



# St Mark's Catholic Primary School



## 4 Operations and Mental Maths Strategies Progression of Skills Document

### **Intent**

Number and arithmetic are at the heart of our maths curriculum here at St. Mark's. We aim for all our children to become familiar with number in a variety of forms from an early age in order to develop confidence and understanding. Through maths games, activities and 'playing with number' our children enjoy the subject and learn key facts, which helps them in many other aspects of the subject.

### Early Years:

Developing a strong grounding in number is essential so that all children develop the necessary building blocks to excel mathematically. Children should be able to count confidently, develop a deep understanding of the numbers to 10, the relationships between them and the patterns within those numbers. 10, the relationships between them and the patterns within those numbers. By providing frequent and varied opportunities to build and apply this understanding children will develop a secure base of knowledge and vocabulary from which mastery of mathematics is built. It is important that children develop positive attitudes and interests in mathematics, look for patterns and relationships, spot connections, 'have a go', talk to adults and peers about what they notice and not be afraid to make mistakes.

### Reception Class

#### Objectives:

- Have a deep understanding of number to 10, including the composition of each number
- Subitise (recognise quantities without counting) up to 5
- Automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts.
- Verbally count beyond 20, recognising the pattern of the counting system
- Compare quantities up to 10 in different contexts, recognising when one quantity is greater than, less than or the same as the other quantity
- Explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally.

#### Strategies (Ensure all learning styles are catered for)

- Recognise numbers in a variety of forms - physically manipulate the objects to make patterns. Think of pairs, groups and common ways for numbers to be shown (eg dominoes, playing cards)
- Find one more or one less by counting on or back.
- Recognise odd and even numbers and doubles up to 10 by making pairs.
- Introduce the commutative law eg  $2 + 3 = 3 + 2$
- Count a variety of objects, including numbers beyond 20, to understand the value of each digit.
- Compare amounts, using the same or different objects.
- Learn number bonds to 5 and practice varying combinations to make these amounts.
- Begin to identify 'special friends' to 10.



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### 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 four operations, including with practical resources.

### Year 1

#### Number / 4 operations Objectives

- read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs
- represent and use number bonds and related subtraction facts within 20
- add and subtract one-digit and two-digit numbers to 20, including zero
- solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as  $7 = \_ - 9$ .
- solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

#### Mental Maths Strategies

- Commutative law - addition can be calculated in any order.
- Using the inverse operation eg  $12 - 7 = 7 + \_ = 12$
- Recognise number bonds 'special friends' - eg  $6 + \_ = 10$
- Counting in 2s, 5s and 10s.
- Bridge through 10 using partitioning eg  $8 + 9 = 9 + 1 + 7$  or  $8 + 2 + 7$



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Key Stage 1:

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Year 2

Number / 4 operations Objectives

- solve problems with addition and subtraction:
  - using concrete objects and pictorial representations, including those involving numbers, quantities and measures
  - applying their increasing knowledge of mental and written methods
- recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100
- add and subtract numbers using concrete objects, pictorial representations, and mentally, including:
  - a two-digit number and ones
  - a two-digit number and tens
  - two two-digit numbers
  - adding three one-digit numbers
- show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot
- recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.
- By the end of year 2, pupils should know the number bonds to 20 and be precise in using and understanding place value.
- recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers

- calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication ( $\times$ ), division ( $\div$ ) and equals (=) signs
- show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot
- solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts

### Mental Maths Strategies

- Use of partitioning in different ways
- Use repeated addition to solve simple multiplication, consolidating counting in 2s, 5s and 10s
- Commutative law for addition and multiplication
- Use known facts to calculate multiples of 10. Eg  $4 + 3 = 7$ , so  $40 + 30 = 70$
- Consolidate 'special friend' number bonds to 10 and number bonds to 20
- Use the inverse operation to calculate or check answers.
- Remember 'fact families' eg  $8 + 5 = 13$ ,  $13 - 5 = 8$  etc
- Bridge through 10 using larger amounts eg  $37 + 8 = 37 + 3 + 5$
- Use 'special friend' number bonds to 10 to assist when adding three 1-digit numbers eg  $7 + 4 + 6 = (4 + 6 \text{ to make } 10, \text{ then add } 7)$
- Spot patterns in number systems to help predict or check answers eg 5 x table end in 5 or 0, so  $4 \times 5$  can't be 22



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### Lower Key Stage 2:

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. Pupils should develop their ability to solve a range of problems.

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

### Year 3

#### Number / 4 Operations Objectives

- add and subtract numbers mentally, including:
  - a three-digit number and ones
  - a three-digit number and tens
  - a three-digit number and hundreds
- add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction
- estimate the answer to a calculation and use inverse operations to check answers
- solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction
- recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables
- write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods
- solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which  $n$  objects are connected to  $m$  objects.

#### Mental Maths Strategies

- Use partitioning in a variety of ways to aid addition and subtraction eg  $127 + 48 = 120 + 40 + 8 + 7$  or  $127 + 40 + 8$

- Use known multiples to work out unknown ones eg for 12 x table, use  $10x + 2x$
- Use rounding to add and subtract mentally (children should be comfortable adding 2-digit + 2-digit numbers with answers beyond 100)
- Make reasonable estimates in order to check if answers are legitimate - use rounding and knowledge of multiplying and dividing by 10 and 100 to assist.
- Practice decision making as to when to use mental or written methods to solve calculations most efficiently.
- Use of doubling and halving eg 8x table = double. Double and double again. Finding a quarter = half and half again.
- Explore commutative law eg discover the best way to calculate  $4 \times 12 \times 5$
- Explore related facts between multiplication and division eg  $15 \times 4 = 60$ .  $4 = 60 / 15$  etc.
- Solve simple problems by selecting the correct operation and calculating answers mentally.

### Written Methods

- Use column methods for addition and subtraction, up to 3 digits.
- Develop reliable written methods for multiplication and division, starting with 2-digit by 1-digit numbers.
- Use the formal written method for all four operations.



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### Lower Key Stage 2:

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. Pupils should develop their ability to solve a range of problems.

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

### Year 4

#### Number / 4 Operations Objectives

- add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate
- estimate and use inverse operations to check answers to a calculation
- solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.
- recall multiplication and division facts for multiplication tables up to  $12 \times 12$
- use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers
- recognise and use factor pairs and commutativity in mental calculations
- multiply two-digit and three-digit numbers by a one-digit number using formal written layout
- solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as  $n$  objects are connected to  $m$  objects.

#### Mental Maths Strategies

- Round numbers and estimate answers before calculating, to check they are reasonable.
- Continue to make decisions about when to use mental strategies and when to use written methods to calculate answers for all 4 operations.

- Use knowledge of multiplying by 10, 100 and 1000 to calculate answers eg  $600 \div 20 = 30$  based on  $3 \times 2 = 6$
- Use rounding and 'near multiples of 10' to estimate answers, then adjust eg  $19 \times 14$ :  $20 \times 14 = 280$ ,  $- 14 = 266$ .
- Use the inverse to check answers
- Use partitioning to assist with the distributive law eg  $26 \times 8 = (20 \times 8) + (6 \times 8) = 160 + 48 = 208$ .
- Use the associative law of multiplication to find answers most efficiently ie when you have more than two numbers to multiply, you can do this in any order eg  $3 \times 5 \times 18 = 18 \times 3 \times 5$  etc
- Solve 2-step problems by selecting the correct operation and calculating answers mentally.
- Use factor pairs to aid calculations eg  $12 \times 15 = (2 \times 6) \times 15$

### Written Methods

- Use column methods for addition and subtraction, beyond 3 digits.
- Develop reliable written methods for short multiplication and division.
- Become fluent with the use of formal written methods for all four operations.



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### Upper Key Stage 2:

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. This should develop 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. By the end of year 6, pupils should be fluent in written methods for all four operations, including long multiplication and division, and in working with fractions, decimals and percentages.

### Year 5

#### Number / 4 Operations Objectives

- add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)
- add and subtract numbers mentally with increasingly large numbers
- use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
- identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers
- know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers
- establish whether a number up to 100 is prime and recall prime numbers up to 19
- multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers
- multiply and divide numbers mentally drawing upon known facts

- divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context
- multiply and divide whole numbers and those involving decimals by 10, 100 and 1000
- recognise and use square numbers and cube numbers, and the notation for squared and cubed
- solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes
- solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign
- solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates.

### Mental Maths Strategies

- Mentally calculate additions and subtractions involving multiples of 10 and 100, using their knowledge of place value eg  $10471 + 12000 = 22471$
- Investigate and explore numbers - know and use terms including factors, multiples, prime and composite numbers, squared and cubed numbers to help with calculations and problem solving eg knowing 93 is not prime as it's in the 3x table.
- Learn to give remainders in division as fractions, using the remainder as the numerator and the original amount as denominator eg  $99 \div 7 = 14 \frac{1}{7}$
- Mentally multiply and divide by 10, 100 and 1000, including use of decimals (Do this written first, but progress to mental as they become more confident)
- Build upon use of the distributive law and introduce basic algebra to support this:  $9 \times 36 = 9(30 + 6) = (30 \times 9) + (6 \times 9)$       $a(b + c) = ab + ac$
- Understand the equals sign as equivalence and solve missing number problems mentally eg  $81 = 3 \times \underline{\quad} \times 9$
- Use rounding, partitioning, near multiples of 10 and knowledge of inverse to calculate and check answers mentally across the 4 operations.

### Written Methods

- Use column methods for addition and subtraction, with increasing large numbers to aid fluency.
- Practice and extend written methods for short multiplication and division, using all known multiplication facts confidently.
- Extend the use of formal written methods for all four operations.



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### Upper Key Stage 2:

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. This should develop 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. By the end of year 6, pupils should be fluent in written methods for all four operations, including long multiplication and division, and in working with fractions, decimals and percentages.

### Year 6

#### Number / 4 Operations Objectives

- multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- perform mental calculations, including with mixed operations and large numbers
- identify common factors, common multiples and prime numbers
- use their knowledge of the order of operations to carry out calculations involving the four operations
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
- solve problems involving addition, subtraction, multiplication and division
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.

### Mental Maths Strategies

- Consolidate fluency through rapid recall and solving mental calculations involving multiplication tables up to  $12 \times 12$ .
- Develop use of rounding to calculate answers and make estimates / check answers.
- Explore use of brackets and BODMAS to decide when to make calculations mentally and when to write them out.
- Practise finding equivalent fractions through knowledge of common factors.
- Use rounding, partitioning, near multiples of 10 and knowledge of inverse to calculate and check answers mentally across the 4 operations.

### Written Methods

- Confidently use addition, subtraction, multiplication and division for larger numbers, using the formal written methods of columnar addition and subtraction, short and long multiplication, and short and long division.