



Welford, Sibbertoft and Sulby Endowed School

Calculation Policy

About our Calculation Policy:

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

Please note that early learning teaching in number and calculations in EYFS (Reception) follows the "Development Matters" EYFS document.

The calculation policy is organised according to progressive steps (not by age) as outlined in the National Curriculum. It is vital these are taught in order and according to the individual child's stage, moving on when they are secure.

It is important that any type of calculation is given a real life context or problem solving approach to help build children's understanding of the purpose of the calculation, and to help them recognise when to use certain operations and methods when faced with problems. This must be a priority in Maths lessons.

Aims of the written calculation policy:

- To support greater consistency in the teaching of written calculations across the school.
- To strengthen continuity and progression in children's understanding of the development of written calculations.
- To form a core set of methods which every child will experience and build upon.
- To build on models and images introduced to promote conceptual understanding.
- To provide reference and guidance on the teaching of calculation skills for teaching staff, teaching assistants and parents.

Good practice in Calculation:

- Establish mental methods based on good understanding of place value in number and times table facts.
- Show children how to set out written calculations vertically, initially using expanded layouts (starting with adjustments of "carrying" and introducing this adjustment slowly and systematically.)
- Link practical, mental and written methods.
- Make strong links between inverse operations of addition/subtraction and multiplication/division.
- Make sure the children always look out for special cases that can be done entirely mentally.
- Gradually refine the written record into a more compact standard method.
- Extend to larger numbers and decimals.
- Ensure that the understanding of remainders, and what to do with them in context, is taught alongside division throughout.
- Once written methods are introduced, keep mental skills sharp by continuing to develop and apply them to appropriate examples (encouraging children to try mental methods first.)
- Encourage children to identify the best method and make choices.
- Encourage children to use a wide range of tools to support their learning e.g. number lines, 100 squares, until they are secure.

Calculation Guidelines for Step 1

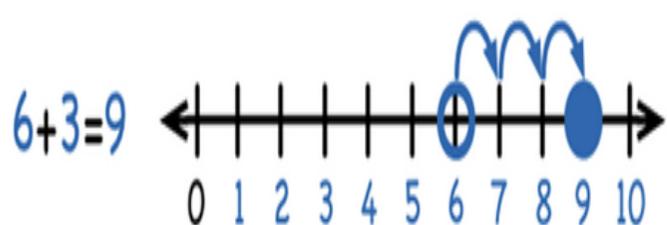
Addition

Add with numbers up to 20.

Key Skills:

Read and write numbers to 100 in numerals, inc 1-20 in words.
 Recall number bonds to 10-20, and addition facts within 20.
 Count to and across 100.
 Count in multiples of 1, 2 ,5, 10.
 Solve simple 1-step problems involving addition, using objects, number lines and pictorial representations.

Use numbered lines to add, by counting on in ones. Encourage children to start with the larger number and count on.



Children should:

Have access to a wide range of counting equipment, everyday objects, number tracks and number lines, and be shown numbers in different contexts.
 Read and write the addition (+) and (=) signs within number sentences.
 Interpret addition sentences and solve missing box problems.

Key Vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line.

Subtraction

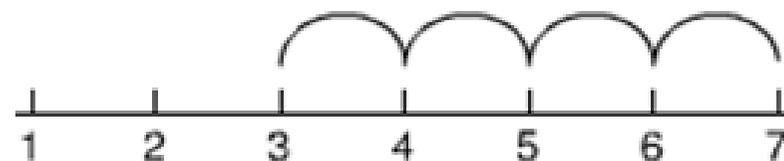
Subtract with numbers up to 20.

Key Skills:

Given a number, say 1 more or 1 less.
 Count to and over 100, forward and back, from any number.
 Represent and use subtraction facts to 20 and within 20.
 Subtract with 1-digit and 2-digit numbers to 20, including 0.
 Solve simple 1-step problems, involving subtraction, using concrete objects and pictures, and missing number problems.
 Read and write numbers from 0-20 in numerals and words.

Children consolidate understanding of subtraction practically, showing subtraction on bead strings, using cubes etc. and in familiar contexts, and are introduced to more formal recording using number lines as below:

Count back in ones on a numbered number line to take away, with numbers up to 20 and count on to find the difference.



Children should:

Start recalling subtraction facts up to and within 10 and 20, and should be able to subtract zero.

Key Vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer/less than, most, least, count back, how many left, how much less is_?

Calculation Guidelines for Step 1

Multiplication

Multiply with concrete objects, arrays and pictorial representations.

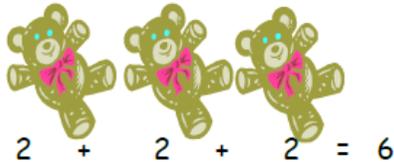
Key skills:

Count in multiples of 2, 5, 10.
Solve 1-step problems involving multiplication, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.
Make connections between arrays, number patterns, and counting in 2s, 5s, and 10s.
Begin to understand doubling using concrete objects and pictorial representations.

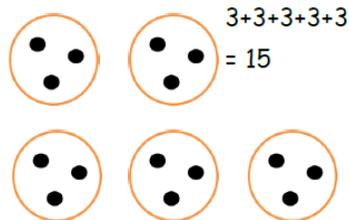
Give children experience of counting equal groups of objects in 2s, 5s and 10s.

Present practical problem solving activities involving counting equal sets or groups as below.

How many legs will 3 teddies have?



There are 3 sweets in one bag.
How many sweets are in 5 bags altogether?



Key Vocabulary: groups of, lots of, times, array, altogether, multiply, count.

Division

Group and Share small quantities.

Key Skills:

Solve 1-step problems involving division, by calculating the answer using concrete objects, pictorial representations arrays with the support of the teacher.
Through grouping and sharing small quantities, pupils begin to understand, division, and finding simple fractions of objects, numbers and quantities.
They make connections between arrays, number patterns, and counting in 2s, 5s, and 10s.

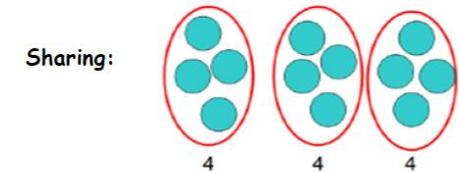
Using objects, diagrams and pictorial representations to solve problems involving both grouping and sharing.

How many groups of 4 can be made with 12 stars = 3



Children should:

Use lots of practical apparatus, arrays and picture representations.
Be taught to understand the difference between 'grouping' objects (How many groups of 2 can you make?) and 'sharing' (Share these sweets between two people.)
Be able to count in multiples of 2s, 5s and 10s.



12 shared between 3 is 4

Key Vocabulary: share, share equally, one each, two each, group, groups of, lots of, array.

Calculation Guidelines for Step 2

Addition

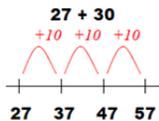
Add with 2 Digit numbers.

Developing mental fluency with addition and place value 2 digit numbers, and then establish more formal methods.

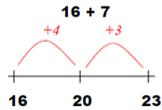
Key Skills:

- Add a 2 digit number and ones and tens.
- Add pairs of 2 digit numbers.
- Add 3 single digit numbers.
- Show that adding can be done in any order.
- Recall bonds to 20 and bonds of tens to 100.
- Count in steps of 2, 3, and 5 and count in tens from any number.
- Understand the place value of a 2 digit number.
- Compare and order numbers to 100 using \leq \geq and $=$ signs.
- Read and write numbers to at least 100 in numerals and words.
- Solve problems with addition, using concrete objects, pictorial representations, involving numbers, quantities and measures, and applying mental and written methods.

1. Add 2-digit numbers and tens.



2. Add 2 digit numbers and units.



3. Add pairs of 2-digit numbers, moving to the partitioned column method when secure adding tens and units.



(Only provide examples that do NOT cross the tens boundary until they are secure with the method itself.) To support understanding, pupils need to physically make and carry out the calculation with place value apparatus, then compare their practical version to the written form, to help them to build an understanding of it.

Key Vocabulary: sum, tens, units, partition, addition, column, tens boundary.

Subtraction

Subtract with 2-digit numbers.

Key Skills:

- Recognise the place value of each digit in a 2 digit number.
- Recall and use subtraction facts to 20 fluently, and derive and use related facts up to 100.
- Subtract using concrete objects, pictorial representations, 100 square and mentally, including 2 digit number and ones, a 2 digit number and tens, and two 2 digit numbers.
- Show that subtraction of one number from another cannot be done in any order.
- Recognise and use inverse relationship between $+$ and $-$, using this to check calculations and missing number problems.
- Solve simple subtraction problems including measures, using concrete objects, pictorial representation, and also applying their increasing knowledge of mental and written methods.
- Read and write numbers to at least 100 in numerals and in words.

Consolidating learning and understanding from Stage 1 before learning to subtract on a number line by counting back, aiming to develop mental subtraction skills.

This strategy will be used for

- 2 digit numbers subtract units.
- 2 digit numbers subtract tens.
- Subtracting pairs of 2 digit numbers.

Children may still choose to count on in a similar way to stage 1 to tackle such calculations.

Subtracting pairs of 2-digit numbers on a number line:

$47 - 23 = 24$ Partition the second number and subtract it in tens and units, as below:

Then subtract units.

Subtract tens first.

Move towards more efficient jumps back, as below:

Combine methods with use of a hundred square to reinforce understanding of number value and order.

Teaching children to **bridge through ten** can help them to become more efficient, for example $42 - 25$:

Key Vocabulary: difference, count on, strategy, partition, tens, units.

Calculation Guidelines for Step 2

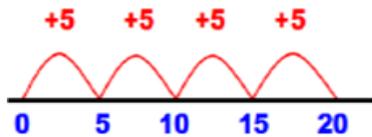
Multiplication

Multiply using arrays and repeated addition (using at least 2s, 5s and 10s)

Key skills:

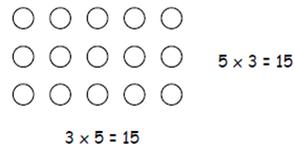
Count in steps of 2, 3, and 5 from 0 and in 10s from any number.
 Recall and use multiplication facts from the 2, 5, 10 multiplication tables including recognising odd and even numbers.
 Write and calculate number statements using the x and = signs.
 Show that multiplication can be done in any order.
 Solve a range of problems involving multiplication, using concrete objects, arrays, repeated addition, mental methods and multiplication facts.
 Pupils use a variety of language to discuss and describe multiplication.

Use repeated addition on a number line:
 Starting from zero, make equal jumps up on a number line to work out multiplication facts and write multiplication statements using x and = signs.

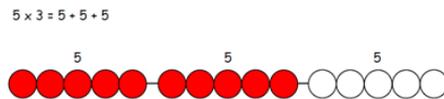


Use arrays:

Use arrays to help teach children to understand the commutative law of multiplication, and give examples such as $3 \times \underline{\quad} = 6$.



Use practical apparatus:



Use mental recall:

Children should begin to recall multiplication facts for 2, 5 and 10 times tables through practice in counting and understanding of the operation.

Key Vocabulary: multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times...

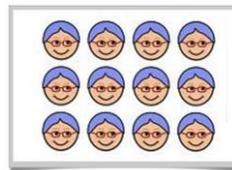
Division

Group and share, using the ÷ and = sign
Use objects, arrays, diagrams and pictorial representations, and grouping on a number line.

Key Skills:

Count in steps of 2, 3 and 5 from 0.
 Recall and use division facts for 2,5,10 multiplication tables, including recognising odd and even numbers.
 Calculate mathematical statements for division with the multiplication tables and write them using the ÷ and = symbol.
 Show the multiplication of 2 numbers can be done in any order and the division of one number by another cannot.
 Solve problems involving division, using materials, arrays, repeated addition, mental methods, division facts, including problems in context.

Arrays: This represents $12 \div 3$, posed as How many groups of 3 are in 12?



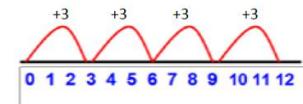
Pupils should also show that the same array can represent $12 \div 4 = 3$ if grouped horizontally.

Know and understand sharing and grouping:

Children should be taught to recognise whether problems require sharing or grouping as per stage 1.

Grouping using a number line:

Group from zero in equal jumps of the divisor to find out 'how many groups of _ in _?'. Pupils could and using a bead string or practical apparatus to work out problems like 'A CD costs £3. How many CDs can I buy with £12?' **This is an important method to develop understanding of division as grouping.**



$12 \div 3 = 4$

Key Vocabulary: divide, divided by, divided into, division, grouping, number line, left, and left over.

Calculation Guidelines for Step 3

Addition

Add 4-digit numbers

Key Skills:

Read and write numbers to 100 in numerals and words.
 Add 2 digit numbers mentally including those exceeding 100.
 Add a 4 digit and 1 digit number mentally.
 Add a 4 digit and tens mentally.
 Add a 4 digit and hundreds mentally.
 Estimate answers to calculations, using the inverse to check answers.
 Solve problems, including missing number problems using number facts, place value, and more complex addition.
 Recognise place value of each digit in a 4 digit number.
 Continue to practise a wide range of mental strategies, i.e. Number bonds, adding the nearest multiple of 10, 100, 100 and adjusting, using near doubles, partitioning and recombining.

Introduce the expanded column addition method:

	2	3	6
+		7	3
<hr/>			
			9
	1	0	0
	2	0	0
<hr/>			
	3	0	9

In order to carry out this method of addition:
 Children need to recognise the value of the hundreds, tens and units without recording the partitioning.
 Pupils need to be able to add in columns, adding the units first in preparation for the compact method.

Key Vocabulary: hundreds boundary, increase, vertical, 'carry', expanded, compact.

Subtraction

Subtracting with 3 and 4 digit numbers.

Key Skills:

Subtract mentally a 4 digit number and ones, a 4 digit number and 10s, 4 digit number and hundreds.
 Estimate answers and use the inverse operations to check.
 Solve problems, including missing number problems.
 Find 10 or 100 more or less than a given number.
 Recognise the place value of each digit in a 4 digit number.
 Counting up differences as a mental strategy when numbers are close together or near multiples of 10.
 Read and write numbers to 1000 in numerals and words.
 Practise mental subtraction strategies, such as subtracting near multiples of 10 and adjusting and select most appropriate methods o subtract explaining why.

$$89 - 35 = \underline{54}$$

Partitioned Column Subtraction

Introduce this method with examples where no exchanging is required.

$$\begin{array}{r} 80 + 9 \\ - 30 + 5 \\ \hline 50 + 4 \end{array}$$

Use counting on as a mental strategy for subtraction:
 Continue to reinforce counting on as a strategy for close-together numbers and also for numbers that are nearly multiples of 10, 100, 1000 or money which make it easier to count on.

Key Vocabulary: decrease, hundreds, value, digit

Calculation Guidelines for Step 3

Multiplication: Multiply 2 digits by 1 digit

Key skills:

Recall and use multiplication facts for the 2, 3, 4, 5, 8 and 10 multiplication tables and multiple multiples of 10.
 Write and calculate number statements using multiplication facts they know, drawing upon mental methods and progressing to reliable written methods.
 Solve multiplication problems, including missing number problems.
 Develop mental strategies using commutativity.
 Solve simple problems in context, deciding which operations and methods to use.
 Develop efficient mental methods to solve a range of problems.

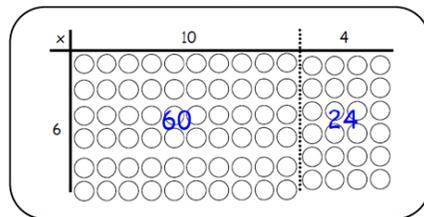
Introduce the grid method for multiplying by a single single-digits:

Eg. $23 \times 8 = 184$

X	20	3
8	160	24

$160 + 24 = 184$

Link the layout of the grid to an array initially:



Introduce the grid method with children physically making an array to represent the calculation, and then translate this to grid method format.

To do this children must already be able to:

Partition numbers into tens and units.
 Multiply multiples of 10 by a single digit using their knowledge of multiplication facts and place value.
 Recall and work multiplication facts in 2, 3, 4, 5, 8 and 10 times tables.
 Work out multiplication facts not known by repeated addition or other taught mental strategies. Strategies to support this are repeated addition using a number line, bead bars and arrays.

Key Vocabulary: partition, grid method, multiple, product, tens, units, value.

Division

Key Skills:

Recall and use division facts for the 2, 3, 4, 5, 8 and 10 multiplication tables (through doubling, connect 2, 4, 8)
 Write and calculate mathematical statements for division using multiplication tables that they know, including for 2 digit numbers times 1 digit numbers, using mental and progressing to formal written methods.
 Solve problems in contexts and including missing number problems involving division.
 Pupils develop efficient mental methods, using \times and \div facts to derive related facts.
 Pupils develop reliable written methods for division, starting with calculations of 2 digit numbers by 1 digit numbers and progressing to the more formal written methods.

Develop understanding of Division by using the inverse:

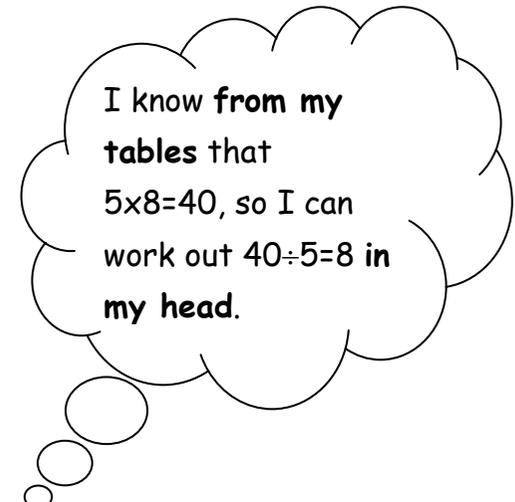
Inverse means opposite, so the opposite of addition is subtraction and the opposite of multiplication is division.

$5 \times 8 = 40$

$8 \times 5 = 40$

$40 \div 5 = 8$

$40 \div 8 = 5$



Using inverse operations is a great way to check answers or to find quicker ways to do them.

Key Vocabulary: inverse, short division, 'carry', remainder, multiple

Calculation Guidelines for Step 4

Multiplication Multiply up to 4 digits by 1 digit.

Key skills:

Count in multiples of 6, 7, 9, 25 and 1000.
 Recall all multiplication facts for all multiplication tables up to 12x12.
 Recognise place value of digits in up to 4 digit numbers.
 Use place value, known facts and derived facts to multiply mentally.
 Use commutativity and other strategies mentally.
 Solve problems with increasingly complex multiplication in a range of contexts.

Eg. $136 \times 5 = 680$

X	100	30	6
5	500	150	30

500
150
+ 30
680

Short multiplication
for multiplying by a
single digit.

Children should be able to:
 Approximate before they calculate, and make this a regular part of their calculating, going back to the approximation to check the reasonableness of their answers.
 Record an approximation to check the final answer against.
 Multiply multiples of 10 and 100 by a single digit, using their multiplication table knowledge.
 Recall all times tables up to 12 x 12.

Key Vocabulary: inverse

Division

Key Skills:

Recall multiplication and division facts for all numbers up to 12x12.
 Use place value, known and derived facts to multiply and divide mentally, including multiplying/dividing by 10 and 100 and 1.
 Pupils practise to become fluent in the formal written method with exact answers when dividing by a 1 digit number.
 Pupils practise mental methods and extend this to 3 digit numbers to derive facts.
 Pupils solve 2 step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This should include correspondence questions such as 3 cakes shared equally between 10 children.

Further develop the children's
understanding of Division through
"chunking."

$64 \div 4 = 16$

We know that $40 \div 4 = 10$

We know that $24 \div 4 = 6$

$$\begin{array}{r} 16 \\ 4 \overline{) 64} \\ \underline{40} \\ 24 \\ \underline{24} \\ 0 \end{array}$$

40 (x 10)
24 (x 6)

$$\begin{array}{r} 16 \\ 4 \overline{) 624} \\ \underline{40} \\ 22 \\ \underline{20} \\ 24 \\ \underline{24} \\ 0 \end{array}$$

Key Vocabulary: divisible by, factor

Calculation Guidelines for Step 5

Addition

Key Skills:

Add numbers mentally with increasingly larger numbers, using and practising a range of mental strategies i.e. add the nearest multiple of 10, 100, 100 and adjust, use near doubles, inverse, partitioning and recombining, using number bonds.
 Use rounding to check answers and accuracy.
 Solve multi step problems in contexts, deciding which operations and methods to use and why.
 Read, write, order and compare numbers to at least 1 million and determine the value of each digit including decimals up to 2 decimal places.
 Round any number up to 1000000 to the nearest 10, 100, 1000, 10,000 and 100,000.
 Add numbers with more than 4 digits and 2 step decimals using formal written methods of column addition.

$\begin{array}{r} \pounds 23.59 \\ + \pounds 7.55 \\ \hline \pounds 31.14 \end{array}$	$\begin{array}{r} 23481 \\ + 1362 \\ \hline 24843 \end{array}$	$\begin{array}{r} 19.01 \\ 3.65 \\ + 0.70 \\ \hline 23.36 \end{array}$
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The decimal point should be aligned in the same way as the other columns, and must be in the same column in the answer.
 Numbers should exceed 4 digits.
 Pupils should be able to add more than 2 values, carefully aligning place value columns.

Children should:

Understand the place value of tenths and hundredths and use this to align numbers with different numbers of decimal places.

Key Vocabulary:

Subtraction

Subtract with up-to 4 digit numbers

Key Skills:

Subtract numbers mentally with increasingly large numbers.
 Use rounding and estimation to check answers to calculations and determine, in a range of contexts levels of accuracy.
 Solve addition and subtraction multi step problems in context, deciding which operations and methods to use and why.
 Read, write, order and compare numbers to at least 1 million (including decimals up to 2 decimal places.) and determine the value of each digit.
 Count forwards or backwards in steps of powers of 10 for any given number up to 1 million.
 Interpret negative numbers in context, counting forwards and backwards with positive and negative integers through 0.
 Round any number up to 1 million to the nearest 10, 100, 1000, 10000 and 100000.
 Solve simple measures and money problems involving fractions and decimals to 2 decimal places.
 Count backwards through zero, including negative numbers.

$2754 - 1562 = 1192$
$\begin{array}{r} 2000 + \overset{600}{\cancel{700}} + 50 + 4 \\ - 1000 + 500 + 60 + 2 \\ \hline 1000 + 100 + 90 + 2 \end{array}$

Partitioned column subtraction with exchanging (decomposition)

As introduced in step 4, but moving towards more complex numbers

and values. Use place value counters to reinforce "exchanging".

Children will need to be secure with number facts and place value before moving on from this method.

Key Vocabulary: tenths, hundredths, decimal point, decimal.

Calculation Guidelines for Step 5

Multiplication

Multiply up to 4 digits by 1 or 2 digits.

Key skills:

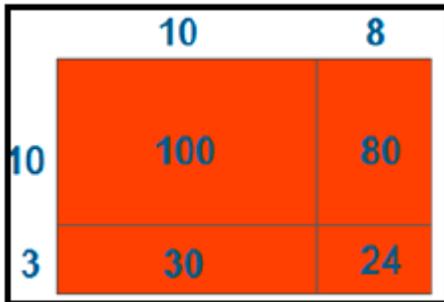
Identify multiples and factors using knowledge of multiplication tables to 12x12.
 Solve problems where larger numbers are decomposed into their factors.
 Multiply and divide integers by 10, 100 and 1000.
 Recognise and use square and cube numbers and their notation.
 Solve problems involving combinations of operations, choosing and using calculations and methods appropriately.

Division

Key Skills:

Multiply and divide numbers mentally, drawing on number facts.
 Identify multiples and factors including finding all factor pairs of a number and common factors of 2 numbers.
 Solve problems using division where larger numbers are decomposed into their factors.
 Multiply and divide whole numbers and those involving decimals by 10, 100, 1000.
 Use the vocabulary of prime numbers, prime factors and composite numbers (non-prime).
 Work out whether a number up to 100 is prime and recall prime numbers to at least 19.
 Divide numbers up to 4 digits using the written method for short division interpreting remainders appropriately.
 Use multiplication and division as the inverse.
 Interpret non-integer answers to short division by expressing the results in different ways according to the context.
 Solve problems involving combinations of all 4 operations, including understanding of = signs, and including division for scaling by different fractions and problems involving simple ratio.

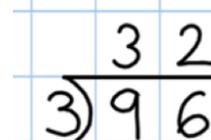
Introduce long multiplication for multiplying by 2 digits.



The grid could be used to introduce long multiplication, as the relationship can be seen in the answers in each row.

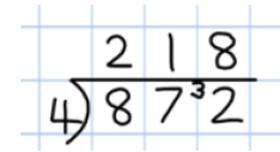
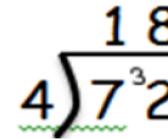
Key Vocabulary: square, factor, integer, decimal, short/long multiplication, 'carry'

To develop the techniques for short division (without remainders initially)



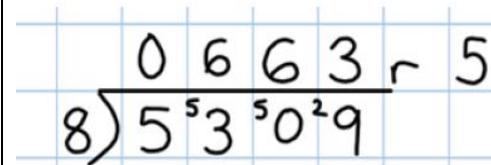
Next pupils need to be secure with the process of short division for dividing 2 digit numbers by a single digit (those that do not result in a final remainder.)

understand how to remainders using within the



but must calculate this to "carry" calculation process.

(see examples)



Use Short division to divide up to 4 digits by a single digit including those with remainders. Division needs to have a real life problem solving context, where

pupils consider the meaning of the remainder and how to express it.

Key Vocabulary: quotient, prime number, prime factors, composite number (non-prime)

Calculation Guidelines for Step 6

Addition

Add several numbers of increasing complexity

Key Skills:

Perform mental calculations, including with mixed operations, large numbers and decimals, using and practising a range of mental strategies.
Solve multi-step problems in context, deciding which operations and methods to use and why.
Use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy.
Read, write, order and compare numbers up to 10 million and decimals with up to 3 decimal places and determine the value of each digit.
Round any whole number and decimal to a required degree of accuracy.
Pupils understand how to add mentally with larger numbers and calculations of increasing complexity.

8	1	0	5	9
	3	6	6	8
	1	5	3	0
+	2	0	5	5
1	2	0	5	7
	1	1	1	1

Adding several numbers with different numbers of decimal places (including money and measures):

Tenths, hundredths and thousandths should be correctly aligned with the decimal point lined up vertically including in the answer row. Zeroes could be added into any empty decimal places, to show there is no value to add.

Subtraction

Subtract with at least 4 digit numbers including money, measures and decimals.

Key Skills:

Solve addition and subtraction multi step problems in context, deciding which operations and methods and use and why.
Read, write, order and compare numbers up to 10 million and decimals with up to 3 decimal places and determine the value of each digit.
Round and whole numbers and decimals up to 3 decimal places. in context, and calculate intervals across 0.
Pupils need to utilise and consider a range of mental subtraction strategies, jottings and written methods before choosing how to calculate.

2	8	1	0	5	6
-		2	1	2	8
<hr/>					
	2	8	9	2	8

Compact column subtraction (with "exchanging") Subtracting with larger integers.

8	9	9	4	9		
-		8	9	9	4	9
<hr/>						
	6	0	7	5	0	

Use the compact column method to subtract more complex integers. Then moving on to using the compact column method to subtract using money and measures, including decimals with different numbers of decimal places.

Pupils should be able to apply their knowledge of a range of mental strategies, mental recall skills, and informal and formal written methods when selecting the most appropriate method to work out subtraction problems.

Key Vocabulary: (as previously)

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