Maltby Learning Trust Calculation Policy

The policy is designed in accordance with the National Curriculum 2014 and helps to develop the three main aims of Fluency, Reasoning and Problem Solving. It is designed to give pupils a consistent and smooth progression of learning when using the four main operations.

Early teaching of number and calculations in Foundation follows the 'Development Matters' EYFS document.

The calculation policy is organised according to age expectations as set out in the National Curriculum 2014, however it is vital that pupils are taught according to the stage that they are currently working at, moving on when they are secure. It is important that any type of calculation is given a real life context or problem solving approach to help build the children's understanding of the purpose of calculation, and to help them recognise when to use certain operations and methods when faced with problems.

Aims of the calculation policy

To support consistency in the teaching of calculations across school.
To strengthen progression.
To form a core set of methods which children will experience and build upon.
To build on models and images introduced to promote conceptual understanding.
To provide reference and guidance on teaching calculation skills for teaching staff, teaching assistants, parents and family members.

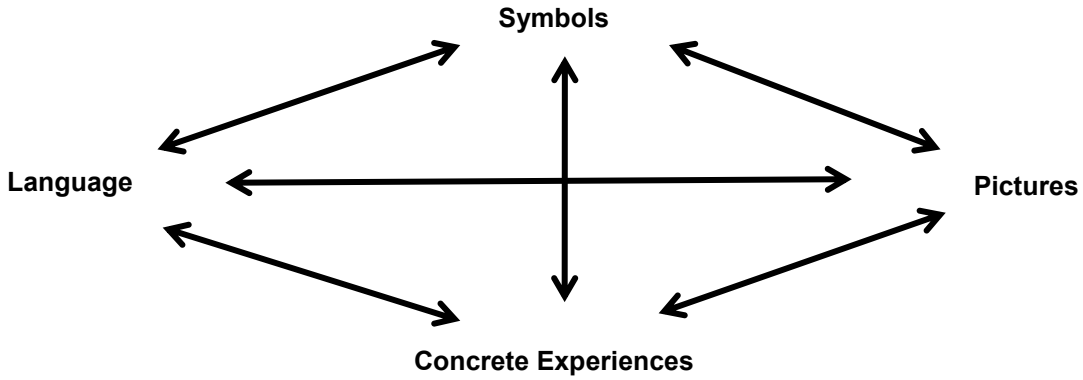
Good practice in calculation

Establish mental methods based on a good understanding of place value in numbers and tables facts.
Link practical, mental and written methods.
Make strong links between inverse operations.
Make sure children always look for special cases.
Gradually refine written methods into a more compact standard method.
Ensure that remainders and what to do with them in context is taught alongside division.
Encourage children to identify the best method and make choices.

Models for calculation

Developing calculation must build on practical experience, visual models and lead to abstract calculation. Although the balance of this model will shift as children's calculation confidence develops, we believe the model shows how they interlink throughout a child's primary education.

Haylock and Cockburn (2008)



Addition and subtraction

Developing Conceptual Understanding

Number bonds

(Ten frame)

Numicon

Use bonds of 10 to calculate bonds of 20

Count all

Count on

Count on, on number track, in 1s

Number bonds

(Ten frame)

Difference between 7 and 10

6 less than 10 is 4

Count out, then count how many are left.

7 – 4 = 3

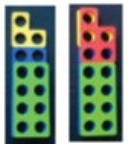
Count back on a number track, then number line.

15 – 6 = 9

Difference between 13 and 8

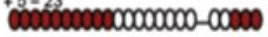
13 – 8 =

8 + _ = 13

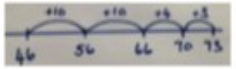


Number track / Number line – jumps of 1 then efficient jumps using number bonds

18 + 5 = 23



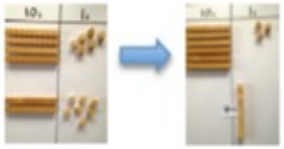
46 + 27 = 73 Count in tens then bridge.



25 + 29 by + 30 then -1 (Round and adjust)

Partition and recombine

46 + 27 = 60 + 13 = 73



24 +10 +10 +10 = 54

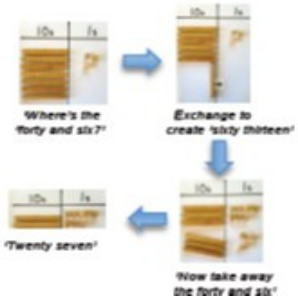
Number track / Number line – jumps of 1 then efficient jumps using number bonds

23 – 5 = 18

Using a number line, 73 – 46 = 26

Difference between 73 – 58 by counting up, 58 + _ = 73

Taking away and exchanging, 73 – 46



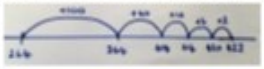
'Where's the forty and six?'

Exchange to create 'sixty thirteen'

'Twenty seven'

'Now take away the forty and six'

Number line: 264 + 158 efficient jumps



40 + 80 = 120 using 4 + 8 = 12

So 400 + 800 = 1200

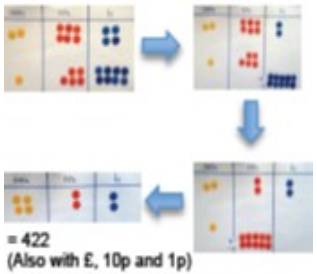
243 + 198 by +200 then -2 (Round and adjust)

Pairs that make 100

23 + 77

Place value counters, 100s, 10s, 1s

264 + 158



= 422

(Also with £, 10p and 1p)

Taking away and exchanging, 344 – 187

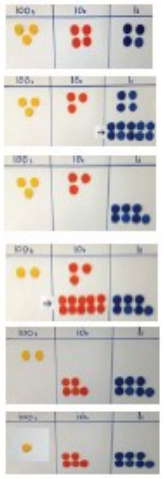
Place value counters

'Where's the one hundred and eighty and seven?

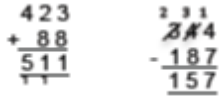
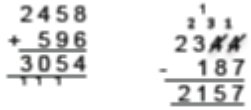
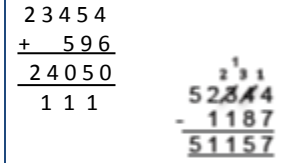
Exchange to create three hundred and thirty and fourteen. Now take away the 'seven'

Exchange to create two hundred, thirteen tens and seven Now take away the 'eighty'

Now take away the 'one hundred



With Jottings or in Your Head	Solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = ☐ – 9	Add and subtract numbers using concrete objects, pictorial representations, and mentally, including: • a two-digit number and ones • a two-digit number and tens • two two-digit numbers • adding three one digit numbers	Add and subtract numbers mentally, including: • a three-digit number and ones • a three-digit number and tens • a three-digit number and hundreds	Solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.	Add and subtract numbers mentally with increasingly large numbers.	Perform mental calculations, including with mixed operations and large numbers.
Mental strategies for addition and subtraction	Use knowledge that addition can be done in any order to do mental calculations more efficiently Add three small numbers by putting the largest number first and/or find a pair totalling10 Add three or four small numbers by putting the largest number first and/or by finding pairs totalling 9, 10 or 11 Add 3 or 4 small numbers, finding pairs totalling 10, or 9 or 11. Add three two-digit multiples of 10, such as 40 + 70 + 50. Partition additions into tens and ones, then recombine. Partition into tens and ones, then recombine (e.g. 34 + 53 = 30 + 50 + 4 + 3). Partition into tens and ones, adding the tens first. Find a small difference by counting up from the smaller to the larger number (e.g. 42 – 39). Find a small difference by counting up from the smaller to the larger number (e.g. 102 – 97). Identify near doubles, using doubles already known Add 9 to single-digit numbers by adding 10 then subtracting 1 Add/subtract 9 or 11: add/subtract 10 and adjust by 1. Begin to add/subtract 19 or 21: add/subtract 20 and adjust by 1. Add and subtract mentally a 'near multiple of 10' to or from a two-digit number by adding or subtracting 10, 20, 30 and adjusting. Use patterns of similar calculations. State the subtraction corresponding to a given addition, and vice versa. Use known number facts and place value to add or subtract a pair of numbers mentally within the range 0 to at least10, then 0 to at least 20. Begin to bridge through 10, and later 20, when adding a single-digit number. Bridge through 10 or 20, then adjust. Bridge through a multiple of 10, then adjust.		Consolidate all strategies from previous year, including: use the relationship between addition and subtraction add several numbers (e.g. our or five single digits, or multiples of 10 such as 40 + 50 + 80). Add several numbers of any size. Partition into H, T and ones, adding the most significant digits first. Find a small difference by counting up (e.g. 5003 – 4996).		Continue to use the relationship between addition and subtraction. Develop further the relationship between addition and subtraction. Find differences by counting up through next multiple of 10, 100 or 1000, e.g. calculate mentally a difference such as 8006 – 2993. Identify near doubles, using known doubles (e.g. 150 + 160). Identify near doubles, such as 1.5 + 1.6. Add or subtract the nearest multiple of 10 or 100, then adjust. Add or subtract the nearest multiple of 10, 100 or 1000, then adjust. Use known number facts and place value to add or subtract mentally, including any pair of two-digit whole numbers. Use known number facts and place value for mental addition and subtraction (e.g. 470 + 380, 810 – 380, 7.4 + 9.8, 9.2 – 8.6).	

Just Know it!	Represent & use number bonds and related subtraction facts within 20. Add and subtract one-digit and two digit numbers to 20, including zero.	Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100.				
Written Methods	Read, write and interpret mathematical statements involving equals (=) signs	Add and subtract two two-digit numbers using concrete objects, pictorial representations progressing to formal written methods. 	Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction. 	Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition where appropriate. 	Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction). 	Solve addition and subtraction multi-step problems in contexts, deciding which operations why
New Vocabulary	Add, more, plus, make, altogether, total, equal to, equal, double, most and count on.	Sum, tens, units, partition, addition, column, tens boundary.	Hundreds boundary, increase, vertical, carry, expanded and compact.	Thousands, digits and inverse.	Decimal place, decimal point, tenths, hundredths and thousandths. Tenths, hundredths, decimal point and decimal.	

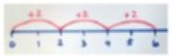
Multiplication and Division

Developing Conceptual Understanding

2 frogs on each lily pad.

6 ÷2 = 3 by sharing into 2 groups and by grabbing groups of 2

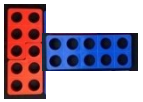
How many 2s?



5 frogs on each lily pad

5 x 3 = 15

5 x 2 = 2 x 5



Build tables on counting stick

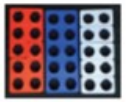
Link to repeated addition

15 ÷ 3 = 5 in each group (sharing)

Link to fractions

15 ÷ 3 = 5 groups of 3 (grouping)

10 ÷2 = 5

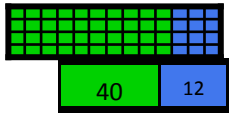


Use language of division linked to tables

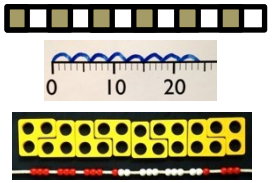
How many 2s?

If I know 10 x 8 = 80 then …

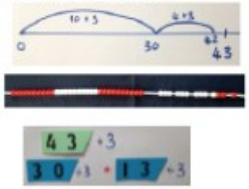
So 13 x 4 = 10 x 4 + 3 x 4



Build tables on counting stick

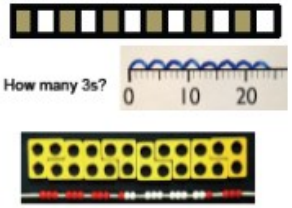


Grouping using partitioning
43 ÷ 3 If I know 10 x 3 …



How many 3s?

Use language of division linked to tables



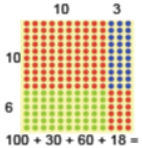
43 x 6 by partitioning

X	40	3
6	240	18

40 x 6 = 240
3 x 6 = 18
43 x 6 = 258

If I know 4 x 6 = 24 the 40 x 60 is ten times bigger.

13 x 16 by partitioning



100 + 30 + 60 + 18 = 208
Build tables on counting stick

Grouping using partitioning
196 ÷ 6 If I know 3 x 6 … then 30 x 6…

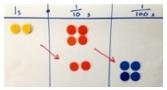
'Chunking up' on a number line
196 ÷ 6 = 32 r 4

Use language of division linked to tables.

Grid method linked to formal written method

x	200	40	3
30	6000	1200	90
6	1200	240	18

If I know 4 x 6 then 0.4 x 6 is ten times smaller 0.4 x 0.6 is ten times smaller again.



192 ÷ 6 using place value counters to support written method

Exchange 100 for ten 10s

19 tens into groups of 6

3 groups so that is 30 x 6, exchange remaining 10 for ten 1s

So 192 ÷ 6 = 32

With Jottings or in Your Head	Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.	Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot. Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in context.	• Write and calculate mathematical statements for multiplication and division using the multiplication tables they know, including for two -digit numbers times one-digit numbers, using mental methods.	Use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by; multiplying together three numbers. Recognise and use factor pairs and commutatively in mental calculations.	Multiply and divide numbers mentally drawing upon known facts. Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000. Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers. Establish whether a number up to 100 is prime.	Perform mental calculations, including with mixed operations and large numbers.
Mental strategies for addition and subtraction	To multiply by 10, shift the digits one place to the left. Say or write a division statement corresponding to a given multiplication statement. Use the relationship between multiplication and division. Use known number facts and place value to carry out mentally simple multiplications and divisions including dividing multiples of 10 by 20.		To multiply by 10/100, shift the digits one/two places to the left. Use doubling or halving, starting from known facts (e.g. 8 x 4 is double 4 x 4). Use doubling or halving, starting from known facts. For example: double/halve two-digit numbers by doubling/halving the tens first; to multiply by 4, double, then double again; to multiply by 5, multiply by 10 then halve; to multiply by 20, multiply by 10 then double; find the 8 times-table facts by doubling the 4 times-table; find quarters by halving halves. Use doubling or halving, starting from known facts. double/halve any two-digit number by doubling/halving the tens first; Double one number and halve the other; to multiply by 25, multiply by 100 then divide by 4 find the x16 table facts by doubling the x8 table; find sixths by halving thirds.		Use related facts and doubling or halving. For example: double or halve the most significant digit first; to multiply by 25, multiply by 100 then divide by 4; double one number and halve the other; find the x24 table by doubling the x6 table twice. Use factors (e.g. 35 x 18 = 35 x 2 x 9). Use the relationship between multiplication and division. Use closely related facts (e.g. to multiply by 9 or 11, multiply by 10 and adjust; develop the x6 table from the x4 and x2 tables). Use closely related facts (e.g. multiply by 19 or 21 by multiplying by 20 and adjusting). Use closely related facts: for example, multiply by 49 or 51 by multiplying by 50 and adjusting. Develop the x 17 table by adding facts from the x 10 and x 7 tables. Partition (e.g. 23 x 4 = (20 x 4) + (3 x 4)). Partition (e.g. 47 x 6 = (40 x 6) + (7 x 6)). Use factors (e.g. 8 x 12 = 8 x 4 x 3). Partition (e.g. 87 x 6 = (80 x 6) + (7 x 6); 3.4 x 3 = (3 x 3) + (0.4 x 3)). Use known number facts and place value to multiply and divide integers, including by 10 and then 100 (whole-number answers).	

Just Know it!	Count in multiples of twos, fives and tens.	Recall x and ÷ facts for the 2, 5 and 10 x tables, including recognising odd and even numbers.	Recall and use the x and ÷ facts for the 3, 4, 6 and 8 times tables.	Recall the x and ÷ facts for the x tables up to 12 x 12.	Recall prime numbers to 19. Know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers. Recognise and use square numbers and cube numbers, and the notation for squared and cubed.	
Written Methods		Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (x), division (÷) and equals (=) signs	Write and calculate mathematical statements for ÷ using x tables they know progressing to formal written methods	Multiply two-digit and three-digit numbers by one-digit numbers using formal written layout 243 x 6 2058 1	Multiply numbers up to 4 digits by one and two-digit numbers using formal written methods, including long multiplication for two-digit numbers 243 x 36 7290 1458 8748 1 194 ÷ 6 3 2 6 | 1 9 1 2 192 ÷ 6 = 32 Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for context.	Multiply multi-digit numbers up to 4 digits by a two digit whole numbers using formal written methods of long multiplication. 5172 x 38 155160 41376 196536 1 Divide numbers up to 4-digits by a two-digit whole number using the formal written method of short division where appropriate for the context 564 ÷ 13 *Known multiplication facts: 13, 26, 39, 52, 65, ... 10 x 13 = 130, 20 x 13 = 260 ...* 4 3 r 5 13 | 5 6 4 564 ÷ 13 = 43 r 5 = 43 5/13 Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context 564 ÷ 13 4 3 . 3 8 ... 13 | 5 6 4 . 0 0 ... 5 2 4 4 - 3 9 5 0 - 3 9 1 1 0 - 1 0 4 6 = 43 r 5 = 43 5/13 = 43.4 (1 dp)
New Vocabulary	Groups of, lots of, times, array, altogether, multiply and count. Share, share equally, group, groups of, lots of and array.	Multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times… Divide, divided by, divided into, division, grouping, number line, left and left over.	Partition, grid method, multiple, product, tens, units and value. Inverse, short division, carry, remainder and multiple.	Inverse Divisible by and factor.	Square, factor, integer, decimal, short/long multiplication and 'carry.' Quotient, prime number, prime factors, composite numbers (non-prime).	Tenths, hundredths and decimal. Common factors.