Shellingford CE (A) Primary School

Headteacher: Miss Judith Terrell

"Inspiring hearts and minds"

MENTAL CALCULATION POLICY

Introduction:

At Shellingford CE (A) Primary School we believe that children should be introduced to the processes of calculation through practical, oral and mental activities. As children begin to understand the underlying ideas they develop ways of recording to support their thinking and calculation methods, use particular methods that apply to special cases, and learn to interpret and use the signs and symbols involved.

Over time children learn how to use models and images, such as empty number lines, to support their mental and informal written methods of calculation. As children's mental methods are strengthened and refined, so too are their informal written methods. These methods become more efficient and succinct and lead to efficient written methods that can be used more generally. By the end of Year 6 children are equipped with **mental**, written and calculator methods that they understand and can use correctly.

When faced with a calculation, children are able to decide which method is most appropriate and have strategies to check its accuracy. At whatever stage in their learning, and whatever method is being used, it must still be underpinned by a secure and appropriate knowledge of number facts, along with those mental skills that are needed to carry out the process and judge if it was successful.

The overall aim is that when children leave Shellingford CE (A) Primary School, they:

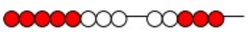
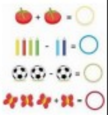
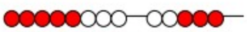
- Have a secure knowledge of number facts and a good understanding of the four operations.
- Are able to use this knowledge and understanding to carry out calculations mentally and to apply general strategies when using one-digit and two-digit numbers and particular strategies to special cases involving bigger numbers.
- Make use of diagrams and informal notes to help record steps and part answers when using mental methods that generate more information than can be kept in their heads.
- Have an efficient, reliable, compact written method of calculation for each operation that children can apply with confidence when undertaking calculations that they cannot carry out mentally.
- Use a calculator effectively, using their mental skills to monitor the process, check the steps involved and decide if the numbers displayed make sense.

The Six Rs of Oral and Mental Work

The table below identifies six features of children's mathematical learning that oral and mental work can support. There is a brief description of the learning focus and an outline of possible activities. These are not independent: oral and mental work may address more than one feature of learning and have more than one purpose. What is important is that the activity is purposeful and children understand what they are engaged in and required to learn during the oral and mental activity. The six Rs provide a vocabulary and guide to use when identifying the purposes of oral and mental work, they are not meant to provide a coverage checklist.

	Learning focus	**Possible activities**
Rehearse	To practise and consolidate existing skills, usually mental calculation skills, set in a context to involve children in problem solving through the use and application of these skills; use of vocabulary and language of number, properties of shapes or describing and reasoning.	Interpret words such as *more*, *less*, *sum*, *altogether*, *difference*, *subtract*; find missing numbers or missing angles on a straight line; say the number of days in four weeks or the number of 5p coins that make up 35p; describe part-revealed shapes, hidden solids; describe patterns or relationships; explain decisions or why something meets criteria.
Recall	To secure knowledge of facts, usually number facts; build up speed and accuracy; recall quickly names and properties of shapes, units of measure or types of charts, graphs to represent data.	Count on and back in steps of constant size; recite the 6-times table and derive associated division facts; name a shape with five sides or a solid with five flat faces; list properties of cuboids; state units of time and their relationships.
Refresh	To draw on and revisit previous learning; to assess, review and strengthen children's previously acquired knowledge and skills relevant to later learning; return to aspects of mathematics with which the children have had difficulty; draw out key points from learning.	Refresh multiplication facts or properties of shapes and associated vocabulary; find factor pairs for given multiples; return to earlier work on identifying fractional parts of given shapes; locate shapes in a grid as preparation for lesson on coordinates; refer to general cases and identify new cases.
Refine	To sharpen methods and procedures; explain strategies and solutions; extend	Find differences between two two-digit numbers, extend to three-digit numbers to
Read	To use mathematical vocabulary and interpret images, diagrams and symbols correctly; read number sentences and provide equivalents; describe and explain diagrams and features involving scales, tables or graphs; identify shapes from a list of their properties; read and interpret word problems and puzzles; create their own problems and lines of enquiry.	Tell a story using an interactive bar chart, alter the chart for children to retell the story; start with a number sentence (e.g. 2 + 11 = 13) children generate and read equivalent statements for 13; read values on scales with different intervals; read information about a shape and eliminate possible shapes; set number sentences in given contexts; read others' results and offer new questions and ideas for enquiry.
Reason	To use and apply acquired knowledge, skills and understanding; make informed choices and decisions, predict and hypothesise; use deductive reasoning to eliminate or conclude; provide examples that satisfy a condition always, sometimes or never and say why.	Sort shapes into groups and give reasons for selection; discuss why alternative methods of calculation work and when to use them; decide what calculation to do in a problem and explain the choice; deduce a solid from a 2-D picture; use fractions to express proportions; draw conclusions from given statements to solve puzzles.

EYFS

Addition	Subtraction	Multiplication	Division
Children are encouraged to gain a sense of the number system through the use of counting concrete objects.   They combine objects in practical ways and count all.  They understand addition as counting on and will count on in ones and twos using objects, cubes, bead string and number line.   They use concrete and pictorial representation to record their calculations. They begin to use + and = They are encouraged to develop a mental picture of the number system in their heads to use for calculations.  Higher attaining children may be able to represent their calculations using symbols and numbers within a written	Children are encouraged to gain a sense of the number system through the use of counting concrete objects.   They understand subtraction as counting out.  They begin to count back in ones and twos using objects, cubes, bead string and number line.   They use concrete and pictorial representation to record their calculations. They begin to use - and = They are encouraged to develop a mental picture of the number system in their heads to use for calculations. Higher attaining children may be able to represent their calculations using symbols and numbers within a written calculation.	Children use concrete objects to make and count equal groups of objects.  They will count on in twos using a bead string and number line. They understand doubling as repeated addition. 2 + 2 = 4 They use concrete and pictorial representation to record their calculations.  Higher attaining children may be able to represent their calculations using symbols and numbers within a written calculation.	Children use concrete objects to count and share equally into 2 groups. 6 cakes shared between 2 people each person gets 3 cakes. 6 ÷2 = 3   They count a set of objects and halve them by making two equal groups. They understand sharing and halving as dividing by 2. They will begin to use objects to make groups of 2 from a given amount. They use concrete and pictorial representation to record their calculations.  Higher attaining children may be able to represent their calculations using symbols and numbers within a written calculation.

Years 1-6

Addition and Subtraction

Recall: **Children should be able to derive and recall:**	**Mental calculation skills:** **Working mentally, with jottings if needed, children should be able to:**	**Mental methods or strategies:** **Children should understand when to and be able to apply these strategies:**
Year 1 number pairs with a total of numbers up to 10, then up to 20, e.g. 3 + 7 = 10, 4 + 5 = 9, 12 + 5 = 17, or what to add to a number to make numbers up to 10, then up to 20, e.g. 3 + ☐ = 10, 6 + ☐ = 13 addition facts for totals to at least 20, e.g. 2 + 3, 14 + 3 addition doubles for all numbers to at least 10, e.g. 8 + 8 one more or one less than a number	**Year 1** add or subtract a pair of single-digit numbers, e.g. 4 + 5, 8 – 3 add or subtract a single-digit number to or from a teens number, e.g. 13 + 5, 17 – 3 add or subtract a single-digit to or from 10, and add a multiple of 10 to a single-digit number, e.g. 10 + 7, 7 + 30 add near doubles, e.g. 6 + 7	**Year 1** reorder numbers when adding, e.g. put the larger number first count on or back in ones, twos or tens partition small numbers, e.g. 8 + 3 = 8 + 2 + 1 partition and combine tens and ones partition: double and adjust, e.g. 5 + 6 = 5 + 5 + 1
Year 2 addition and subtraction facts for all numbers up to at least 10, e.g. 3 + 4, 8 – 5	**Year 2** add or subtract two or three single-digit numbers, including crossing 10,	**Year 2** reorder numbers when adding, either by beginning with the largest number to support

number pairs with totals to 20 all pairs of multiples of 10 with totals up to 100, e.g. 30 + 70, or 60 + ☐ = 100 what must be added to any two-digit number to make the next multiple of 10, e.g. 52 + ☐ = 60 addition doubles for all numbers to 20, e.g. 17 + 17 and multiples of 10 to 50, e.g. 40 + 40 recall addition and subtraction facts to 20 fluently, and derive and use related facts to 100. e.g. use knowledge that 7 + 2 = 9 to derive that 27 + 2 = 29 or that 20 + 70 = 90. one or ten more or less than a given number	e.g. 5 + 8, 12 – 7, 6 + 3 +4 add any single-digit number to or from a multiple of 10, e.g. 60 + 5 subtract any single-digit number from a multiple of 10, e.g. 80 – 7 add or subtract a single-digit number to or from a two-digit number, including crossing the tens boundary, e.g. 23 + 5, 57 – 3, then 28 + 5, 52 – 7 add or subtract a multiple of 10 to or from any two-digit number, e.g. 27 + 60, 72 – 50 add or subtract two two-digit number 34 + 65, 68 – 35 add 9, 19, 29, … or 11, 21, 31, … add near doubles, e.g. 13 + 14, 39 + 40 identify and use inverse operations from a given fact	calculation, or by identifying known number facts within a calculation partition: bridge through 10 and multiples of 10 when adding and subtracting partition and combine multiples of tens and ones use knowledge of pairs making 10 partition: count on in tens and ones to find the total partition: count on or back in tens and ones to find the difference partition: add a multiple of 10 and adjust by 1 partition: double and adjust
Year 3 addition and subtraction facts for all numbers to 20, e.g. 9 + 8, 17 – 9, drawing on knowledge of inverse operations sums and differences of multiples of 10, e.g. 50 + 80, 120 – 90 pairs of two-digit numbers with a total of 100, e.g. 32 + 68, or 32 + ☐ = 100 addition doubles for multiples of 10 to 100, e.g. 90 + 90 round numbers to the nearest 10 or 100 1, 10 or 100 more or less than a given number	**Year 3** add near doubles, e.g. 18 + 16, 60 + 70, 100 + 98, 230 + 227 . add and subtract a three-digit number and ones e.g. 345 + 8, 256 - 7 add and subtract a three-digit number and tens e.g. 345 + 20, 256 -30 add and subtract a three-digit number and hundreds e.g. 345 + 300, 256 -100 add and subtract fractions with the same denominator within one whole, for example $^{5}/_{7} + {}^{1}/_{7} = {}^{6}/_{7}$	**Year 3** reorder numbers when adding identify pairs totalling 10 or multiples of 10 partition: add tens and ones separately, then recombine partition: count on in tens and ones to find the total partition: count on or back in tens and ones to find the difference partition: add or subtract 10, 20, 30 and so on and adjust partition: add or subtract 100, 200, 300 and so on and adjust partition: double and adjust partition: count on or back in minutes and hours, bridging through 60 (analogue times) estimate the answer to a calculation and use inverse

		operations to check answers
Year 4 sums and differences of pairs of multiples of 10, 100 or 1000 addition doubles of numbers 1 to 100, e.g. 38 + 38, and the corresponding halves what must be added to any three-digit number to make the next multiple of 100, e.g. 521 + ☐ = 600 pairs of fractions that total 1 rounding any number to the nearest 10, 100 or 1000 1, 10, 100 or 1000 more or less than a given number sums and differences of decimals, e.g. 6.5 + 2.7, 7.8 – 1.3 doubles and halves of decimals, e.g. half of 5.6, double 3.4 what must be added to a decimal with units and tenths to make the next whole number, e.g. 7.2 + ☐ = 8	**Year 4** add or subtract any pair of two-digit numbers, including crossing the tens and 100 boundary, e.g. 47 + 58, 91 – 35 add or subtract a near multiple of 10, e.g. 56 + 29, 86 – 38, 132 + 129 add near doubles of two-digit or three-digit numbers, e.g. 38 + 37, 145 + 147 add or subtract two-digit or three-digit multiples of 10, e.g. 120 – 40, 140 + 150, 370 – 180 add and subtract fractions with the same denominator	**Year 4** count on or back in hundreds, tens and ones partition: add tens and ones separately, then recombine partition: subtract tens and then ones, e.g. subtracting 27 by subtracting 20 then 7 subtract by counting up from the smaller to the larger number partition: add or subtract a multiple of 10 and adjust, e.g. 56 + 29 = 56 + 30 – 1, or 86 – 38 = 86 – 40 + 2 partition: double and adjust use knowledge of place value and related calculations, e.g. work out 140 + 150 = 290 using 14 + 15 = 29 partition: count on or back in minutes and hours, bridging through 60 (analogue and digital times) Estimate and use inverse operations to check answers to calculations
Year 5 that must be added to any four-digit number to make the next multiple of 1000, e.g. 4087 + ☐ = 5000 round any number up to 1000000 to the nearest 10, 100, 1000, 10000 and 100000 round decimals with two decimal places to the nearest whole number and one decimal place	**Year 5** add or subtract a pair of two-digit numbers or three-digit multiples of 10, e.g. 38 + 86, 620 – 380, 350+ 360 add or subtract a near multiple of 10 or 100 to any two-digit or three-digit number, e.g. 235 + 198 find the difference between near multiples of 100, e.g. 607 – 588, or of 1000, e.g. 6070 – 4087 add or subtract any pairs of decimal fractions each with units and tenths, e.g. 5.7 + 2.5, 6.3 – 4.8 add and subtract numbers mentally with increasingly large numbers	**Year 5** count on or back in hundreds, tens, ones and tenths partition: add hundreds, tens or ones separately, then recombine subtract by counting up from the smaller to the larger number add or subtract a multiple of 10 or 100 and adjust partition: double and adjust use knowledge of place value and related calculations, e.g. 6.3 – 4.8 using 63 – 48 partition: count on or back in minutes and hours, bridging through 60 (analogue and digital times)

	convert mixed numbers and improper fractions from one form to another	use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
Year 6 addition and subtraction facts for multiples of 10 to 1000 and decimal numbers with one decimal place, e.g. 650 + ☐ = 930, ☐ – 1.4 = 2.5 what must be added to a decimal with units, tenths and hundredths to make the next whole number, e.g. 7.26 + ☐ = 8 round any whole number to a required degree of accuracy	**Year 6** add or subtract pairs of decimals with~~,~~ tenths or hundredths, e.g. 0.7 + 3.38 find doubles of decimals each with ones and tenths and hundredths e.g. 1.61 + 1.61 add near doubles of decimals, e.g. 2.59 + 2.62	**Year 6** count on or back in hundreds, tens, ones, tenths and hundredths use knowledge of place value and related calculations, e.g. 680 + 430, 6.8 + 4.3, 0.68 + 0.43 can all be worked out using the related calculation 68 + 43 use knowledge of place value and of doubles of ~~two-digit~~ whole numbers partition: double and adjust partition: add or subtract a whole number and adjust, e.g. 4.3 + 2.9 = 4.3 + 3 – 0.1, 6.5 – 3.8 = 6.5 – 4 + 0.2 partition: count on or back in minutes and hours, bridging through 60 (analogue and digital times, 12-hour and 24-hour clock) use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy

Multiplication and Division

Recall: **Children should be able to derive and recall:**	**Mental calculation skills:** **Working mentally, with jottings if needed, children should be able to:**	**Mental methods or strategies:** **Children should understand when to and be able to apply these strategies:**
Year 1 doubles of all numbers to 10, e.g. double 6 odd and even numbers to 20	**Year 1** count on from and back to zero in ones, twos, fives or tens	**Year 1** use patterns of last digits, e.g. 0 and 5 when counting in fives
Year 2 doubles of all numbers to 20, e.g. double 13, and corresponding halves doubles of multiples of 10 to 50, e.g. double 40, and	**Year 2** count in steps of 2, 3 and 5 from and back to zero, and in tens from any number forward and backward double any multiple of 5 up to	**Year 2** partition: double the tens and ones separately, then recombine • use knowledge that halving is the inverse of doubling and that doubling is equivalent to

corresponding halves multiplication facts for the 2, 5 and 10 times-tables, and corresponding division facts odd and even numbers to 100	50, e.g. double 35 halve any multiple of 10 up to 100, e.g. halve 90 find half of even numbers to 40 find the total number of objects when they are organised into groups of 2, 5 or 10 find remainders	multiplying by two use knowledge of multiplication facts from the 2, 5 and 10 times-tables, e.g. recognise that there are 15 objects altogether because there are three groups of five
Year 3 multiplication facts for the 2, 3, 4, 5, 8 and 10 times-tables, and corresponding division facts doubles of multiples of 10 to 100, e.g. double 90, and corresponding halves calculate statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers. fraction and decimal equivalents of one-half, quarters, and tenths, e.g. $^{3}/_{10}$ is 0.3	**Year 3** double any multiple of 5 up to 100, e.g. double 35 halve any multiple of 10 up to 200, e.g. halve 170 multiply one-digit or two-digit numbers by 10 or 100, e.g. 7 × 100, 46 × 10, 54 x 100 find unit and non-unit fractions of numbers and quantities involving fractions with small denominators find remainders that arise from division	**Year 3** partition: when doubling, double the tens and ones separately, then recombine • partition: when halving, halve the tens and ones separately, then recombine • use knowledge that halving and doubling are inverse operations • recognise that finding a unit fraction is equivalent to dividing by the denominator and use knowledge of division facts Recognise that the numerator acts as a multiplier when finding a non-unit fraction recognise that when multiplying by 10 the digits move one or two places to the left and zero is used as a place holder
Year 4 multiplication facts to 12 x 12 and the corresponding division facts doubles of numbers 1 to 100, e.g. double 58, and corresponding halves doubles of multiples of 10 and 100 and corresponding halves fraction and decimal equivalents of one-half, quarters, tenths and hundredths, e.g. $^{3}/_{10}$ is 0.3 and $^{3}/_{100}$ is 0.03 rounding any number to the nearest 10, 100 or 1000	**Year 4** double any two-digit number, e.g. double 39 double any multiple of 10 or 100, e.g. double 340, double 800, and halve the corresponding multiples of 10 and 100 halve any even number to 200 find unit fractions and simple non-unit fractions of numbers and quantities, e.g. 38 of 24 multiply and divide numbers to 1000 by 10 and then 100 (whole-number answers), e.g. 325 × 10, 42 × 100, 120 ÷ 10, 600 ÷ 100, 850 ÷ 10 multiply a multiple of 10 to 100 by a single-digit number, e.g. 40 × 3	**Year 4** P partition: double or halve the tens and ones separately, then recombine • use understanding that when a number is multiplied or divided by 10 or 100, its digits move one or two places to the left or the right and zero is used as a place holder • use knowledge of multiplication facts and place value, e.g. 7 x 8 = 56 to find 70 x 8, 7 x 80 use partitioning and the distributive law to multiply, e.g.13 × 4 = (10 + 3) × 4 = (10 × 4) + (3 × 4) = 40 + 12 = 52

	multiply numbers to 20 by a single-digit, e.g. 17 × 3 identify the remainder when dividing ~~by 2, 5 or 10~~	
Year 5 squares to 12 x 12 and cubes of small numbers division facts corresponding to tables up to 10 × 10, and the related unit fractions, e.g. 7 × 9 = 63 so one-ninth of 63 is 7 and one-seventh of 63 is 9 percentage equivalents of one-half, one-quarter, three-quarters, tenths and hundredths factor pairs to 100 common factors of two numbers round any number up to 1000000 to the nearest 10, 100, 1000, 10000 and 100000 round decimals with two decimal places to the nearest whole number and one decimal place multiply and divide whole numbers and those involving decimals by 10, 100 and 1000 prime numbers to 19 and how to identify other prime numbers to 100	**Year 5** find cubed numbers multiply and divide two-digit numbers by 4 or 8, e.g. 26 × 4, 96 ÷ 8 multiply two-digit numbers by 5 or 20, e.g. 320 × 5, 14 × 20 multiply by 25 or 50, e.g. 48 × 25, 32 × 50 double three-digit multiples of 10 to 500, e.g. 380 × 2, and find the corresponding halves, e.g. 760 ÷ 2 find the remainder after dividing a two-digit number by a single-digit number, e.g. 27 ÷ 4 = 6 r 3 multiply and divide whole numbers and decimals by 10, 100 or 1000, e.g. 4.3 × 10, 0.75 × 100, 25 ÷ 10, 673 ÷ 100, 74 ÷ 100 multiply pairs of multiples of 10, e.g. 60 × 30, and a multiple of 100 by a single digit number, e.g. 900 × 8 divide a multiple of 10 by a single-digit number (whole number answers) e.g. 80 ÷ 4, 270 ÷ 3 find fractions of whole numbers or quantities, e.g. 23 of 27, 45 of 70 kg find 50%, 25% or 10% of whole numbers or quantities, e.g. 25% of 20 kg, 10% of £80 find factor pairs for numbers to 100, e.g. 30 has the factor pairs 1 × 30, 2 × 15, 3 × 10 and 5 × 6	**Year 5** multiply or divide by 4 or 8 by repeated doubling or halving • form an equivalent calculation, e.g. to multiply by 5, multiply by 10, then halve; to multiply by 20, double, then multiply by 10 • use knowledge of doubles/halves and understanding of place value, e.g. when multiplying by 50 multiply by 100 and divide by 2 • use knowledge of division facts, e.g. when carrying out a division to find a remainder • use understanding that when a number is multiplied or divided by 10 or 100, its digits move one or two places to the left or the right relative to the decimal point, and zero is used as a place holder • use knowledge of multiplication and division facts and understanding of place value, e.g. when calculating with multiples of 10 • use knowledge of equivalence between fractions and percentages, e.g. to find 50%, 25% and 10% use knowledge of multiplication and division facts to find factor pairs
Year 6 squares to 12 x 12 and cubes to 12 x 12 x 12 squares of the corresponding	**Year 6** find squared and cubed numbers	**Year 6** partition: use partitioning and the distributive law to divide tens and ones separately, e.g.92 ÷ 4 = (80 + 12) ÷ 4 = 20

multiples of 10 prime numbers less than 100 equivalent fractions, decimals and percentages for hundredths, e.g. 35% is equivalent to 0.35 or 35100 round any whole number to a required degree of accuracy	multiply pairs of two-digit and single-digit numbers, e.g. 28 × 3 divide a two-digit number by a single-digit number, e.g. 68 ÷ 4 divide by 25 or 50, e.g. 480 ÷ 25, 3200 ÷ 50 double decimals with units and tenths, e.g. double 7.6, and find the corresponding halves, e.g. half of 15.2 multiply pairs of multiples of 10 and 100, e.g. 50 × 30, 600 × 20 divide multiples of 100 by a multiple of 10 or 100 (whole number answers), e.g. 600 ÷ 20, 800 ÷ 400, 2100 ÷ 300 multiply and divide two-digit decimals such as 0.8 × 7, 4.8 ÷ 6 find 10% or multiples of 10%, of whole numbers and quantities, e.g. 30% of 50 ml, 40% of £30, 70% of 200 g simplify fractions by cancelling scale up and down using known facts, e.g. given that three oranges cost 24p, find the cost of four oranges identify numbers with odd and even numbers of factors and no factor pairs other than 1 and themselves use scale factors to increase or decrease quantities identify missing values where the relative sizes of missing values can be found by using integer multiplication and division	+ 3 = 23 • form an equivalent calculation, e.g. to divide by 25, divide by 100, then multiply by 4; to divide by 50, divide by 100, then double • use knowledge of the equivalence between fractions and percentages and the relationship between fractions and division • recognise how to scale up or down using multiplication and division, e.g. if three oranges cost 24p:one orange costs 24 ÷ 3 = 8p four oranges cost 8 × 4 = 32p Use knowledge of multiplication and division facts to identify factor pairs and numbers with only two factors

Written by: Jane Merritt (Mathematics Subject Leader)

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Policy Agreed by the Governing Body on ……………………………………………………

Signed ………………………………………………… **Chair of Governing Body**

Signed .... Headteacher