# **Primary Initial Teacher Education: Curriculum Plan**

# **Subject Mathematics Undergraduate Programmes**

# **Links to *mathematical fluency/ reasoning/ problem solving/ mastery***

# **Curriculum Vision:**

**Curriculum Aims:** Through our Initial Teacher Education Curriculum, it is our aim that all our trainees will:

* understand that mathematics is the route to developing both accurate and fluent numeracy skills and the importance of this in relation to everyday life, transferable skills and financial literacy
* understand that this approach is supported by robust evidence
* understand the purpose of the three aims of the mathematics national curriculum and how these can be addressed for all areas of the mathematics curriculum.
* develop their confidence and promote an enthusiasm and passion for mathematics.
* believe that all children can be successful mathematicians, regardless of social background or other circumstances and that this is their moral purpose as educators.

| **Phase 1 - Introductory** |
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| **University Based Learning** | **School/Practical Based Learning** |
| **Learn That** | **Learn How** | **Learn That** | **Learn How** |
| **Component Knowledge** | * There are three aims of the mathematics curriculum.LT3.1
* One of the key aims of the mathematics curriculum is for pupils to 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. L.T 1.3, LT3.1, LT4.8
* This will specifically link to understanding of declarative and procedural knowledge. LT3.3, LT3.5, LH3.11
* One of the key aims of the mathematics curriculum is for pupils to reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language. LT3.1
* One of the key aims of the mathematics curriculum is for pupils to 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. LT 1.3, LT3.1
* This will specifically link to understanding of conditional knowledge.
* There are 5 counting principles.
* There is declarative and procedural subject knowledge required to plan, teach and assess the following areas effectively and confidently: counting, place value, common mental calculation strategies, common informal written calculation strategies, the formal written calculation strategies as defined in the appendix of the National Curriculum document.LT2.2, LH2.3, LH2.7, LT3.3, LT3.5, LT4.2, LT6.1, LT6.3, LT6.4
* There are advantages of talk and language in mathematics lessons LH1.2, LT4.3, LT4.7
* There are cognitive factors leading to mathematical difficulties. LT2.4, LT4.5
* The 5 big ideas promote the teaching of Mastery (NCETM).LT3.3
* Mastery is misunderstood and not all teachers are clear about it what it actually means.LT1.6, LT3.3
* Mastery was popularised after its success in East Asia, but it was explicitly based on theories from around the world. LH2.3, LT3.3
 | * The three aims of the mathematics curriculum relate to each other.LT3.1
* The term fluency relates to mathematical progression and the declarative and procedural knowledge associated with number and calculationLT3.1, LT3.3, LT3.5, LH3.11
* Calculation and place value are linked. LT2.2, LT2.6, LH2.3, LH2.7, LT3.7
* Fluency is not just rapid number recall it is developing a sense of number.LT2.5, LH3.11
* Encourage fluency across the whole mathematics curriculum. LT2.5, LT2.7, LT3.3, LT3.5, LH3.11
* Mental recall supports the learning and understanding of number bonds, times tables and how this links to working memory and long term memory.LT2.3, LT2.4, LT2.5, LH3.11
* To encourage checking and estimating to demonstrate proficiency in measure and calculation.
* To use the specific technical vocabulary associated within counting, place value, calculation and statistics. LH1.2
* Mental strategies inform the informal and formal written strategies to calculation – procedural knowledge. LT2.6, LH2.7, LT3.5, LT3.7, LH3.8, LT4.2
* To teach the declarative knowledge needed to support successful completion of the Multiplication Tables Check (MTC) –. LT3.3, LT3.5, LH3.11
* To teach mathematical reasoning.
* Mastery is an approach to teaching mathematics ensuring all children achieve to their full potential.LT3.3
* To develop an understanding of a mathematical mindset in relation to the work by Carol Dweck and more recently, Jo Boaler. LT2.1
* The Concrete, Pictorial, Abstract (CPA) approach, in relation to Bruner’s principles of enactive, iconic, symbolic supports adaptive teaching and the value of dual coding. LH3.12, LT4.3
* To teach the conditional knowledge required by pupils to reason mathematically and problem solve in relation to number and calculation. LT2.1, LH2.7, LT4.2
* To plan for and teach the different types of problem solving, not just word problems.
* To plan for and teach the number of skills required to become an efficient problem solver. LH2.3, LT3.5
* To teach the different stages to the problem-solving process.
* Conditional knowledge is required by pupils to reason mathematically and problem solve across all areas of the mathematics curriculum. LT2.1, LH2.3, LH2.7, LT4.2
* Their own mathematical schema has developed over time, particularly in relation to calculation strategies. LT2.9, LT3.7
 | * Planning, teaching and assessing a sequence of lessons develops both conceptual and procedural understanding of number, including counting, place value and both mental and written calculation. LH1.1, LH2.3, LH2.7, LH2.9, LT3.5, LH3.3, LH3.7, LH3.8, LT4.6, LT6.1, LT6.2 LT6.3, LT6.4, LH6.1, LH6.3
* Times tables can be taught using effective strategies without just using drill and practice LT2.1, LT2.5, LT2.7, LT2.8, LH2.9, LH3.3, LH3.11, LT4.2, LT6.1, LT6.2 LT6.3, LT6.4, LH6.1, LH6.3
* Mathematics specific vocabulary should be promoted across all areas of mathematics. LT4.7
* Appropriate concrete and visual resources support number sense and a conceptual understanding of calculation strategies when considering the CPA approach..LH2.3, LH2.9, LH3.12, LT4.3, LH4.3, LH4.8, LH5.9, LT6.1
 | * To identify their developmental needs as mathematical educators and independently address these.
* To plan, teach and assess a sequence of lessons developing both conceptual and procedural understanding of number, including counting, place value and both mental and written calculation. LH1.1, LH2.3, LH2.7, LH2.9, LT3.5, LH3.3, LH3.7, LH3.8, LT4.6, LT6.1, LT6.2 LT6.3, LT6.4, LH6.1, LH6.3
* To plan, teach and assess times tables using effective strategies without just using drill and practice and use these strategies to enable pupils to make connections between this knowledge and the inverse operation of division. LT2.1, LT2.5, LT2.7, LT2.8, LH2.9, LH3.3, LH3.11, LT4.2, LT6.1, LT6.2 LT6.3, LT6.4, LH6.1, LH6.3
* To promote the use of mathematics specific vocabulary across all areas of mathematics..LT4.7
* To plan to utilise appropriate concrete and visual resources to support number sense and a conceptual understanding of calculation strategies considering the CPA approach. LH2.3, LH2.9, LH3.12, LT4.3, LH4.3, LH4.8, LH5.9, LT6.1
* To promote a mathematical mindset for pupils irrespective of background or ability. LT1.1, LT1.2, LT1.3, LT2.1, LT4.1, LT7.4
* To promote positive attitudes to mathematics.

LT1.1, LT1.2, LT1.3, LT2.1, LT4.1, LT7.4 | Intent |
| **Assessment** | Assessment | Assessment |  |
| Assessment will take the form of NNC at the start of the phase which will inform trainees of their own target areas for subject knowledge in mathematics. A score of 70+ is required prior to PP1a and a score of 80+ is required prior to PP1b. As deemed by the National Numeracy Organisation, this score indicates the participant “possess the fundamentals in mathematics”. A written submission will evaluate how children’s literature can be used as a tool to support teaching and learning in mathematics, specifically number and calculation. | Through lesson observation and feedback. Mentors will feedback in relation to CCF content observed in lessons and to specific mathematics content taught and trainees mathematical subject knowledge. Trainees will be deemed ready to progress in this area. | Impact |
| **Composite Knowledge** | **Composite knowledge/understanding/skills** |
| *By the end of this phase trainees will* ***know:*** | *By the end of this phase trainees will* ***understand:*** | *By the end of this phase trainees will* ***be able to:*** |
| *By the end of this phase trainees will* ***know:**** a range of strategies to support pupil understanding of how to calculate successfully, using mental, informal and formal written methods, including the relevant declarative and procedural knowledge associated with number and calculation.**LT2.2, LT2.7, LT2.8, LT2.9, LH2.3, LH2.7, LH2.9, LT3.3, LT3.5, LT3.7, LH3.8, LT4.2, LH4.3**
 | *By the end of this phase trainees will* ***understand:**** a secure knowledge of place value underpins the ability to calculate both mentally and use formal written methods.**LT2.2, LT2.6, LT2.7, LT2.8, LT2.9, LH2.3, LH2.7, LT3.2, LT3.7, LH3.7, LH3.8, LT4.2**
 | *By the end of this phase trainees will* ***be able to:**** plan, teach and assess a high-quality number (counting, place value, calculation) lesson.**LH2.9, LH3.3, LH3.7, LT6.1, LT6.3, LT6.4**
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| **Research** | **KEY RESEARCH****That Trainees will know that informs teaching and learning in M**athematics |
| DEPARTMENT of EDUCATION. 2013. *The national curriculum in England: key stages 1 and 2 framework document.* Available at: <https://www.gov.uk/government/publications/national-curriculum-in-england-primary-curriculum>DEPARTMENT of EDUCATION. 2020. *Mathematics guidance: key stages 1 and 2 Non-statutory guidance for the national curriculum in England*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\_data/file/1017683/Maths\_guidance\_KS\_1\_and\_2.pdfHAYLOCK, D. and MANNING, R., 2019. *Mathematics Explained for Primary Teachers*. 6th ed. London. Sage.NCETM. *Mastery Materials*. Available at: https://www.ncetm.org.uk/teaching-for-mastery/mastery-materials/NCETM. *Progression maps for Key Stages 1 and 2*. Available at: <https://www.ncetm.org.uk/classroom-resources/progression-maps-for-key-stages-1-and-2/>NCETM. Various videos. Available from: https://www.ncetm.org.uk/NRICH. Available from https://nrich.maths.org/OFSTED. 2021. *Research Review Series: Mathematics.* Available at: <https://www.gov.uk/government/publications/research-review-series-mathematics> |

| **Phase 2 - Developmental** |
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| **University Based Learning** | **School/Practical Based Learning** |
| **Learn That** | **Learn How** | **Learn That** | **Learn How** |
| **Component Knowledge** | • There is a difference between an error and a misconception.LH1.3, LT2.6• There are strategies for addressing common misconceptions across all areas of the mathematics curriculum.LH1.3, LT2.6, LH2.6, LT3.4• There are names and properties of common 2d and 3d shapes and the associated vocabulary – declarative knowledge and developing associated schema. LH1.2, LT3.5, LT3.7• There are conversion procedures for common measurements.- procedural knowledge and the links to place value and calculation.LT2.2, LT3.5* Checking and estimating are key concepts to understand to demonstrate proficiency in measure and calculation.

• There are methods to convert between fractions, decimals and percentages. Have a secure understanding of ratio and proportion and use this to teach these concepts in creative ways.- procedural knowledge LT3.5, LT4.2• There are cognitive factors leading to mathematical difficulties. LT2.4• Polya’s 4 step process supports the skill of problem solving.• Van Hiele’s levels of geometric thinking develop geometric understanding.• The 5 big ideas promote the teaching of Mastery (NCETM).LT3.3* Adaptive teaching supports the development of different levels of number sense, meeting the needs of SEN/D pupils, in particular dyscalculic children and helping to avoid overload. LT1.3, LT5.1, LT5.2, LT5.3, LT5.7, LH5.2
 | • To teach the progression sequence through Fractions, Decimals and Percentages (FDP), geometry, measure and algebra.LH2.3• To correctly use specific technical vocabulary used within fractions, decimals and percentages, geometry, measure and algebra and the role of the long term memory in storing this information.LH1.2• There is a difference between tiling and iteration and the implications for measuring accurately.• The terms transitivity and conservation in relation to measure and how they are used to assess children’s basic understanding of measure.• The concepts of procedural and conceptual variation support understanding.• Talk and language in mathematics lessons can support progress and assessment. LT4.7• Encourage fluency across the whole mathematics curriculum. LT2.5, LT2.7, LT3.3, LT3.5, LH3.11• There are different forms of questioning that can elicit different response. LT4.6, LH4.14, LH4.15, LH5.12• To use specific vocabulary associated with reasoning that develops as children progress through the curriculum. LH1.2• To teach the differentof types of problem solving, not just word problems.• To teach the number of skills required to become an efficient problem solver. LH2.3, LT3.5• To teach the different stages to the problem-solving process.• To develop the conditional knowledge required by pupils to reason mathematically and problem solve across all areas of the mathematics curriculum.LT2.7, LT3.7, LT4.2• Spaced learning can benefit cognitive load, working memory and long term memory. LT2.4, LT2.8, LH2.11, LH3.10 | • They need to plan for pupils to have opportunities to learn and develop reasoning skills by including a variety of teaching and learning approaches.- conditional knowledge..LT2.7, LH2.8, LT3.5, LH3.3, LH4.1• Assessing reasoning skills through questioning, observation and scaffolded conversations can be a very useful form of assessment.LH2.8, LT3.5, LT4.6, LH4.14, LH4.15, LH5.12, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3, LH6.6• The national curriculum requires implementation of a problem-solving culture into every mathematics lesson where pupils are engaged by the challenge and demonstrate resilience.- conditional knowledge. LT1.1, LT1.2, LT3.2, LT7.4 | • To promote resilience and perseverance when problem solving, including what children should do when they are stuck, whist considering the role of long term memory, working memory and CLT- conditional knowledge.. LT2.3, LT2.4, LT2.5, LT2.7, LT7.4• To adapt the teaching of number sense to meet the needs of SEN/D pupils, in particular dyscalculic children. LT1.3, LT5.1, LT5.2, LT5.3, LT5.7, LH5.2• To plan, teach and assess a sequence of lessons following a mastery approach. LT2.7, LH2.3, LH2.9, LH3.3, LH3.4, LH3.7, LH4.1, LH5.6, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3• To plan, teach and assess a guided group session..LH2.8, LH3.3, LT4.9, LH4.1, LH5.8, LT6.1, LT6.3, LT6.4 , LH6.1, LH6.3• To plan for pupils to have opportunities to learn and develop reasoning skills by including a variety of teaching and learning approaches.- conditional knowledge..LT2.7, LH2.8, LT3.5, LH3.3, LH4.1• To assess reasoning skills through questioning, observation and scaffolded conversations..LH2.8, LT3.5, LT4.6, LH4.14, LH4.15, LH5.12, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3, LH6.6• To implement a problem-solving culture into every mathematics lesson where pupils are engaged by the challenge and demonstrate resilience.- conditional knowledge. LT1.1, LT1.2, LT3.2, LT7.4 | Intent |
| **Assessment** |  |  | Impact |
| All students will have achieved 80+ on the NNC before commencing PP1b.At the end of the module a written assignment will assess students’ understanding of how a sequence of lessons facilitates progress in mathematics, drawing on their understanding of planning and assessment learned so far in the course and on their Professional Practice. | Through lesson observation and feedback. Mentors will feedback in relation to CCF content observed in lessons and to specific mathematics content taught and trainees mathematical subject knowledge. Trainees will be deemed ready to progress in this area. |
| **Composite Knowledge** | **Composite knowledge/understanding/skills** |
| *By the end of this phase trainees will* ***know:*** | *By the end of this phase trainees will* ***understand:*** | *By the end of this phase trainees will* ***be able to:*** |
| *By the end of this phase trainees will* ***know:**** common misconceptions across all areas of the mathematics curriculum. **LH1.3**
* the relevant declarative and procedural knowledge associated with extended number, geometry and measure.**LH1.3, LT3.4, LT3.5, LT4.2, LH4.3, LH6.4**
 | * how to address common misconceptions across all areas of the mathematics curriculum.**LH1.3, LT2.6, LH2.6, LT3.4, LH6.4, LH6.5, LH6.7**
 | * plan and teach lessons a series of lessons to avoid misconceptions occurring.**LH1.3, LH2.8, LH2.9, LT3.4, LH3.3, LH4.1, LH6.4**
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| **Research** | **KEY RESEARCH****That Trainees will know that informs teaching and learning in M**athematics |
| DEPARTMENT of EDUCATION. 2013. *The national curriculum in England: key stages 1 and 2 framework document.* Available at: <https://www.gov.uk/government/publications/national-curriculum-in-england-primary-curriculum>DEPARTMENT of EDUCATION. 2020. *Mathematics guidance: key stages 1 and 2 Non-statutory guidance for the national curriculum in England*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\_data/file/1017683/Maths\_guidance\_KS\_1\_and\_2.pdfFRANCOME, T. and HEWITT, D. 2017. My math lessons are all about learning from your mistakes”: how mixed-attainment mathematics grouping affects the way students experience mathematics. *Educational Review*. 72 (4)HANSEN, A., 2020. *Children’s Errors in Mathematics*. 5th ed. Exeter. Learning Matters.HAYLOCK, D. and MANNING, R., 2019. *Mathematics Explained for Primary Teachers*. 6th ed. London. Sage.NCETM. *Mastery Materials*. Available at: https://www.ncetm.org.uk/teaching-for-mastery/mastery-materials/NCETM. *Progression maps for Key Stages 1 and 2*. Available at: <https://www.ncetm.org.uk/classroom-resources/progression-maps-for-key-stages-1-and-2/>NCETM. Various videos. Available from: https://www.ncetm.org.uk/NRICH. Available from https://nrich.maths.org/OFSTED. 2021. *Research Review Series: Mathematics.* Available at: https://www.gov.uk/government/publications/research-review-series-mathematics |

| **Phase 3 - Consolidation** |
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| **University Based Learning** | **School/Practical Based Learning** |
| **Learn That** | **Learn How** | **Learn That** | **Learn How** |
| **Component Knowledge** |  |  |  |  | Intent |
| • Mastery is misunderstood and not all teachers are clear about it what it actually means.LT1.6, LT3.3, LT4.1, LT4.10, LT7.4, • Mastery was popularised after its success in East Asia, but it was explicitly based on theories from around the world. LT1.6, LT3.3• Children need to know how to apply their previous knowledge to link different areas and skills of mathematics - conditional knowledge LT2.2, LT3.5, LT4.2, LT7.7• There is a difference between a working wall and a passive display.* Mathematics can be taught in creative ways, including outside the classroom.
* Mathematics proficiency encapsulates numerous transferable skills , ie problem solving.
 | • To create an effective and engaging mathematics working wall.• To support parents and how to engage them effectively.LH1.4, LT8.4• To incorporate drama to promote mathematical thinking and how to incorporate different mathematical topics into longer projects and activities such as “murder mysteries” and “real world” problems.• The term “maths anxiety” relates to cognitive load theory and the possible impact on learning and progress. LT1.1, LT1.2* To plan and assess a mathematics lesson set outside the classroom.
 | •Including a variety of teaching and learning approaches supports pupils to have opportunities to learn and develop reasoning skills. LT3.5, LH4.1•The NCETM materials can support planning and assessment using a mastery approach, LT2.8, LH2.3, LH2.8, LH2.9, LT3.3, LH3.3, LH3.4, LH3.7, LH4.1, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3, LH8.3 • It is important to identify their developmental needs as mathematical educators and independently address these.• There are common “symptoms” of maths anxiety and propose strategies to support children with their learning with reference to the latest research and support networks (Maths Anxiety Trust)..LT1.1, LT1.2 | • To plan, teach and assess creative and engaging mathematics lessons..LH3.3, LH4.1, LH6.1, LH6.3• To engage parents in their child’s mathematical development..LH1.4, LT8.4• To plan for pupils to have opportunities to learn and develop reasoning skills by including a variety of teaching and learning approaches.. LT3.5, LH4.1• To plan and assess using a mastery approach, supported by the NCETM materials..LT2.8, LH2.3, LH2.8, LH2.9, LT3.3, LH3.3, LH3.4, LH3.7, LH4.1, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3, LH8.3• To promote resilience and perseverance when problem solving, whist considering the role of long term memory, working memory and CLT- conditional knowledge.. LT1.1, LT1.2, LT7.4• To design an effective and interactive working wall. This may be consolidated whilst on professional practice.  •To identify common “symptoms” of maths anxiety and propose strategies to support children with their learning with reference to the latest research and support networks (Maths Anxiety Trust). LT1.1, LT1.2 |
| **Assessment** | **Assessment** | **Assessment** | Impact |
| At the end of the module an academic poster will assess students’ understanding of the impact of LOTC as a creative approach to the teaching and learning of mathematics. drawing on their understanding of planning and assessment learned so far in the course and on their Professional Practice | Through lesson observation and feedback. Mentors will feedback in relation to CCF content observed in lessons and to specific mathematics content taught and trainees mathematical subject knowledge. Trainees will be deemed ready to progress in this area. |
| **Composite Knowledge** | **Composite knowledge/understanding/skills** |
| *By the end of this phase trainees will* ***know:*** | *By the end of this phase trainees will* ***understand:*** | *By the end of this phase trainees will* ***be able to:*** |
| * approaches to teaching mathematics creatively.
 | * a creative approach to mathematics teaching supports understanding of the relevance of mathematics in the real world, promotes engagement and develops enthusiasm. **LT1.1, LT1.2, LT3.2**
 | * confidently and effectively plan, teach and assess children’s mathematics skills and understanding through a series of lessons. **LT3.5, LH3.3, LH4.1, LT6.1, LT6.3, LT6.4**
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| **Research** | **KEY RESEARCH****That Trainees will know that informs teaching and learning in M**athematics |
| DEPARTMENT of EDUCATION. 2013. *The national curriculum in England: key stages 1 and 2 framework document.* Available at: <https://www.gov.uk/government/publications/national-curriculum-in-england-primary-curriculum>DEPARTMENT of EDUCATION. 2020. *Mathematics guidance: key stages 1 and 2 Non-statutory guidance for the national curriculum in England*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\_data/file/1017683/Maths\_guidance\_KS\_1\_and\_2.pdfHAYLOCK, D. and MANNING, R., 2019. *Mathematics Explained for Primary Teachers*. 6th ed. London. Sage.NCETM. *Mastery Materials*. Available at: https://www.ncetm.org.uk/teaching-for-mastery/mastery-materials/NCETM. *Progression maps for Key Stages 1 and 2*. Available at: <https://www.ncetm.org.uk/classroom-resources/progression-maps-for-key-stages-1-and-2/>NCETM. Various videos. Available from: https://www.ncetm.org.uk/NRICH. Available from https://nrich.maths.org/OFSTED. 2021. *Research Review Series: Mathematics.* Available at: <https://www.gov.uk/government/publications/research-review-series-mathematics>OTTE, C.R., BOLLING, M., ELSBORG, P., NIELSEN, G., BENTSEN, P. 2019.Teaching mathematics outside the classroom, does it make a difference? *Educational Research*. 61 (1)PRODROMOU, T. and FREDERIKSEN, N., 2018. The Effects of Mathematics Anxiety on Primary Students. 2018. *In Hunter, J., Perger, P., & Darragh, L. (Eds.). Making waves, opening spaces (Proceedings of the 41st annual conference of the Mathematics Education Research Group of Australasia)* pp. 639- 646. Auckland: Merga. Available from: <https://files.eric.ed.gov/fulltext/ED592472.pdf>STEM. Available from https://www.stem.org.uk/resources/community/collection/11448/mathematics-outside-classroom |

**Footnote:** Within our mathematics focus module we consider the role of future subject leadership and the importance of championing mathematics by promoting ways to encourage and celebrate maths skills, ie maths challenges, maths days.

**External Verification**

I have reviewed this plan and I confirm that I believe it offers a balanced, well-planned and well sequenced curriculum for nurturing young mathematicians.

**Dr Ems Lord (Director of NRICH)**