Blacko Primary School

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MATHEMATICS CALCULATION POLICY

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POLICY

NUMBERS - COUNTING

Numbers seem simple but actually are exceedingly complex. There are three different aspects, each of which is highly relevant to how we teach young children.

1. *Numbers as names*
When we give buses a number, we are effectively naming them. The number 3 bus is not called '3' because it is third in a line or because it goes to three places. Here, numbers are being used as names. House numbers, car numbers and many others are identifiers, in the same way as names are. We could call our cars Fred, Annie, Parvati, Sunil, Harry, etc. but we choose to use numbers instead.

Chanting the numbers in order, first to 20 and then on to 100, is an essential pre-requisite for all arithmetic. Great emphasis should be laid on the ability to count to 100 in company with the rest of the class, as without this skill, children's capacity to manipulate numbers is likely to suffer. We help children to recognise the numbers, starting with those up to 10 and 20, distinguish each numeral and identify numbered houses, etc. especially their own.

2. *Numbers as the 'how-many-ness' of a set (Cardinality)*
Children come to understand that we can count to establish how many are in a set. We find out how many objects, images, sounds or actions by counting.

(i) One-to-one correspondence – children need to practise counting when they touch or move each object. This ensures that they match a spoken number to an object each time. The correct number in the set is established by the final number in the count.

(ii) Conservation of number – children need to realise that number does not depend on arrangement. So if we count the number of cups on a tray and establish that there are six, then when we move the cups around the tray children should see that there is no need to re-count them; there are still six cups.

(iii) Children understand zero (0) as the empty set, and also begin to understand that it can mean 'no 1s' in numbers such as 20 and 30.

3. *Numbers as places in a line or sequence (Ordinality)*
Seeing numbers pegged on a washing line, or as tiles making up a number track along the floor, allows children to appreciate the ordinal aspect of numbers. Understanding that numbers form a sequence and knowing that '4' comes between '3' and '5' on the number line, are as important as being able to count four things.

The number line (numbers represented visually in an ordered sequence) is arguably the most important model that we give primary children. On their mathematical journey, the image of the number line will be developed through the use of the bead-bar and beaded line, the landmarked line and on to the use of empty number lines, and zoomed sections. So the pegged number line is an essential part of every nursery and reception classroom, and children's attention should be drawn to it on a daily basis. *Which number has gone walkabout? Which two numbers has 'naughty puppet' muddled up?*

All the above forms of counting are important. Children are taught to:

- Chant the numbers in order so that they can 'count' from 1 to 20 with total confidence and many can count from 1 to 100
- Establish how many there are in a set by counting, making one-to-one correspondence, and understanding conservation of number
- Identify and place numbers on a line, compare numbers saying which is larger or smaller and order a set of numbers.

Positive Relationships: what adults can do

30-40 months	40-60 months
• Use number language, e.g. 'one', 'two', 'three', 'lots', 'fewer', 'hundreds', 'how many?' and 'count' in a variety of situations. • Support children's developing understanding of abstraction by counting things that are not objects, such as hops, jumps, clicks or claps. • Model counting of objects in a random layout, showing the result is always the same as long as each object is only counted once. • Model and encourage use of mathematical language, e.g. asking questions such as, 'How many saucepans will fit on the shelf?' • Use pictures and objects to illustrate counting songs, rhymes and number stories.	• Encourage estimation, e.g. how many sandwiches are needed for the picnic. • Encourage use of mathematical language, e.g. number names to ten: *'Have you got enough to give me three?'* • Add numerals to all areas of learning and development, e.g. to a display of a favourite story, such as *The Three Billy Goats Gruff*. • Emphasise the empty set and introduce the concept of nothing or zero. • Make books about numbers that have meaning for the child such as favourite numbers, birth dates or telephone numbers. • Show interest in how children solve problems and value their different solutions. • Make sure children are secure about the order of numbers before asking what comes after or before each number. • Use mathematical vocabulary and demonstrate methods of recording, using standard notation where appropriate. • Give children who are learning English as additional language opportunities to work in their home language, to ensure accurate understanding of concepts.

NUMBERS – ADDITION AND SUBTRACTION

Addition has two aspects and both need to be developed in parallel.

1. Adding as counting on

Children need to understand that adding involves increase. Thus, although children may combine two sets by counting all of the objects, we need to progress to adding two sets by starting with the larger and counting on by the smaller, e.g. we start with five ducks on the pond and add three ducks by counting each one as they swim in – start with five, then six, seven, eight. We now have eight.

The essential pre-requisite for addition is being able to say the 'next number' *without counting from one*. So, if we say 'six', it is crucial that the child can respond 'seven' without having to begin at one and count up. Saying the number one more than any number up to first 10, and then 20, is a key skill for Reception children as their subsequent work in addition hangs on it.

We start recording additions using a number sentence with + and =. It is exceptionally important that children encounter and, with the teacher and peers, read these sentences aloud, and it is less important that they are able to write them. Laying out addition sentences using magnetic numbers/symbols on whiteboards is very useful and helps avoid the need for good hand-to-eye coordination. Lack of this could hold up mathematical development.

Once children can say the next number, they can count on small amounts. Additions such as 5 + 2 and 8 + 3 become possible, using fingers as markers in the count. We start with 8, putting it in our heads, and count on using one finger for each number spoken: 9, 10, 11.

2. Adding as splitting sets: number bonds

Knowing that 5 can be split into 4 and 1, into 3 and 2 and even into 5 and 0, is the basis for this aspect of addition. We do not want children to have to count on to add 3 and 2 more, any more than we want them to count five things; they should subitise, i.e. recognise that there are five without counting (see Number). Subitising is the basis for number bonds.

Teaching children that 5 can be split into 5 + 0, 4 + 1 and 3 + 2, that 6 can be split into 6 + 0, 5 + 1, 4 + 2 and 3 + 3, etc. is essential in Reception. Using strings of four, five or six beads, which children can fiddle with, four, five or six pegs on a hanger and four, five or six cubes in a tower, means that children can play with these sets and kinaesthetically absorb the relevant number bonds (pairs of numbers that make 4, 5 and 6), and begin to learn the bonds for 7, 8 and 9.

Children need to see adults recording these additions using number sentences, preferably arranged so as to make the patterns clear:
0 + 5 = 5
1 + 4 = 5
2 + 3 = 5
Bonds to 10 are essential for the development of numerical fluency, and these are started in Reception. Children at this early stage are highly receptive and will absorb these crucial pairs. If the number bonds for ten are chanted, modelled on fingers, with pegs on hangers and using bead strings, on a weekly basis, there will not be a 5-year old child who does not know them off by heart – a really good predictor for later fluency.

Subtraction has three aspects. Two of these should be developed in parallel, and one is touched on in Reception, but not really developed until Y1.

1. Subtraction as counting back or taking away

This is perhaps the most intuitive aspect of subtraction. Children can establish how many in a set and then count back as one, two or three objects are removed. This is recorded using the '–' sign. There are six apricots on a plate, we eat two, how many are left?

Teacher records as 6 – 2 = 4 and reads this with the children as six take away two leaves four or six subtract two equals four. It is important to read the – sign as 'take away', and also as 'count back' and as 'subtract'.

As children progress, they are introduced to the notion that we can model this 'taking away' on the number line. We point at six and count back two to reach four. 6 – 2 = 4. Tiger Ted is on 9 on our number track. If we count on two, we reach 11. This models adding two more. If we count back two, we reach 7. This models taking away two.

2*. Subtraction as number bonds*

Just as addition must be related to splitting a number into two sets, 5 is 2 and 3 or 4 and 1, so subtraction needs to be seen as the inverse of this.

5 = 3 + 2

5 – 2 = 3

The easiest and quickest way of showing this is on fingers. Show five fingers, two on one hand and three on the other. Say the addition together. Three add two is five. Fold down the two fingers. Say the subtraction together. Five subtract two is three. Repeat, holding up all five fingers and saying the addition again. Then fold down three fingers and say the subtraction. Five subtract three is two.

3*. Subtraction as difference*

This aspect of subtraction will prove to be the most important for achieving numerical fluency by Year 3, when children will perform many subtractions by counting up. However, in Reception, we do not expect children to use counting up to subtract, even at a simple level.

However, we do want to draw upon the notion of difference since this is a very familiar concept for small children and one which resonates with their own experience. If Tyler has five strawberries and Cindy has three, it will be clear to both children that Tyler has more. And they will often be able to tell you how many more. So we draw upon children's experience of difference and use the language of 'how many more?' and 'what is the difference?' as we record these situations.

Tyler has 5; Cindy has 3; Tyler has two more than Cindy.

It is the vocabulary of difference that we are developing here, and this is especially helpful in the context of measures. The pencil is six cubes long. The crayon is four cubes long. The pencil is two cubes longer. However, this is not recorded as a formal subtraction at this early stage.

Positive Relationships: what adults can do

30-40 months	40-60 months
• Use number language, e.g. 'one', 'two', 'three', 'lots', 'fewer', 'hundreds', 'how many?' and 'count' in a variety of situations. • Model and encourage use of mathematical language, e.g. asking questions such as 'How many saucepans will fit on the shelf?' • As you read number stories or rhymes, ask e.g. *'When one more frog jumps in, how many will there be in the pool altogether?'* • Use pictures and objects to illustrate counting songs, rhymes and number stories. • Encourage children to use mark-making to support their thinking about numbers and simple problems. • Talk with children about the strategies they are using, e.g. to work out a solution to a simple problem by using fingers or counting aloud.	• Encourage estimation e.g. how many sandwiches are needed for the picnic. • Encourage use of mathematical language, e.g. number names to ten: *'Have you got enough to give me three?'* • Ensure that children are involved in making displays, e.g. making their own pictograms of lunch choices. Develop this as a 3D representation using bricks and discuss the most popular choices. • Use rhymes, songs and stories involving counting on and counting back in 1s, 2s, 5s and 10s. • Emphasise the empty set and introduce the concept of nothing or zero. • Show interest in how children solve problems and value their different solutions. • Discuss with children how problems relate to others they have met, and their different solutions. • Talk about the methods children use to answer a problem they have posed, e.g. 'Get one more, and then we will both have two.' • Encourage children to make up story problems for other children to solve. • Use mathematical vocabulary and demonstrate methods of recording, using standard notation where appropriate. • Give children who are learning English as additional language opportunities to work in their home language, to ensure accurate understanding of concepts.

NUMBERS – MULTIPLICATION AND DIVISION

Multiplication is introduced in Reception as 'clever counting' and also as doubling.
Division relates to halving and sharing into two or four sets.

1. Clever Counting
Once children are confident at counting from 1 to 20 individually, and from 1 to 100 as part of a larger group, they will start counting in 2s, 5s and 10s.
Counting in 2s helps children to develop the concept of even and odd numbers, and is also an essential pre-requisite for doubling and halving. We like children to start by doing 'whisper' counting where they say every number, but the even numbers are whispered. One, *two*, three, *four*, five, *six*… etc. They can then progress to just saying the whispered numbers: two, four, six, etc. This chant, in 2s, to 20 is learned by heart.
Counting in 5s comes a little later and is, again, an easy chant to learn. We match this to hands, showing that five, ten, fifteen, twenty can be shown by holding up one, two, three, four hands.
Counting in 10s is not only useful as a precursor for the 10× table, but really helps children to distinguish the -ty numbers from the -teen numbers, e.g. thir**ty** from thir**teen**. We call the multiples of ten the 'cuppa tea' numbers to emphasis the ending.

2. Doubling
Children can start by doubling the numbers 1 to 5 using the fingers of both hands. The 'one and one is two, two and two is four', etc. chant, where thumbs on both hands are held up, then finger and thumb, then three digits, etc. is an excellent way of helping children really learn these doubles. Creating doubles using cubes and beads and other mathematical equipment helps to reinforce the fact that a double is a number multiplied by 2; there are two 5s in double 5.

3. Division as sharing
Once children understand their doubles, it is a natural progression to create the matching halves. *Double two is four and half of four is two*. We can then demonstrate that some numbers of cubes can be halved (even numbers) and some can't (odd numbers). It is important to emphasise that if we are talking about cakes or biscuits, odd numbers can be halved, i.e. we can share three cakes fairly – we get 1½ each! Children need to understand that we can find half of small odd numbers, as well as knowing the halves of the even numbers up to 10.

Once children are very familiar with the concept of halving, we can model sharing small multiples of four into quarters. So, for example, eight toy cars may be fairly shared amongst four children. Or a large cake may be cut into quarters.

It is important to emphasise that we are only expecting Reception children to get to grips with one aspect of division – that aspect of 'sharing' which is related to fractions. We are not demonstrating the arguably more important aspect of division as the inverse of multiplication – namely grouping. Four groups of five make twenty (4 × 5 = 20). How many groups of five in 20? Children will be introduced to formal multiplication in Year 1 and division as grouping is taught mainly in Year 2.

Positive Relationships: what adults can do	
30-40 months	**40-60 months**

• Model and encourage use of mathematical language, e.g. asking questions such as 'How many saucepans will fit on the shelf?' • Help children to understand that one thing can be shared by a number of pieces, e.g. a pizza. • Use pictures and objects to illustrate counting songs, rhymes and number stories. • Talk with children about the strategies they are using, e.g. to work out a solution to a simple problem by using fingers or counting aloud.	• Encourage use of mathematical language, e.g. number names to ten: *'Have you got enough to give me three?'* • Ensure that children are involved in making displays, e.g. making their own pictograms of lunch choices. Develop this as a 3D representation using bricks and discuss the most popular choices. • Use rhymes, songs and stories involving counting on and counting back in 1s, 2s, 5s and 10s. • Discuss with children how problems relate to others they have met, and their different solutions. • Talk about the methods children use to answer a problem they have posed, e.g. *'Get one more, and then we will both have two.'* • Encourage children to make up their own story problems for other children to solve. • Encourage children to extend problems, e.g. *'Suppose there were three people to share the bricks between instead of two'.* • Use mathematical vocabulary and demonstrate methods of recording, using standard notation where appropriate. • Give children who are learning English as additional language opportunities to work in their home language, to ensure accurate understanding of concepts.

SHAPE, SPACE AND MEASURE

Shape
Children are introduced to a variety of 2D and 3D shapes. They explore their properties, and develop the use of specific vocabulary to describe these. Using words such as 'corners, sides, straight, curved, flat, roll, surface' as well as the names of common 2D and 3D shapes, children can identify, talk about and describe these in the world around them.

Children learn the difference between 2D and 3D shapes; they construct 3D shapes using a wide variety of construction materials, and then describe the 2D shapes they see on the faces of 3D shapes. They use these in activities such as printing.

A wide variety of shapes will be drawn upon, following children's own experiences, but in particular children will name and discuss rectangles, including squares and oblongs, circles, triangles, cubes, cuboids, spheres, cones and pyramids.

Children begin to appreciate symmetry, and create and identify symmetrical patterns.

Space
Children are introduced to the language of position and direction. They identify forward and backward, and begin to learn left and right. Words such as up, down, below, above, inside and outside start to become familiar and children are encouraged to describe where objects are in relation to others. They indicate direction, both by gesture and vocabulary, and are encouraged to use increasingly more specific terminology, such as behind, in front of, beside, next to.

Measure
Children begin to see that we can find out how long or wide or tall things are, either by comparing them directly, or by measuring them using uniform non-standard units. They will measure their own height in crayons and see that Jimmy is taller than they are because more crayons fit along his length. In this way, they can compare two or three items.

This progression, from direct comparison to the use of a non-standard uniform unit to measure and compare, is used in the development of children's understanding of mass and capacity. Children first compare directly, pouring a teapot into a jug and vice versa, and balancing a shoe against a small book. They then measure, weighing the shoe and the book in marbles, and counting how many cups of tea the teapot will pour for our dolls' picnic.

Children begin to understand that we can tell the time and that we speak of time in relation to days and nights (how many sleeps?) and in relation to longer time spans: weeks, months and years. They compare lengths of time, talking of longer and shorter time spans. They sequence familiar events, and begin to relate these to o'clock times on a daily schedule, understanding that they can measure short periods of time using egg timers, sun dials and water clocks as well as digital and analogue clocks.

Children learn to identify coins and begin to use these to create small amounts. Through playing shops and other experiences, including visiting real shops, children learn the processes of buying, paying and giving change. They become more proficient at coin recognition and are able to say which coins are higher value and will buy more.

Pattern
Children create and re-create patterns. They use a wide variety of objects, images and actions or sounds. They become proficient at pattern recognition and are able to use their skills of identifying patterns in relation to their work in number.

Positive Relationships: what adults can do

30-40 months	40-60 months
• Demonstrate the language for shape, position and measures in discussions, e.g. *'sphere', 'shape', 'box', 'in', 'on', 'inside', 'under', 'long', 'longer', 'longest', 'short', 'shorter', 'shortest', 'heavy', 'light', 'full' and 'empty'*. • Find out and use equivalent terms for these in home languages. • Encourage children to talk about the shapes they see and use and how they are arranged and used in constructions. • Value children's constructions, e.g. helping to display them or taking photographs of them.	• Ask 'silly' questions, e.g. show a tiny box and ask if there is a bicycle in it. • Play peek-a-boo, revealing shapes a little at a time and at different angles, asking children to say what they think the shape is, what else it could be or what it could not be. • Be a robot and ask children to give you instructions to get somewhere. Let them be the robot and you instruct them. • Introduce children to the use of mathematical names for 'solid' 3D shapes and 'flat' 2D shapes, and the mathematical terms to describe shapes. • Encourage children to use everyday words to describe position, e.g. when following pathways or playing with outdoor apparatus.

KEY STAGE 1		
Children in Years 1 and 2 will be given a really solid foundation in the basic building blocks of mental and written arithmetic. Through being taught place value, children will develop an understanding of how numbers work, so that they are confident with 2-digit numbers and beginning to read and say numbers above 100.		
Addition and Subtraction: A focus on number bonds, first via practical hands-on experiences and subsequently using memorisation techniques, enables a good grounding in these crucial facts, and ensures that all children leave Year 2 knowing the pairs of numbers which make all the numbers up to 10 at least. Children will also have experienced and been taught pairs to 20. Children's knowledge of number facts enables them to add several 1-digit numbers, and to add/subtract a 1-digit number to/from a 2-digit number. Another important conceptual tool is the ability to add/subtract 1 or 10, and to understand which digit changes and why. This understanding is extended to enable children to add and subtract multiples of 10 to and from any 2-digit number. The most important application of this knowledge is the ability to add or subtract any pair of 2-digit numbers by counting on or back in 10s and 1s. Children may extend this to adding by partitioning numbers into 10s and 1s.	**Multiplication and Division:** Children will be taught to count in 2s, 3s, 5s and 10s, and will relate this skill to repeated addition. Children will meet and begin to learn the associated ×2, ×3, ×5 and ×10 tables. Engaging in a practical way with the concept of repeated addition and the use of arrays enables children to develop a preliminary understanding of multiplication, and asking them to consider how many groups of a given number make a total will introduce them to the idea of division. Children will also be taught to double and halve numbers, and will thus experience scaling up or down as a further aspect of multiplication and division.	**Fractions:** Fractions will be introduced as numbers and as operators, specifically in relation to halves, quarters and thirds.

Year 1			
	Mental calculation	**Written calculation**	**Default for ALL children**
Y1 +	Number bonds ('story' of 5, 6, 7, 8, 9 and 10) Count on in 1s from a given 2-digit number Add two 1-digit numbers Add three 1-digit numbers, spotting doubles or pairs to 10 Count on in 10s from any given 2-digit number Add 10 to any given 2-digit number Use number facts to add 1-digit numbers to 2-digit numbers e.g. *Use 4 + 3 to work out 24 + 3, 34 + 3* Add by putting the larger number first		Pairs with a total of 10 Count in 1s Count in 10s Count on 1 from any given 2-digit number
Y1 –	Number bonds ('story' of 5, 6, 7, 8, 9 and 10) Count back in 1s from a given 2-digit number Subtract one 1-digit number from another Count back in 10s from any given 2-digit number Subtract 10 from any given 2-digit number Use number facts to subtract 1-digit numbers from 2-digit numbers e.g. *Use 7 – 2 to work out 27 – 2, 37 – 2*		Pairs with a total of 10 Count back in 1s from 20 to 0 Count back in 10s from 100 to 0 Count back 1 from any given 2-digit number

Y1 ***×***	Begin to count in 2s, 5s and 10s Begin to say what three 5s are by counting in 5s, or what four 2s are by counting in 2s, etc. Double numbers to 10		Begin to count in 2s and 10s Double numbers to 5 using fingers
Y1 ***÷***	Begin to count in 2s, 5s and 10s Find half of even numbers to 12 and know it is hard to halve odd numbers Find half of even numbers by sharing Begin to use visual and concrete arrays or 'sets of' to find how many sets of a small number make a larger number		Begin to count in 2s and 10s Find half of even numbers by sharing

Year 2			
	Mental calculation	**Written calculation**	**Default for ALL children**
Y2 +	Number bonds – know all the pairs of numbers which make all the numbers to 12, and pairs with a total of 20 Count on in 1s and 10s from any given 2-digit number Add two or three 1-digit numbers Add a 1-digit number to any 2-digit number using number facts, including bridging multiples of 10 e.g. *45 + 4* e.g. *38 + 7* Add 10 and small multiples of 10 to any given 2-digit number Add any pair of 2-digit numbers		Know pairs of numbers which make each total up to 10 Add two 1-digit numbers Add a 1-digit number to a 2-digit number by counting on in 1s Add 10 and small multiples of 10 to a 2-digit number by counting on in 10s
Y2 –	Number bonds – know all the pairs of numbers which make all the numbers to 12 Count back in 1s and 10s from any given 2-digit number Subtract a 1-digit number from any 2-digit number using number facts, including bridging multiples of 10 e.g. *56 – 3* e.g. *53 – 5* Subtract 10 and small multiples of 10 from any given 2-digit number Subtract any pair of 2-digit numbers by counting back in 10s and 1s or by counting up		Know pairs of numbers which make each total up to 10 Subtract a 1-digit number from a 2-digit number by counting back in 1s Subtract 10 and small multiples of 10 from a 2-digit number by counting back in 10s

Y2 ***×***	Count in 2s, 5s and 10s Begin to count in 3s Begin to understand that multiplication is repeated addition and to use arrays e.g. *3 × 4 is three rows of 4 dots* Begin to learn the ×2, ×3, ×5 and ×10 tables, seeing these as 'lots of' e.g. *5 lots of 2, 6 lots of 2, 7 lots of 2* Double numbers up to 20 Begin to double multiples of 5 to 100 Begin to double 2-digit numbers less than 50 with 1s digits of 1, 2, 3, 4 or 5		Count in 2s, 5s and 10s Begin to use and understand simple arrays e.g. *2 × 4 is two lots of four* Double numbers up to 10 Double multiples of 10 to 50
Y2 ***÷***	Count in 2s, 5s and 10s Begin to count in 3s Using fingers, say where a given number is in the 2s, 5s or 10s count e.g. *8 is the fourth number when I count in 2s* Relate division to grouping e.g. *How many groups of 5 in 15?* Halve numbers to 20 Begin to halve numbers to 40 and multiples of 10 to 100 Find $^1/_2$, $^1/_3$, $^1/_4$ and $^3/_4$ of a quantity of objects and of amounts (whole number answers)		Count in 2s, 5s and 10s Say how many rows in a given array e.g. *How many rows of 5 are in an array of* *3 × 5?* Halve numbers to 12 Find $^1/_2$ of amounts

LOWER KEY STAGE 2		
In Lower Key Stage 2, children build on the concrete and conceptual understandings they have gained in Key Stage 1 to develop a real mathematical understanding of the four operations, in particular developing arithmetical competence in relation to larger numbers.		
Addition and subtraction: Children are taught to use place value and number facts to add and subtract numbers mentally and they will develop a range of strategies to enable them to discard the 'counting in 1s' or fingers-based methods of Key Stage 1. In particular, children will learn to add and subtract multiples and near multiples of 10, 100 and 1000, and will become fluent in complementary addition as an accurate means of achieving fast and accurate answers to 3-digit subtractions. Standard written methods for adding larger numbers are taught, learned and consolidated, and written column subtraction is also introduced.	**Multiplication and division:** This key stage is also the period during which all the multiplication and division facts are thoroughly memorised, including all facts up to 12 × 12. Efficient written methods for multiplying or dividing a 2-digit or 3-digit number by a 1-digit number are taught, as are mental strategies for multiplication or division with large but 'friendly' numbers, e.g. when dividing by 5 or multiplying by 20.	**Fractions and decimals:** Children will develop their understanding of fractions, learning to reduce a fraction to its simplest form, as well as finding non-unit fractions of amounts and quantities. The concept of a decimal number is introduced and children consolidate a firm understanding of 1-place decimals, multiplying and dividing whole numbers by 10 and 100.

Year 3			
	Mental calculation	**Written calculation**	**Default for ALL children**
Y3 +	Know pairs with each total to 20 e.g. *2 + 6 = 8, 12 + 6 = 18, 7 + 8 = 15* Know pairs of multiples of 10 with a total of 100 Add any two 2-digit numbers by counting on in 10s and 1s or by using partitioning Add multiples and near multiples of 10 and 100 Perform place-value additions without a struggle e.g. *300 + 8 + 50 = 358* Use place value and number facts to add a 1-digit or 2-digit number to a 3-digit number e.g. *104 + 56 is 160 since 104 + 50 = 154 and 6 + 4 = 10* *676 + 8 is 684 since 8 = 4 + 4 and 76 + 4 + 4 = 84* Add pairs of 'friendly' 3-digit numbers e.g. *320 + 450* Begin to add amounts of money using partitioning	Use expanded column addition to add two or three 3-digit numbers or three 2-digit numbers Begin to use compact column addition to add numbers with 3 digits Begin to add like fractions e.g. $^3/_8 + {}^1/_8 + {}^1/_8$ Recognise fractions that add to 1 e.g. $^1/_4 + {}^3/_4$ e.g. $^3/_5 + {}^2/_5$	Know pairs of numbers which make each total up to 10, and which total 20 Add two 2-digit numbers by counting on in 10s and 1s e.g. *56 + 35 is 56 + 30 and then add the 5* Understand simple place-value additions e.g. *200 + 40 + 5 = 245* Use place value to add multiples of 10 or 100
Y3 –	Know pairs with each total to 20 e.g. *8 – 2 = 6* e.g. *18 – 6 = 12* e.g. *15 – 8 = 7* Subtract any two 2-digit numbers Perform place-value subtractions without a struggle e.g. *536 – 30 = 506* Subtract 2-digit numbers from numbers > 100 by counting up e.g. *143 – 76 is done by starting at 76. Then add 4 (80), then add 20 (100), then add 43, making the difference a total of 67* Subtract multiples and near multiples of 10 and 100 Subtract, when appropriate, by counting back or taking away, using place value and number facts Find change from £1, £5 and £10	Use counting up as an informal written strategy for subtracting pairs of 3-digit numbers e.g. *423 – 357* Begin to subtract like fractions e.g. $^7/_8 - {}^3/_8$	Know pairs of numbers which make each total up to 10, and which total 20 Count up to subtract 2-digit numbers e.g. *72 – 47* Subtract multiples of 5 from 100 by counting up e.g. *100 – 35* Subtract multiples of 10 and 100

Y3 ×	Know by heart all the multiplication facts in the ×2, ×3, ×4, ×5, ×8 and ×10 tables Multiply whole numbers by 10 and 100 Recognise that multiplication is commutative Use place value and number facts in mental multiplication e.g. *30 × 5 is 15 × 10* Partition teen numbers to multiply by a 1-digit number e.g. *3 × 14 as 3 × 10 and 3 × 4* Double numbers up to 50	Use partitioning (grid multiplication) to multiply 2-digit and 3-digit numbers by 'friendly' 1-digit numbers	Know by heart the ×2, ×3, ×5 and ×10 tables Double given tables facts to get others Double numbers up to 25 and multiples of 5 to 50
Y3 ÷	Know by heart all the division facts derived from the ×2, ×3, ×4, ×5, ×8 and ×10 tables Divide whole numbers by 10 or 100 to give whole number answers Recognise that division is not commutative Use place value and number facts in mental division e.g. *84 ÷ 4 is half of 42* Divide larger numbers mentally by subtracting the 10th multiple as appropriate, including those with remainders e.g. *57 ÷ 3 is 10 + 9 as 10 × 3 = 30 and 9 × 3 = 27* Halve even numbers to 100, halve odd numbers to 20	Perform divisions just above the 10th multiple using horizontal or vertical jottings and understanding how to give a remainder as a whole number Find unit fractions of quantities and begin to find non-unit fractions of quantities	Know by heart the division facts derived from the ×2, ×3, ×5 and ×10 tables Halve even numbers up to 50 and multiples of 10 to 100 Perform divisions within the tables including those with remainders e.g. *38 ÷ 5*

Year 4			
	Mental calculation	**Written calculation**	**Default for ALL children**
Y4 +	Add any two 2-digit numbers by partitioning or counting on Know by heart/quickly derive number bonds to 100 and to £1 Add to the next 100, £1 and whole number e.g. *234 + 66 = 300* e.g. *3·4 + 0·6 = 4* Perform place-value additions without a struggle e.g. *300 + 8 + 50 + 4000 = 4358* Add multiples and near multiples of 10, 100 and 1000 Add £1, 10p, 1p to amounts of money Use place value and number facts to add 1-, 2-, 3- and 4-digit numbers where a mental calculation is appropriate e.g. *4004 + 156 by knowing that 6 + 4 = 10 and that 4004 + 150 = 4154 so the total is 4160*	Column addition for 3-digit and 4-digit numbers e.g. 5347 2286 +1495 121 9128 Add like fractions e.g. $^3/_5 + ^4/_5 = ^7/_5 = 1\ ^2/_5$ Be confident with fractions that add to 1 and fraction complements to 1 e.g. $^2/_3 + \_ = 1$	Add any 2-digit numbers by partitioning or counting on Number bonds to 20 Know pairs of multiples of 10 with a total of 100 Add 'friendly' larger numbers using knowledge of place value and number facts Use expanded column addition to add 3-digit numbers
Y4 –	Subtract any two 2-digit numbers Know by heart/quickly derive number bonds to 100 Perform place-value subtractions without a struggle e.g. *4736 – 706 = 4030* Subtract multiples and near multiples of 10, 100, 1000, £1 and 10p Subtract multiples of 0·1 Subtract by counting up e.g. *503 – 368 is done by adding 368 + 2 + 30 + 100 + 3 (so we added 135)* Subtract, when appropriate, by counting back or taking away, using place value and number facts Subtract £1, 10p, 1p from amounts of money Find change from £10, £20 and £50	Use expanded column subtraction for 3- and 4-digit numbers Use complementary addition to subtract amounts of money, and for subtractions where the larger number is a near multiple of 1000 or 100 e.g. *2002 – 1865* Subtract like fractions e.g. $^4/_5 - ^3/_5 = ^1/_5$ Use fractions that add to 1 to find fraction complements to 1 e.g. $1 - ^2/_3 = ^1/_3$	Use counting up with confidence to solve most subtractions, including finding complements to multiples of 100 e.g. *512 – 287* e.g. *67 + _ = 100*

Y4 ×	Know by heart all the multiplication facts up to 12 × 12 Recognise factors up to 12 of 2-digit numbers Multiply whole numbers and 1-place decimals by 10, 100, 1000 Multiply multiples of 10, 100 and 1000 by 1-digit numbers e.g. *300 × 6* e.g. *4000 × 8* Use understanding of place value and number facts in mental multiplication e.g. *36 × 5 is half of 36 × 10* e.g. *50 × 60 = 3000* Partition 2-digit numbers to multiply by a 1-digit number mentally e.g. *4 × 24 as 4 × 20 and 4 × 4* Multiply near multiples by rounding e.g. *33 × 19 as (33 × 20) – 33* Find doubles to double 100 and beyond using partitioning Begin to double amounts of money e.g. *£35·60 doubled is £71·20*	Use a vertical written method to multiply a 1-digit number by a 3-digit number (ladder method) Use an efficient written method to multiply a 2-digit number by a number between 10 and 20 by partitioning (grid method)	Know by heart multiplication tables up to 10 × 10 Multiply whole numbers by 10 and 100 Use the grid method to multiply a 2-digit or a 3-digit number by a number ≤ 6
Y4 ÷	Know by heart all the division facts up to 144 ÷ 12 Divide whole numbers by 10, 100, to give whole number answers or answers with 1 decimal place Divide multiples of 100 by 1-digit numbers using division facts e.g. *3200 ÷ 8 = 400* Use place value and number facts in mental division e.g. *245 ÷ 20 is half of 245 ÷ 10* Divide larger numbers mentally by subtracting the 10th or 20th multiple as appropriate e.g. *156 ÷ 6 is 20 + 6 as 20 × 6 = 120 and 6 × 6 = 36* Find halves of even numbers to 200 and beyond using partitioning Begin to halve amounts of money e.g. *half of £52·40 is £26·20*	Use a written method to divide a 2-digit or a 3-digit number by a 1-digit number Give remainders as whole numbers Begin to reduce fractions to their simplest forms Find unit and non-unit fractions of larger amounts	Know by heart all the division facts up to 100 ÷ 10 Divide whole numbers by 10 and 100 to give whole number answers or answers with 1 decimal place Perform divisions just above the 10th multiple using the written layout and understanding how to give a remainder as a whole number Find unit fractions of amounts

UPPER KEY STAGE 2		
Children move on from dealing mainly with whole numbers to performing arithmetic operations with both decimals and fractions.		
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, decimals, percentages and ratio:** 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	**Written calculation**	**Default for ALL children**
Y5 +	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 decimal e.g. *3 + 8 + 6 + 4 + 7* e.g. *0·6 + 0·7 + 0·4* e.g. *2056 + 44*	Use column addition to add two or three whole numbers with up to 5 digits Use column addition to add any pair of 2-place decimal numbers, including amounts of money Begin to add related fractions using equivalences e.g. $^1/_2 + {}^1/_6 = {}^3/_6 + {}^1/_6$ Choose the most efficient method in any given situation	Add numbers with only 2 digits which are not zeros e.g. *3·4 + 5·8* Derive swiftly and without any difficulty number bonds to 100 Add 'friendly' large numbers using knowledge of place value and number facts Use expanded column addition to add pairs of 4- and 5-digit numbers
Y5 –	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. $1\ {}^2/_5 + {}^3/_5 = 2$	Use compact or expanded column subtraction to subtract numbers with up to 5 digits Use complementary addition for subtractions where the larger number is a multiple or near multiple of 1000 Use complementary addition for subtractions of decimal numbers with up to 2 places, including amounts of money Begin to subtract related fractions using equivalences e.g. $^1/_2 - {}^1/_6 = {}^2/_6$ Choose the most efficient method in any given situation	Derive swiftly and without difficulty number bonds to 100 Use counting up with confidence to solve most subtractions, including finding complements to multiples of 1000 e.g. *3000 – 2387*

Y5 ×	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*	Use short multiplication to multiply a 1-digit number by a number with up to 4 digits Use long multiplication to multiply 3-digit and 4-digit numbers by a number between 11 and 20 Choose the most efficient method in any given situation Find simple percentages of amounts e.g. *10%, 5%, 20%, 15% and 50%* Begin to multiply fractions and mixed numbers by whole numbers ≤ 10 e.g. *$4 \times {}^2/_3 = {}^8/_3 = 2\,{}^2/_3$*	Know multiplication tables to 11 × 11 Multiply whole numbers and 1-place decimals by 10, 100 and 1000 Use knowledge of factors as aids to mental multiplication e.g. *13 × 6 is double 13 × 3* e.g. *23 × 5 is $^1/_2$ of 23 × 10* Use the grid method to multiply numbers with up to 4 digits by 1-digit numbers Use the grid method to multiply 2-digit numbers by 2-digit numbers
Y5 ÷	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	Use short division to divide a number with up to 4 digits by a number ≤ 12 Give remainders as whole numbers or as fractions Find non-unit fractions of large amounts Turn improper fractions into mixed numbers and vice versa Choose the most efficient method in any given situation	Know by heart division facts up to 121 ÷ 11 Divide whole numbers by 10, 100 or 1000 to give answers with up to 1 decimal place Use doubling and halving as mental division strategies Use an efficient written method to divide numbers ≤ 1000 by 1-digit numbers Find unit fractions of 2- and 3-digit numbers

Year 6			
	Mental calculation	**Written calculation**	**Default for ALL children**
Y6 +	Know by heart number bonds 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*	Use column addition to add numbers with up to 5 digits Use column addition to add decimal numbers with up to 3 decimal places Add mixed numbers and fractions with different denominators	Derive, swiftly and without difficulty, number bonds to 100 Use place value and number facts to add 'friendly' large or decimal numbers e.g. *3·4 + 6·6* e.g. *26 000 + 54 000* Use column addition to add numbers with up to 4-digits Use column addition to add pairs of 2-place decimal numbers
Y6 –	Use number bonds 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 and 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	Use column subtraction to subtract numbers with up to 6 digits Use complementary addition for subtractions where the larger number is a multiple or near multiple of 1000 or 10 000 Use complementary addition for subtractions of decimal numbers with up to 3 places, including money Subtract mixed numbers and fractions with different denominators	Use number bonds to 100 to perform mental subtraction of numbers up to 1000 by complementary addition e.g. *1000 – 654 as 46 + 300 in our heads* Use complementary addition for subtraction of integers up to 10 000 e.g. *2504 – 1878* Use complementary addition for subtractions of 1-place decimal numbers and amounts of money e.g. *£7·30 – £3·55*

Y6 ×	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)*	Use short multiplication to multiply a 1-digit number by a number with up to 4 digits Use long multiplication to multiply a 2-digit number by a number with up to 4 digits Use short multiplication to multiply a 1-digit number by a number with 1 or 2 decimal places, including amounts of money Multiply fractions and mixed numbers by whole numbers Multiply fractions by proper fractions Use percentages for comparison and calculate simple percentages	Know by heart all the multiplication facts up to 12 × 12 Multiply whole numbers and 1- and 2-place decimals by 10, 100 and 1000 Use an efficient written method to multiply a 1-digit or a teen number by a number with up to 4 digits by partitioning (grid method) Multiply a 1-place decimal number up to 10 by a number ≤ 100 using the grid method
Y6 ÷	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	Use short division to divide a number with up to 4 digits by a 1-digit or a 2-digit number Use long division to divide 3-digit and 4-digit numbers by 'friendly' 2-digit numbers Give remainders as whole numbers or as fractions or as decimals Divide a 1-place or a 2-place decimal number by a number ≤ 12 using multiples of the divisors Divide proper fractions by whole numbers	Know by heart all the division facts up to 144 ÷ 12 Divide whole numbers by 10, 100, 1000 to give whole number answers or answers with up to 2 decimal places Use an efficient written method, involving subtracting powers of 10 times the divisor, to divide any number of up to 1000 by a number ≤ 12 e.g. *836 ÷ 11 as 836 – 770 (70 × 11) leaving 66 which is 6 × 11, giving the answer 76* Divide a 1-place decimal by a number ≤ 10 using place value and knowledge of division facts