Date reviewed: September 2021
Next review: September 2022

This policy contains the key pencil and paper procedures that will be taught within our school.
It has been written to ensure consistency and progression throughout the school and reflects a whole school agreement.

Although the focus of the policy is on pencil and paper procedures it is important to recognise that the ability to calculate mentally lies at the heart of the National Curriculum for mathematics. The mental methods will be taught systematically from Foundation 2 onwards and pupils will be given regular opportunities to develop the necessary skills. However mental calculation is not at the exclusion of written recording and should be seen as complementary to and not as separate from it. In every written method there is an element of mental processing. Sharing written methods with the teacher encourages children to discuss and think about the mental strategies that underpin them and to develop new ideas. Therefore, written recording both helps children to clarify their thinking and supports and extends the development of more fluent and sophisticated mental strategies.

During their time at this school, children will be encouraged to see mathematics as both a written and spoken language. Teachers will support and guide children through the following important stages:

- developing the use of pictures and a mixture of words and symbols to represent numerical activities;
- using standard symbols and conventions;
- use of jottings to aid a mental strategy;
- use of pencil and paper procedures;

This policy concentrates on the introduction of standard symbols, the use of the empty number line as a jotting to aid mental calculation and on the introduction of pencil and paper procedures. It is important that children do not abandon jottings and mental methods once pencil and paper procedures are introduced. Therefore, children will always be encouraged to look at a calculation/problem and then decide which is the best method to choose – pictures, mental calculation (with or without jottings), or a formal written method. Our long-term aim is for children to be able to select an efficient method of their choice (whether this be mental, written or in upper Key Stage 2) that is appropriate for a given task. They will do this by always asking themselves:

- *'Can I do this mentally?'*
- *'Can I do this in my head using drawings or jottings?'*
- *'Do I need to use a pencil and paper procedure?'*

UPPER KEY STAGE 2

In upper Key Stage 2 children move on from dealing mainly with whole numbers to performing arithmetic operations with both decimals and fractions.

Manipulatives are still part of our teaching; they are used to help reinforce children's understanding. Children are taught strategies explicitly, but are encouraged to make appropriate choices for themselves based on the problems they are faced with.

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Addition and Subtraction:

Children will consolidate their use of written procedures in adding and subtracting whole numbers with up to 6 digits and also decimal numbers with up to 2 decimal places. Mental strategies for adding and subtracting increasingly large numbers will also be taught. These will draw upon children's robust understanding of place value and knowledge of number facts. Negative numbers will be added and subtracted.

Multiplication and Division:

Efficient and flexible strategies for mental multiplication and division are taught and practised, so that children can perform appropriate calculations even when the numbers are large, such as *40 000 × 6* or *40 000 ÷ 8*. In addition, it is in Years 5 and 6 that children extend their knowledge and confidence in using written algorithms for multiplication and division.

Fractions and Decimals:

Fractions and decimals are also added, subtracted, divided and multiplied, within the bounds of children's understanding of these more complicated numbers. Children will also calculate simple percentages and ratios.

Year 5 Mental Calculation (Addition)

Know number bonds to 1 and to the next whole number

Add to the next 10 from a decimal number

e.g. *13·6 + 6·4 = 20*

Add numbers with 2 significant digits only, using mental strategies

e.g. *3·4 + 4·8*

e.g. *23 000 + 47 000*

Add 1- or 2-digit multiples of 10, 100, 1000, 10 000 and 100 000

e.g. *8000 + 7000*

e.g. *600 000 + 700 000*

Add near multiples of 10, 100, 1000, 10 000 and 100 000 to other numbers

e.g. *82 472 + 30 004*

Add decimal numbers which are near multiples of 1 or 10, including money

e.g. *6·34 + 1·99*

e.g. *£34·59 + £19·95*

Use place value and number facts to add two or more 'friendly' numbers, including money and decimals

e.g. *3 + 8 + 6 + 4 + 7*

e.g. *0·6 + 0·7 + 0·4*

e.g. *2056 + 44*

Year 5 Mental Calculation (Subtraction)

Subtract numbers with 2 significant digits only, using mental strategies

e.g. *6·2 – 4·5*

e.g. *72 000 – 47 000*

Subtract 1- or 2-digit multiples of 10, 100, 1000, 10 000 and 100 000

e.g. *8000 – 3000*

e.g. *60 000 – 200 000*

Subtract 1- or 2-digit near multiples of 10, 100, 1000, 10 000 and 100 000 from other numbers

e.g. *82 472 – 30 004*

Subtract decimal numbers which are near multiples of 1 or 10, including money

e.g. *6·34 – 1·99*

e.g. *£34·59 – £19·95*

Use counting up subtraction, with knowledge of number bonds to 10, 100 or £1, as a strategy to perform mental subtraction

e.g. *£10 – £3·45*

e.g. *1000 – 782*

Recognise fraction complements to 1 and to the next whole number

e.g. *1 $^2/_5$ + $^3/_5$ = 2*

Year 5 Mental Calculation (Multiplication)

Know by heart all the multiplication facts up to 12 × 12

Multiply whole numbers and 1- and 2-place decimals by 10, 100, 1000, 10 000

Use knowledge of factors and multiples in multiplication

e.g. *43 × 6 is double 43 × 3*

e.g. *28 × 50 is $^1/_2$ of 28 × 100 = 1400*

Use knowledge of place value and rounding in mental multiplication

e.g. *67 × 199 as 67 × 200 – 67*

Use doubling and halving as a strategy in mental multiplication

e.g. *58 × 5 is half of 58 × 10*

e.g. *34 × 4 is 34 doubled twice*

Partition 2-digit numbers, including decimals, to multiply by a 1-digit number mentally

e.g. *6 × 27 as 6 × 20 (120) plus 6 × 7 (42)*

e.g. *6·3 × 7 as 6 × 7 (42) plus 0·3 × 7 (2·1)*

Double amounts of money by partitioning

e.g. *£37·45 doubled is £37 doubled (£74) plus 45p doubled (90p) giving a total of £74·90*

Year 5 Mental Calculation (Division)

Know by heart all the division facts up to 144 ÷ 12

Divide whole numbers by 10, 100, 1000, 10 000 to give whole number answers or answers with 1, 2 or 3 decimal places

Use doubling and halving as mental division strategies

e.g. *34 ÷ 5 is (34 ÷ 10) × 2*

Use knowledge of multiples and factors, as well as tests for divisibility, in mental division

e.g. *246 ÷ 6 is 123 ÷ 3*

e.g. *We know that 525 divides by 25 and by 3*

Halve amounts of money by partitioning

e.g. *$^1/_2$ of £75·40 = $^1/_2$ of £75 (£37·50) plus half of 40p (20p) which is £37·70*

Divide larger numbers mentally by subtracting the 10th or 100th multiple as appropriate

e.g. *96 ÷ 6 is 10 + 6, as 10 × 6 = 60 and 6 × 6 = 36*

e.g. *312 ÷ 3 is 100 + 4 as 100 × 3 = 300 and 4 × 3 = 12*

Know tests for divisibility by 2, 3, 4, 5, 6, 9 and 25

Know square numbers and cube numbers

Reduce fractions to their simplest form

Year 6 Mental Calculation (Addition)

Know by heart number bonds through to 100 and use these to derive related facts

    e.g. *3·46 + 0·54*

Derive, quickly and without difficulty, number bonds to 1000

Add small and large whole numbers where the use of place value or number facts makes the calculation do-able mentally

    e.g. *34 000 + 8000*

Add multiples of powers of 10 and near multiples of the same

    e.g. *6345 + 199*

Add negative numbers in a context such as temperature where the numbers make sense

Add two 1-place decimal numbers or two 2-place decimal numbers less than 1

    e.g. *4·5 + 6·3*

    e.g. *0·74 + 0·33*

Add positive numbers to negative numbers

e.g. *Calculate a rise in temperature or continue a sequence beginning with a negative number*

Year 6 Mental Calculation (Subtraction)

Use number bonds through to 100 to perform mental subtraction of any pair of integers by complementary addition

    e.g. *1000 – 654 as 46 + 300 in our heads*

Use number bonds to 1 through 10 to perform mental subtraction of any pair of 1-place or 2-place decimal numbers using complementary addition and including money

    e.g. *10 – 3·65 as 0·35 + 6*

    e.g. *£50 – £34·29 as 71p + £15*

Use number facts and place value to perform mental subtraction of large numbers or decimal numbers with up to 2 places

    e.g. *467 900 – 3005*

    e.g. *4·63 – 1·02*

Subtract multiples of powers of 10 and near multiples of the same

Subtract negative numbers in a context such as temperature where the numbers make sense

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Year 6 Mental Calculation (Multiplication)

Know by heart all the multiplication facts up to 12 × 12

Multiply whole numbers and decimals with up to 3 places by 10, 100 or 1000

    e.g. *234 × 1000 = 234 000*

    e.g. *0·23 × 1000 = 230*

Identify common factors, common multiples and prime numbers and use factors in mental multiplication

    e.g. *326 × 6 is 652 × 3 which is 1956*

Use place value and number facts in mental multiplication

    e.g. *4000 × 6 = 24 000*

    e.g. *0·03 × 6 = 0·18*

Use doubling and halving as mental multiplication strategies, including to multiply by 2, 4, 8, 5, 20, 50 and 25

    e.g. *28 × 25 is a quarter of 28 × 100 = 700*

Use rounding in mental multiplication

    e.g. *34 × 19 as (34 × 20) – 34*

Multiply 1- and 2-place decimals by numbers up to and including 10 using place value and partitioning

    e.g. *3·6 × 4 is 12 + 2·4*

    e.g. *2·53 × 3 is 6 + 1·5 + 0·09*

Double decimal numbers with up to 2 places using partitioning

e.g. *36·73 doubled is double 36 (72) plus double 0·73 (1·46)*

Year 6 Mental Calculation (Division)

Know by heart all the division facts up to 144 ÷ 12

Divide whole numbers by powers of 10 to give whole number answers or answers with up to 3 decimal places

Identify common factors, common multiples and primes numbers and use factors in mental division

    e.g. *438 ÷ 6 is 219 ÷ 3 which is 73*

Use tests for divisibility to aid mental calculation

Use doubling and halving as mental division strategies, for example to divide by 2, 4, 8, 5, 20 and 25

    e.g. *628 ÷ 8 is halved three times: 314, 157, 78·5*

Divide 1- and 2-place decimals by numbers up to and including 10 using place value

    e.g. *2·4 ÷ 6 = 0·4*

    e.g. *0·65 ÷ 5 = 0·13*

    e.g. *£6·33 ÷ 3 = £2·11*

Halve decimal numbers with up to 2 places using partitioning

    e.g. *Half of 36·86 is half of 36 (18) plus half of 0·86 (0·43)*

Know and use equivalence between simple fractions, decimals and percentages, including in different contexts

Recognise a given ratio and reduce a given ratio to its lowest terms