Maths Written Calculation Policy

**"Every Child,
Every Chance,
Every Day"**

Written by: Matt Jones

Every Child, Every Chance, Every Day

St Marks CE Primary School
Policy for Maths written calculation

As children progress through the school they will need to develop ways of recording to support their mental calculation and thinking.

The intention of this policy is to ensure that:

'By the end of Y6, children are equipped with mental, written and calculator methods that they can understand and use correctly'

(Primary Framework, Guidance Paper, Calculation)

It is organised into year groups so that teachers can use the document to support their planning and delivery of lessons and parents can identify what their children should be using for homework. Mental calculation will continue to be used; written calculations are not a substitute for this. Mental calculation will be addressed at the beginning of every lesson and during an additional discrete lesson once a day.

The policy will be monitored during the Maths book and planning monitoring cycle to ensure written calculations are being taught as the policy sets out.

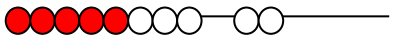
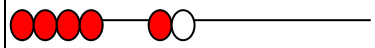
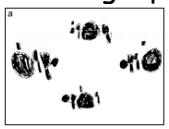
The policy intends to be for practical use by class teachers every day, therefore is in a summary format. It will also be shared with teaching assistants and parents. If further information is required, this can be found in the Primary Framework guidance paper and Cambridge Education at Islington Calculation Policy documents from the Maths Subject Leader.

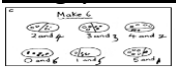
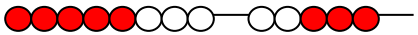
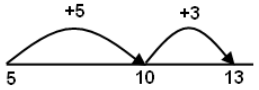
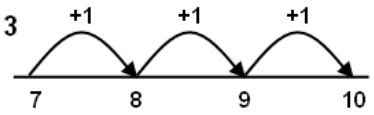
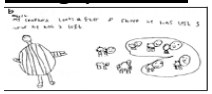
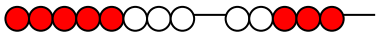
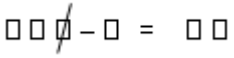
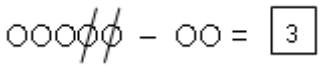
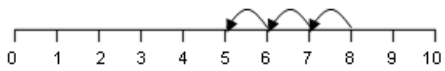
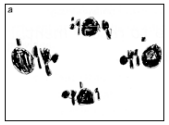
A selection of mental calculation strategies that need to be taught through discrete mental maths lesson every day, throughout the school.

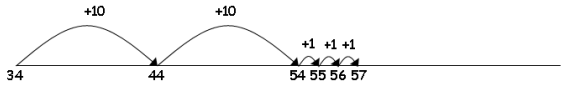
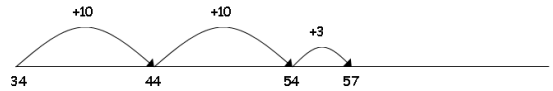
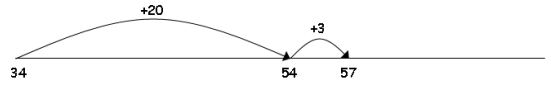
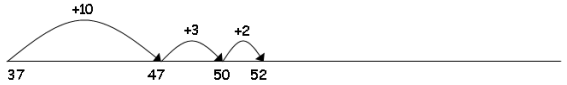
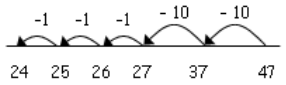
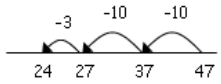
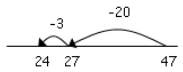
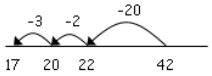
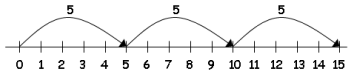
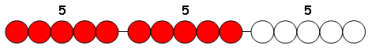
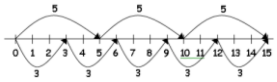
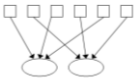
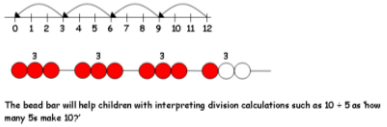
Addition	**Mental recall of number bonds** 6 + 4 = 10 ☐ + 3 = 10 25 + 75 = 100 19 + ☐ = 20 **Use near doubles** 7+ 8 = double 7 + 1 = 15 **Addition using partitioning and recombining** 43 + 54 = (40 + 50) + (3 + 4) = 97 **Counting on or back in repeated steps of 1, 10, 100, 1000** 86 + 57 = 143 (by counting on in tens and then in ones) 460 + 320 = 780 (by counting on in hundreds then in tens) **Add the nearest multiple of 10, 100 and 1000 and adjust** 24 + 19 = 24 + 20 – 1 = 43 458 + 71 = 458 + 70 + 1 = 529 **Use the relationship between addition and subtraction** 36 + 19 = 55 19 + 36 = 55 55 – 19 = 36 55 – 36 = 19
Subtraction	**Mental recall of addition and subtraction facts** 10 – 6 = 4 17 - ☐ = 11 20 - 17 = 3 10 - ☐ = 2 **Find a small difference by counting up** 82 – 79 = 3 **Counting on or back in repeated steps of 1, 10, 100, 1000** 86 - 52 = 34 (by counting back in tens and then in ones) 460 - 300 = 160 (by counting back in hundreds) **Subtract the nearest multiple of 10, 100 and 1000 and adjust** 24 - 19 = 24 - 20 + 1 = 5

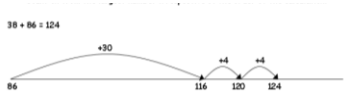
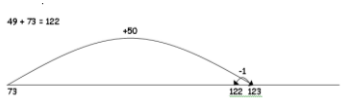
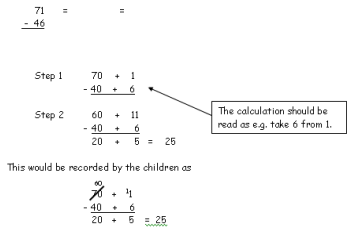
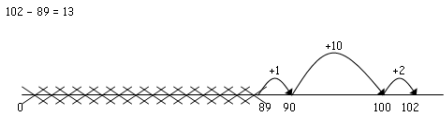
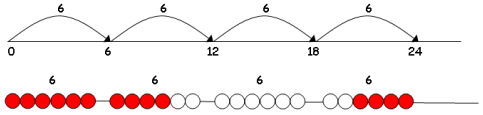
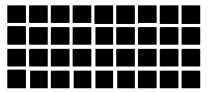
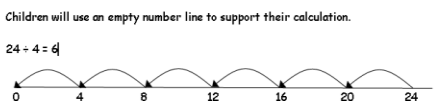
	458 - 71 = 458 - 70 - 1 = 387 **Use the relationship between addition and subtraction** 36 + 19 = 55 19 + 36 = 55 55 – 19 = 36 55 – 36 = 19
Multiplication	**Doubling and halving** Applying the knowledge of doubles and halves to known facts. e.g. 8 x 4 is double 4 x 4 **Using multiplication facts** ***Tables should be taught everyday from Y2 onwards, either as part of the mental oral starter or other times as appropriate within the day.*** **Year 1** Count on or back in 1s, 2s, 5s and 10s and use this knowledge to derive the multiples of 2,5 and 10 to the tenth multiple. Recall the doubles of all numbers to at least 10. **Year 2** Pupils should be taught to derive and recall multiplication facts for: 2 times table 5 times table 10 times table **Year 3** Pupils should be taught to derive and recall multiplication facts for: 2 times table 3 times table 4 times table 6 times table 5 times table 10 times table **Year 4** Pupils should be taught to derive and recall multiplication facts for: All tables up to 10 x 10 **Year 5** Recall quickly multiplication facts up to 10 x 10 and use them to multiply pairs of multiples of 10 and 100

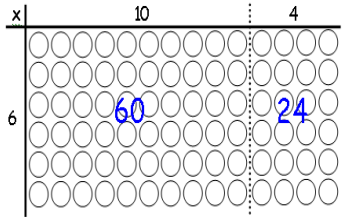
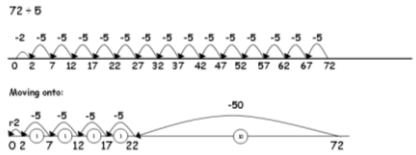
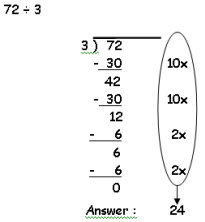
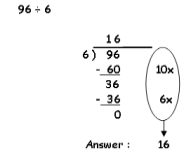
Division	**Doubling and halving** Knowing that halving is dividing by 2 **Deriving division facts** ***Tables should be taught everyday from Y2 onwards, either as part of the mental oral starter or other times as appropriate within the day.*** **Year 1** Count on and back in twos, fives and tens **Year 2** Derive the related division facts for the: 2 times table 5 times table 10 times table **Year 3** Derive the related division facts for the: 2 times table 3 times table 4 times table 5 times table 6 times table 10 times table **Year 4** Derive the related division facts for multiplication facts up to 10 x 10. **Year 5** Derive *quickly* division facts up to 10 x 10 **Year 6** Use knowledge of multiplication and division facts to derive division facts involving decimals (e.g. 4.8 ÷ 6). **Using and applying division facts** Children should be able to utilise their tables knowledge to derive other facts. e.g. If I know 24 ÷ 6 = 4, what else do I know? 240 ÷ 6 = 40 , 2400 ÷ 6 = 400, 24000 ÷ 6 = 4000, 2.4 ÷ 6 = 0.4 etc **Dividing by 10 or 100** Knowing that the effect of dividing by 10 is a shift in the digits one place to the right. Knowing that the effect of dividing by 100 is a shift in the digits two places to the right. **Use of factors** 378 ÷ 21 378 ÷ 3 = 126 378 ÷ 21 = 18 126 ÷ 7 = 18 **Use related facts** Given that 1.4 x 1.1 = 1.54 What is 1.54 ÷ 1.4, or 1.54 ÷ 1.1?

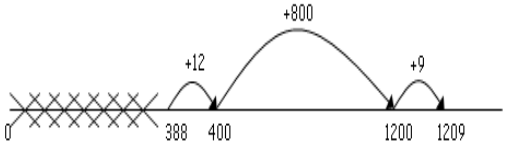
	addition	subtraction	multiplication	division
RECEPTION	Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures, etc.  Bead strings or bead bars can be used to illustrate addition  8+2=10 They use number lines and practical resources to support calculation and teachers *demonstrate* the use of the number line.	Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures etc.  Bead strings or bead bars can be used to illustrate subtraction including bridging through ten by counting back 3 then counting back 2.  **6-2=4** They use number lines and practical resources to support calculation. Teachers *demonstrate* the use of the number line.	Children will experience equal groups of objects. They will count in 2s and 10s and begin to count in 5s. They will work on practical problem solving activities involving equal sets or groups. 	Children will understand equal groups and share items out in play and problem solving. They will count in 2s and 10s and later in 5s. 

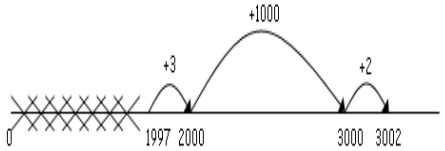
	addition	subtraction	multiplication	division
YEAR ONE	**<u>Using pictures</u>**  **<u>Bead strings or bead bars</u>** can be used to illustrate addition including bridging through ten by counting on 2 then counting on 3.  They use number lines and practical resources to support calculation and teachers *demonstrate* the use of the number line. Children then begin to use **<u>numbered lines</u>** to support their own calculations using a numbered line to count on in ones. work out mentally that 5+8 = 5 + (5 and 3) = 5 + 5 + 3 = 10 + 3 = 13  7 + 3  	**<u>Using pictures</u>**  **<u>Bead strings or bead bars</u>** can be used to illustrate subtraction including bridging through ten by counting back 3 then counting back 2.  Children then begin to use numbered lines to support their own calculations - using a numbered line to count back in ones. The **<u>number line</u>** should also be used to show that 6 - 3 means the 'difference between 6 and 3' or 'the difference between 3 and 6' and how many jumps they are apart. Symbolic representations: How many less?   8 – 3 = 5  	Children will experience equal groups of **<u>objects</u>**. They will count in 2s and 10s and begin to count in 5s. They will work on practical problem solving activities involving equal sets or groups.  Initially **<u>pictorially</u>** 2 + 2 + 2 + 2 = 8 2 x 4 = 8 4 groups of 2 = 8 2 multiplied four times 2 groups of 3: using story sentences e.g. 2 bags with 3 apples each, practical activities column x row • • • • • • 4 x 2 • • • • • • • • 2 x 4 **<u>Number tracks & lines.</u>** Grouping objects pictorially	Children will understand equal groups and share items out in play and problem solving. They will count in 2s and 10s and later in 5s.  How many groups of 2 in 6? •• •• •• = 3 Recording **<u>pictorially</u>** using **<u>concrete objects</u>**. **<u>Partitioning sets</u>**

	addition	subtraction	multiplication	division
YEAR TWO	**Empty number lines** Children will begin to use 'empty number lines' themselves starting with the larger number and counting on. ✓ First **counting on** in tens and ones. 34 + 23 = 57  ✓ Then helping children to become more efficient by adding the units in one jump (by using the known fact 4 + 3 = 7). 34 + 23 = 57  ✓ Followed by **adding the tens in one jump and the units in one jump.** 34 + 23 = 57  ✓ **Bridging through ten** can help children become more efficient. 37 + 15 = 52  Use of a hundred square to support calculation  Begin to develop use of **partitioning** when using number lines	**Empty number lines** Children will begin to use empty number lines to support calculations. **Counting back:** ✓ First counting back in tens and ones. 47 – 23 = 24  ✓ Then helping children to become more efficient by subtracting the units in one jump (by using the known fact 7 – 3 = 4). 47 – 23 = 24  ✓ **Subtracting the tens in one jump and the units in one jump.** 47 – 23 = 24  ✓ Bridging through ten can help children become more efficient. 42 – 25 = 17  **Counting on:** The number line should still show 0 so children can cross out the section from 0 to the smallest number. They then associate this method with 'taking away'.	Children will develop their understanding of multiplication and use jottings to support calculation: **Repeated addition** 3 times 5 is 5 + 5 + 5 = 15 or 3 lots of 5 or 5 x3 Repeated addition can be shown easily on a number line: 5 x 3 = 5 + 5 + 5  and on a bead bar: 5 x 3 = 5 + 5 + 5  **Commutative** Children should know that 3 x 5 has the same answer as 5 x 3. This can also be shown on the number line.  **Arrays** Children should be able to model a multiplication calculation using an array. This knowledge will support with the development of the grid method.  	Children will develop their understanding of division and use jottings to support calculation **Sharing equally** 6 sweets shared between 2 people, how many do they each get?  **Grouping or repeated subtraction** There are 6 sweets, how many people can have 2 sweets each?  **Repeated subtraction using a number line or bead bar** 12 ÷ 3 = 4  The bead bar will help children with interpreting division calculations such as 10 ÷ 5 as 'how many 5s make 10?' **Using symbols to stand for unknown numbers to complete equations using inverse operations** □ ÷ 2 = 4 20 ÷ △ = 4 □ ÷ △ = 4

	addition	subtraction	multiplication	division
YEAR THREE	**Empty number lines** Children will continue to use empty number lines with increasingly large numbers, including compensation where appropriate. ✓ **Count on from the largest number** irrespective of the order of the calculation.  ✓ **Compensation**  **Partitioning** Children will begin to use informal pencil and paper methods (jottings) to support, record and explain partial mental methods building on existing mental strategies. Adding the least significant digits first 67 + 24 11 (7+ 4) 80 (60+20) 91 267 + 85 12 (7 + 5) 140 (60+80) 200 352	**Number lines** Children will continue to use empty number lines with increasingly large numbers. Children will begin to use informal pencil and paper methods (jottings). **Partitioning and decomposition** • Partitioning – demonstrated using arrow cards • Decomposition - base 10 materials **NOTE** When solving the calculation 89 – 57, children should know that 57 **does NOT EXIST AS AN AMOUNT** it is what you are subtracting from the other number. Therefore, when using base 10 materials, children would need to count out only the 89. 89 = 80 + 9 - 57 50 + 7 30 + 2 = 32 ✓ **Begin to exchange**  Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line should be used.  	**Repeated addition** Children will continue to use this: 4 times 6 is 6 + 6 + 6 + 6 = 24 or 4 lots of 6 or 6 x 4 Children should use number lines or bead bars to support their understanding.  **Arrays** Children should be able to model a multiplication calculation using an array. This knowledge will support with the development of the grid method.  9 x 4 = 36 **Scaling** e.g. Find a ribbon that is 4 times as long as the lue ribbon  ✓ **Using symbols to stand for unknown numbers to complete equations using inverse operations** □ x 5 = 20 3 x △ = 18 □ x O = 32 **Partitioning** 38 x 5 = (30 x 5) + (8 x 5) = 150 + 40 = 190 Some may prefer **grid method** (see Year 4)	Ensure that the emphasis in Y3 is on grouping rather than sharing. **Repeated subtraction** Children will continue to use: ✓ **using a number line**  Children should also move onto calculations involving remainders.  ✓ **Using symbols to stand for unknown numbers to complete equations using inverse operations** 26 ÷ 2 = □ 24 ÷ △ = 12 □ ÷ 10 = 8

	addition	subtraction	multiplication	division
YEAR FOUR	✓ Consolidate Year 3 partitioning **Carrying below the line** Introduce this method: 625 + 48 = 673 (1) 783 + 42 = 825 (1) 367 + 85 = 452 (11) *Using similar methods, children will:* ✓ *add several numbers with different numbers of digits;* ✓ *begin to add two or more three-digit sums of money, with or without adjustment from the pence to the pounds;* ✓ *know that the decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. £3.59 + 78p.*	**Partitioning and decomposition** 754 − 86 = Step 1: 700 + 50 + 4 − 80 + 6 Step 2: 700 + 40 + 14 − 80 + 6 *(adjust from T to U)* Step 3: 600 + 140 + 14 − 80 + 6 *(adjust from H to T)* 600 + 60 + 8 = 668 This would be recorded by the children as 600 140 ~~700~~ + ~~50~~ + 14 − 80 + 6 600 + 60 + 8 = 668 **Decomposition** 614 1 ~~7~~~~5~~4 − 86 668 *Children should:* ✓ *be able to subtract numbers with different numbers of digits;* ✓ *using this method, children should also begin to find the difference between two three-digit sums of money, with or without 'adjustment' from the pence to the pounds;* ✓ *know that decimal points should line up under each other.* £8.95 − £4.38 = 8 + 0.9 + 0.05 − 4 + 0.3 + 0.08 = 8 + 0.8 + 0.15 − 4 + 0.3 + 0.08 *(adjust from T to U)* = 4 + 0.5 + 0.07 = £4.57 leading to 1 8.95 − 4.38	**Arrays** Children will continue to use arrays where appropriate leading into the grid method of multiplication.  (6 x 10) + (6 x 4) 60 + 24 84 **Grid method** **TU x U - Short multiplication** 23 x 8 Children will approximate first 23 x 8 is approximately 25 x 8 = 200 x 20 3 8 160 24 160 + 24 184	**Repeated subtraction** Children will develop their use of repeated subtraction to be able to subtract multiples of the divisor. Initially, these should be multiples of 10s, 5s, 2s and 1s – numbers with which the children are more familiar.  Then onto the vertical method: **Short division TU ÷ U** **Chunking method**  Leading to subtraction of other multiples.  Any remainders should be shown as integers, i.e. 14 remainder 2 or 14 r 2. Children need to be able to decide what to do after division and round up or down accordingly. They should make sensible decisions about rounding up or down after division.

	addition	subtraction	multiplication	division
YEAR FIVE	**Carrying method** Children should extend the carrying method to numbers with at least four digits. 587 + 475 = 1062 (11) 3587 + 675 = 4262 (111) *Using similar methods, children will:* ✓ *add several numbers with different numbers of digits;* ✓ *begin to add two or more decimal fractions with up to three digits and the same number of decimal places;* ✓ *know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. 3.2 m – 280 cm.*	**Partitioning and decomposition** Step 1: 754 = 700 + 50 + 4; − 286 = − 200 + 80 + 6 Step 2: 700 + 40 + 14 − 200 + 80 + 6 *(adjust from T to U)* Step 3: 600 + 140 + 14 − 200 + 80 + 6 = 400 + 60 + 8 = 468 *(adjust from H to T)* This would be recorded by the children as 600 140 700 + 50 + 14 − 200 + 80 + 6 400 + 60 + 8 = 468 **Decomposition** 614 1 ~~7~~ ~~5~~4 − 286 468 *Children should:* ✓ *be able to subtract numbers with different numbers of digits;* ✓ *begin to find the difference between two decimal fractions with up to three digits and the same number of decimal places;* *know that decimal points should line up under each other* Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line should be used. 1209 - 388 = 821 	**Grid and column methods** **HTU x U - Short multiplication** ***Grid*** 346 x 9 Children will approximate first 346 x 9 is approximately 350 x 10 = 3500 × 300 40 6 9 2700 360 54 2700 + 360 + 54 = 3114 (11) **TU x TU - Long multiplication** ***Grid*** 72 x 38 Children will approximate first 72 x 38 is approximately 70 x 40 = 2800 × 70 2 30 2100 60 8 560 16 2100 + 560 + 60 + 16 = 2736 (1) ***Decimals*** *Using similar methods, they will be able to multiply decimals with one decimal place by a single digit number, approximating first. They should know that the decimal points line up under each other.* e.g. 4.9 x 3 Children will approximate first 4.9 x 3 is approximately 5 x 3 = 15 × 4 0.9 3 12 2.7 12 + 2.7 = 14.7 **Column methods (long and short)** Extend these to **column methods when ready**: 38 × 7 = 266 (5) 56 × 27 = 1000 + 120 + 350 + 42 = 1512 (1) 50 × 20 = 1000 6 × 20 = 120 50 × 7 = 350 6 × 7 = 42 56 × 27 = 1120 + 392 = 1512 (1) 56 × 20 56 × 7	**Short division HTU ÷ U** **Chunking method** Children will continue to use written methods to solve short division TU ÷ U. Children can start to subtract larger multiples of the divisor, e.g. 30x 196 ÷ 6 32 r 4 6) 196 - 180 (30x) 16 - 12 (2x) 4 Answer : 32 remainder 4 or 32 r 4 Any remainders should be shown as integers, i.e. 14 remainder 2 or 14 r 2. Children need to be able to decide what to do after division and round up or down accordingly. They should make sensible decisions about rounding up or down after division. **Short compact method** Also a can be taught: 97 3) 2 9 2 1

	addition	subtraction	multiplication	division
YEAR SIX	**Carrying method** Children should extend the carrying method to number with any number of digits. 7648 + 1486 = 9134 (1 1 1) 6584 + 5848 = 12432 (1 1 1) *Using similar methods, children will* ✓ *add several numbers with different numbers of digits;* ✓ *begin to add two or more decimal fractions with up to four digits and either one or two decimal places;* ✓ *know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. 401.2 + 26.85 + 0.71.*	**Decomposition method** 5131 6467 - 2684 3783 + 4681 11944 1 2 1 *Children should:* ✓ *be able to subtract numbers with different numbers of digits;* ✓ *be able to subtract two or more decimal fractions with up to three digits and either one or two decimal places;* ✓ *know that decimal points should line up under each other.* Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line should be used. 3002 - 1997 = 1005  	**Grid and column methods** **ThHTU x U - Short multiplication** **Grid** 4346 x 8 Children will approximate first 4346 x 8 is approximately 4346 x 10 = 43460 × 4000 300 40 6 8 32000 2400 320 48 32000 + 2400 + 320 + 48 = 34768 **HTU x TU - Long multiplication** **Grid** 372 x 24 Children will approximate first 372 x 24 is approximately 400 x 25 = 10000 × 300 70 2 20 6000 1400 40 4 1200 280 8 6000 + 1400 + 1200 + 280 + 40 + 8 = 8928 **Decimals** *Using similar methods, they will be able to multiply decimals with up to two decimal places by a single digit number and then two digit numbers, approximating first. They should know that the decimal points line up under each other.* *For example:* 4.92 x 3 Children will approximate first 4.92 x 3 is approximately 5 x 3 = 15 × 4 0.9 0.02 3 12 2.7 0.06 12 + 0.7 + 0.06 = 12.76 **Column methods (long and short)** 38 × 7 = 266 (5) 56 × 27 = 1000 + 120 + 350 + 42 = 1512 (1) 50 × 20 = 1000 6 × 20 = 120 50 × 7 = 350 6 × 7 = 42 56 × 27 = 1120 + 392 = 1512 (1) 56 × 20 56 × 7	**Short division TU ÷ U and HTU ÷ U** **Chunking (see Year 5)** Children will continue to use **chunking** written methods to solve short division problems **Long division HTU ÷ TU** **Chunking** 972 ÷ 36 27 36) 972 - 720 (20x) 252 - 252 (7x) 0 Answer: 27 Any remainders should be shown as fractions, i.e. if the children were dividing 32 by 10, the answer should be shown as $3\ ^{2}/_{10}$ which could then be written as $3\ ^{1}/_{5}$ in it's lowest terms. **Decimals** Extend to decimals with up to two decimal places. Children should know that decimal points line up under each other. 87.5 ÷ 7 12.5 7) 87.5 - 70.0 (10x) 17.5 - 14.0 (2x) 3.5 - 3.5 (0.5x) 0 Answer : 12.5 **Short compact** (consolidate): 3) 2 9 (2) 1 → 9 7 **Long 'chunking' compact:** 24) 560 → 23 −480 80 −72 8 Answer: 23 R 8 **Long division (traditional) level 5/6 children** 25) 4 2 5 → 0 1 7 0↓ 42 25 175 175 000

Reviewed and ratified by Governing body	Spring Term 2015		
Next Revision (Please highlight as appropriate)	Annual	**Biennial**	Tri-annual
To be reviewed	Spring Term 2017		