RIVINGTON FOUNDATION PRIMARY SCHOOL

CALCULATION POLICY

MENTAL AND WRITTEN CALCULATIONS

This policy outlines both the **mental** and **written** methods that should be taught from Year 1 to Year 6.

The policy has been written according to the National Curriculum 2014 and the written calculations for all four operations are as outlined on the appendices of the Programme of Study.

The document builds on the inter-connectedness of mathematics and outlines the progression for addition, subtraction, multiplication and division. It is our intention that addition and subtraction should be taught at the same time to ensure children are able to see the clear links between the operations and the inverse nature of them along with multiplication and division.

Children should be secure in mental strategies. They are encouraged to develop a mental picture of the number system in their heads to use for calculations. They are taught the strategy of counting forwards and backwards in ones and tens first and then special strategies are introduced. Children are taught to look carefully at the calculation and decide, which strategy they should use. Children should explain and reason as to why they have chosen a strategy and whether it is the most efficient.

The formal written methods should be introduced with caution. Calculations that require a written method should be presented to the children and models and images, such as dienes apparatus, place value counters, etc. should be used to ensure children have a conceptual understanding of the written method.

The policy outlines the **mental strategies** that children should be encouraged to use:

A mental strategy that they can always rely on E.g. counting in tens and ones, forwards and backwards E.g. 56 – 25 (count back in 10s 56, 46, 36 and back in ones 36, 35, 34, 33, 32, 31)

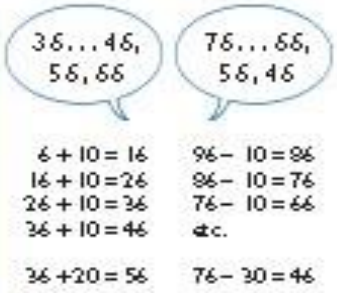
A special strategy they can select from a small range of strategies if they can see something special about the numbers they are being asked to calculate with E.g. 46 – 24 (I can use near doubles to support my calculation E.g. 46 – 23 – 1)

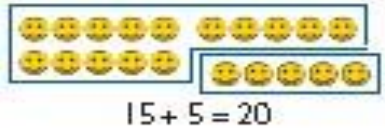
The policy outlines the **written methods** as suggested on the appendices of the Curriculum 2014 and suggests that children:

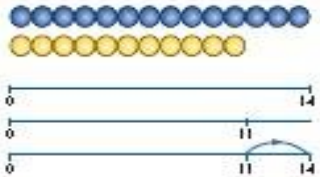
- Look at a calculation and decide whether it can be done mentally, mentally with a jotting or whether it needs a written method.
- Should always be shown written methods with place value apparatus to ensure children are clear about the value of the numbers that they are calculating with and the numbers do not just become digits.
- Estimate, calculate and check to ensure that the answer they generate has some meaning.

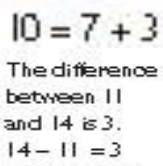
For the purpose of developing understanding there may be occasions when examples that can be completed mentally may be shown as a written method purely to develop understanding of the method. This needs to be made very clear to children and when they are practising the methods, appropriate calculations should be used.

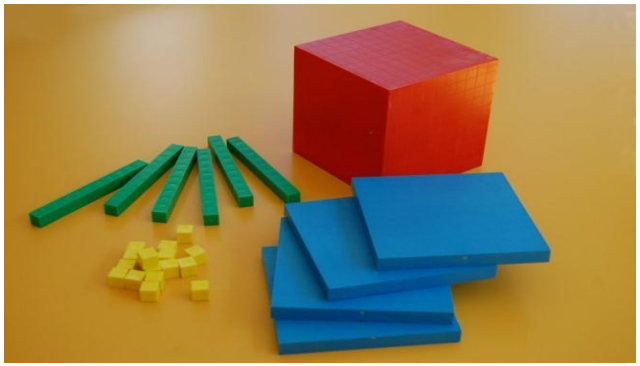
Key representations to support conceptual understanding of addition and subtraction.











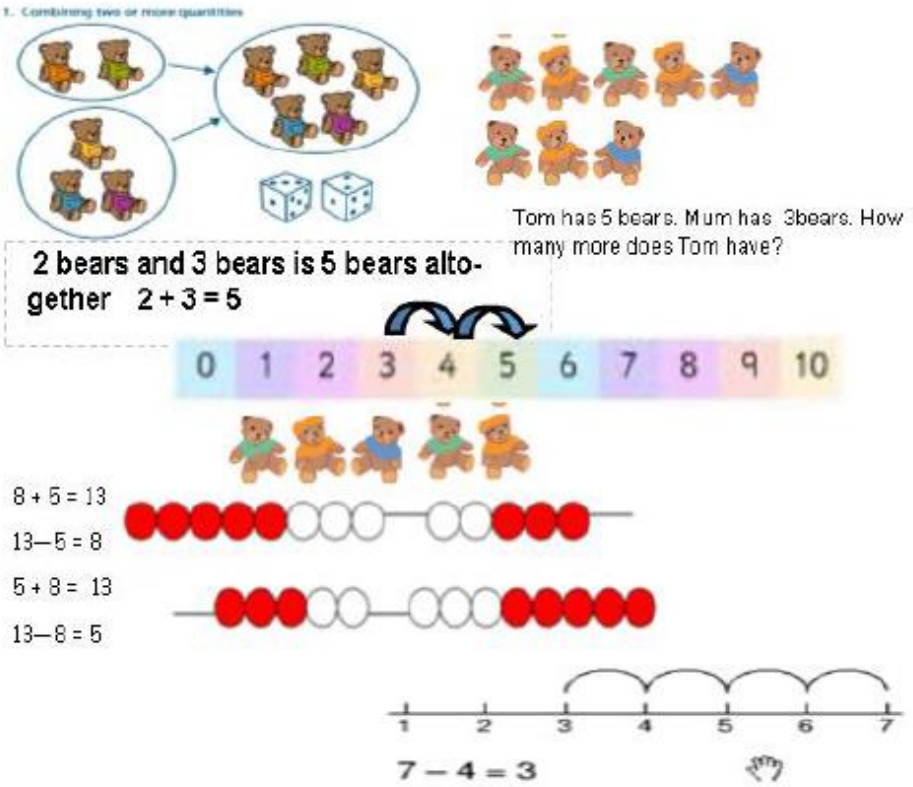
DEVELOPING UNDERSTANDING OF ADDITION AND SUBTRACTION

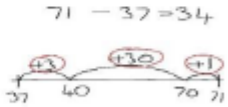
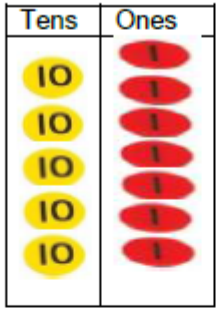
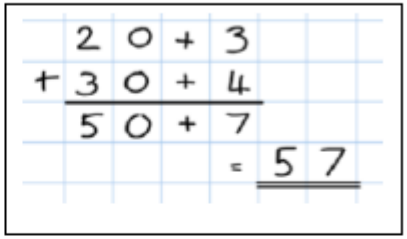
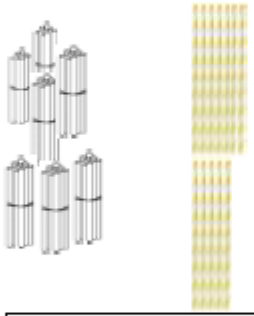
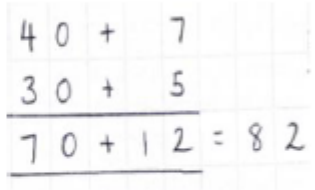
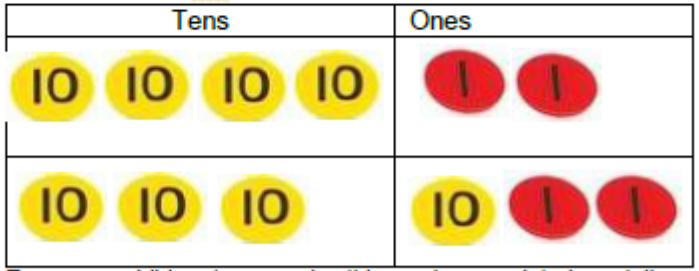
Year 1	
Objectives	**Recall of Facts**
read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs **represent** and **use** number bonds and related subtraction facts within 20 add and subtract one-digit and two-digit numbers to 20, including zero	■ = ■ + ■ If we know 4 + 5 = 9 We also know: , 5 + 4 = 9 9 - 5 = 4 9 - 4 = 5 14 + 5 = 19 19 - 14 = 5, etc Work with all numbers up to 20.

Children need to be secure with Using and Applying these skills in unfamiliar contexts before moving into the Year 2 objectives.

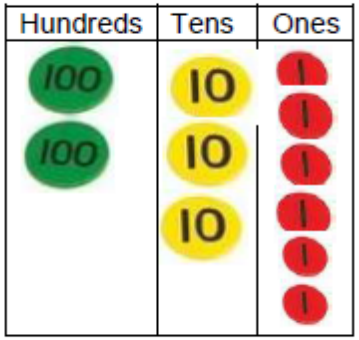
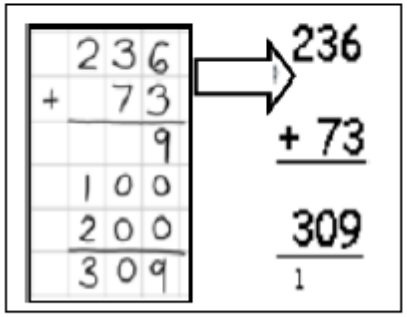
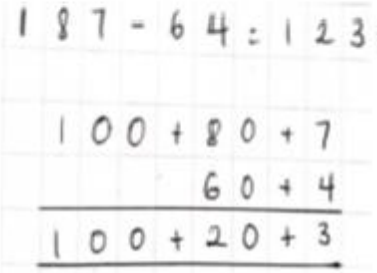
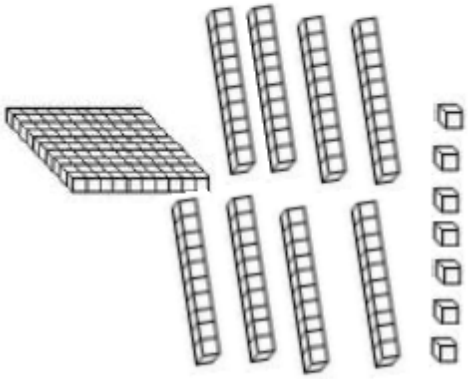
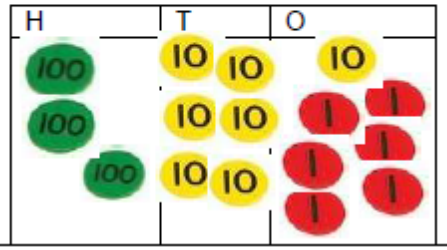
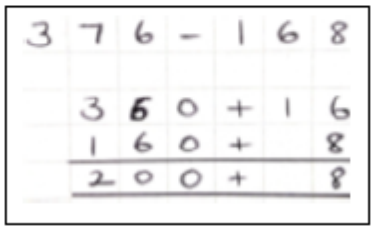
Mental Jottings with representations

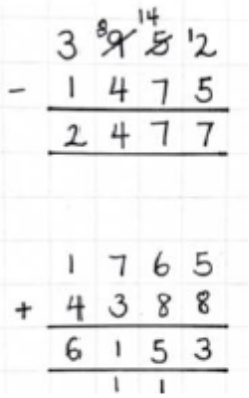
Immerse children in practical opportunities to develop understanding of addition and subtraction. Link practical representations on a number track on a beadstring to recording on a number line. By the end of Year 1 children should be able to recall and use facts within and to 20.



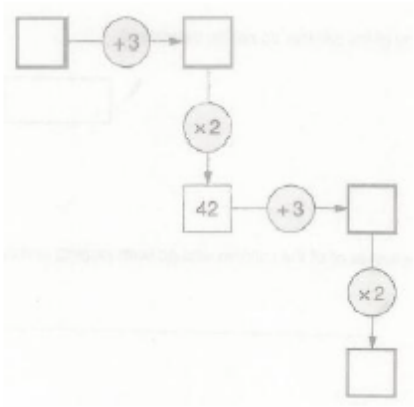
Year 2		
Objectives:	**Mental Recall/Jottings:**	**Written Methods with representations**
Show that addition of two numbers can be done in any order and subtraction cannot. Recall and use addition and subtraction facts to 20 fluently and derive and use related facts up to 100. Add and subtract numbers using concrete objects, pictorial presentations and mentally including: 2 digit number and ones 2 digit number and tens Two 2 digit numbers Add three 1 digit numbers Solve problems with addition and subtraction: · using concrete objects and pictorial representations, including those involving numbers, quantities and measures · applying their increasing knowledge of mental and written methods	**Using known facts** If I know: 2+3 = 5 I also know: 3+2 = 5 20 + 30 = 50 30 + 20 = 50 50—30 = 20 50—20 = 30 **Bridge through 10** 26 + 7 = 26 + 4 + 3 26 + 4 = 30 30 + 3 = 33 **Counting on/back in10s** 26 + 20 = 67-20 **Partitioning** 23 + 34 = 46—25 **Special Strategy** **Rounding and adjusting** + 9—9 +11—11 **Bonds to 10** 2 + 7 + 8 = 8 + 2 + 7 **Finding the difference between two numbers. 71 – 37:**  **Partitioning numbers in different ways in preparation for subtracting using decomposition:** 90 + 2 80 + 12 (I have subtracted a ten and added it onto the ones) Continue to record mental jottings as outlined in Year 2 with increasingly larger numbers. Use suitable resources as required (See models and images page). Children that have not achieved the age related expectations for Year 2 should not move onto formal written methods until they are secure with mental recall/jottings.	Recording addition and subtraction in columns supports place value and prepares for formal written methods.      Encourage children to recognise this can be completed mentally: 42 → 40 + 2 → 30 + 12 → 42 – 15 = 27 -15 → 10 + 5 → 10 + 5 20 + 7

Year 3

Objectives:	Mental Recall/Jottings:	Written Methods with representations
Add and subtract numbers mentally A 3 digit number and 1s A 3 digit number and 10s A 3 digit number and 100s Add and subtract numbers with up to 3 digits using formal written methods of columnar addition and subtraction. Estimate Calculate Check	**Bridging to 10** 425 + 8 = 425 + 5 + 3 = 430 + 3 = 433 **Rounding and Adjusting** 425 + 90 = 425 + 100 = 525 - 10 = 515 146 – 9 = 146 – 10 + 1 = 136 + 1 = 137 146 – 50 = 146 – 40 – 10 = 106 – 10 = 96 **Counting forwards or backwards in 100s** 636 – 500 = 136	Pupils use their understanding of place value and partitioning, and practise using columnar addition and subtraction with incr easingly large numbers up to three digits to become fluent     376—168 = Using my knowledge of partitioning in different ways. 376 = 360 + 16.  

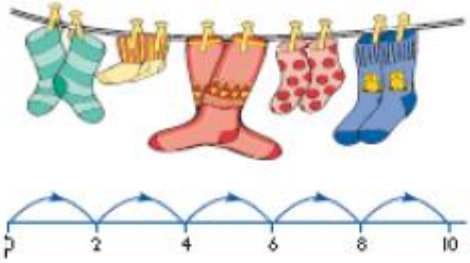
Year 4		
Objectives:	**Mental Recall/Jottings:**	**Written Methods:**
Continue to secure and extend mental methods from previous year groups. To select whether a calculation can be done mentally, with a jotting or using a formal written method. Add and subtract numbers with up to 4 digits using formal written methods of column addition and subtraction where appropriate.	Develop confidence at calculating mentally with larger numbers. Using the full range of strategies: · **Counting in 1s/10s** · **Bridging through multiples of 10** · **Partitioning** · **Rounding and Adjusting** · **Reordering** · **Near Doubles** · **Bridging through 60 when calculating with time.** **Can I do it mentally?** **Should I use a jotting?** **Should I use a written method?**	Add and subtract numbers up to four digits.  Revert to expanded methods if the children experience any difficulty. Use the written method with decimals in the context of money £ 32.50 + £ 21.75 = £54.25 £32.50 + £21.75 £54.25 1 £ 42.50 - £ 13.35 = £ 29.15 £ 3 4 1 2. 4 5 1 0 - £ 1 3. 3 5 £ 2 9. 1 5 Using number to ensure children understand the process before quickly moving into numbers that do require a written method.

Year 5		
Objectives:	**Mental Recall/Jottings:**	**Written Methods:**
Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction) Add and subtract numbers mentally with increasingly large numbers Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.	12 462 – 2300 Use knowledge of place value to calculate mentally with increasingly larger numbers. Employ a range of special strategies to develop confidence in calculating mentally. E.g. **2364 + 1999 =** 2364 + 2000 = 4364 4364—1 = 4363 **13484 + 2400 =** 13000 + 2000 = 15000 484 + 400 = 884 15000 + 884 = 15884 4 = 2001—1997 1997 2000 2001 13486—5000 13486—3000 = 10486 10486—2000 = 8486	**Estimate:** 800 + 640 = 1440 789 + 642 becomes 7 8 9 + 6 4 2 1 4 3 1 1 1 Answer: 1431 900 – 500 = 400 874 – 523 becomes 8 7 4 – 5 2 3 3 5 1 Answer: 351 900 – 500 = 400 932 – 457 becomes 8 12 1 9 3 2 – 4 5 7 4 7 5 Answer: 475 932 – 457 becomes 1 1 9 3 2 – 4 5 7 5 6 4 7 5 Answer: 475 **Check:** **Is your estimate close to the answer you have calculated?** 25.356 + 346.28 becomes: Estimate: 25 + 350 = 375 25.356 +346.28 371.636 1 1 9.076 – 3.142 becomes: Estimate: 9 – 3 = 6 8 1 9.076 3. 142 5. 934

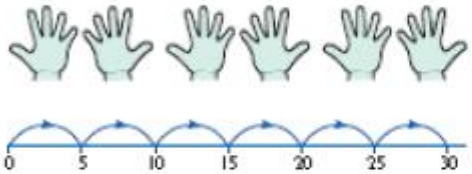
Year 6		
Objectives:	**Mental Recall/Jottings:**	**Written Methods:**
Perform mental calculations, including with mixed operations and large numbers Use their knowledge of the order of operations to carry out calculations involving the four operations Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why	**Ensure children use a wide range of mental strategies when calculating including decimals and increasingly larger numbers.** **What is 2 minus 0.005?** **What is 5.7 added to 8.3?**  **57 + ☐ = 125** **911 – 47 = ☐** **149 + 137 + 158 = ☐** **(☐ + ☐) x ☐ = 10**	12 462 + 8456 Estimate: 21 000 = 12 500 + 8 500 12 462 + 8 456 20 918 1 1 3906 = 12 462 – 8556 Estimate: 4000 = 12 500 – 8 500 $\cancel{1}\,{}^{1}\cancel{1}\cancel{2}\,{}^{1}4\,{}^{5}\cancel{6}\,{}^{1}2$ - 8 5 5 6 3 9 0 6 Add and subtract numbers with a different number of decimal places. 12.4 – 3.56 = Estimate: 12 – 4 = 8 (my answer should be between 8 and 9) $1\,{}^{1}\cancel{2}.\,{}^{13}\cancel{4}\,{}^{1}0$ - 3. 5 6 8. 8 4

Tth	Th	H	T	U

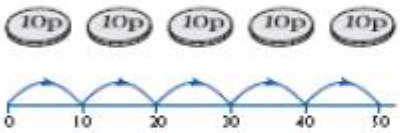
Key representations to support conceptual understanding of multiplication and division



$2 + 2 + 2 + 2 + 2 = 10$
$2 \times 5 = 10$
2 multiplied by 5
5 pairs
5 hops of 2

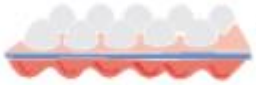


$5 + 5 + 5 + 5 + 5 + 5 = 30$
$5 \times 6 = 30$
5 multiplied by 6
6 groups of 5
6 hops of 5



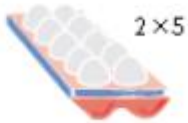
$10p + 10p + 10p + 10p + 10p = 50p$
$10p \times 5 = 50p$
5 hops of 10

$4 \times 2 = 8$
$2 \times 4 = 8$

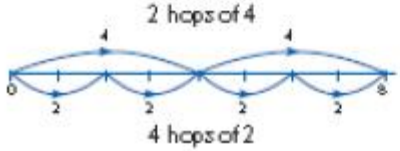


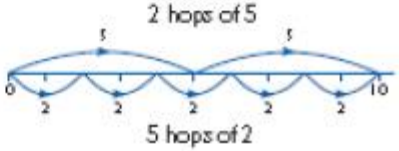
$5 \times 2 = 10$
$2 \times 5 = 10$

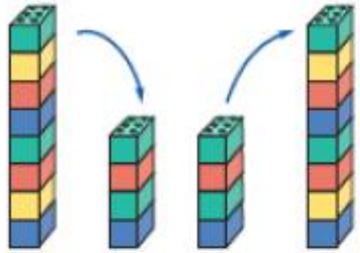
$2 \times 4 = 8$
$4 \times 2 = 8$



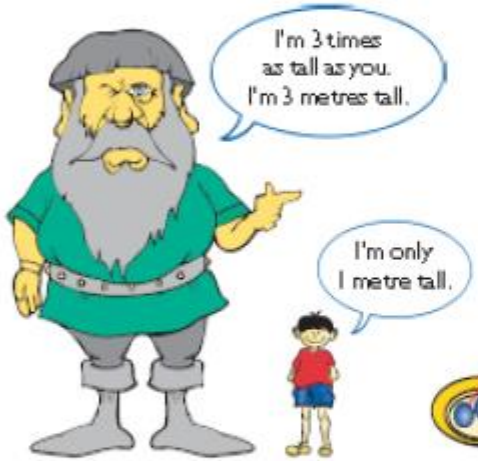
$2 \times 5 = 10$
$5 \times 2 = 10$

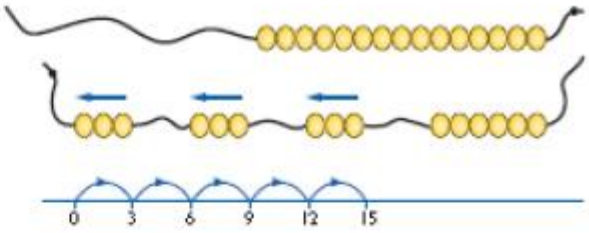


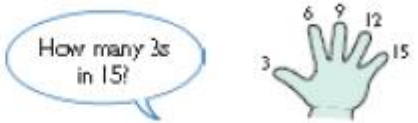




half of 8 is 4
$8 \div 2 = 4$
double 4 is 8
$4 \times 2 = 8$

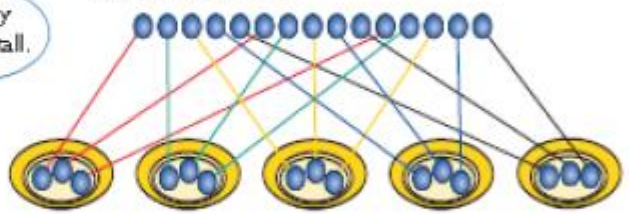


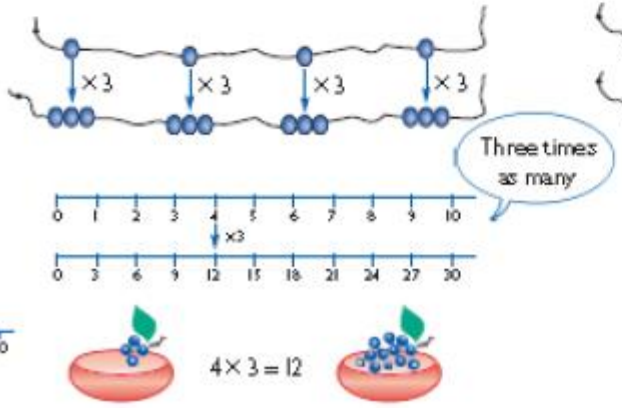


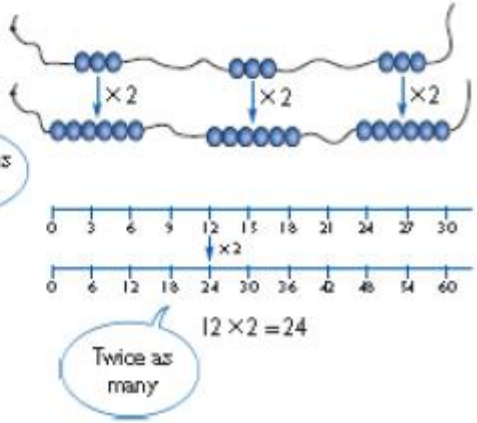


$15 \div 3 = 5$

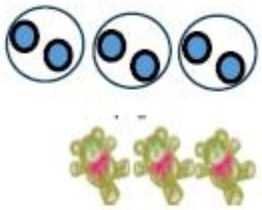
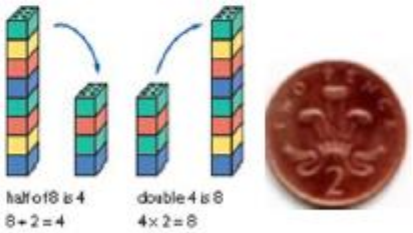
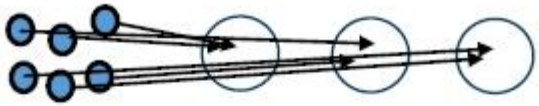
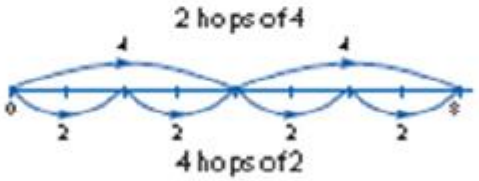
5 hops in 15. How big is each hop?
$15 \div 5 = 3$
15 shared between 5

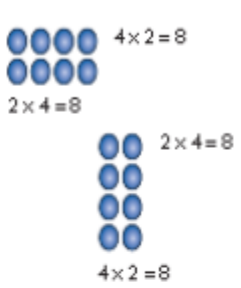
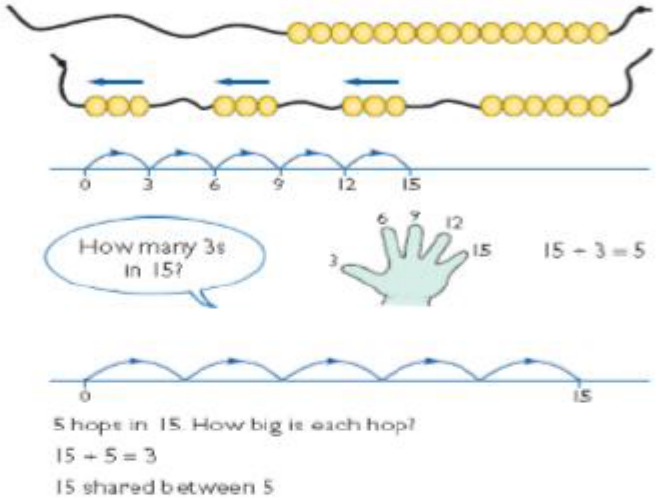
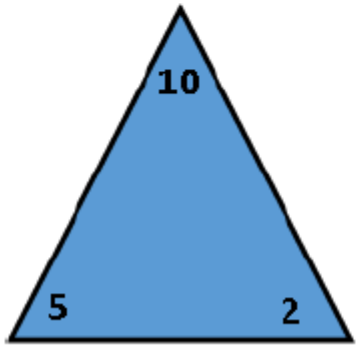
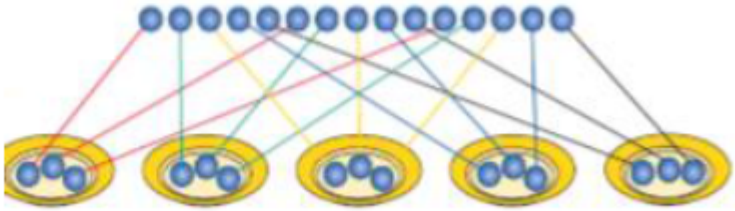


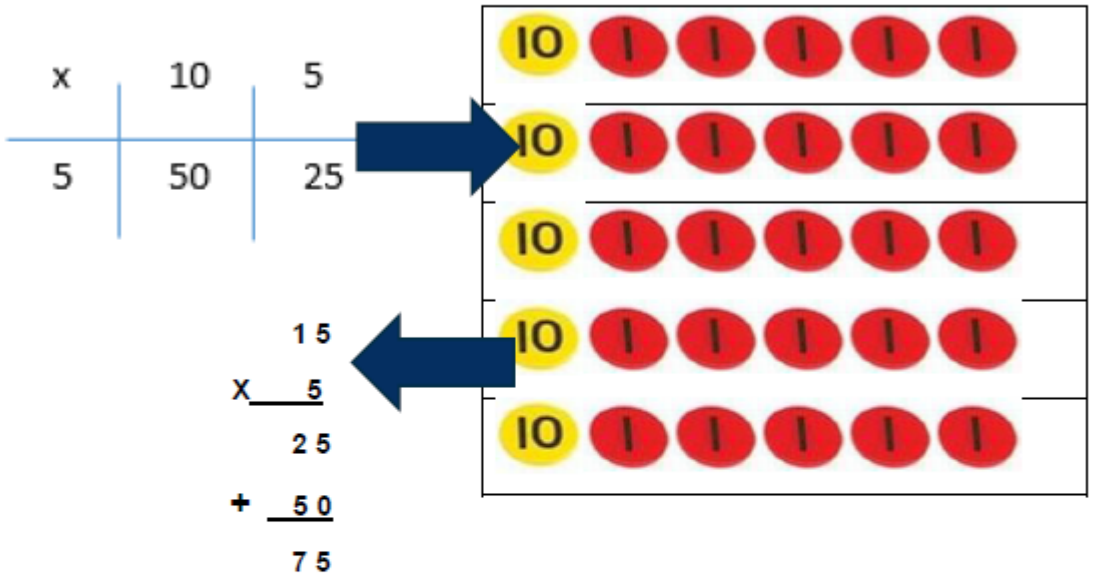
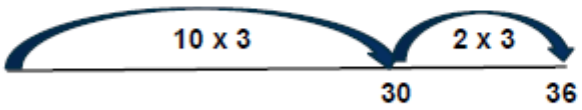
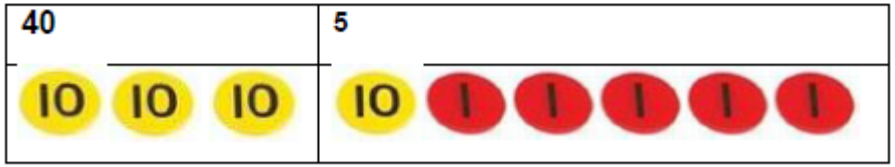


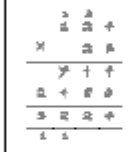
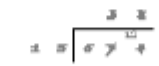
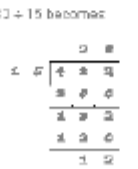
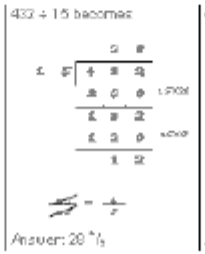
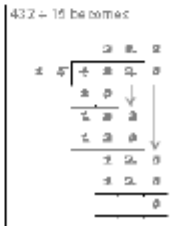


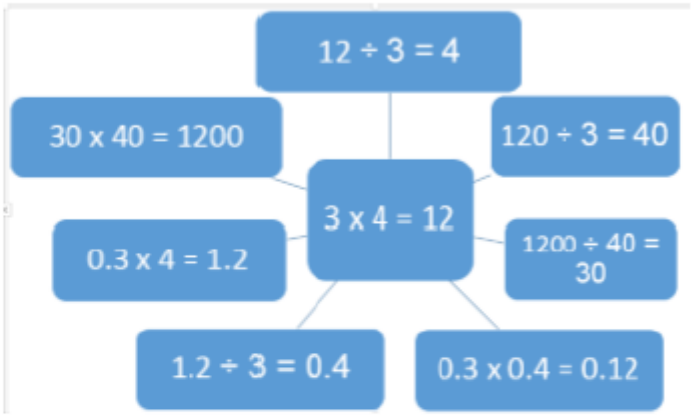
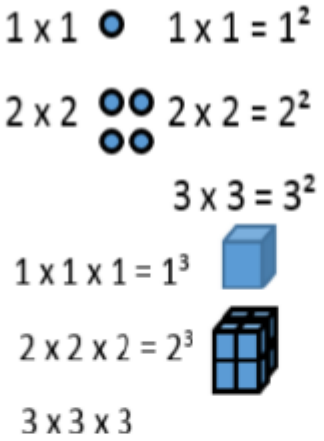
Year 1

Objective	Examples	Representations
count, read and write numbers to 100 in numerals; count in multiples of twos, fives and tens Double numbers to 20	Use of visual models to support counting in 2, 5, 10 Ensure children begin to see the patterns of counting in 2, 5, 10. Double/halve numbers up to: 10 + 10 = 10 x 2 20 – 10 = 20 ÷ 2 Children do not need to record number sentences using the symbols. Develop the vocabulary by encouraging children to explain what they are doing.	Grouping and sharing  How many legs will 3 teddies have?   Arrays 

Year 2		
Objective	**Examples**	**Models and Images**
count in steps of 2, 3, and 5 from 0, and in tens from any number, forward or backward (copied from Number and Place Value) recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot Written calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs	2 x 5 = 10 5 x 2 = 10 10 ÷ 2 = 5 10 ÷ 5 = 2 Use knowledge of doubling: 2 x 10 = 20 10 x 2 = 20 20 ÷ 2 = 10 20 ÷ 10 = 2	    3 x 5 = 15 15 ÷ 5 = 3

Year 3		
Objective	**Mental Recall Examples**	**Progressing from Mental to Written Methods with representations**
count from 0 in multiples of 4, 8, 50 and 100 (copied from Number and Place Value) recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods (appears also in Written Methods)	If the children know 2/5/10 facts they now need to learn: 3 x 3 4 x 4 6 x 8 4 x 3 6 x 4 7 x 8 6 x 3 7 x 4 8 x 8 7 x 3 8 x 4 9 x 8 8 x 3 9 x 4 11 x 8 9 x 3 11 x 4 12 x 8 11 x 3 12 x 4 12 x 3 With corresponding division facts. Recall facts along with counting in steps sizes. **4 x 3 = 3 x 4** **12 ÷ 3 = 4** **12 ÷ 4 = 3** To make 6 fairy cakes you need... How much will you need for 12?	 **36 ÷ 3 =**  **45 ÷ 3 = 15** 3 ⟌ 4 5  **Short multiplication and division rely on mental methods – children should be given short multiplication and division involving 2/3/4/5/6/10 times tables**

Year 4		
Objective	**Mental Methods**	**Written Methods with representations**
count in multiples of 6, 7, 9, 25 and 1 000 (copied from Number and Place Value) recall multiplication and division facts for multiplication tables up to 12 × 12 use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers. recognise and use factor pairs and commutativity in mental calculations (appears also in Properties of Numbers) multiply two-digit and three-digit numbers by a one-digit number using formal written layout	If the children know multiplication and division facts for: 2/5/10/3/4/8/ they now need to learn. 6 x 6 7 x 7 9 x 9 11 x 11 7 x 6 9 x 7 11 x 9 12 x 11 9 x 6 11 x 7 12 x 9 12 x 12 11 x 6 12 x 7 12 x 6 Explore what happens when we divide by 1 and 0. To solve 24 x 3 Use knowledge of factor pairs. 8 x 3 x 3 6 x 4 x 3 In measuring and scaling contexts, (for example, four times as high, eight times as long etc.) and correspondence problems in which m objects are connected to n objects (for example, 3 hats and 4 coats, how many different outfits?; 12 sweets shared equally between 4 children; 4 cakes shared equally between 8 children).	**These are the methods from the appendix of the National Curriculum. Schools should agree the methods that they are going to use.** Short multiplication 24 × 6 becomes Answer: 144 24 × 12 becomes Answer: 288 124 × 12 becomes Answer: 1 488 Long multiplication 24 × 16 becomes Answer: 384 24 × 33 becomes Answer: 788 124 × 36 becomes  Answer: 3 224 Short division 432 ÷ 5 becomes Answer: 86 remainder 2 574 ÷ 15 becomes  Answer: 38 $^{4}/_{15}$ 511 ÷ 35 becomes Answer: 14.6 Long division 432 ÷ 15 becomes  Answer: 28 remainder 12 432 ÷ 15 becomes  Answer: 28 $^{4}/_{5}$ 432 ÷ 15 becomes  Answer: 28.8

Year 5	
Objective	**Mental Methods**
count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000 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. know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers establish whether a number up to 100 is prime and recall prime numbers up to 19 recognise and use square numbers and cube numbers, and the notation for squared (2) and cubed (3)	  **Multiplying and dividing whole numbers and decimals by 10, 100 and 1000.** **Thousands** | **Hundreds** | **Tens** | **Ones** | **/10 (tenths)** | **/100 (Hundredths)** | | | | | |

Year 5 Continued.

Objective	Written Methods
multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context	2307 x 8 = Estimate: 2000 x 8 = 16000 Calculate: (Short multiplication) 2 3 0 7 X 8 18 4 5 6 2 5 1431 x 23 = Estimate: 1431 x 20 = 28620 1 Calculate: (Long multiplication) 1 4 3 1 X 2 3 4 2 9 3 (1431 x 3) 2 8 6 2 0 (1431 x 20) 3 2 9 1 3 1 1 Examples with decimals: 4.65 x 9 = 432 ÷ 5 = Estimate: 400 ÷ 5 = 80 Calculate (short division) 432 ÷ 5 becomes 8 6 r 2 5 | 4 3 2 3 Answer: 86 remainder 2 Estimate: 450 ÷ 15 = 30 Calculate: (Long division) 432 ÷ 15 becomes 2 8 r 12 1 5 | 4 3 2 3 0 0 1 3 2 1 2 0 1 2 Examples with decimals: 37.2 ÷ 8 =

Ensure children are able to express remainders either as remainder, fraction or decimal. For example remainder 12 or 12/15 (4/5) or 0.8)

Year 6	
Objective	**Mental Methods**
perform mental calculations, including with mixed operations and large numbers	They undertake mental calculations with increasingly large numbers and more complex calculations. Pupils continue to use all the multiplication tables to calculate mathematical statements in order to maintain their fluency. Pupils round answers to a specified degree of accuracy, for example, to the nearest 10, 20, 50 etc., but not to a specified number of significant figures.
identify common factors, common multiples and prime numbers	Pupils explore the order of operations using brackets; for example, 2 + 1 x 3 = 5 and (2 + 1) x 3 = 9. Common factors can be related to finding equivalent fractions.
Use their knowledge of the order of operations to carry out calculations involving the four operations	Calculate 900 ÷ (45 × 4). A bag of four oranges costs thirty seven pence. How much do twelve oranges cost?

Year 6 Continued	
Objective	**Written Methods**
multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication 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 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	**Short division** 98 ÷ 7 becomes 1 4 7 | 9 (2) 8 Answer: 14 432 ÷ 5 becomes 8 6 r 2 5 | 4 3 (3) 2 Answer: 86 remainder 2 496 ÷ 11 becomes 4 5 r 1 1 1 | 4 9 (5) 6 Answer: $45\frac{1}{11}$ **Long division** 432 ÷ 15 becomes 2 8 r 12 1 5 | 4 3 2 3 0 0 1 3 2 1 2 0 1 2 432 ÷ 15 becomes 2 8 1 5 | 4 3 2 3 0 0 15×20 1 3 2 1 2 0 15×8 1 2 $\frac{12}{15} = \frac{4}{5}$ 432 ÷ 15 becomes 2 8 · 8 1 5 | 4 3 2 · 0 3 0 ↓ 1 3 2 1 2 0 ↓ 1 2 0 1 2 0 0