The Meadows Primary School

KS2 Calculation Policy

Version Control

Version	Date	Purpose	Author
2	27/04/2022	Update of previous policy	L.Heath

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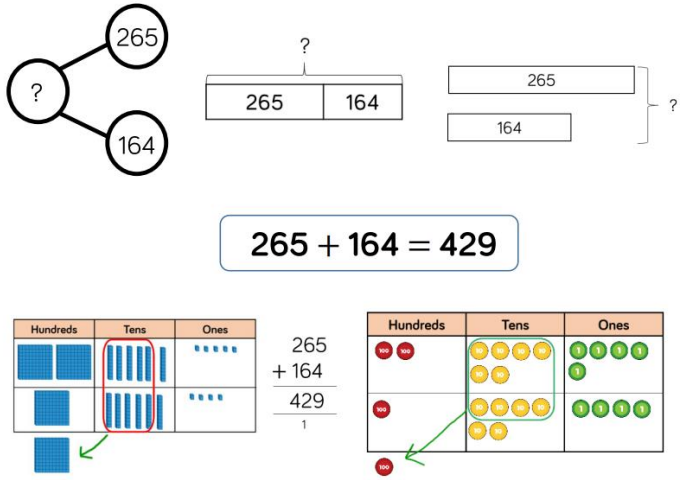
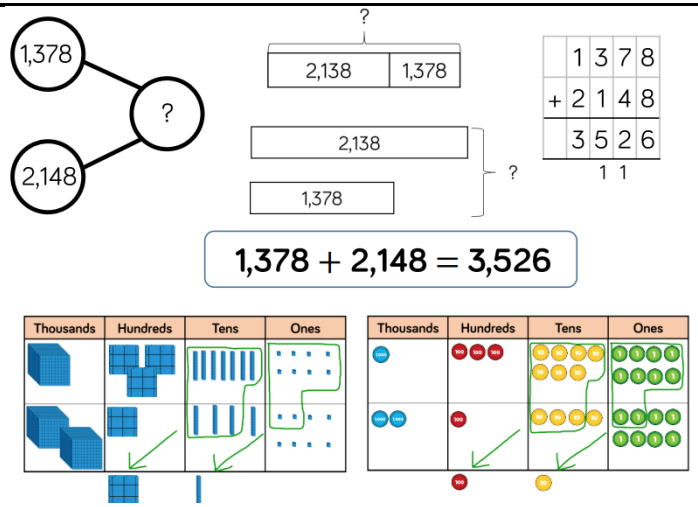
Rationale

At The Meadows we believe in implementing a Calculation Policy which reflects the teaching across school. Our policy shows how we use a specific range of representations consistently to support the conceptual understanding of maths. Mathematical understanding is developed through the use of representations with a Concrete – Pictorial -Abstract approach (CPA).

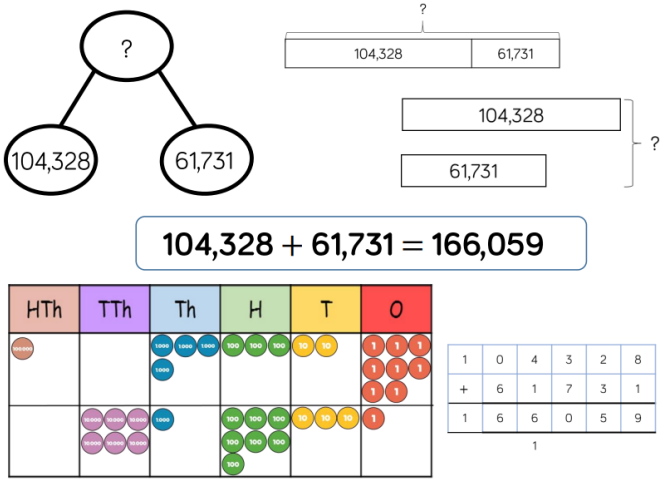
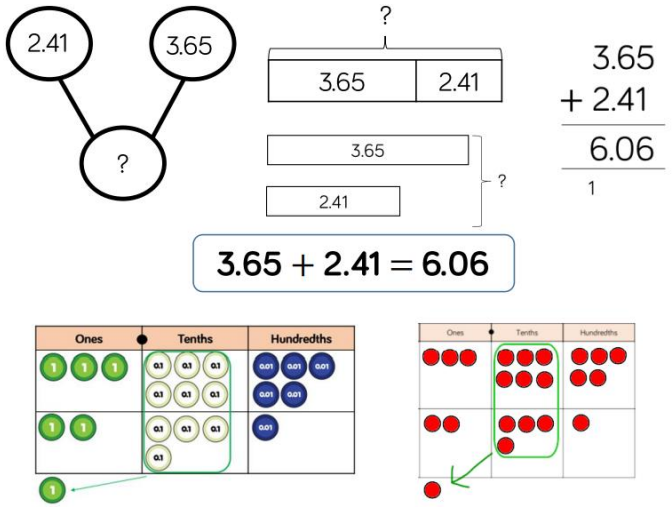
e.g. Concrete (Base 10, Place Value Counters)
Pictorial (Bar Model, Part-Whole diagram)
Abstract (Columnar methods)

We plan our units of work using the White Rose Materials as a firm foundation. This Calculation Policy is in line with their suggested approach of teaching the four operations and we have carefully selected the path our learning journey takes. Each operation is broken down to show models and images which underpin the teaching of calculation in each year group. The representations are consistent and build progressively and can be applied to both written and mental methods.

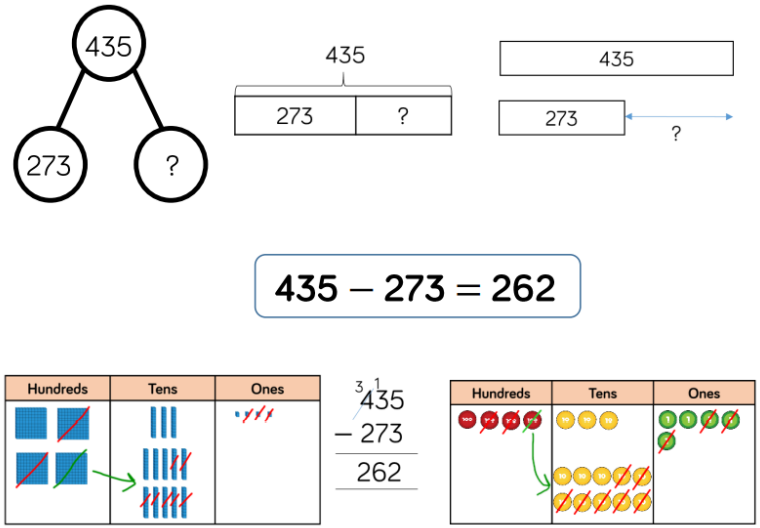
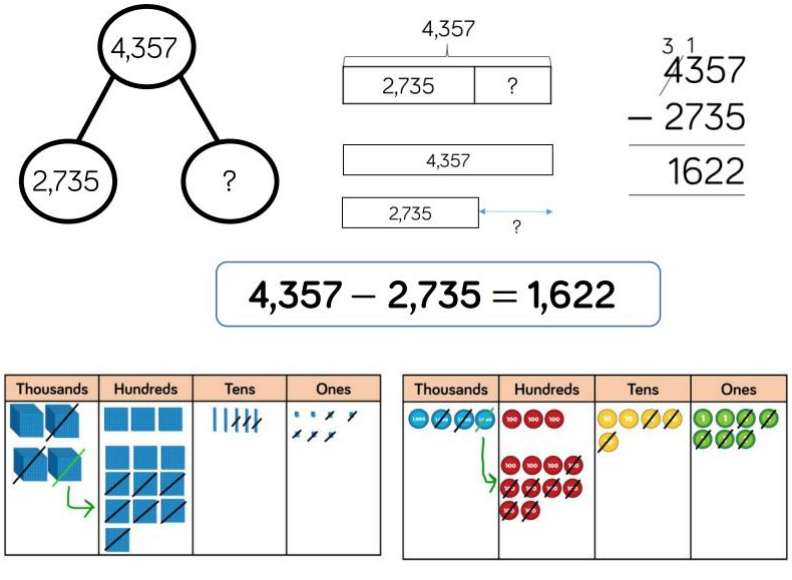
ADDITION

	Year 3	Year 4
NC Objectives	• +/- numbers mentally, including: HTO + O; HTO + TO; HTO + HTO • +/- numbers with up to three digits, using formal written methods of columnar addition and subtraction. • Estimate the answer to a calculation and use inverse operations to check answers. Solve problems, including missing number problems, using number facts, place value, and more complex +/-	• Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate. • Estimate and use inverse operations to check answers to a calculation. • Solve addition and subtraction two step problems in contexts, deciding which operations and methods to use and why.
Supporting Concrete & Pictorial Representations		
Vocabulary	sum, total, parts, wholes, plus, add, altogether, more, 'is equal to', 'is the same as' column addition	

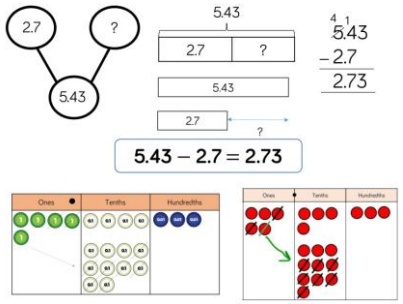
ADDITION

	Year 5	Year 6
NC Objectives	• Add and subtract numbers mentally with increasingly large numbers. • Add and subtract whole numbers with more than 4digits, including using formal written methods (columnar addition and subtraction). 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.	• Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why. • 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 problems involving addition, subtraction, multiplication and division. • Use estimation to check answers to calculations and determine in the context of a problem, an appropriate degree of accuracy.
Supporting Concrete & Pictorial Representations		
Vocabulary	sum, total, parts, wholes, plus, add, altogether, more, 'is equal to', 'is the same as' efficient written methods, order of operations	

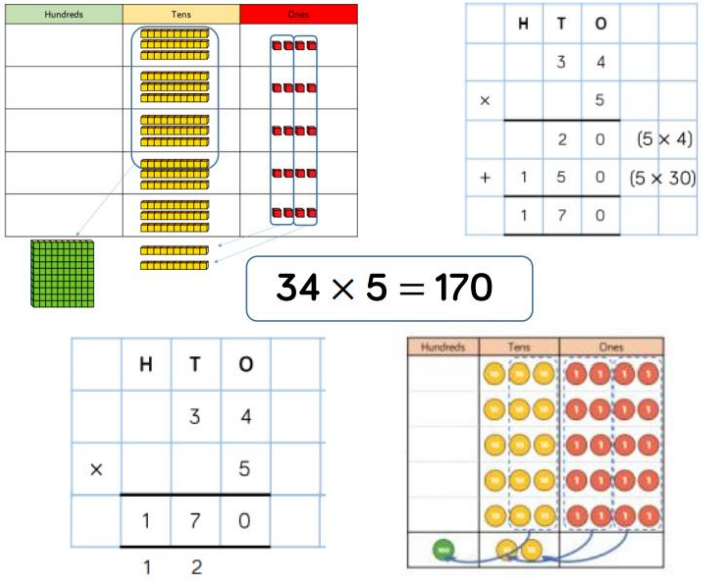
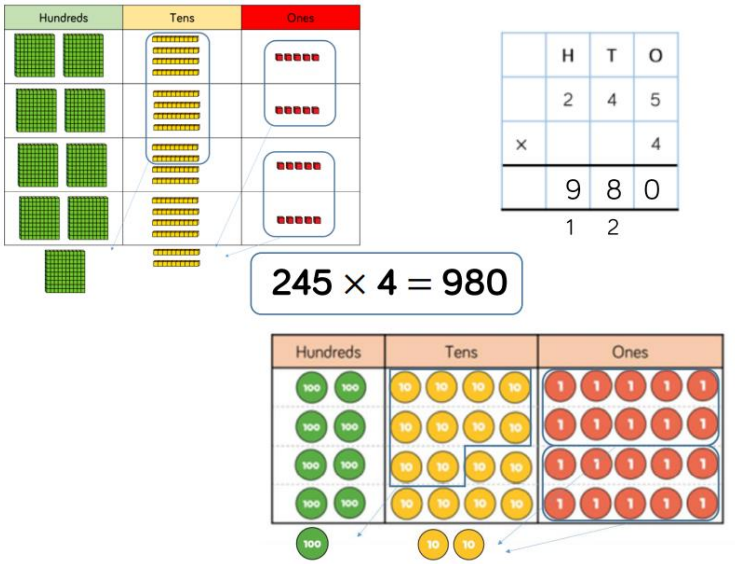
SUBTRACTION

	Year 3	Year 4
NC Objectives	• +/- numbers mentally, including: HTO + O; HTO + TO; HTO + HTO • +/- numbers with up to three digits, using formal written methods of columnar addition and subtraction. • Estimate the answer to a calculation and use inverse operations to check answers. Solve problems, including missing number problems, using number facts, place value, and more complex +/-	• Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate. • Estimate and use inverse operations to check answers to a calculation. • Solve addition and subtraction two step problems in contexts, deciding which operations and methods to use and why.
Supporting Concrete & Pictorial Representations		
Vocabulary	take away, less than, the difference, subtract, minus, fewer, decrease, column subtraction	

SUBTRACTION

	Year 5	Year 6
NC Objectives	• Add and subtract numbers mentally with increasingly large numbers. • Add and subtract whole numbers with more than 4digits, including using formal written methods (columnar addition and subtraction). 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.	• Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why. • 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 problems involving addition, subtraction, multiplication and division. • Use estimation to check answers to calculations and determine in the context of a problem, an appropriate degree of accuracy.
Supporting Concrete & Pictorial Representations		
Vocabulary	Take away, less than, the difference, subtract, minus, fewer, decrease efficient written methods, order of operations	

MULTIPLICATION

	Year 3	Year 4
NC Objectives	• Count from 0 in multiples of 4, 8, 50 and 100. • Recall/use multiplication & division facts for the 3, 4 and 8 tables • Write and calculate mathematical statements for multiplication and division using the multiplication tables they know, including for TO x O numbers, using mental and progressing to formal written methods. • Solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems	• Recall and use multiplication and division facts for multiplication tables up to 12 ×12. • Count in multiples of 6, 7, 9, 25 and 1,000 • 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. • Solve problems involving multiplying and adding, including using the distributive law to multiply two-digit numbers by one-digit, integer scaling problems and harder correspondence problems
Supporting Concrete & Pictorial Representations		
Vocabulary	double, times, multiplied by, the product of, groups of, lots of, equal groups multiples of __, scale up, multiplication facts, division facts, derive, inverse	

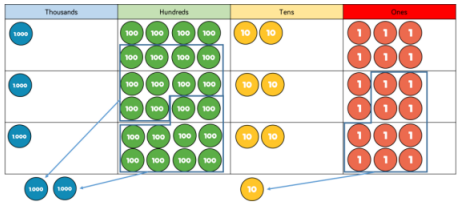
MULTIPLICATION

<table>
<tr><th></th><th>Year 5</th><th>Year 6</th></tr>
<tr><td>NC Objectives</td><td>

Multiply and divide numbers mentally drawing upon known facts.
Multiply and divide whole numbers by 10, 100 and 1000.
Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers.
Recognise and use square numbers and cube numbers and the notation for squared (2) and cubed (3)
Solve problems involving multiplication and division including using their knowledge of factors and multiples, squares/cubes
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

</td><td>

Multiply multi-digit number up to 4 digits by a 2-digit number using the formal written method of long multiplication.
Perform mental calculations, including with mixed operations and large numbers.
Identify common factors, common multiples and prime numbers.
Use their knowledge of the order of operations to carry out calculations involving the four operations.
Solve problems involving +/-/x/÷
Use estimation to check answers to calculations and determine in the context of a problem, an appropriate degree of accuracy.

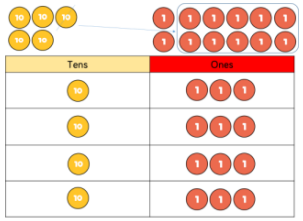
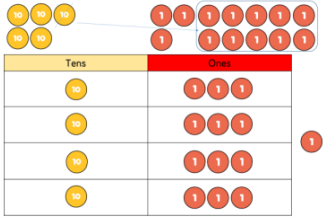
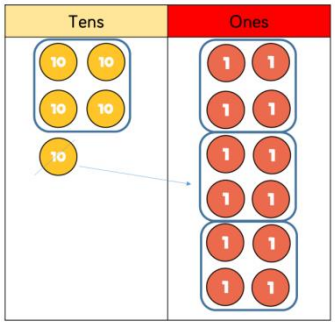
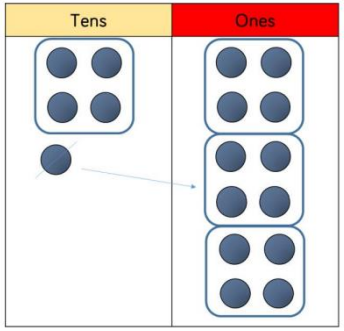
</td></tr>
<tr><td>Supporting Concrete & Pictorial Representations</td><td>


1,826 × 3 = 5,478
<table>
<tr><td></td><td>Th</td><td>H</td><td>T</td><td>O</td></tr>
<tr><td></td><td>1</td><td>8</td><td>2</td><td>6</td></tr>
<tr><td>×</td><td></td><td></td><td></td><td>3</td></tr>
<tr><td></td><td>5</td><td>4</td><td>7</td><td>8</td></tr>
<tr><td></td><td></td><td>2</td><td>1</td><td></td></tr>
</table>

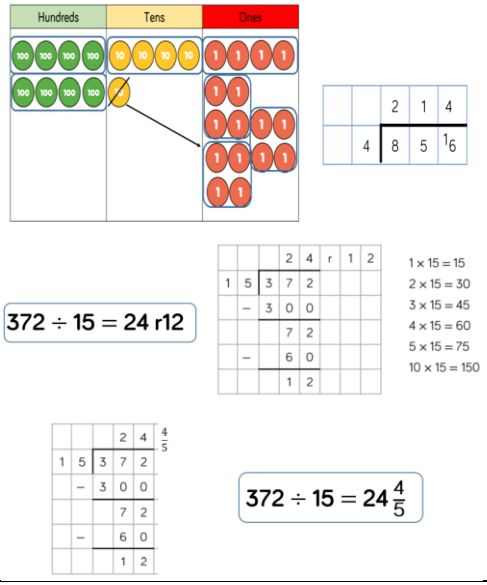
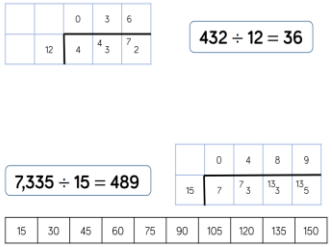
234 × 32 = 7,488
<table>
<tr><td>×</td><td>200</td><td>30</td><td>4</td></tr>
<tr><td>30</td><td>6,000</td><td>900</td><td>120</td></tr>
<tr><td>2</td><td>400</td><td>60</td><td>8</td></tr>
</table>

2,739 × 28 = 76,692
<table>
<tr><td>TTh</td><td>Th</td><td>H</td><td>T</td><td>O</td></tr>
<tr><td></td><td>2</td><td>7</td><td>3</td><td>9</td></tr>
<tr><td>×</td><td></td><td></td><td>2</td><td>8</td></tr>
<tr><td>2 2</td><td>1 5</td><td>9 3</td><td>1 7</td><td>2</td></tr>
<tr><td>5 1</td><td>4</td><td>7 1</td><td>8</td><td>0</td></tr>
<tr><td>7</td><td>6</td><td>6</td><td>9</td><td>2</td></tr>
<tr><td></td><td></td><td></td><td>1</td><td></td></tr>
</table>
</td></tr>
<tr><td>Vocabulary</td><td colspan="2">double, times, multiplied by, the product of, groups of, lots of, equal groups
factor pairs, composite numbers, prime numbers, prime factors, square number, cubed number
formal written method, order of operations
common factors, common multiples</td></tr>
</table>

DIVISION

	Year 3	Year 4
NC Objectives	• Recall/use multiplication and division facts for the 3, 4, 8 tables. • Write and calculate mathematical statements for x/÷ using the multiplication tables they know, including for TO x O numbers, using mental and progressing to formal written methods. • Solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems	• Recall/use multiplication and division facts 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. • Solve problems involving multiplying and adding, including using the distributive law to multiply two-digit numbers by one-digit, integer scaling problems and harder correspondence problems
Supporting Concrete & Pictorial Representations	52 ÷ 4 = 13  53 ÷ 4 = 13 r1  	  52 ÷ 4 = 13
Vocabulary	share, group, divide, divided by, half, division facts, multiplication facts, derive, inverse	

DIVISION

	Year 5	Year 6
NC Objectives	• Multiply and divide numbers mentally drawing upon known facts. • Multiply and divide whole numbers by 10, 100 and 1000. • Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers. • Solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes. • 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	• Divide numbers up to 4 digits by a 2-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. • Divide numbers up to 4 digits by a 2-digit number using the formal written method of short division, interpreting remainders according to the context. • 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 problems involving +/-/x/÷
Supporting Concrete & Pictorial Representations		
Vocabulary	double, times, multiplied by, the product of, groups of, lots of, equal groups factor pairs, composite numbers, prime numbers, prime factors, square number, cubed number formal written method, order of operations common factors, common multiples	

KEY SKILLS

We have identified the following areas as important key skills which the children need to be fully secure in identifying, retrieving and calculating. These should be regularly visited, built into planning and links made throughout lessons.

Fact families +/- (eight facts) incorporating Commutative Law (*i.e. if I know a+b=c, then I also know that b+a=c)*

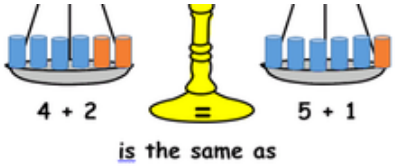
43 + 21 = 64	64 = 43 + 21	64 - 43 = 21	21 = 64 - 43
21 + 43 = 64	64 = 21 + 43	64 - 21 = 43	43 = 64 - 21

9 x 12 = 108	108 = 9 x 12	108 ÷ 9 = 12	12 = 108 ÷ 9
12 x 9 = 108	108 = 12 x 9	108 ÷12 = 9	9 = 108 ÷ 12

Generating facts from known facts

Exploit where possible… if I know that 3 x 4 = 12, then I also know that 30x4=120, 3x40=120, 30x40=120 etc

Balance Equations



$$\frac{3}{4} = \frac{9}{\square} = \frac{\square}{24}$$

Missing Number Equations

$$\square - 10 = 298$$

$$3{,}050{,}020 = 3{,}000{,}000 + \square + 20$$

Estimation and Inverse Calculations

When calcualting using a formal or mental method, incorporate the skills of ESTIMATING (before – linked to rounding) and CHECKING WITH AN INVERSE (method).

Glossary

Addend - A number to be added to another.

Aggregation - combining two or more quantities or measures to find a total.

Augmentation - increasing a quantity or measure by another quantity.

Commutative – numbers can be added in any order.

Complement – in addition, a number and its complement make a total e.g. 300 is the complement to 700 to make 1,000

Difference – the numerical difference between two numbers is found by comparing the quantity in each group.

Exchange – Change a number or expression for another of an equal value.

Minuend – A quantity or number from which another is subtracted.

Partitioning – Splitting a number into its component parts.

Reduction – Subtraction as take away.

Subitise – Instantly recognise the number of objects in a small group without needing to count.

Subtrahend - A number to be subtracted from another.

Sum - The result of an addition.

Total – The aggregate or the sum found by addition.

Glossary

Array – An ordered collection of counters, cubes or other item in rows and columns.

Commutative – Numbers can be multiplied in any order.

Dividend – In division, the number that is divided.

Divisor – In division, the number by which another is divided.

Exchange – Change a number or expression for another of an equal value.

Factor – A number that multiplies with another to make a product.

Multiplicand – In multiplication, a number to be multiplied by another.

Partitioning – Splitting a number into its component parts.

Product – The result of multiplying one number by another.

Quotient – The result of a division

Remainder – The amount left over after a division when the divisor is not a factor of the dividend.

Scaling – Enlarging or reducing a number by a given amount, called the scale factor