23 academic year.

Subject Curriculum Maps: Mathematics

Disciplinary Rigour

Do pupils know that proficiency in mathematics requires sustained effort and focus? Are pupils encouraged to be precise, accurate and systematic in their mathematical endeavours? Do plans give pupils undisturbed opportunities to hone their effort and focus?

White Rose Maths provides a coherent structure and supports teacher subject knowledge and the programme aligns with our mastery principles. Teachers can be confident that children are regularly exposed to the models, images and representations consistent with the mastery approach including procedural and conceptual variations and regular opportunities for mathematical reasoning.

Children are taught all together as a class and are not split into 'ability' groupings. Carefully structured teaching, planned in small steps, provides both the necessary scaffold for all to achieve, and the necessary detail and rigour of all aspects of the mathematics, in order to facilitate deeper thinking. The small steps are connected and concepts are built, leading to a generalisation of the mathematics, and the ability to apply it to multiple contexts and solve problems. It is expected that those that will achieve well on a particular topic may not necessarily be the same children that achieved well on other topics.

An additional teaching input of approximately10 to 15 minutes is provided on a daily basis for any pupils who do not fully grasp the lesson content, in order that they 'keep up' with the class. Each day starts with a daily math revision session where staff can target those pupils who did not securely acquire the required knowledge during the previous maths lesson. Our experience shows that it is not always the same pupils who require this form of intervention and this boosts the self-belief of previously low attaining pupils.

Pedagogy

Instruction: Are instructional approaches systematic, with new content introduced in a logical order, building on what pupils know? Can pupils answer questions without needing to guess or cast around for clues? Does instruction make sense to pupils? Are diagrams and physical apparatus helpful?

Pupil practice: Do plans prioritise successful rehearsal and consolidation over time spent 'finding out' what was intended to be learned? Does task design minimise the need for equipment choices or expectations that pupils to work out what to do? Are pupils given enough time to rehearse core content such as efficient methods? Do pupils experience successful use of core facts and methods to complete exercises and solve problems, in addition to demonstrating their understanding?

At St. Michael's, when teaching maths, the whole class moves through topics and lessons at broadly the same pace, starting from the same point. All children are given the same opportunities and the support or intervention given, will vary from lesson to lesson. Each topic is studied in depth and the teacher does not move to the next stage until children demonstrate that they have a secure understanding of the mathematical concepts.

Children are given time to think deeply about the maths and really understand concepts at a relational level, rather than as a set of rules or procedures. This slower pace leads to greater progress because it ensures that students are secure in their understanding and teachers don't need to revisit topics once they have been covered in depth.

Though the whole class goes through the same content at roughly the same pace, there is still plenty of opportunity for differentiation. Those pupils who grasp concepts quickly are challenged with rich and sophisticated problems within the topic. Children who have grasped the fluency elements (pitched at the age related expectations) are then given the opportunity to challenge themselves by completing reasoning and problem solving challenges, some of which will begin their independent activities during the lesson at this point. Those children who are not sufficiently fluent are provided with additional support to consolidate their understanding before moving on.

ST. MICHAEL'S CE PRIMARY ACADEMY

Pedagogy

This element is in the form of same day intervention, both in class during the lesson or as a follow up intervention if needed.

Concrete, pictorial, abstract (CPA) is a highly effective approach to teaching that develops a deep and sustainable understanding of maths in pupils. Often referred to as the concrete, representational, abstract framework, CPA was developed by American psychologist Jerome Bruner. It is an essential technique within the Singapore method of teaching maths for mastery.

The basics of the CPA Approach:

- An essential technique of maths mastery that builds on a child’s existing understanding.
- A highly effective framework for progressing pupils to abstract concepts like fractions.
- Involves concrete materials and pictorial/representational diagrams.
- Based on research by psychologist Jerome Bruner.
- Along with bar modelling and number bonds, it is an essential maths mastery strategy.

Concrete:

Concrete is the “doing” stage. During this stage, students use concrete objects to model problems. Unlike traditional maths teaching methods where teachers demonstrate how to solve a problem, the CPA approach brings concepts to life by allowing children to experience and handle physical (concrete) objects. With the CPA framework, every abstract concept is first introduced using physical, interactive concrete materials.

Pictoral:

Pictorial is the “seeing” stage. Here, visual representations of concrete objects are used to model problems. This stage encourages children to make a mental connection between the physical object they just handled and the abstract pictures, diagrams or models that represent the objects from the problem.

Building or drawing a model makes it easier for children to grasp difficult abstract concepts (for example, fractions). Simply put, it helps students visualise abstract problems and make them more accessible.

Abstract:

Abstract is the “symbolic” stage, where children use abstract symbols to model problems. Students will not progress to this stage until they have demonstrated that they have a solid understanding of the concrete and pictorial stages of the problem. The abstract stage involves the teacher introducing abstract concepts (for example, mathematical symbols). Children are introduced to the concept at a symbolic level, using only numbers, notation, and mathematical symbols (for example, +, –, x, /) to indicate addition, multiplication or division.

Subject Curriculum Maps: Mathematics

Assessment

Component parts (facts and methods): Are pupils regularly tested on their recall of core maths facts? Are the prescribed benchmarks for accuracy and speed of recall true indicators of automaticity? Do pupils know they are improving? Do plans incorporate opportunities for assessing pupils' knowledge of core methods such as finding equivalent fractions, converting measurements or using short division outside of requirements to use these methods for problem solving? Composite skills (applied facts and methods): Are pupils prepared for tests of composite skills? Are summative tests of this nature kept to a minimum? Are pupils familiar with the typical language used in these tests?

Teachers check for understanding in each session and quickly identify those children in need of additional teaching. We find that the most powerful feedback is given to children verbally during the lesson so that children can correct their work at the time. Self and peer assessment are also used when appropriate, although teachers will oversee this and acknowledge the work. If necessary teachers will adapt their planning if particular misconceptions need to be addressed or if children require additional challenge.

We use a range of low stakes testing approaches both to help children remember key information and to identify those in need of additional help and support. Some of these such as Timetables Rock Stars and Numbots are very pupil centred and give children instant feedback on their performance.

We assess children summatively at the end of each term. We use a combination of NFER tests, past SATs papers and Heartforshire Teacher Assessment tools for this purpose. Data is entered into our online database Arbor and used to inform target setting and for reporting to parents. Our data is also collated at Trust level which enables benchmarking to take place between schools.

This curriculum is for all our children. We aim to provide scaffolding and a variety of experiences for those with different needs before offering alternative content. Similarly, we avoid accelerating our relatively high attainers through content too quickly, preferring to focus on developing a greater depth of understanding.

We prefer a 'keep up' to a 'catch up' approach in terms of supporting our less confident mathematicians. However, we recognise that there are times when significant gaps in learning have been identified and time-limited precision interventions are necessary to address these.

We monitor the quality and impact of our mathematics curriculum through a range of approaches including learning walks, subject leader interviews, teacher interviews, book looks and pupil perception meetings. This is carried out at both school and Trust level. We also have moderation meetings across Trust schools so that teachers are able to compare pupils learning outcomes.

Systems

Is success engineered? How do leaders prevent the need for interventions? Can the school readily explain and qualify potential systemic issues? What mechanisms are there for curriculum construction, sequencing and improvement? How well are staff supported in developing their own subject and subject-specific pedagogical knowledge? Is the subject led and overseen effectively? How are parents kept informed of their child's proficiency in mathematics?

Staff are supported via bespoke ongoing CPD programmes. Each teacher is provided with tailored support ranging from weekly sessions of co-planning, team teaching and staff observations. External support is utilized where appropriate e.g. NCTEM Mastering Number porgramme.

Whole-school CPD focuses on the fundamentals of our maths curriculum - fluency, reasoning and problem solving, as well as the CPA approach.

Parents are informed about their child's progress in maths every half-term via report cards.

Policy

Is the homework policy equitable and effective, supporting consolidation of learning and closing knowledge and retention gaps? Are adequate resources available? Does the calculation policy prioritise learning/use of efficient and accurate methods of calculation for all pupils? Is the marking policy reasonable and clear?

Pupils are provided with weekly maths homework via the online platforms of Numbots and TT Rockstars. A whole-school reward system encourages the use of these platforms, and success is celebrated each week in Celebration Assembly.

Teachers make use of additional resources from TT Rockstars, Test Base and White Rose Maths when issuing additional homework tasks.

White Rose Maths calculation policies provide a systematic breakdown of the methods and techniques that should be taught for each of the four operations.

Teachers check for understanding in each session and quickly identify those children in need of additional teaching. We find that the most powerful feedback is given to children verbally during the lesson so that children can correct their work at the time. Self and peer assessment are also used when appropriate, although teachers will oversee this and acknowledge the work. If necessary teachers will adapt their planning if particular misconceptions need to be addressed or if children require additional challenge.

Subject Curriculum Maps: Mathematics

Early Years Foundation Stage

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14
Autumn	Getting to Know You			Just Like Me!			It's Me 1 2 3!			Light and Dark			Consolidation	
Spring	Alive in 5!			Growing 6, 7, 8			Building 9 and 10			Consolidation				
Summer	To 20 and Beyond			First Then Now			Find My Pattern			On The Move				

Year One

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn term	Number **Place value** (within 10) VIEW					Number **Addition and subtraction** (within 10) VIEW					Geometry **Shape** VIEW	Consolidation
Spring term	Number **Place value** (within 20) VIEW			Number **Addition and subtraction** (within 20) VIEW			Number **Place value** (within 50) VIEW		Measurement **Length and height** VIEW		Measurement **Mass and volume** VIEW	
Summer term	Number **Multiplication and division** VIEW			Number **Fractions** VIEW		Geometry **Position and direction** VIEW	Number **Place value** (within 100) VIEW		Measurement **Money** VIEW	Measurement **Time** VIEW		Consolidation

Subject Curriculum Maps: Mathematics

Year Two

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn term	Number Place value VIEW				Number Addition and subtraction VIEW					Geometry Shape VIEW		
Spring term	Measurement Money VIEW		Number Multiplication and division VIEW					Measurement Length and height VIEW		Measurement Mass, capacity and temperature VIEW		
Summer term	Number Fractions VIEW			Measurement Time VIEW			Statistics VIEW		Geometry Position and direction VIEW		Consolidation	

Year Three

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn term	Number Place value VIEW			Number Addition and subtraction VIEW					Number Multiplication and division A VIEW			
Spring term	Number Multiplication and division B VIEW			Measurement Length and perimeter VIEW			Number Fractions A VIEW			Measurement Mass and capacity VIEW		
Summer term	Number Fractions B VIEW		Measurement Money VIEW		Measurement Time VIEW			Geometry Shape VIEW		Statistics VIEW		Consolidation

Subject Curriculum Maps: Mathematics

Year Four

Autumn term	Week 1 – Week 4	Number	Place value
Autumn term	Week 5 – Week 7	Number	Addition and subtraction
Autumn term	Week 8	Measurement	Area
Autumn term	Week 9 – Week 11	Number	Multiplication and division A
Autumn term	Week 12		Consolidation
Spring term	Week 1 – Week 3	Number	Multiplication and division B
Spring term	Week 4 – Week 5	Measurement	Length and perimeter
Spring term	Week 6 – Week 9	Number	Fractions
Spring term	Week 10 – Week 12	Number	Decimals A
Summer term	Week 1 – Week 2	Number	Decimals B
Summer term	Week 3 – Week 4	Measurement	Money
Summer term	Week 5 – Week 6	Measurement	Time
Summer term	Week 7		Consolidation
Summer term	Week 8 – Week 9	Geometry	Shape
Summer term	Week 10		Statistics
Summer term	Week 11 – Week 12	Geometry	Position and direction

Year Five

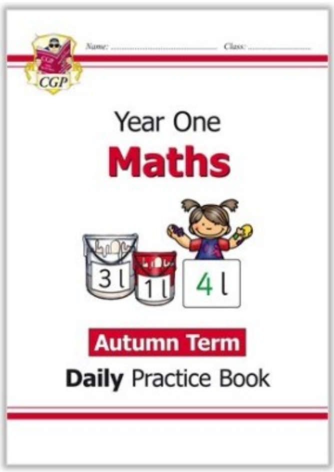
Autumn term	Week 1 – Week 3	Number	Place value
Autumn term	Week 4 – Week 5	Number	Addition and subtraction
Autumn term	Week 6 – Week 8	Number	Multiplication and division A
Autumn term	Week 9 – Week 12	Number	Fractions A
Spring term	Week 1 – Week 3	Number	Multiplication and division B
Spring term	Week 4 – Week 5	Number	Fractions B
Spring term	Week 6 – Week 8	Number	Decimals and percentages
Spring term	Week 9 – Week 10	Measurement	Perimeter and area
Spring term	Week 11 – Week 12		Statistics
Summer term	Week 1 – Week 3	Geometry	Shape
Summer term	Week 4 – Week 5	Geometry	Position and direction
Summer term	Week 6 – Week 8	Number	Decimals
Summer term	Week 9	Number	Negative numbers
Summer term	Week 10 – Week 11	Measurement	Converting units
Summer term	Week 12	Measurement	Volume

Subject Curriculum Maps: Mathematics

Year Six

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn term	Number Place value VIEW		Number Addition, subtraction, multiplication and division VIEW					Number Fractions A VIEW		Number Fractions B VIEW		Measurement Converting units VIEW
Spring term	Number Ratio VIEW		Number Algebra VIEW		Number Decimals VIEW		Number Fractions decimals and percentages VIEW		Measurement Area, perimeter and volume VIEW		Statistics VIEW	
Summer term	Geometry Shape VIEW			Geometry Position and direction VIEW	Themed projects, consolidation and problem solving VIEW							

Arithmetic and Multiplication Facts



Year 2 and Year 3

Daily revision of mathematical knowledge using CGP Daily Practice Books.

Year 4

Daily practice of multiplication facts with TT Rock Stars.

Year 5 and Year 6

Daily practice of multiplication facts, number facts and other key mathematical facts using Numeracy Ninja.