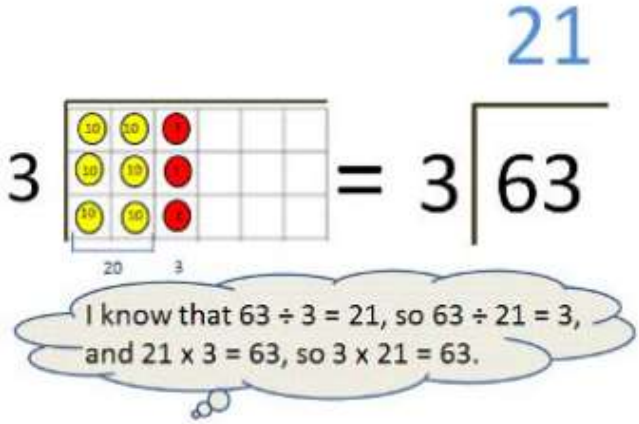
THE BEDIFFERENT FEDERATION



CALCULATION POLICY

Revised September 2024

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Introduction and Rationale

This policy has been written to support the implementation and changes as a result of the revised National Curriculum (2014). A document for each operation addresses what and how to teach year by year. This policy is a working document and will be revised and amended as necessary. Many variations have been included to provide teachers with a range of tools to support pupils in their grasp of number and calculation. To ensure consistency for pupils, it is important that that the mathematical language used in math's lessons reflects the vocabulary used throughout this policy. The policy lays out expectations for both mental and written calculations, including calculations of fractions, and includes statements from the National Curriculum and supplementary guidance as below:

- National Curriculum statutory statements in **bold**
- National Curriculum non-statutory guidance in *italics*
- Additional/Supplementary guidance in plain text

Orange boxes provide teaching tips and guidance, whilst speech bubbles denote examples either of key questions a teacher might ask or of children's thinking/speaking. A vocabulary list is provided with suggested vocabulary for each year group. This is not an exhaustive list.

Representations

The key to successful implementation of a school calculation policy is consistent use of representations (models and images that support conceptual understanding of the Mathematics) and this policy promotes a range of relevant representations across the primary years. Mathematical understanding is developed through use of representations that are first of all concrete (e.g. Numicon, Dienes rods) and then pictorial (e.g. Array, place value counters) to then facilitate abstract working (e.g. column addition, long multiplication). This policy guides teachers through an appropriate progression of representations, and if at any point a child is struggling they should revert to familiar pictorial and/or concrete methods as appropriate. Whilst some children will be able to choose the most appropriate representation and procedure to carry out a calculation, whether written or mental, teachers should support children with carefully selected representations that underpin calculation methods and ensure there is consistency across year groups. The 'representations to support mental and written calculation' box on each page provides a range of models and images that underpin calculation in that year group. This is not an exhaustive collection.

Progression in Calculation

This policy promotes particular methods and procedures with particular representations alongside to support understanding of calculation, in order to meet requirements. We must ensure consistency in both procedure and conceptual understanding to ensure fluency and confidence with written methods. This policy guides teachers in progression for each operation to ensure smooth transition. It is important that conceptual understanding, supported by the use of representations, is secure for procedures, and if at any point a child is struggling, they should revert to concrete and/or pictorial resources and representations to solidify understanding. Additional resources are used within the long-term planning for this curriculum subject to include the ready to progress guidance and curriculum progression maps.

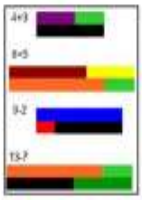
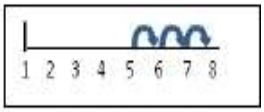
Videos to Support mathematical teaching and learning

Multiplication https://www.ncetm.org.uk/resources/40530 KS1 – Multiple Representation of Multiplication KS1 – The commutative law for multiplication Lower KS2 – Grid multiplication as an interim step Upper KS2 – Moving from grid to column	**Number and Place Value** https://www.ncetm.org.uk/resources/40534 KS1 - Counting in steps of one and ten KS1 – Partitioning in different ways KS1 – Addition and Subtraction KS1 – Using resources to develop fluency and understanding KS2 – Partitioning (subtraction)
Subtraction https://www.ncetm.org.uk/resources/40532 Lower KS2 – Partitioning Lower KS2 – Discussing subtraction strategies Lower KS2 – Developing column subtraction Upper KS2 – Column subtraction	**Algebra** https://www.ncetm.org.uk/resources/43649 KS1 – Look at 'missing numbers' KS2 – Equations and substitution
Division https://www.ncetm.org.uk/resources/43589 KS1 – Sharing and grouping KS2 – Place value counters for division	**Fractions** https://www.ncetm.org.uk/resources/43609 KS1 – Adding fractions and mixed numbers KS2 – Using an array to add fractions KS2 – Bar model dividing by fractions
Multiplicative Reasoning https://www.ncetm.org.uk/resources/43669 KS2 – Bar model for multiplication	**Number Facts** https://www.ncetm.org.uk/resources/40533 KS1 – Number bonds to ten KS1 – Consolidation and practice

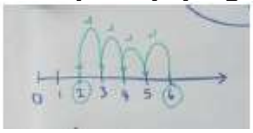
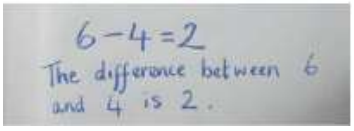
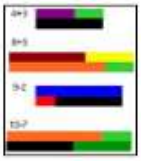
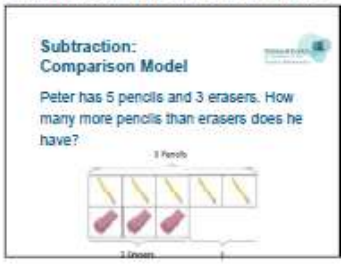
(Addition and Subtraction)
KS1 – Reinforcing table facts
KS1 – Rapid recall of multiplication facts

Year 1 - Addition

Mental Calculations
 	
Written Calculations
	• **Read, write and interpret mathematical statements using +, -, =**
	• **Represent and use number bonds and related addition facts within 20**
	• **Add one digit and two digit numbers up to 20, including zero**
	• **Solve one-step problems using concrete objects and pictorial representations, and missing number problems such as 7 = ? – 9**
	• **Given a number, identify (and use the language) one more**
	• Begin to compare (what's the same/different?) for commutative sums e.g. 3 + 7 = 7 + 3
	• *Memorise and reason with number bonds to 10 and 20 in several forms*
	• Add using objects, Numicon, cubes etc and number lines and tracks
	• Check with everyday objects
	• Ensure pre-calculation steps are understood, including:
	  ○ Counting objects (including solving simple concrete problems)
	  ○ Conservation of number
	  ○ Recognise place value in numbers beyond 20
	  ○ Counting as reciting and as enumerating

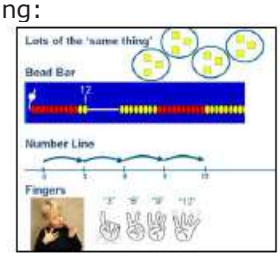
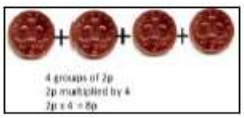
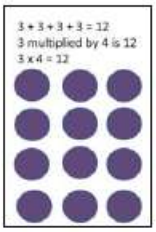
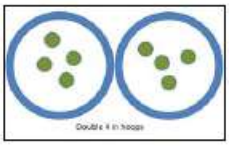
Representations to support mental and written calculations	     Number lines    Bead strings  Number tracks   Real everyday objects   
Links from other strands	• *Combine and increase numbers, counting forwards and backwards* • *Develop the concept of addition and subtraction and use these operations flexibly* • *Discuss and solve problems in familiar practical contexts, including using quantities* • *Compare, describe and solve practical (measure) problems together e.g. longer, more than, heavier than* • Problems terminology should include: put together, add, altogether, total, take away, distance between, difference between, more than and less than.

Year 1 - Subtraction

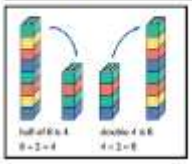
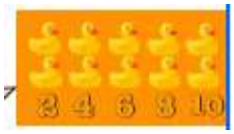
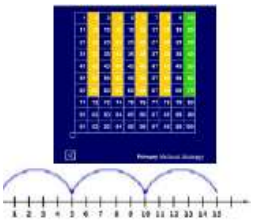
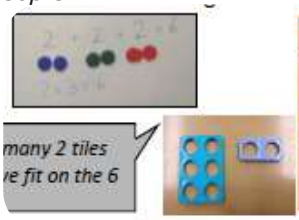
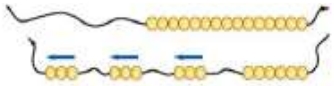
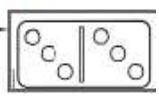
Mental Calculations	• **Subtract one digit and two-digit numbers up to 20, including zero** • **Read, write and interpret mathematical statements using symbols (+, -, =)** • **Represent and use number bonds and related addition facts within 20** • **Solve one-step problems using concrete objects and pictorial representations, and missing number problems such as 7 = ? – 9** • Memorise and reason with number bonds • Add using objects, Numicon, cubes, number lines, tracks etc • Check with everyday objects • Ensure pre-calcuation steps are understood, including: • Counting objects • Conversion of number
Written Calculations	**Subtract one-digit and two-digit numbers to 20, including zero.** **Read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs**    **Represent and use number bonds and related subtraction facts within 20**
Representations to support mental and written calculations	Use a range of concrete and pictorial representations, including:  Straw bundles  Hands, and children themselves.   Bead strings, number tracks and lines    
Links from other strands	• **Children should combine and increase numbers, counting forwards and backwards.** • ***Children should develop the concept of addition and subtraction and use these operations flexibly.*** • ***Problems should include the terms: put together, add, altogether, total, take away, distance between, difference between, more than and less than, so that children develop the concept of addition and subtraction and are enabled to use these operations flexibly*** • **Children discuss and solve problems in familiar practical contexts** • **Children compare, describe and solve practical (measurement) problems**

Year 1 - Multiplication

Mental Calculations	• **Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with support of the teacher**
	• **Count in multiples of twos, fives and tens** with equipment, songs and rhythms, and including by rote
	  ○ Counting in 2s e.g. counting socks, shoes, animal legs…
	  ○ Counting ion 5s e.g. counting fingers, toes, fingers in gloves…
	  ○ Counting in 10s e.g. counting fingers, toes
	• Doubles up to 10
	• Recognising odd and even numbers
	• Write as a number pattern e.g. 5, 10, 15…; 2, 4, 6…; 10, 20, 30…)
	
	What's the sequence?
	
	It is important to use a range of models to develop understanding of multiplication, and that children make connections between arrays, number patterns, and counting in twos, fives and tens.

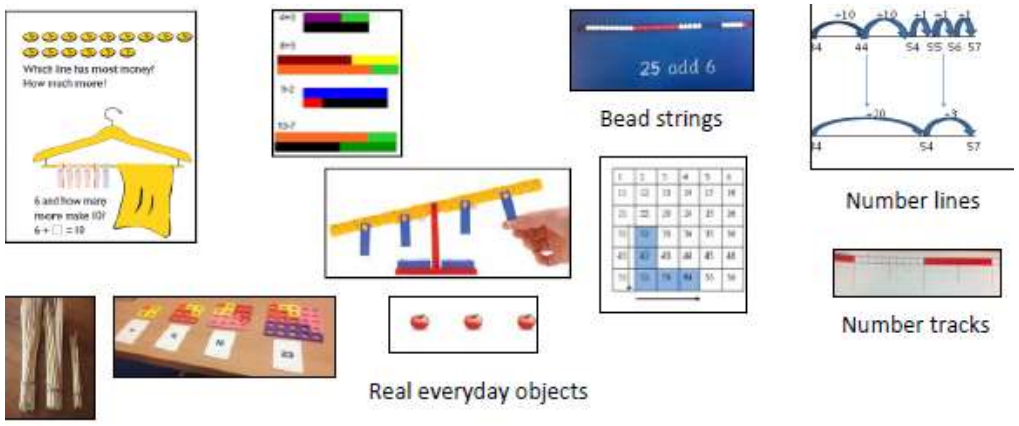
Written Calculations	Although there is no statutory requirement for written multiplication in Year 1, it may be helpful to encourage children to begin to write it as a repeated addition sentence in preparation for Year 2 e.g. 2 + 2 + 2 = 8
Representations to support mental and written calculations	Use a range of concrete and pictorial representations, including:           
Links from other strands	• **Count in multiples of twos, fives and tens** (from number and place value), as above • *Counting in twos, fives and tens from different multiples to develop their recognition of patterns in the number system* • *They discuss and solve problems in familiar practical contexts, including use quantities*

Year 1 - Division

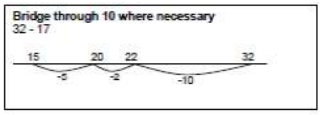
Mental Calculations	**Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.** ***Children make connections between arrays, number patters, and counting in twos, fives and tens.***
Written Calculations	 Pictorial jottings to support the calculation of 8 ÷ 4  Count on or back in 2s, 5s and look for patterns.  Children should experiment with the concepts of sharing and grouping in a number of contexts. Initially they use their own recording – moving towards fluent, symbolic notation in Year 2. Conceptual understanding and recording should be continuously supported by the use of **arrays** as a default model, as well as other representations (see below).  The relationship between multiplication and division must be continually considered.
Representations to support mental and written calculations	Use a range of concrete and pictorial representations, including: - Manipulatives to support children's own recording; and understanding of *sharing* and the link with multiplication *'How can we share 6 cakes between 2 people?'*  Here, the cakes are placed in an array formation.  Moving from concrete to pictorial, counters represent the cakes to reinforce the relationship between multiplication and division. Manipulatives, and real life objects to support children's own recording; and understanding of *grouping* and the link with multiplication.   Coat hangers and socks support calculation of 8÷2 Bead strings  15 ÷ 2 using grouping model *"Double 3 is 6. Half of 6 is 3."*  Dominoes and dice to reinforce concepts of doubling and halving.
Links from other strands	***Children practise counting as reciting numbers and counting as enumerating objects, and counting in twos, fives and tens from different multiples to develop their recognition of patterns in the number system (for example, odd and even numbers). (Place value).*** ***Children are taught half and quarters as 'fractions of' by solving problems using shares, objects and quantities (Fractions)***

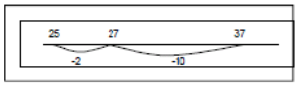
Year 2 - Addition

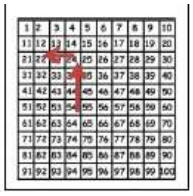
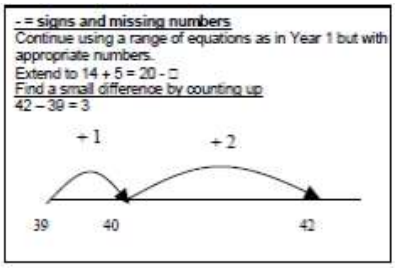
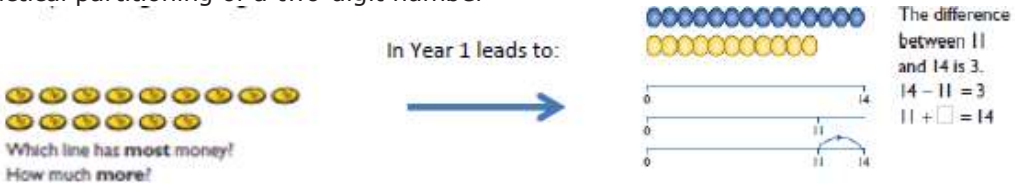
Mental Calculations	• **Add numbers using concrete objects, pictorial representations, and mentally, including:**
	  ○ **a two-digit number and ones**
	  ○ **a two-digit number and tens**
	  ○ **two two-digit numbers**
	  ○ **adding three one-digit numbers**

Written Calculations	• **Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100** • **Demonstrate the commutative law of addition** • Re-partition numbers • Use a hundred square • *Check calculations using inverse and adding numbers in different order* • Begin to *record addition in columns to support place value and prepare for formal written methods with larger numbers*
Representations to support mental and written calculations	Use a range of pictorial and concrete representations, including: 
Fractions	Counting in fractions up to 10, starting from any numbers and using the 1/2 and 2/4 equivalence on the number line.
Links from other strands	• Solve problems: • Using concrete objects, pictorial representations (numbers, quantities and measures) • Applying increasing knowledge of mental and written methods • Partition numbers in different ways • *Discuss and solve problems that emphasise the value of each digit in two-digit numbers* Children should develop the concept of addition and subtraction and use these operations flexibly.

Year 2 - Subtraction

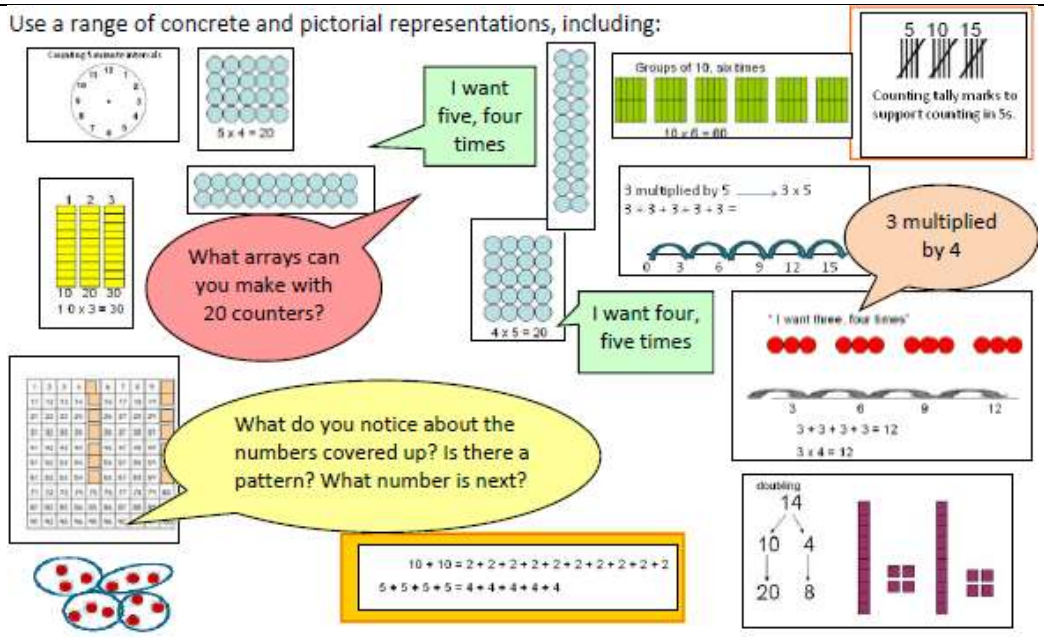
<table>
<tr><td>Mental Calculations</td><td rowspan="2">Add and subtract numbers using concrete objects, pictorial representations, and mentally, including:
a two-digit number and ones
a two-digit number and tens
two two-digit numbers
adding three one-digit numbers
Jottings to support informal methods:
 

Written recording:
37 – 12 = 37 – 10 - 2
= 27 – 2
= 25
 

 
54—32 = 22
 
</td></tr>
<tr><td>Written Calculations</td></tr>
<tr><td>Representations to support mental and written calculations</td><td><u>Informal methods to support written subtraction calculations</u>
Practical partitioning of a two-digit number
 

Bundles of straws or dienes to represent and partition two-digit numbers
Subtract (without decomposition) using partitioning and equipment, e.g.
 
To calculate 35-22, remove 22.
 
Then record: 35-22=13.
Continue to use a range of concrete and pictorial representations from Year 1 – including Bar model to support understanding of difference (see below)</td></tr>
<tr><td>Fractions</td><td>Children should count in fractions up to 10, starting from any number and using the equivalent on the number line (for example 1 ¼, 1 ½, 1 ¾, 2)
Use concrete and pictorial models of fractions to assist with counting e.g. paper cups, plates, shapes etc.</td></tr>
<tr><td>Links from other strands</td><td>Recall and use addition and subtraction facts to 20 fluently and derive and use related facts up to 100
Children should partition numbers in different ways (e.g. 23 = 20 + 3 and 23 = 10 + 13) to support subtraction
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
children should extend their understanding of the language of addition and subtraction to include sum and difference</td></tr>
</table>

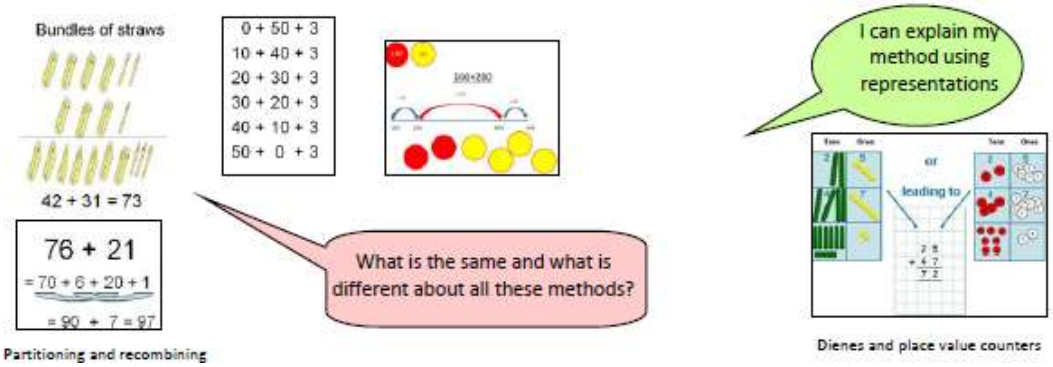
Year 2 – Multiplication

Mental Calculations	• **Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables,** *connecting the 2, 5 and 10 multiplication tables to each other* • *Connect the 10 multiplication table to place value* • **Recognise odd and even numbers** • **Show that multiplication of two numbers can be done in any order (commutative)** • *Use a variety of language to describe multiplication and division* • Apply doubling of numbers up to ten to doubling larger numbers
Written Calculations	• **Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (x), division (÷) and equals (=) signs** • *Begin to use other multiplication tables and recall facts to perform written calculations* • *Use a range of materials and contexts…including arrays and repeated addition*
Representations to support mental and written calculations	Use a range of concrete and pictorial representations, including: 
Fractions	**Write simple fractions for example ½ of 6 = 3 and recognise the equivalent of 2/4 and 1/2** *Begin to relate multiplication and division models to fractions and measures*
Links from other strands	• **Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts** • *Use commutativity and inverse relations to develop multiplicative reasoning (e.g. 4 x 5 = 20 and 20 ÷ 5 = 4)* • **Statistics – interpret and construct simple pictograms, tally charts and block diagrams** • Measurement – counting 5 minute intervals on a clock face • Place value **count in steps of 2, 3 and 5 from 0 and in tens from any number, forwards and backwards**

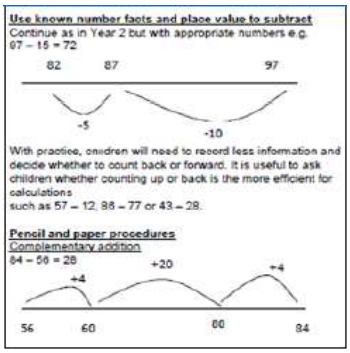
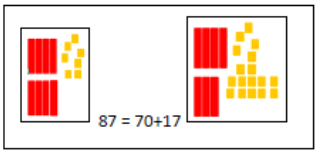
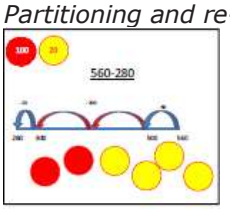
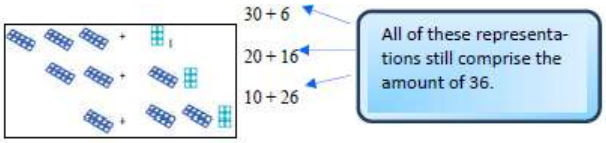
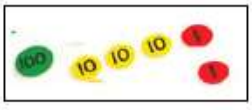
Year 2 – Division

Mental Calculations	**The relationship between multiplication and division must be continually considered.** • **Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers** • **Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (x), division (÷) and equals (=) signs** • **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 contexts (see below)**   
Written Calculations	  ½ of 26 = 13 26 ÷ 2 = 13 Children decode a problem first, represent it using manipulatives and jottings, and finally record it symbolically.
Representations to support mental and written calculations	Use a range of concrete and pictorial representations, including: • Arrays  7 x 2 = 14 14 ÷ 2 = 7  2 x 7 = 14 14 ÷ 7 = 2 • Number lines to support grouping   Grouping ITP • Representations to support multiplicative reasoning:  Using Dienes: *"If 40 ÷ 10 = 4 and 30 ÷ 10 = 3, what do you think 70 ÷ 10 would be? Why?"*  Is 14 an odd number? How do you know?  Odd / even *"How many groups of 5 minutes have passed when the minute hand reaches twenty past?"*
Fractions	**Recognise, find, name and write fractions 1/3, ¼, ¾. 2/4 of a length, shape, set of objects or quantity** **Write simple fractions, for example, ½ of 6 = 3 and recognise the equivalence of ½ and 2/4**
Links from other strands	• **Count in steps of 2, 3 and 5 from 0, and in tens from any number, forward and backward** • **Recognise the place value of each digit in a two-digit number (tens, ones) (Place value)** • **Tell and write the time to five minutes, including quarter past/to the hour and draw the hands on a clock face to show these times (Measures)**

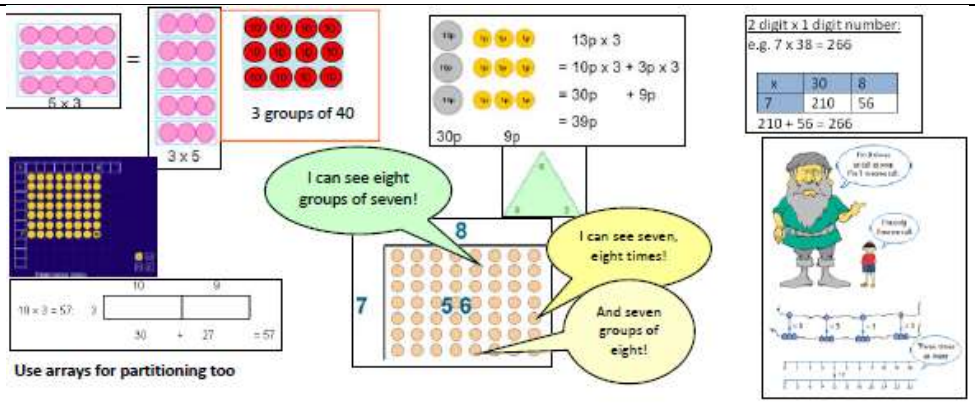
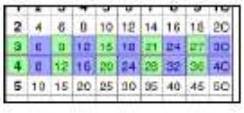
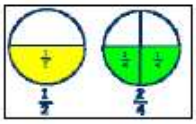
Year 3 - Addition

Mental Calculations	**Add numbers mentally, including:** • **a three-digit number and ones** • **a three-digit number and tens** • **a three-digit number and hundreds** • Partition all numbers and recombine, start with TO + TO then HTO + TO • Use straws, dienes, place value counters, empty number lines **Common mental calculation strategies:** Partitioning and recombining Doubles and near doubles Use number pairs to 10 and 100 Adding near multiples of ten and adjusting Using patterns of similar calculations Using known number facts Bridging through ten, hundred Complementary addition
Written Calculation	**Add numbers with up to three digits, using formal written (column) methods** Add to three digit numbers using physical and abstract representations (e.g. straws, dienes, place value counters, empty number lines) 30 + 4 20 + 5 50 + 9 34 + 25 59 200 + 30 + 4 500 + 20 +7 700 + 60 + 1 10 234 + 527 761 1 Revert to concrete or expanded methods if children find column method difficult.
Representations to support mental and written calculations	Use a range concrete, pictorial and abstract representations, including those below: 
Fractions	Addition of fractions with the same denominator within one whole. 2/5 + 3/5 = 5/5
Links from other strands	• Children should estimate the answers to a calculation and use inverse operations to check answers. • Add amounts of money using both £ and p in practical contexts • Measure, compare and add lengths (m/cm/mm), mass (kg/g) and volume/capacity (l/ml).

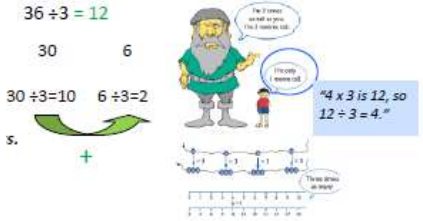
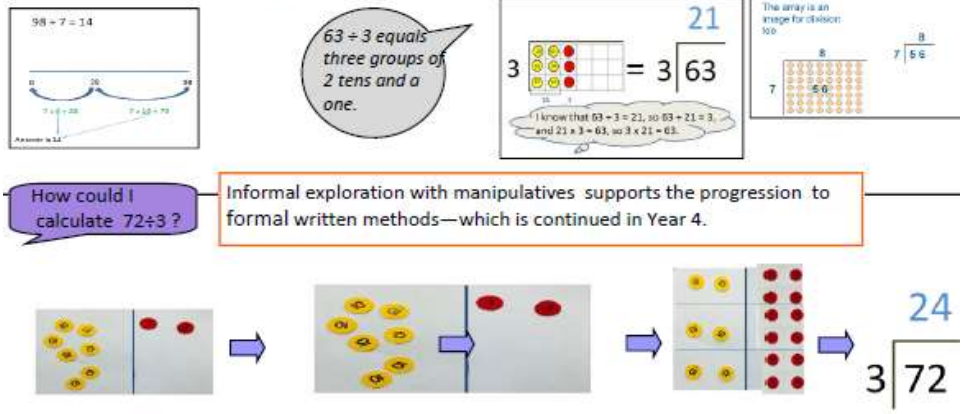
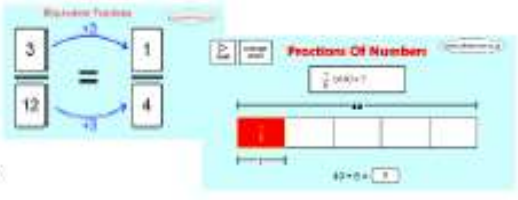
Year 3 - Subtraction

Mental Calculations	**Add and subtract numbers mentally, including:** • **a three-digit number and ones** • **a three-digit number and tens** • **a three-digit number and hundreds** Use a number line, dienes, hundred squares, two hundred squares, and similar representations, to support mental calculations 
Written Calculation	**Add and subtract numbers with up to three digits, using formal written methods and column addition and subtraction** Extended column – no exchange 80 and 7 - 50 and 3 30 and 4 = 34 Extended column – with exchange 70 + 17 – 50 + 18 20 + 9 
Representations to support mental and written calculations	*Partitioning and re-partitioning* support understanding of place value   Introduce transition from concrete place value representations (e.g. dienes or straws) to pictorial – such as place value counters or money   132 in dienes 132 in place value counters. Revert to concrete manipulatives and expanded methods whenever difficulties arise.
Fractions	Count up and down in tenths. Add and subtract fractions with the same denominator within one whole.
Links from other strands	Money and calculating duration of events (with number lines)For example ***"Add and subtract amounts of money to give change, using both £ and p in practical contexts"*** ***"Compare durations of events (for example to calculate the time taken by particular events or tasks" (Measurement)***

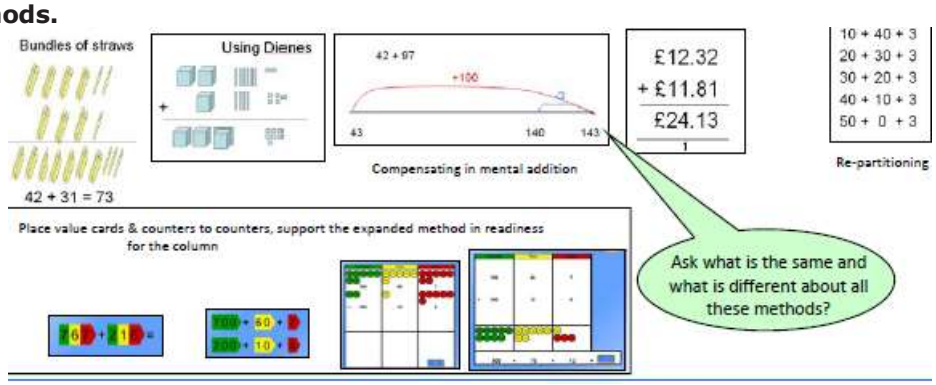
Year 3 - Multiplication

Mental Calculations	• **Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables** (and 2, 5 and 10 tables from year 2) • Use doubling to connect 2, 4 and 8 multiplication tables • Develop efficient mental methods using commutativity and associativity • Derive related multiplication and division facts • **Calculate mathematical statements for multiplication using the multiplications tables they know, including for two-digit numbers time one-digit numbers, using mental methods** • Partitioning: multiply the tens first and then multiply the units, e.g. 57 x 6 = (50 x 6) + (7 x 6) = 300 + 42 = 342 • Children can apply these skills to solve spoken word problems too • Include missing number statements e.g. 72 + ☐ = 8 Ensure opportunities to learn multiplication tables through use of visual models, images and also rote learning I have 8 packets, each containing 12 crayons. How many crayons do I have in total?
Written Calculation	• **write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, progressing to formal written methods** • estimate before calculating • ensure written methods build on/relate to mental methods
Representations to support mental and written calculations	
Fractions	**Recognise and show, using diagrams, equivalent fractions with small denominators**  
Links from other strands	• **Solve problems, including missing number problems, involving multiplication, including positive integer scaling problems and correspondence problems in with n objects are connected to m object** • *The comparison of measures including simple scaling by integers (for example, a given quantity or measure is twice as long or five time as high)* • *Children now use multiples of 2, 3, 4, 5, 10, 50 and 100* • Children understand and use simple scales (for example 2, 5, 10 units per cm) in pictograms and bar charts with increasing accuracy

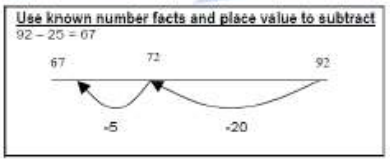
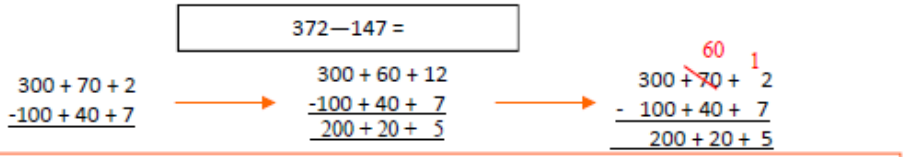
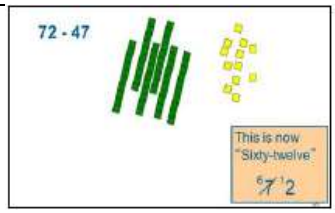
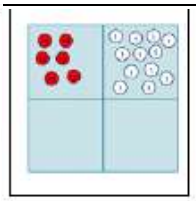
Year 3 - Division

Mental Calculations	**Children should be taught to recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables.** ***Children continue to practise their mental recall of multiplication tables…in order to improve fluency.*** ***Children develop efficient mental methods, for example, using commutativity and associativity (e.g. 4 x 12 x 5 = 4 x 5 x 12 =*** ***20 x 12 = 240) and multiplication and division facts to derive related facts.*** 
Written Calculation	**Children should be taught to:** • **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** • **Solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence probles in which n objects are connects to m objects (see Links from other strands, below)** New written methods can be modelled alongside mental or informal methods to ensure understanding.
Representations to support mental and written calculations	Use a range of concrete and pictorial resources, including: 
Fractions	• **Recognise that tenths arise from dividing an object into 10 equal parts and in dividing one-digit numbers or quantities by 10** • **Recognise and show, using diagrams, equivalent fractions with small denominators** • **Recognise, find and write fractions of a discrete set of objects; unit fractions and non-unit fractions with small denominators** • 
Links from other strands	**Children solve simple problems in contexts, including measuring and scaling contexts (e.g. four times as high etc) and correspondence problems.**

Year 4 – Addition

Mental Calculations	• Practise mental methods with increasingly large numbers • Consolidate partitioning and re-partitioning • Use compensation for adding too much/little and adjusting • Use straws, deines, place value counters, empty number lines etc I know that 63 + 29 is the same as 63 + 30 - 1 55 + 37 = 55 + 30 + 7 = 85 + 7 = 92 **Common mental calculation strategies:** Partitioning and recombining Doubles and near doubles Use number pairs to 10 and 100 Adding near multiples of ten and adjusting Using patterns of similar calculations Using known number facts Bridging through ten, hundred Complementary addition
Written Calculation	**Add numbers with up to four digits, using the formal written (column) method** Add three digit numbers using column method and then move onto four digits. Include decimal addition for money 789 + 642 becomes: 7 8 9 + 6 4 2 1 4 3 1 Revert to expanded methods if children find formal calculation method difficult.
Representations to support mental and written calculations	**Use physical/pictorial representations alongside expanded and column methods.** 
Fractions	Addition of fractions with the same denominator to *become fluent through a variety of increasingly complex problems beyond one whole.* *Counting using simple fractions and decimals, both forwards and backward* 1/2 + 2/4 = 2/4 + 2/4 = 1
Links from other strands	• Estimate and use inverse operations to check answers • Solve addition and subtraction two step problems in context, deciding which operations and methods to use and why • Identify, represent and estimate numbers using different representations (place value) • Recognise the place value of each digit in a four-digit number • Estimate, compare and calculate different measures, including amounts of money in £ and p (including fractions and decimals)

Year 4 - Subtraction

Mental Calculations	***Continue to practise mental methods with increasingly large numbers to aid fluency.*** Methods to support fluent calculation and encourage efficiency of method: - Find a small difference by counting up e.g. 5003 – 4996 - Subtract nearest multiple of ten and adjust - Partition larger numbers *This could be done using an empty number line. Children should recall and use number facts to reduce the number of steps.* Whenever possible, children should be encouraged to visualise number lines and other basic, supporting representations to promote fluent work without jottings. 
Written Calculation	**Add and subtract numbers with upto four digits using the formal written methods of column addition and subtraction where appropriate.** Build on formal, extended methods using exchange wherever necessary. Continue to use representations and manipulatives to develop understanding of place value.  Apply understanding of subtraction with larger integers to that of decimals in context of money and measures (see Year 5)
Representations to support mental and written calculations	   Dienes blocks or place value counters can be used to model calculations and the underlying place value concepts. Use physical and/or pictorial representations and expanded algorithms alongside column methods. Ask: *What is the same? What is different?* Compare and discuss the suitability of different methods in context. Children **decide which operations and methods to use and why.**
Fractions	**Count up and down in hundredths.** **Add and subtract fractions with the same denominator.** **Solve simple measure and money problems involving fractions and decimals to two decimal places.**
Links from other strands	**Identify, represent and estimate numbers using different representations (place value)** **Recognise the place value of each digit in a four digit number** **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** **Estimate, compare and calculate different measures, including money in pounds and pence.**

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Year 4 - Multiplication

Mental Calculations

Recall multiplication and division facts for multiplication tables up to 12 x 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**

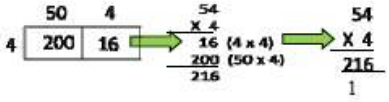
Recognise and use factor pairs and commutativity in mental calculations
Practise mental methods and extend this to three-digit numbers to derive facts, (for example 600 ÷ 3 = 200 can be derived from 2 x 3 = 6)

Using the **distributive** law: 39 x 7 = 30 x 7 + 9 x 7
Using the **associative** law: (2 x 3) x 4 = 2 x (3 x 4)

Using facts and rules:
2 x 6 x 5 = 10 x 6 = 60

Written Calculation

Multiply two-digit and three-digit numbers by a one digit number using formal written layout
Estimate before calculating
Ensure written methods build on/relate to mental methods (e.g. grid method)
Introduce alongside grid and expanded column methods



Key skills to support:
- know or quickly recall multiplication facts up to 12 x 12
- understand the effect of multiplying numbers by 10, 100 or 1000
- multiply multiples of 10, e.g. 20 x 40
- approximate e.g. recognise that 70 x 40 = 2800 and us this information to check whether their answer appears sensible

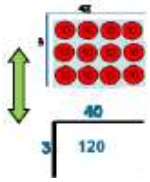
Revert to expanded methods if children find formal calculation method difficult

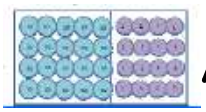
Representations to support mental and written calculations

Ensure children can confidently multiply and divide by 10 and 100, that multiplying by 10 makes the number bigger and all digits move one place to the left, while dividing by 10 makes the number smaller and all the digits move one place to the right.

Children need to understand and apply the language of multiples and factors and use it in solving multiplication and division problems, for example 'All factors of 36 are multiples of 2, true or false? Find me two factors of 48 that are also multiples of 3'.

Use arrays made with place value counters to demonstrate the link between multiplication and division. This will support understanding of the grid method.





I can use place value counters to model the grid method.

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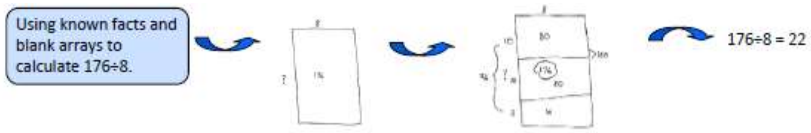
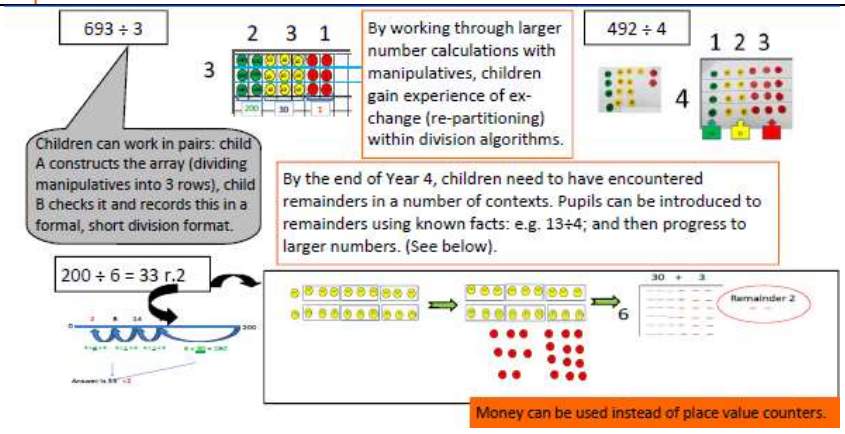
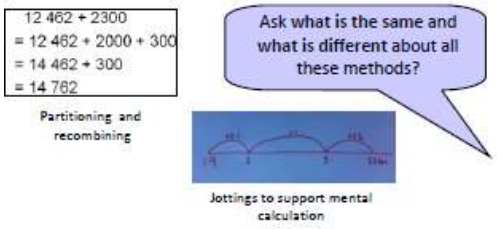
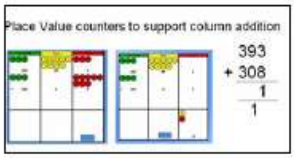
Fractions	**Recognise and show, using diagrams, families of common equivalent fractions** Understand the relation between non-unit fractions and multiplication and division of quantities, with particular emphasis on tenths and hundredths Make connections between fractions of a length, of a shape and as a representation of one whole or set of quantities Use factors and multiples to recognise equivalent fractions and simplify where appropriate
Links from other strands	• **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 such as n objects are connected to m objects** • **Convert between different units of measure (e.g. km to m) –** use multiplication to convert from larger to smaller units • *Understand the relation between non-unit fractions and multiplication/division of quantities. With larger emphasis on tenths and hundredths* • *Relate area to arrays and multiplication* • Problem solving work can involve finding all possibilities and combinations drawing on knowledge of multiplication tables facts • *Children understand and use a great range of scales in their representations (*statistics)

Year 4 – Division

Mental Calculations	**Children should be taught to:** • **Recall multiplication and division facts for multiplication tables up to 12 x 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**  ***Children practise mental methods and extend this to three-digit numbers to derive facts.***
Written Calculation	**Children should be taught to:** • **Multiply two-digit and three-digit numbers by a one digit-number using formal written layout** • **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 such as n objects are connected to m objects** ***Children practise to become fluent in the formal written method of short multiplication and short division with exact answers.*** Revert to expanded methods if children find formal calculation method difficult.
Representations to support mental and written calculations	

Fractions	**Children should be taught to:** • *Recognise and show, using diagrams, families of common equivalent fractions* • *Recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten* • *Solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number* • *Find the effect of dividing a one- or two-digit number by 10 and 100, identifying the value of the digits in the answer as ones, tenths and hundredths*
Links from other strands	• **Convert between different units of measure (for example, kilometre to metre, hour to minute)** • **Estimate, compare and calculate different measures, including money in pounds and pence (Measures)** • **Recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten (Fractions)**

Year 5 - Addition

Mental Calculations	• **Add numbers mentally with increasingly large numbers e.g. 12 462 + 2300 = 14 762** • **Mentally add tenths, and one-digit numbers and tenths** • **Add decimals, including a mix of whole numbers and decimals, decimals with different numbers of places, and complements of 1 (e.g. 0.83 + 0.17 = 1)** Children use representation of choice Refer back to pictorial and physical representations when needed **Common mental calculation strategies:** Partitioning and recombining Doubles and near doubles Use number pairs to 10 and 100 Adding near multiples of ten and adjusting Using patterns of similar calculations Using known number facts Bridging through ten, hundred, tenth Complementary addition
Written Calculation	**Add whole numbers with more than four digits, using the formal written (column) method** Add three digit numbers using column method and then move onto four digits. Include decimal addition for money 2417m + 5929m = 30101m £563.14 + £207.88 = £771.02 Revert to expanded methods if children find formal calculation method difficult (see Year 3)
Representations to support mental and written calculations	**Use physical/pictorial representations alongside expanded and column methods where needed.**  
Fractions	• **Add fractions with the same denominators that are multiples of the same number** *(to become fluent through a variety of increasingly complex problems and add fractions that exceed 1 as a mixed number)* 1/2 + 3/4 = 2/4 + 3/4 = 5/4
Links from other strands	• Solve problems involving up to three decimal numbers • Solve addition and subtraction multi step problems in context, deciding which operations and methods to use and why • Use all four operations to solve problems involving measure (e.g. length, mass, volume, money) using decimal notation • Calculate the perimeter of composite rectilinear squares in cm and m • Use angle sum facts and other properties to make deductions about missing angles • Solve comparison, sun and different problems using information presented in a line graph

Year 5 - Subtraction

Mental Calculations

- **Subtract numbers mentally with increasingly large numbers e.g. 12 462 – 2300 = 10 162**
- **Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy**
- ***Children practise adding and subtracting decimals, including a mix of whole numbers and decimals, decimals with different numbers of decimal places and complements of 1 (e.g. 1 – 0.17 = 0.83)***
- ***Children mentally add and subtract tenths, and one-digit whole numbers and tenths***

Children use, or visualise, representation of choice. Refer back to physical representation as required.

Basic Mental Strategies for Subtraction

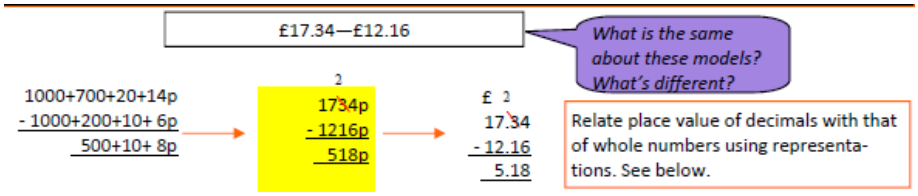
- Find differences by counting up
- Partitioning
- Applying known fact
- Bridging through 10 and multiples of 10
- Subtracting 9, 11 etc. by compensating
- Counting on to, or back from, the largest number

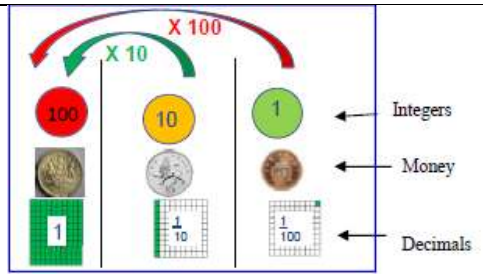
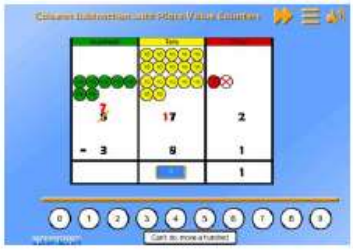
Which method works best? Why? How else could we do it?

Written Calculation

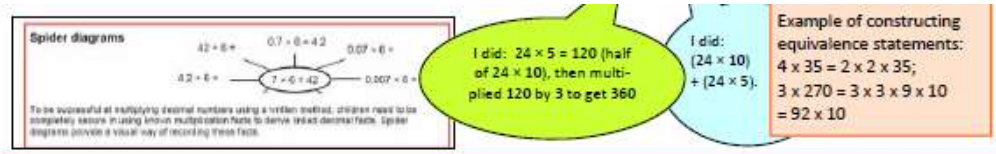
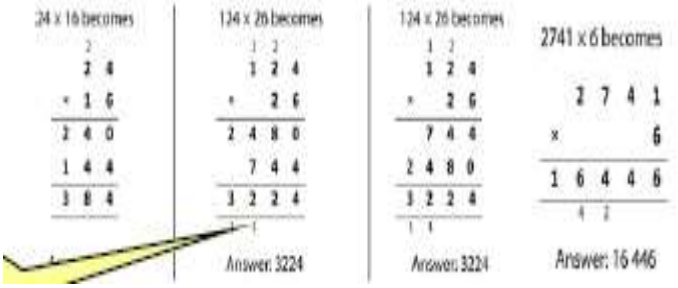
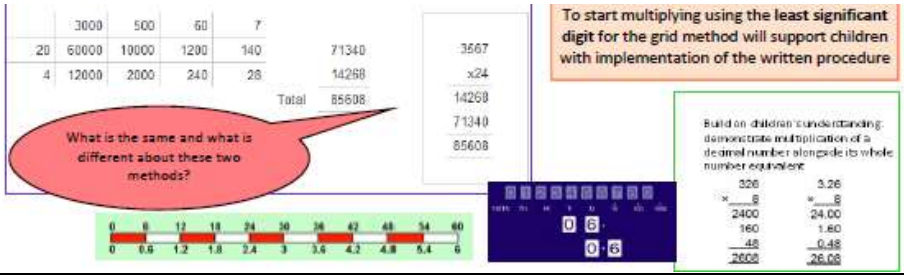
Add and subtract whole numbers with more than four digits, including using formal written methods (column addition and subtraction)
Children practise adding and subtracting decimals.
Begin with three-digit numbers using formal, column method; then move into four-digit numbers.

As in Year 4, compare physical and/or pictorial representations and expanded algorithms alongside column methods. Ask: *What is the same? What is different?*
Compare and discuss the suitability of different methods (mental or written) in context
Revert to expanded methods whenever difficulties arise.

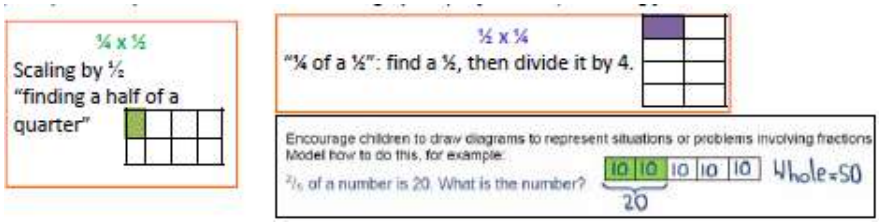


Representations to support mental and written calculations	  Use physical and pictorial representations to stress the place value relationships between money, decimals and whole numbers. A place value mat such as this one could be used, moving away from the traditional: *Hundreds, tens and ones* model used in Lower KS2 and KS1.
Fractions	**Subtract fractions with the same denominator and denominators that are multiples of the same number (*include fractions exceeding 1 as a mixed number).*** **Solve problems involving number up to three decimal places.** **Mentally add and subtract tenths, and one-digit whole numbers and tenths.**
Links from other strands	**Solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign.** **Use all four operations to solve problems using time, money and measure using decimal notation (up to three decimal places)**

Year 5 – Multiplication

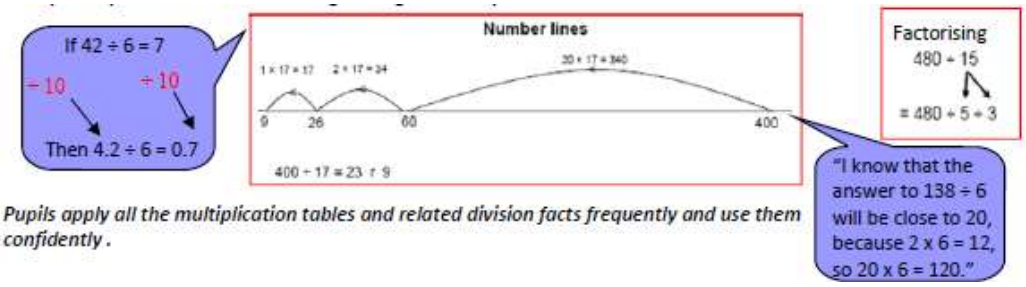
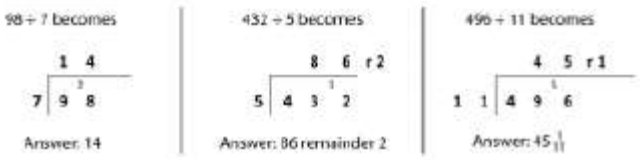
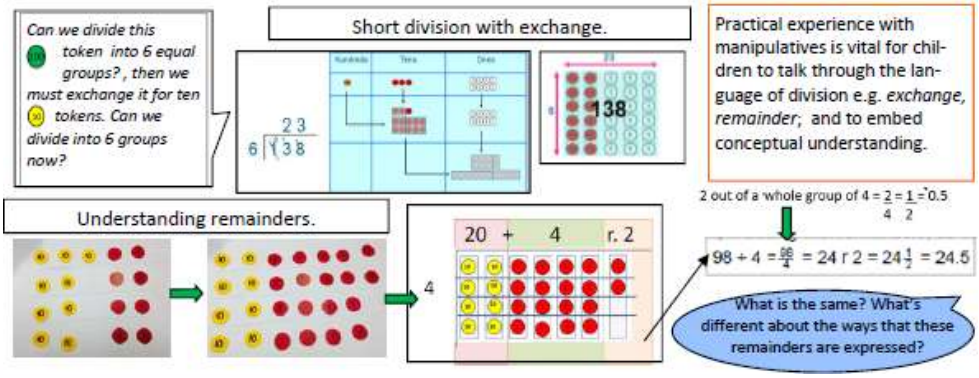
Mental Calculations	**Multiply and divide numbers mentally drawing upon known facts** **Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000** **Recognise and use square and cube numbers (and notation)**  Children should be taught throughout that percentages, decimals and fractions are different ways of expressing proportions.
Written Calculation	**Multiplying numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers.**  Compact methods for multiplication are efficient but often do not make the value of each digit explicit. When introducing multiplication of decimals, it is sensible to take children back to an expanded for such as the grid method where the value of each digit is clear, to ensure that children understand the process. Revert to expanded methods if children find formal calculation method difficult (see Yea 3/4)
Representations to support mental and written calculations	

Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams
Identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths
Children connect multiplication by a fraction to using fractions as operators (fractions of) and to division, building on work from previous years. This relates to scaling by simple fractions, including fractions greater than 1.



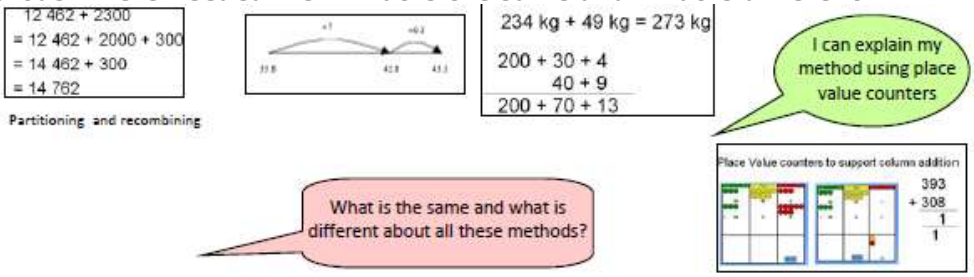
Identify multiples and factors, including finding all factor pairs of a number and common factors of two numbers
Know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers
Establish whether a number up to 100 is prime and recall prime numbers up to 19
Solve problems involving multiplication and division including using scaling by simple fractions and problems involving simple rates
Use all four operations to solve problems involving measure (for example, length, mass, volume, money) using decimal notation, including scaling
Convert between different units of metric measure; problems including money
Other links: ratio,
Children use their knowledge of place value and multiplication and division to convert between standard units
Children calculate the perimeter of rectangle and related composite shapes, including using the relations of perimeter or area to find unknown lengths. Missing measures questions such as these can be expressed algebraically, for example 4 + 2b = 20 for a rectangle of sides 2cm and b cm and perimeter of 20cm.
Children calculate the area from scale drawings using given measurements.

Year 5 – Division

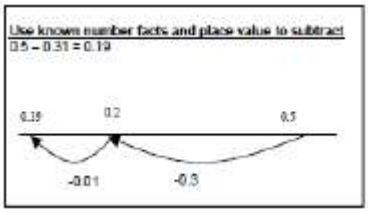
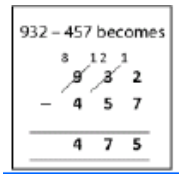
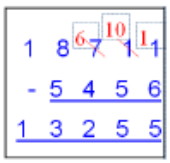
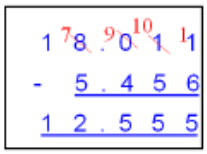
Mental Calculations	**Children should be taught to:** • **Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000** • **Multiply and divide numbers mentally drawing upon known facts** • **Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers**  *Pupils apply all the multiplication tables and related division facts frequently and use them confidently .*
Written Calculation	**Children practise and extend their use of the formal written methods of short multiplication and short division.** • **Divide numbers up to 4 digits by a one-digit number using the formal written mthod of short division and interpret remainders appropriately for the context**  • **Children interpret non-integer answers to division by expressing results in different ways according to the context, including with remainders, as fractions, as decimals or by rounding (see Representations below)** Revert to expanded methods if children find formal calculation method difficult.
Representations to support mental and written calculations	

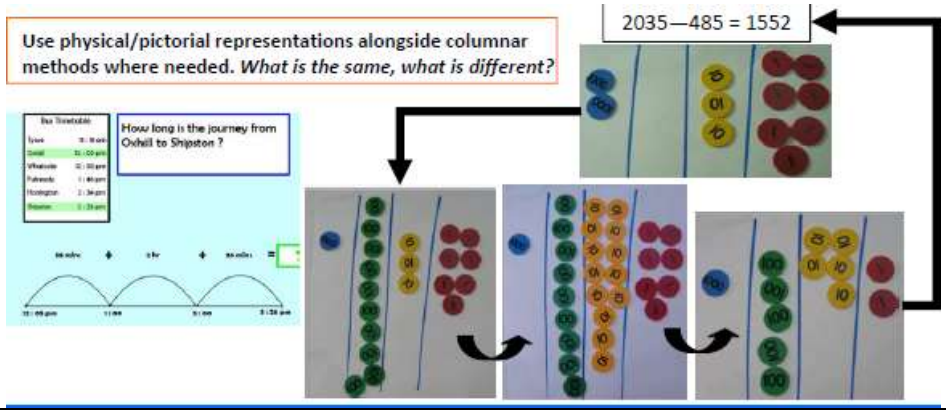
Fractions	• **Recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements greater than 1 as a mixed number** • ***Children connect equivalent fractions greater than 1 that simplify to integers with division and other fractions greater than 1 to division with remainders*** • ***Children connect multiplication by a fraction to using fractions as operators (fractions of) and to division*** • ***Children should make connections between percentages, fractions and decimals***
Links from other strands	• ***Children use all four operations in problems involving time and money, including conversions…using decimal notation, including scaling*** • ***Calculate and compare the area of rectangles (including squares) (Measures)*** • **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)** • **Solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes and including scaling by simple fractions and problems involving simple rates** • **Solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding of the meaning of the equals sign (Number – Multiplication and Division)**

Year 6 – Addition

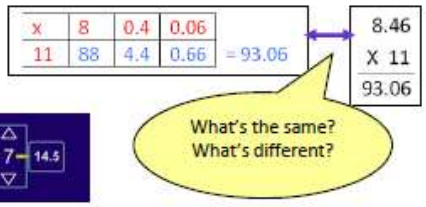
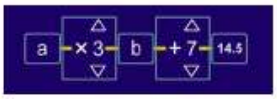
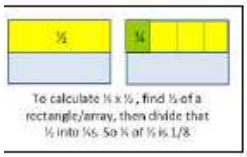
Mental Calculations	• **Perform mental calculations, including with mixed operations and large numbers** *(more complex calculations)* Children use representation of choice. Consolidate partitioning and re-partitioning. Use compensation for adding too much/little and adjusting. Refer back to pictorial and physical representation when needed. **Common mental calculation strategies:** Partitioning and recombining Doubles and near doubles Use number pairs to 10 and 100 Adding near multiples of ten and adjusting Using patterns of similar calculations Using known number facts Bridging through ten, hundred, tenth Complementary addition
Written Calculation	**Add larger numbers using the formal written (column) method** Add three digit numbers using column method and then move onto four digits. Include decimal addition for money 7 8 9 + 6 4 2 = 1 4 3 1 £563.14 + £207.88 = £771.02 Revert to expanded methods if children find formal calculation method difficult (see Year 3)
Representations to support mental and written calculations	**Use physical/pictorial representations alongside expanded and column methods where needed. Ask what is the same and what is different?** 
Fractions	• **Add fractions with different denominators and mixed numbers, using the concept of equivalent fractions** • Start with fractions where the denominator of one fraction is a multiple of the other (e.g. 1/2 + 1/8 = 5/8) and progress to varied and increasingly complex problems • Practise calculations with simple fractions and decimal equivalents to aid fluency
Links from other strands	• Use their knowledge of the order of operations to carry out calculations involving the four operations • Solve problems involving all four operations • Algebra: use symbols and letters to represent variable and unknowns *a+b* • Solve problems involving the calculation and conversions of units of measure, using decimal notation of up to three decimal places where appropriate • *Using the number line, children use, add and subtract positive and negative integers for measures such as temperature* • Calculate and interpret the mean as an average • Interpret and construct pie charts and line graphs and use these to solve problems • Find missing angles and *express geometry relationships algebraically*

Year 6 – Subtraction

Mental Calculations	**Children:** • **Perform mental calculations, including with mixed operations and large numbers** • **Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy** • ***Children undertake mental calculations with increasingly large numbers and more complex calculations*** Children draw on basic, mental subtraction strategies (see Year 5). Children use, or visualise, representation of choice. Refer back to physical representations as required. 
Written Calculation	**Add and subtract whole numbers with more than four digits, including using formal written methods (column additon and subtration). Solve problems involving the calculation and conversions of units of measure, using decimal notation of up to three decimal places where appropriate (measures).** Move towards consolidation of formal, column method. For more complex calculations, with increasingly larger or smaller numbers, compare representations and expanded algorithms alongside column methods. Ask: What is the same? What is different? Compare and discuss the suitability of different methods, (mental or written), in context. Revert to expanded methods wherever difficulties arise.  Consolidate columnar methods , paying particular attention to the occurrence of zeros as place holders.  

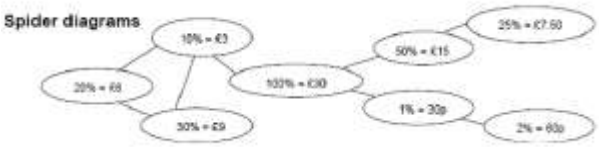
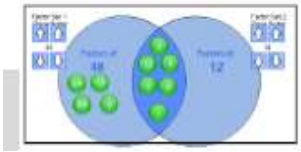
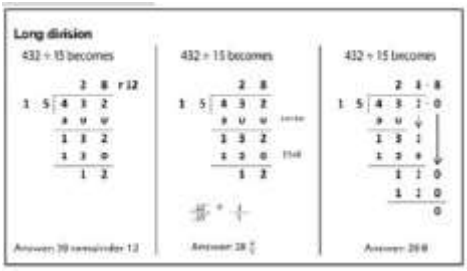
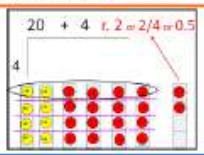
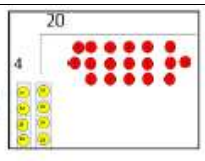
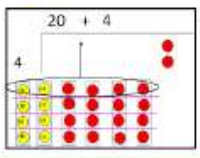
Representations to support mental and written calculations	**Use physical/pictorial representations alongside column methods where needed. Ask what is the same and what is different?** 
Fractions	**Add and subtract fractions with different denominators and mixed numbers.** ***Children practise calculations with simple fractions and decimal fraction equivalents to aid fluency.***
Links from other strands	**Use children's knowledge of the order of operations to carry out calculations involving the four operations** **Solve problems involving all four operations** **Algebra: use symbols and letters to represent variable and unknowns e.g. a + b = b + a** **Using the number line, children use, add and subtract positive and negative integers for measures such as temperature.**

Year 6 – Multiplication

Mental Calculations	**Perform mental calculations, including with mixed operations and large numbers** (increasingly large numbers and more complex calculations) *Use all the multiplication tables to calculate mathematical statements in order to maintain fluency* **Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy** **Identify the value of each digit in numbers given to three decimal places and multiply and divide numbers by 10, 100 and 1000 giving answers up to three decimal places** Children should know the square numbers up to 12 x 12 and derive the corresponding squares of multiples of 10 e.g. 80 x 80 = 6400 How many different x/÷ facts can you make using 72? 7.2? 0.72? Use mental strategies to solve problems e.g. - X4 by doubling and doubling again - X5 by x10 and halving - X20 by x10 and doubling - X9 by multiplying by 10 and adjusting - X6 by multiplying by 3 and
Written Calculation	**Multiply multi digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication** (short and long multiplication) **Multiply one-digit numbers with up to two decimal places by whole numbers** Revert to expanded methods if children find formal calculation method difficult (see Year 4/5)
Representations to support mental and written calculations	Look at long-multiplication calculations containing errors, identify the errors and determine how they should be corrected  
Fractions	**Multiply simple pairs of proper fractions, writing the answer in its simplest form e.g. ¼ x ½ = 1/8**  Three key applications of understanding: - Recognise that ¼ of 12, ¼ x 12 and 12 divided by 4 are equivalent - Use cancellation to simplify the product of a fraction and an integer e.g. 1/5 x 15 = 3, 2/5 x 15 = 2 x 1/5 x 15 = 2 x 3 = 6 - Work out how many ½ in 15, how many 2/5 in 15, how many 2/5 in 1 etc Children should use a variety of images to support their understanding of multiplication with fractions. This follows earlier work about fractions as operators (fractions of), as numbers, and as equal parts of objects, e.g. as parts of a rectangle.

Links from other strands	• **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 addition, subtraction, multiplication and division** • *Explore the order of operations using brackets, for example 2 + 1 x 3 = 5 and (2 + 1) x 3 = 9* • **Fractions, decimals and percentages** including equivalences in different contexts • **Solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts** • **Solve problems involving the calculation of percentages (for example, of measures, and such as 15% of 360) and the use of percentages for comparison** • **Solve problems involving similar shapes where the scale factor is known or can be found** • **Solve problems involving unequal sharing and grouping using knowledge of fractions and multiples** • **Algebra** including formulae, linear number sequences, combinations of variables • **Measurement** including solving problems with conversion of units, decimal notation, area and volume • **Statistics** including pie charts, line charts and calculating the mean

Year 6 – Division

Mental Calculations	**Children should be taught to:** • **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** • **Identify common factors, common multiples and prime numbers**  • **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** 
Written Calculation	• **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** • **Divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context** • ***Children practise division for larger numbers, using the formal written methods of short and long division***  Revert to expanded method if children find formal calculation method difficult.
Representations to support mental and written calculations	 To introduce the long division model, use a calculation which can be represented both with manipulatives and by a short division algorithm. Use questioning and discussion to compare written methods. £1362.72 ÷ 40 = ? *£1362.72 ÷ 4 = £340.68* *[½ and ½ again.]* *£340.68 ÷ 10 = £34.068* *which rounds to £34.07.*  2 4 r.2 4 9 ¹8 - 8 0 (4 x 20) 1 8 - 1 6 (4 x 4) 2 *What's the same? What's different?*  

Fractions	• **Use common factors to simplify fractions** • **Compare and order fractions, including fractions greater than 1** • **Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions** • **Divide proper fractions by whole numbers (for example, 1/3 ÷2 = 1/6)** • **Associate a fraction with division and calculate decimal fraction equivalents (for example 0.375)** • ***Children use their understanding of the relationship between unit fractions and division to work backwards.*** **Use written division methods in cases with the answer has up to 2 decimal places**
Links from other strands	• ***Children are introduced to the division of decimal numbers by one-digit whole numbers, initially, in practical contexts involving measures and money. They recognise division as the inverse of multiplication*** • ***Children also develop their skills of rounding and estimating. This includes rounding answers to a specified degree of accuracy and checking the reasonableness of their answers (Fractions)*** • ***Solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate*** • ***Use, read, write and convert between standard units…using decimal notation up to three decimal places (Measures)*** • ***Interpret and construct pie charts and line graphs and use these to solve problems*** • ***Calculate and interpret the mean as an average (Statistics)*** • ***Solve problems involving the relative sizes of two quantities where missing values can be found using integer multiplication and division facts (Ration and Proportion)***