Maths Calculations Policy

Date accepted	March 2014
Date reviewed	March 2016
Reviewed by	Chris Atkinson

Totley Primary School

- The calculation policy is linked closely to the progression in Age Related Expectations.
- Within the school there will be a development of recording mental strategies, which allows the children to make their thinking visible.
- The identified mental strategies for each year group will be taught at the start of each lesson as Upside Down Inside Out maths.
- Initially children will be given opportunities to record just using the numerals or pictorial representations without the use of signs for operations or the equals sign. From the offset, children will be encouraged to use the language of 'is equal to' when talking about numbers.

Addition and subtraction	Multiplication and Division
• At all opportunities, children will be encouraged to use addition and subtraction simultaneously to develop a deep understanding of the inverse operations. • Children will then develop understanding of plus and minus signs by using appropriate contexts.	• Division facts will be taught alongside multiplication facts to reinforce the inverse nature of ÷ and x • Children will be taught multiplication first by repeated addition. E.g. 3x5 = is taught 5+5+5= and division will

- Children may record on plain or squared paper as appropriate to the task.
- Throughout the equals sign will be used accurately, e.g. 3+4=7+8=15 is not appropriate, but 3 + 4 = 7 7 + 8 = 15 is appropriate. This will always be referred to as 'is equal to' to build comprehension of number sentences representing equal values.
- Children will have experience of a range of word sentences in a diversity of forms.

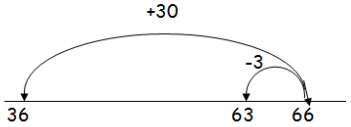
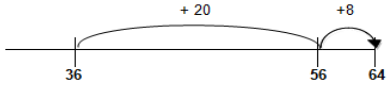
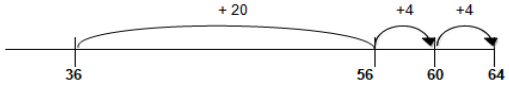
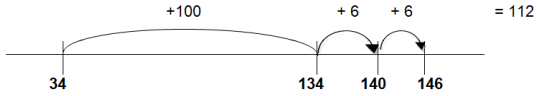
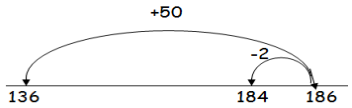
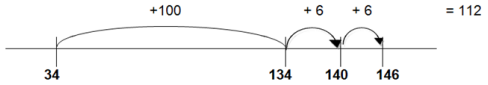
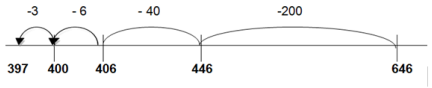
  e.g. 3 + 4 + 5 is equal to 12 7 is equal to 4 + 3, so 7 – 3 is equal to 4 3 + 4 is equal to 5 + 2
- Children will have the opportunity to experience missing box problems with the box being in any of the three positions.

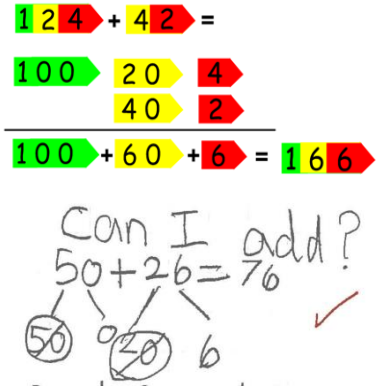
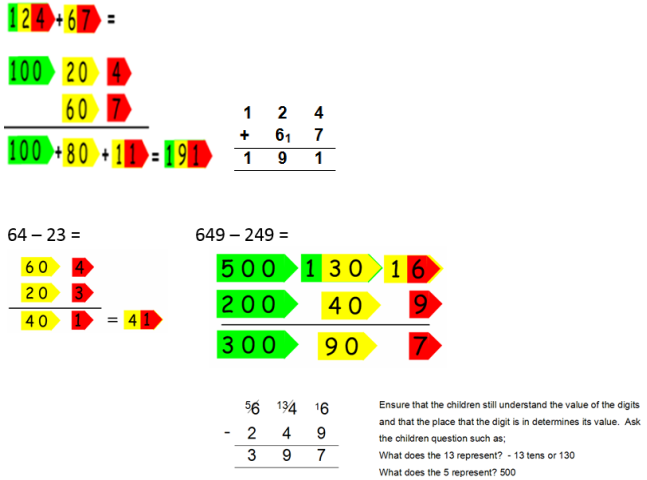
  e.g. 7 + ☐ = 12 ☐ = 7 + 5 7 = 12 - ☐

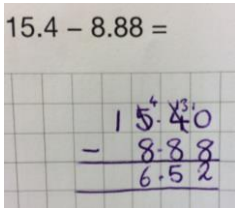
first be taught by repeated subtraction. E.g. 12 ÷ 4 is taught 12 – 4 – 4 – 4 'How many 4s have been subtracted?'
- Children will be taught through arrays, or visible patterns (see over leaf)
- Simple multiplications and divisions will be recorded in number sentences using appropriate symbols.
- The language of (but not limited to) 'lots of', 'multiplied by', 'is equal to' and 'shared into _ groups' will be used to deepen understanding of the operations.
- Children will then develop understanding of the division sign by using appropriate contexts, including whether it is sensible to round up or down after division with remainders

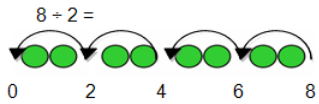
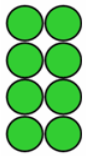
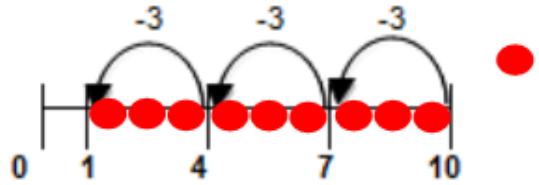
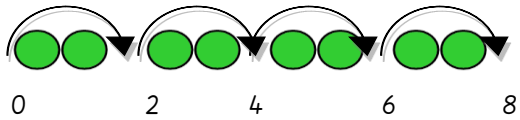
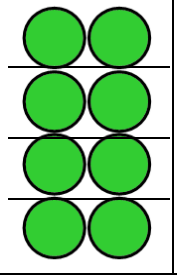
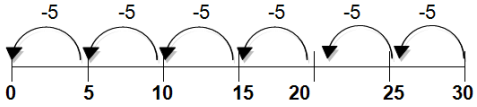
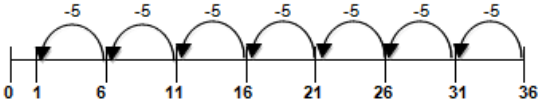
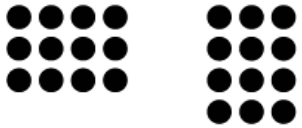
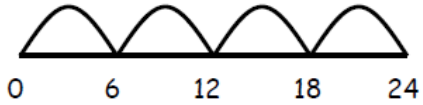
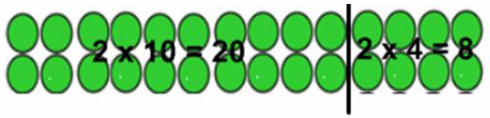
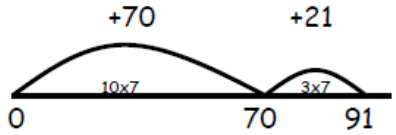
  E.g. 46 ÷ 5 = 9 remainder 1, but whether the answer should be rounded down to 9 or up to 10 depends on the context:
- Children will tackle missing box problems with the box being in any of the three positions.

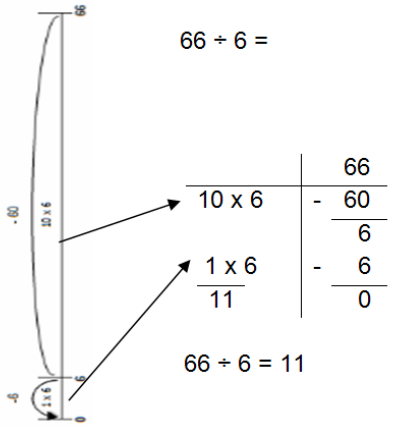
  e.g. 7 x ☐ = 21 ☐ = 7 x 5 28 = 7 x ☐

	Stage 1	Stage 2	Stage 3
Empty number lines	15 – 3 = 12 15 **take away** 3 (counting back)  A teddy bear costs £5 and a doll costs £2. How much more does the bear cost?  **Find the difference** (Counting on) 36 + 27=  28 + 36 =   	▪ Children will be expected to partition numbers into its parts in order to add or subtract as 'jumps' on the number line. ▪ They should add and subtract 'near numbers' (those near a multiple of ten) by going to the nearest multiple of ten, then adjusting.  136 + 48=  Find the difference between 146 and 34  646 – 249 = 397  	▪ By stage 3, children will move away from using number lines and arrow diagrams to add and subtract. They will, instead, move to more formal columnar / partitioning methods.

Columnar methods	▪ Children will use concrete materials to develop their understanding of the value of the digits in two-digit numbers. ▪ Addition and subtraction problems will be broken down into constituent parts (as in the examples below). 	▪ As in stage 1, children will break addition and subtraction problems down into partitioned calculations. Children will be stretched by using larger numbers. ▪ Children should be able to add and subtract two numbers (less than 100) and demonstrate their method. This should be supported with concrete materials or pictorial representations. 	▪ Children will be expected to 'borrow,' 'steel' and 'carry' to complete addition and subtraction problems. ▪ These will be represented in a formal, written strategy, supported with concrete materials if appropriate. 
Upside Down Inside Out maths	• Recall addition and subtraction facts for each number up to 10. • Recall doubles of numbers up to 10+10. • Recall halves of even numbers up to 20. • Add a single digit number to any number up to 20 by counting on. • Subtract a single digit number from any number up to 20 by counting back.	• Recall addition and subtraction facts for each number up to 20. • Recall doubles of simple 2-digit numbers. • Recall halves of simple even numbers. • Add a single digit number to any 2-digit number. • Subtract a single digit number from any 2-digit number.	• Recall addition and subtraction facts for each number up to 20. • Recall pairs of multiples of 100 that make 1,000. • Halve any even 2-digit number to 100. • Recall addition and subtraction facts for 100 (multiples of 5 and 10). • Partition 3-digit numbers. • Identify the value of each digit to 1-decimal place. • Recall addition and subtraction facts for 100.

	Stage 4	Stage 5	Stage 6
Empty number lines	Number lines will be used if appropriate for individual children, such as to help understand negative number questions about temperature. They will be expected to self-select such support materials.		
Columnar methods	▪ Children, at this stage, need to be able to accurately use a formal written method to add and subtract pairs of numbers with different digits. ▪ Children will need to 'carry' and steel' across up to two columns. 33.7 + 25.8 = 59.5 21.4 − 17.5 = 3.9	▪ In stage 5, children will use their existing written methods to tackle addition and subtraction of larger numbers, pairs of numbers with a different number of digits, decimal numbers. ▪ Children will learn how to complete missing number problems in addition and subtraction calculations. 53242 − 21357 = 31885 24565 + 7617 = 32182	▪ In stage 6, children will be taught how to use zero as a place holder when adding and subtracting pairs of numbers with different decimal places. ▪ Children will work with numbers up to three decimal places. ▪ Children will be expected to carry across or steel from three or more columns. ▪ Children will need to complete 'missing number' problems by using their inverse skills. 
Upside Down Inside Out maths criteria	• Recall addition and subtraction facts for each number up to 20. • Recall addition and subtraction facts for 100. • Recall and use addition and subtraction facts for multiples of 100 totalling 1,000.	• Find pairs of numbers with a calculations of 100. • Derive related facts from those already known, e.g. 5x0.7 linked to 5x7; and 2+8 linked to 0.2+0.8).	• Derive related facts from those already known, e.g. 5x0.7 linked to 5x7; and 2+8 linked to 0.2+0.8). • Recall and use addition and subtraction facts for 1 (with decimal numbers to 2-decimal places).

	Stage 1	Stage 2	Stage 3
Empty number lines	Children will use populated number lines (those with the numbers written on for them). 8 ÷ 2 = 4   10 ÷ 3 = 3 remainder 1  4 x 2 =  2 + 2 + 2 + 2=8 4 lots of 2 = 8 2 x 4 = 8 	30 ÷ 5 = 6  36 ÷ 5 = 7 remainder 1  4 x 3 =  Drawing an array (3 rows of 4 or 3 columns of 4) gives children an image of the answer. It also helps develop the understanding that 4 x 3 has the same answer as 3 x 4. 4 x 6 = 	 We have taken away 14 "chunks" of 6 and 1 is left over 85 ÷ 6 = 14 remainder 1 Partitioned array 14 x 2 =  20 + 8 = Number Line 13 x 7 = 

Columnar methods			66 ÷ 6 = Known Facts: 10 x 6 = 60 20 x 6 = 120 
Upside Down Inside Out maths criteria	• Count on and back in multiples of 2, 5 and 10. • Recall doubles of numbers up to 10+10. • Recall halves of even numbers up to 20.	• Count on and back in multiples of 2, 3 5 and 10. • Recall doubles of simple 2-digit numbers. • Recall halves of simple even numbers. • Count on and back in 10s from any number. • Recall multiplication facts for x2, x5 and x10tables.	• Recall multiplication facts for 2, 3, 4, 5 and 10 times tables and deduce associated division facts. • Double any number to 50. • Halve any even 2-digit number to 100. • Count on and back in 1s, 10s or 100s from any 2-digit number or 3-digit number. • Count on and back in multiples of 4 or 8 from 0. • Double any number to 100. • Double any multiple of 50 up to 500. • Halve any number up to 100.

<table>
<tr><th></th><th>Stage 4</th><th>Stage 5</th><th>Stage 6</th></tr>
<tr><td>Empty number lines</td><td colspan="3">

Children will now be exclusively using formal columnar methods to divide and multiply.
In all cases, children will be taught to develop self-checking strategies, such as comparing a final answer to an initial estimation.

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<tr><td>Columnar methods</td><td>

Children will use 'chunking' (a repeated subtraction method) to divide _ _ _ ÷ _, including with a remainder.

159 ÷ 4 =
<table>
<tr><td></td><td>159</td></tr>
<tr><td>30 x 4</td><td>- 120</td></tr>
<tr><td></td><td>39</td></tr>
<tr><td>5 x 4</td><td>- 20</td></tr>
<tr><td></td><td>19</td></tr>
<tr><td>4 x 4</td><td>- 16</td></tr>
<tr><td>39</td><td>3</td></tr>
</table>
Known Facts
5 x 4 = 20
10 x 4 = 40
20 x 4 = 80
30 x 4 = 120
40 x 4 = 160

159 ÷ 4 = 39 r 3

Children will use the grid method (see below) as a stepping stone to using short multiplication to multiply one digit by 3 digit numbers.

Grid method:
<table>
<tr><td>x</td><td>600</td><td>10</td><td>3</td></tr>
<tr><td>5</td><td>3000</td><td>50</td><td>15</td></tr>
</table>
Short multiplication:
Th H T U
9 3 4 ×
6
5 6 0 4
2 2
</td><td>
36 x 54 =
<table>
<tr><td></td><td></td><td>3</td><td>6</td><td></td></tr>
<tr><td></td><td>X</td><td>5</td><td>4</td><td></td></tr>
<tr><td></td><td>1</td><td>4</td><td>4</td><td>36 x 4</td></tr>
<tr><td>1</td><td>8</td><td>0</td><td>0</td><td>36 x 50</td></tr>
<tr><td>1</td><td>9</td><td>4</td><td>4</td><td></td></tr>
</table>

For division, children will use chunking to tackle _ _ _ ÷ _ _.
They will be encouraged to estimate, calculate and check.
Children will apply their written multiplication and division skills to work with decimal numbers.
To multiply or divide decimals, children will be taught to multiply out the decimal, tackle as a whole number sum, then divide back in the decimals.

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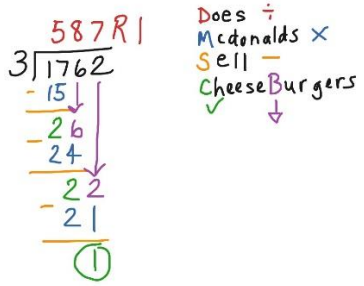
The strategies will be as in stage 5, with the added challenge of _ _ _ _ ÷ _ _



When multiplying, children will use the same formal method to tackle _ _ _ x _ _ and to multiply decimals with different numbers of decimal places (e.g. 3.4 x 3.56).

</td></tr>
</table>

Upside Down Inside Out maths criteria	▪ Multiply and divide numbers by 10, including those which have answers to one decimal place. ▪ Use partitioning to double or halve any number, including decimals to one decimal place. ▪ Recall multiplication facts for all times tables up to 12x12 and derive	▪ Derive related facts from those already known, e.g. 5x0.7 linked to 5x7; and 2+8 linked to 0.2+0.8). ▪ Use partitioning to double and halve any number, including decimals to 2-decimal places. ▪ Multiply and divide whole numbers and decimals with up to 2-decimal places mentally by 10 or 100, and integers by 1000 and use this to convert between units of measurement, e.g. cm to m; g to kg etc. ▪ Know by heart all multiplication facts to 12x12, including deduced division facts and decimal facts (e.g. 7 x 7 = 49, so 0.7 x 7 = 4.9)	▪ Multiply and divide whole numbers and decimals mentally by 10 or 100 and integers by 1000 and use this to convert between units of measurement. ▪ Mentally multiply and divide 2-digit decimals by a single digit number, e.g. U.t.xU or U.t÷U. ▪ Use partitioning to double or halve any number. ▪ Mentally multiply and divide pairs of multiples by 10 and 100. ▪ Identify the multiples/factors of given numbers.