NOTE: This policy should be read in conjunction with the QPA Mathematics Curriculum Policy.

Aims:

In line with the National Curriculum (2014), the teaching of maths within the academy should aim for children to:

- *Become fluent in the fundamentals of mathematics, including practice at increasingly complex problems, so that children can use and apply their knowledge practically.*
- *Reason mathematically by following a line of enquiry, establishing relationships and generalisations, and developing an argument, justification or proof using mathematical language.*
- *Solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into smaller steps and persevering.*

In addition, at QPA we aim to ensure that all pupils develop:

- Conceptual understanding of number, measurement, geometry and statistics;
- A wide range of written and mental methods that they can use to answer questions and solve problems;
- A broad range of skills which can be applied both within the academy (across a range of curriculum areas) and within their everyday lives;
- A deep and lasting interest in mathematics.

In order to achieve these aims, at QPA we believe that it is crucial for all pupils to be given the opportunity to develop their mental mathematics skills.

Classroom Provision – Mental Mathematics:

- All pupils in KS1 and KS2 are given the opportunity to develop mental calculation strategy skills (see Appendix A for guidance) and practise basic facts during the daily mental/oral starter (part of the daily mathematics lesson – *see QPA Mathematics Curriculum Policy*).
- Opportunities for reasoning and communicating are provided within the daily oral/mental starter, enabling pupils to make connections (developing conceptual understanding).
- A programme of basic number facts and multiplication tables learning is in place in each year group (see Appendix B).

<u>Mastering Number (F2-Y2)</u>

Each class has an additional 15-minute daily timetabled slot* to focus on developing fluency in calculation and number sense (4 days per week). It is important that teachers are using this time effectively and following the NCETM planning, guidance and training. One session per week will be used for Mental Maths.

*Foundation Stage can be flexible in the way this daily session is delivered.

- NumBots provides a personalised learning programme for pupils to develop their addition and subtraction skills (Y1-3). Regular NumBots sessions are timetabled for each class (at least 2 x per week) and pupils are encouraged to play the NumBots games regularly at home.
- Times Table Rockstars (TTRS) provides a personalised learning programme for pupils to develop their multiplication skills (Y2-6). Weekly TTRS sessions are timetabled for each class and pupils are encouraged to play the TTRS games regularly at home.
- Other opportunities for developing mental strategy skills and practising basic facts will be provided at other points in the school day.

Planning The Oral/Mental Starters:

- Planning is based on the material provided in the National Curriculum 2014, QPA Maths Assessment Criteria for each year-group (based on NCETM/DfE Ready to Progress (RtP) Criteria), the multiplication tables programme and the mental calculation progression table (Appendices A & B).
- The oral/mental starters within weekly plans, which give specific detail of daily learning objectives and appropriate differentiated activities, should be developed from these documents. NOTE: These sessions can take place at any suitable time during the school day.
- White Rose documents and the NCETM materials may also provide additional support and resources in the planning process.

Mental Mathematics Assessment:

In addition to the formative and summative assessments listed in the curriculum policy (*see QPA Mathematics Curriculum Policy*), teachers will carry out the following mental mathematics assessments:

- Times tables assessment for Y3 & Y4 before and after completing each times table chanter booklet (see Appendix B for Times Tables Termly Planner).
- A TTRS 'Soundcheck' in Year 4 (weekly, from the Spring Term) - to prepare for the Year 4 Multiplication Check (MTC).

<u>Monitoring the effectiveness of the Policy:</u>

The practical application of this policy will be reviewed annually or when the need arises by the Mathematics Leader of Learning, the Principal and other members of the SLT.

<u>Key documents supporting this document include:</u>

- Mental Calculation Progression Document (Appendix A)
- Basic Number Facts & Multiplication Tables Programme (Appendix B)
- National Curriculum 2014 Mathematics Programme of Study
- QPA Maths Assessment Criteria
- NCETM/DfE Ready to Progress (RtP) Criteria (in *Mathematics Guidance* document)
- QPA Mathematics Curriculum Policy & QPA Calculation Policy
- White Rose Planning documents
- NCETM materials
- Times Table Rockstars (TTRS) & NumBots

Appendix A - Mental Calculation Progression:

The following progression table clearly shows the progression of mental maths skills across the year groups. Professional judgement should be used to ensure that children are working on and using appropriate methods for their current attainment. For consistency, only the methods set out below or those found in the QPA Calculation Policy should be taught. Any questions regarding the teaching of these methods need to be addressed to the Mathematics Leader of Learning.

Stage 1:
By the end of Year 1, the majority of pupils should have achieved Stage 1.

Rapid Recall & Counting	Mental Strategies	Mental Calculation Expectations
• Count to and across 100, forwards and backwards, beginning with 0 or 1, or from any given number. • Count in multiples of twos, fives and tens. • Know by heart the number bonds and related subtraction facts up for numbers 10 and up 20. • Recall doubles to at least 10 + 10 and corresponding halves.	• Re-order numbers in a calculation, e.g. 3 + 5 to 5 + 3, noticing that this does not change the answer. • Begin to bridge through 10 when adding a 1-digit number. • Use known number facts and place value to add or subtract pairs of 1-digit numbers. • Add 9 to 1-digit numbers by adding 10 then subtracting 1. • Identify near doubles, using doubles already known, e.g. 5 + 6 is 5 + 5 + 1, or 6 + 6 - 1. • Use patterns of similar calculations, e.g. 5 + 1 = 6, 5 + 2 = 7, 5 + 3 = 8. • Begin to partition to add numbers close to a multiple of 10, e.g. 4 + 9 = 4 + 10 – 1 (using a number line).	• Add or subtract a 1-digit number to or from a 1-digit number without crossing 10, e.g. 4 + 3, 9 – 5. • Add or subtract a 1-digit number to or from 10. • Add or subtract a 1-digit number to or from a 'teens' number, without crossing 20 or 10, e.g. 14 + 3, 18 – 5. • Doubles of all numbers to 20, e.g. 6 + 6, double 8.

Stage 2:

By the end of Year 2, the majority of pupils should have achieved Stage 2.

Rapid Recall & Counting	Mental Strategies	Mental Calculation Expectations
• Count in steps of 2, 3, 5 and 10 from any number forwards and backwards. • Count in fractions up to 10, using ½ and 2/4 equivalence. • Recall and use addition and subtraction facts to 20. • Know by heart which two multiples of 10 make 100. • Know by heart the multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers.	• Find 10 more or 10 less than numbers to 100. • Find a difference by calculating from the smaller to the larger number. • Re-order numbers in a calculation. • Add three 1-digit numbers by putting the largest number first and/or finding a pair totalling 10, e.g. 2 + 3 + 8 becomes (8 + 2) + 3 = 13. • Respond to problems such as: 'Tell me three numbers that add to 20'. • Work out missing number problems by using the inverse. • Bridge through numbers other than 10, e.g. 1 year = 12 months. • Partition addition calculations (into tens and ones) then recombine mentally with 2-digit numbers that total <100. • Partition bridging through multiples of 10. • Use known number facts and place value to add or subtract pairs of numbers. • Multiply or divide by 10 using place value (i.e. moving digits to the left/right to multiply/divide by 10). • Add or subtract 9, 19, 11 or 21 by rounding then adjusting, i.e. 47 + 9 = 47 + 10 – 1 = 56. • Use near doubles, 13 + 14. • Understand halving as the inverse of doubling. • Use the relationship between addition and subtraction, e.g. 7 + 6 = 13 therefore 13 – 7 = 6 and 13 – 6 = 7. • Use knowledge of number facts and place value to multiply and divide by 2, 5 and 10.	• Add or subtract a 1-digit number to or from any 2-digit number without crossing the tens boundary, e.g. 64 + 3, 69 – 5. • Add or subtract a 1-digit number to or from a multiple of 10, e.g. 70 + 6, 90 – 8. • Add or subtract any 'teens' number to or from any 2-digit number, without crossing the tens boundary, e.g. 34 + 13, 57 – 24. • Find what must be added to any 2-digit multiple of 10 to make 100. • Add or subtract 10 or a multiple of 10 to or from any 2-digit number, recognising patterns and the digit that changes. • Doubles of all numbers to at least 20. • Double any multiple of 5 to at least 50, e.g. double 45. • Halve any multiple of 10 up to 100, e.g. halve 50. • Mental addition and subtraction of two 2-digit numbers, totalling <100.

	• Use patterns of similar calculations, e.g. 13 + 6 = 19; 130 + 60 = 190.	

Stage 3:

By the end of Year 3, the majority of pupils should have achieved Stage 3.

Rapid Recall & Counting	Mental Strategies	Mental Calculation Expectations
• Count in multiples of 4, 8, 50 and 100. • Know 10 or 100 more than numbers to 1000. • Count up and down in tenths up to 10. • Know by heart the multiplication and division facts for the 3, 4 and 8 multiplication tables. • Recognise multiples of 2, 5 and 10 up to 1000. • Know all pairs of multiples of 100 with a total of 1000, e.g. 700 + 300. • Know all pairs of multiples of 5 with a total of 100, e.g. 35 + 65.	• Find a difference by calculating from the smaller to the larger number. • Re-order numbers in a calculation. • Add three or four small numbers by putting the largest number first and/or finding pairs totalling 10. • Partition into tens and ones then recombine (answers >100). • Bridge through a multiple of 10 and adjust (including 3-digit numbers, e.g. 139 + 42 = 139 + 1 + 41, 140 + 41 = 181). • Add and subtract: a 3-digit and a 1-digit number; a 3-digit number and tens; a 3-digit number and hundreds using place value. • Recognise and use inverses (add/subtract, multiply/divide, double/halve). • Add or subtract mentally a 'near multiple of 10' to or from a 2-digit number, e.g. 46 + 81 = 46 + 80 + 1. • Identify near doubles. • Use patterns of similar calculations. • Move digits one/two places to the left to multiply by 10/100. • Use knowledge of number facts and place value to multiply and divide by 2, 3, 4, 5 and 8.	• Find what must be added to any multiple of 100 to make 1000. • Add or subtract any pair of 2-digit numbers (including crossing tens boundary or 100). • Add and subtract: a 3-digit and a 1-digit number; a 3-digit number and tens; a 3-digit number and hundreds. • Subtract any 3-digit number from any 3-digit number when the difference is less than 10. • Multiply 1-digit numbers by 10 or 100. • Divide any multiple of 10 by 10.

Stage 4:

By the end of Year 4, the majority of pupils should have achieved Stage 4.

Rapid Recall & Counting	Mental Strategies	Mental Calculation Expectations
- Count in multiples of 6, 7, 9, 25 and 1000. - Say 1000 more or less than a given number. - Count up and down in hundredths. - Recall multiplication and division facts for multiplication tables up to 12 × 12. - Know decimal equivalents to 1/4, 1/2, ¾ and any number of tenths and hundredths. - Double any 2- or 3-digit number. - Halve any 2- or 3-digit number.	- Round any number to the nearest 10, 100 or 1000 using place value. - Show use of number facts and place value in mental calculation and be able to talk about them. - Bridge through 100 or 1000 (e.g. 89 + 57. 89 + 11 = 100, so 89 + 11 + 46 = 146). - Add or subtract by rounding then adjusting (e.g. 9, 19, 29, 11, 21, etc.) - Use knowledge of near doubles. - Use inverses. - Use knowledge of multiplication and division facts to find related facts (e.g. 7 x 8 = 56 therefore 70 x 8 = 560; 560 ÷ 8 = 70, etc.). - Partition to carry out multiplication, e.g. 56 x 7 = (50 x 7) + (6 x 7) = 350 + 42 = 392. - Use factor pairs. - Double 2- and 3-digit numbers.	- Find what must be added to any 2-digit number to make 100. - Add or subtract any pair of 2-digit numbers. - Find out what must be added to / subtracted from any 2- or 3-digit number to make the next multiple of 100 (e.g. 436 + ? = 500). - Subtract any 4-digit number from any 4-digit number when the difference is small (e.g. 8002 – 7991). - Multiply any 2-digit number by 10. - Divide a multiple of 100 by 10. - Multiply any 2-digit multiple of 10 by 2, 3, 4 or 5.

Stage 5:

By the end of Year 5, the majority of pupils should have achieved Stage 5.

Rapid Recall & Counting	Mental Strategies	Mental Calculation Expectations
- Count in steps of powers of 10 for any given number up to 1000000. - Round any number to 10, 100, 1000, 10000 or 100000. - Count in fractions and decimals understanding the place value of each digit (including thousandths). - Double /halve any number with up to 2 decimal places. - Recall quickly multiplication and division facts up to 12 x 12 and use them to multiply and divide pairs of multiples of 10 and 100. - Identify pairs of factors for 2-digit whole numbers. - Recall prime numbers to 19. - Recall square numbers. - Know connections between fractions, decimals and percentages.	- Use estimation in calculating (and verbalise). - Use partitioning and place value. - Add or subtract to the nearest multiple of 10, 100 or 1000, then adjust. - Use doubling and halving. - Identify near doubles. - Use factors and prime factors (e.g. 15 x 6: 15 x 3 = 45, 45 x 2 = 90). - Work out fractions using known fractions (e.g. work out sixths by halving thirds). - Use knowledge of multiplication and division facts to find related facts, e.g. 13 x 15 = (10 x 15) + (3 x 15). - Use inverses.	- Add or subtract any pair of 3-digit numbers. - Find what must be added to a decimal with ones and tenths to make the next whole number. - Add or subtract any pair of decimals (both to either 1 or 2 decimal places). - Subtract a 4-digit number just less than a multiple of 1000 from a 4-digit number just more than a multiple of 1000, e.g. 8002 – 2999. - Multiply or divide whole numbers and those involving decimals by 10, 100 and 1000. - Find 50%, 25% or 10% of a small whole number or quantity. - Calculate complements of 1 with two decimal numbers to 2 places.

Stage 6:

By the end of Year 6, the majority of pupils should have achieved Stage 6.

Rapid Recall & Counting	Mental Strategies	Mental Calculation Expectations
- Continue to count regularly: whole numbers, fractions, decimals & negative numbers. - Know by heart all the squares and square roots of numbers between 12 x 12. - Know common factors and common multiples. - Recognise and recall factors of numbers up to 100 and corresponding multiples of 100. - Use knowledge of place value and number facts to derive related facts, e.g. 0.7 x 8 = 5.6. - Know by heart tests of divisibility for multiples of 2, 3, 4, 5, 6, 9, 10 and 12.	- Consolidate all strategies from previous years. - Use partitioning and place value. - Add or subtract to the nearest multiple of 10, 100, 1000 or 10000, then adjust. - Use doubling and halving. - Identify near doubles. - Use factors and prime factors (e.g. 35 x 18 = 35 x 2 x 3 x 3). - Use knowledge of multiplication and division facts to find related facts (e.g. 17 times tables using 10 and 7 times tables). - Use inverses. - Use knowledge of fractions and decimals to calculate remainders.	- Practise mental calculations (speed and accuracy). - Perform mental calculations with mixed operations. - Multiply any 2-digit number by a 1-digit number. - Multiply any 2-digit number by 50 (x 100, then halve) or by 25 (x 100, then ÷ 4). - Multiply or divide numbers by 10, 100 and 1000 giving answers up to three decimal places. - Find squares of multiples of 10 to 100. - Find any multiple of 10% of a whole number or quantity.

Appendix B – Basic Number Facts & Multiplication Tables Programme:

All children need to have accurate and rapid recall of basic number bonds to 20 and multiplication table facts (NCETM, 2015: 2). Therefore, any pupils who have not yet become fluent in these basic facts will continue to learn the facts after the year-group stated.

Basic Number Facts in KS1

Facts	Number bonds to 20	Subtraction facts to 20	Doubles to double 10	Halves to half of 20	Addition facts to 100	Subtraction facts to 100
Year *	Y1	Y1	Y1	Y1	Y2	Y2

* The majority of children should know these facts by the end of this year-group (based on NC2014 Mathematics Programme of Study).

Times Tables Termly Planner for Y1-4

Term	Y1	Y2
Aut1	Count in multiples of 2 (link to even numbers and to support doubles)	Count in multiples of 2 and 10 (up to x12 fluently)
Aut2	Count in multiples of 10 (in order up to 120)	Count in multiples of 5 up to 60 (link to multiples of 10)
Spr1	Count in multiples of 5 up to 60 (link to multiples of 10)	Recall multiples of 2 in any order (including missing numbers and related division facts)
Spr2	Count in multiples of 2, 10 and 5(develop fluency)	Recall multiples of 10 in any order (including missing numbers and related division facts)
Sum 1	Count in multiples of 2, 10 &5 (growing fluency)	Recall multiples of 5 in any order (including missing numbers and related division facts)
Sum 2	Count in multiples of 2, 10 & 5 in order fluently	Consolidation *Ext: Count in multiples of 3 in order*

Term	Y3	Y4
Aut 1	Recall multiples of 10 in any order (including missing numbers and related division facts)	Recall multiples of 2 & 4 in any order (including missing numbers and related division facts)
Aut 2	Recall multiples of 5 in any order (including missing numbers and related division facts) Recall multiples of 2 in any order (including missing numbers and related division facts)	Recall multiples of 8 in any order Recall multiples of 3 in any order Count in multiples of 6 (link to 3x) Recall multiples of 6 in any order (including missing numbers and related division facts for 8x, 3x & 6x)
Spr 1	Count in multiples of 4 fluently (link to 2x). Recall multiples of 4 in any order (including missing numbers and related division facts)	Count in multiples of 9 (link to 10x & adjust) Recall multiples of 9 in any order (including missing numbers and related division facts) Count in multiples of 7 Recall multiples of 7 in any order (including missing numbers and related division facts)
Spr 2	Count in multiples of 8 fluently (link to 4x). Recall multiples of 8 in any order (including missing numbers and related division facts)	Count in multiples of 11 (identify Tens & Ones) Recall multiples of 11 in any order Count in multiples of 12 (link to 10x then add 2 more groups) Recall multiples of 12 in any order (including missing numbers and related division facts)
Sum 1	Count in multiples of 3 fluently. Recall multiples of 3 in any order (including missing numbers and related division facts)	Consolidation
Sum 2	Consolidation	Revision

NOTE: Y5 should be used to consolidate the recall of all times tables up to 12 x 12 and related division facts.

Basic Number Facts in Year 5 & 6 (** = be able to derive quickly)

Facts	Prime Numbers (to 19)	Composite Numbers	Prime Factors **	Square Numbers	Cube Numbers **	Common Factors	Common Multiples	Prime Numbers (>100) **
Year *	Y5	Y5	Y5	Y5	Y5	Y6	Y6	Y6

* The majority of children should know these facts by the end of this year-group (based on NC2014 Mathematics Programme of Study).