

Approach to Calculations at Tadpole Farm CE Primary Academy



Tadpole Farm
CE Primary Academy

Contents

What is this approach for?	2
How do I use this approach?	2
Early Years Foundation Stage	3
Year 1	5
Year 2	7
Year 3	9
Year 4	11
Year 5 & 6 Addition and Subtraction	13
Year 5 Multiplication and Division	14
Year 6 Multiplication and Division	16

What is this approach for?

This approach is intended to demonstrate how we teach different forms of calculation at Tadpole Farm CE Primary Academy. It is organised in year groups although some higher ability children may use methods from later year groups. By the time children reach the KS2 tests at the end of year 6, children are expected to use written formal methods for all four operations (addition, subtraction, multiplication and division).



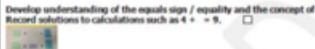

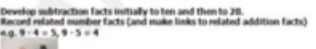

This approach is designed to help teachers and staff members at the school ensure that calculation is taught consistently across the school and to aid them in helping children who may need extra support or challenges.

This approach is also designed to help parents, carers and other family members support children's learning by letting them know the expectations for their child's year group and by providing an explanation of the methods used in our school.

How do I use this approach?

Each page follows a similar format to help you find the information you need. Addition is paired with subtraction and division with multiplication as these operations are the inverse (opposite) of each other.

These are the objectives from the National Curriculum.

Year 1	
Objectives: <ul style="list-style-type: none">• read, interpret and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs• represent and use number bonds and related subtraction facts within 20• add and subtract one-digit and two-digit numbers to 20, including zero• solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as: $7 = \square + 9$• pupils memorise and reason with number bonds to 10 and 20 in several forms (for example, $9 + 7 = 16$; $16 - 7 = 9$; $7 + 16 = 23$). They should realise the effect of adding or subtracting zero. This establishes addition and subtraction as related operations.• pupils combine and increase numbers, counting forwards and backwards.• They discuss and solve problems in familiar practical contexts, including using quantities. Problems should include the terms: put together, add, altogether, total, take away, difference between, more than and less than, so that pupils develop the concept of addition and subtraction and are enabled to use these operations flexibly.	
Addition <p>Count on using number tracks / number lines / 100 grids to support.</p>  <p>Record related number facts. e.g. $4 + 5 = 9$, $5 + 4 = 9$, $9 - 4 = 5$, $9 - 5 = 4$</p>  <p>Develop understanding of the equals sign / equality and the concept of 'empty box' questions. Record solutions to calculations such as $4 + \square = 9$.</p>  <p>Use practical apparatus e.g. counters, multilink, objects etc.</p> <p>Vocabulary: Add, plus, and, altogether, more, make, sum, total, how many more to make?</p>	Subtraction <p>Count back using number tracks / number lines / 100 grids to support the development of the concept of subtraction as take away.</p>  <p>Develop subtraction facts initially to ten and then to 20. Record related number facts (and make links to related addition facts) e.g. $9 - 4 = 5$, $9 - 5 = 4$</p>  <p>Develop understanding of the equals sign / equality and the concept of 'empty box' questions. Record solutions to calculations such as $9 - \square = 5$.</p>  <p>Use practical apparatus e.g. counters, multilink, objects etc.</p> <p>Vocabulary: subtract, take away, minus, less, left over, how many are left? How many are gone? Find the difference.</p>

This is some of the vocabulary that will be used in lessons and that the children are expected to know.

These examples show you the type of work and methods that children will be using in class.

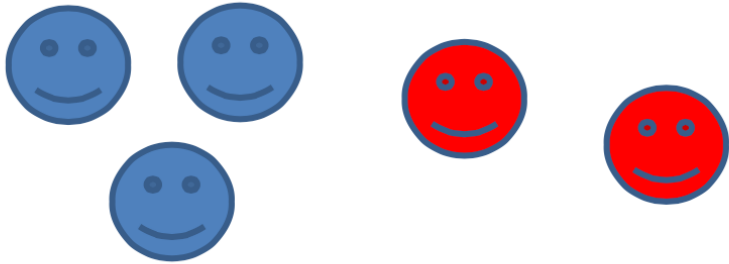
Early Years Foundation Stage

Objectives (Early Learning Goal)

- Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer. What adults could do:
- Use mathematical vocabulary and demonstrate methods of recording, using standard notation where appropriate
- Encourage children to make up their own story problems for other children to solve.

Addition

Finds the total number of items in two groups by counting all of them
 $3 + 2$



Vocabulary: add, plus, and, altogether, more, make, sum, total, how many more to make?

Subtraction

Subtraction as take away (using objects or drawing and crossing out).
 $6 - 2 =$



Vocabulary: Subtract, take away, minus, leave, less, left over, how many are left, how many are gone, fewer

Early Years Foundation Stage

Objectives (Early Learning Goal)

- Solve problems, including doubling, halving and sharing. What adults can do:
- Use mathematical vocabulary and demonstrate methods of recording, using standard notation where appropriate.
- Talk about the methods children use to answer a problem they have posed, e.g. 'Get one more, and then we will both have two.'
- Encourage children to extend problems, e.g. "Suppose there were three people to share the bricks between instead of two."

Multiplication

Practical ways of doubling

Find that many again.

I have 3 apples, can you double the number of apples?

There are 6 apples in total.



Division

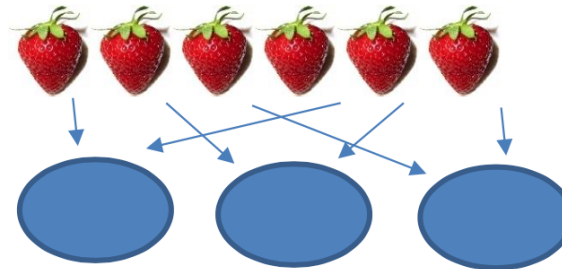
Practical ways of halving

Give half of these pencils to the next table.



Practical ways of sharing

Share these strawberries between 3 children– how many will they have each?



Each child will get 3 strawberries

Vocabulary: Doubles, groups.

Vocabulary: Sharing, into groups, , halve, share, one each... two each... three each etc.

Year 1

Objectives:

- read, write and interpret mathematical statements involving addition (+), subtraction (−) and equals (=) signs
- represent and use number bonds and related subtraction facts within 20
- add and subtract one-digit and two-digit numbers to 20, including zero
- Solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as $7 = \quad - 9$.
- Pupils memorise and reason with number bonds to 10 and 20 in several forms (for example, $9 + 7 = 16$; $16 - 7 = 9$; $7 = 16 - 9$). They should realise the effect of adding or subtracting zero. This establishes addition and subtraction as related operations.
- Pupils combine and increase numbers, counting forwards and backwards.
- They discuss and solve problems in familiar practical contexts, including using quantities. Problems should include the terms: put together, add, altogether, total, take away, distance between, difference between, more than and less than, so that pupils develop the concept of addition and subtraction and are enabled to use these operations flexibly.

Addition

Count on using number tracks / number lines / 100 grids to support.



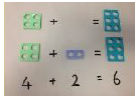
Record related number facts.

e.g. $4 + 5 = 9$, $5 + 4 = 9$, $9 = 4 + 5$, $9 = 5 + 4$



Develop understanding of the equals sign / equality and the concept of 'empty box' questions.

Record solutions to calculations such as $4 + \quad = 9$.



Use practical apparatus e.g. counters, multilink, objects etc.

Vocabulary: Add, plus, and, altogether, more, j, sum, total, how many more to make?

Subtraction

Count back using number tracks / number lines / 100 grids to support the development of the concept of subtraction as take away.



Develop subtraction facts initially to ten and then to 20.

Record related number facts (and make links to related addition facts)

e.g. $9 - 4 = 5$, $9 - 5 = 4$



Develop understanding of the equals sign / equality and the concept of 'empty box' questions. Record solutions to calculations such as $9 - \quad = 5$.

Use practical apparatus e.g. counters, multilink, objects etc.

Vocabulary: subtract, take away, minus, leave, less, left over, how many are left? How many are gone? Find the difference.

Year 1

Objectives:

- 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.
- Through grouping and sharing small quantities, pupils begin to understand: multiplication
- and division; doubling numbers and quantities; and finding simple fractions of objects, numbers and quantities.
- They make connections between arrays, number patterns, and counting in twos, fives and tens.

Multiplication

x2, x5, x10 – Practical methods

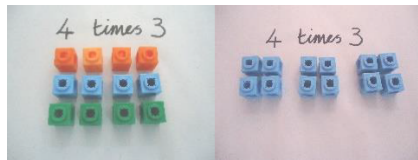
Counting aloud in jumps of the above amounts

0, 2, 4, 6, 8, 10, 12, 14...

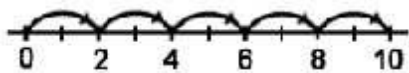
0, 5, 10, 15, 20, 25...

0, 10, 20, 30, 40, 50...

Repeated addition



Number line



$$5 \times 2 = 10$$

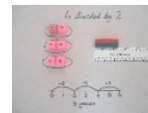
Vocabulary: Lots of, groups, repeat, same size.

Division

Develop division as sharing



Develop division as repeated grouping (repeated subtraction of sets of the same size) using practical apparatus and diagrams.



How many sets of two stars could you make with ten stars?



5 sets.

10 stars give five sets of two stars.

Vocabulary: Sharing into groups, fairly, equal, halve, share, one each...two each...three each... etc.

	Year 2
--	--------

Objectives:

- 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
- recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100
- add and subtract numbers using concrete objects, pictorial 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
- show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot
- recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.
- Pupils extend their understanding of the language of addition and subtraction to include sum and difference.
- Pupils practise addition and subtraction to 20 to become increasingly fluent in deriving facts such as using $3 + 7 = 10$; $10 - 7 = 3$ and $7 = 10 - 3$ to calculate $30 + 70 = 100$; $100 - 70 = 30$ and $70 = 100 - 30$. They check their calculations, including by adding to check subtraction and adding numbers in a different order to check addition (for example, $5 + 2 + 1 + 2 = 1 + 2 + 5$). This establishes commutability and associativity of addition.
- Recording addition and subtraction in columns supports place value and prepares for formal written methods with larger numbers.

[illegible]

Continue to use practical apparatus e.g. counter, blocks, objects etc.

Develop understanding of partitioning and place value and use this to support

41+ 8	42+33
-------	-------

$$40 + 1 + 8 \quad 40 + 30 \text{ (collect the 'tens' together)}$$
$$70 + 5 = 75 \text{ (add the totals together)}$$

Practical apparatus is used to support this, as are number tracks /100 squares and number lines

(numbered and empty). Record the outcomes of calculations in horizontal format.



When confident with concepts of partitioning and place value, horizontal recording can be replaced with recording in columns with a focus on place value.

$$\begin{array}{r} \text{T} \quad \text{U} \\ 4 \quad 1 \\ + \quad 8 \\ \hline 4 \quad 9 \end{array}$$

Vocabulary: Add, addition, plus, and, altogether, more, make, sum, total, increase, number line, count on, partition, inverse.

	Subtraction
--	-------------

Continue to use practical apparatus e.g. counter, blocks, objects etc.

Develop understanding of partitioning and place value and use this to support

TV HTU – TV

17 40-1-7 30-10=20 (subtract the 'tens') start from 33

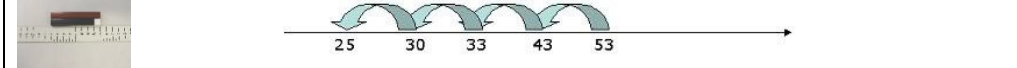
10=23 20+1=21 (add the two totals together) subtract the unit 23-

$$7=16\ 33-12=21$$

and empty).

Record the outcomes of calculations in horizontal format.

	-5	-3	-10	-10
--	----	----	-----	-----



 $41 - 8 = 33$

When confident with concepts of partitioning and place value, horizontal recording can be replaced with recording in columns with a focus on place value.

When using column subtraction, children are not expected to be borrowing / exchanging in Year 2

T	U
4	8
-	7

Vocabulary: subtract, subtraction, take away, minus, leave, less, left over, how many are left? How many are gone? Inverse, decrease, difference, fewer than. **Borrowing should not be used as a term because it implies that the borrowed number needs to go back. It is included here as it used to be a common term.**

Year 2

Objectives:

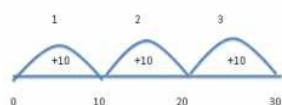
- recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers
- calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (\times), division (\div) 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.
- Pupils use a variety of language to describe multiplication and division.
- Pupils are introduced to the multiplication tables. They practise to become fluent in the 2, 5 and 10 multiplication tables and connect them to each other.
- They connect the 10 multiplication table to place value, and the 5 multiplication table to the divisions on the clock face.
- They begin to use other multiplication tables and recall multiplication facts, including using related division facts to perform written and mental calculations.
- Pupils work with a range of materials and contexts in which multiplication and division relate to grouping and sharing discrete and continuous quantities, to arrays and to repeated addition.
- They begin to relate these to fractions and measures (for example, $40 \div 2 = 20$, 20 is a half of 40). They use commutatively and inverse relations to develop multiplicative reasoning (for example, $4 \times 5 = 20$)

Multiplication

Develop an understanding of multiplication using arrays and number lines showing repeated groups.

4×5 5×4
 ooooo oooo
 ooooo oooo
 ooooo oooo
 ooooo oooo
 4 rows of 5 5 rows of 4

Use number lines to show repeated grouping (repeated addition of sets of the same size)



3 x 10 (3 jumps of 10)

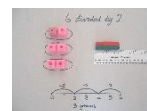
Correction: above shows 3 times 4

Vocabulary: Lots of groups, repeat, same size, times, multiply, jumps of, steps of, multiplied by, multiple of, array, row, column, double, repeated addition.

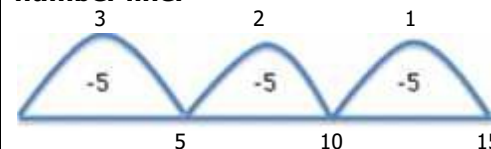
Division

Develop an understanding of division using arrays and number lines showing repeated groups

Use number lines to show repeated grouping (repeated subtraction of sets of the same size)



Division as repeated subtraction using a number line.



Start at 15. Jump back in fives until zero is reached.
Count the number of jumps.
 $15 \div 5 = 3$

Questions that give rise to remainders.

Use the 'array' format above.

$17 \div 5 =$

OOOOO 1 Three groups of 5

OOOOO 2 2 left over (remainder)

OOOOO 3 $17 \div 5 = 3$ remainder 2

OO

Vocabulary: sharing, share equally, into groups, fairly, equal, halve, share, one each...two each...three each...divided by, divided into, left over, remainder, how many groups?

Year 3

Objectives:

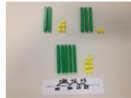
- add and subtract numbers mentally, including ; a three-digit number and ones; a three-digit number and tens; a three-digit number and hundreds
- add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction
- estimate the answer to a calculation and use inverse operations to check answers
- Solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction.
- Pupils practise solving varied addition and subtraction questions. For mental calculations with two-digit numbers, the answers could exceed 100.
- Pupils use their understanding of place value and partitioning, and practise using columnar addition and subtraction with increasingly large numbers up to three digits to become fluent

Addition

Continue to develop understanding of partitioning and place value and use this to support addition. Use practical apparatus to support this, as are number tracks /100 squares and number lines.

Where units combine to make totals greater than 10, regroup using partitioning skills

$$\begin{array}{l} 25 + 36 \\ 20 + 30 = 50 \\ 5 + 6 = 11 \\ 50 + 11 = 50 + 10 + 1 = 61 \end{array}$$



Pupils continue to determine when calculations are best carried out using mental strategies.

Record in columns with a focus on place value. Use expanded recording and apparatus to illustrate concept initially if required before moving towards the formal written method.

TU + TU HTU+TU HTU+HTU

$$\begin{array}{r} \text{T} \quad \text{U} \quad \quad \text{H} \quad \text{T} \quad \text{U} \\ 2 \quad 5 \quad \quad 5 \quad 6 \quad 7 \\ + 3 \quad 6 \quad + 5 \quad 4 \\ \hline 6 \quad 1 \quad 6 \quad 2 \quad 1 \\ 1 \quad \quad 1 \quad 1 \end{array}$$

Subtraction

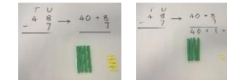
Continue to develop understanding of partitioning and place value and use this to support subtraction.

Use practical apparatus to support this, as are number tracks /100 squares and number lines.

Use expanded recording and apparatus to illustrate concept initially if required before moving towards the formal written method.

No exchange

$$\begin{array}{r} \text{T} \quad \text{U} \\ 4 \quad 8 \\ - 7 \\ \hline \end{array} \rightarrow \begin{array}{r} 40 + 8 \\ - 7 \\ \hline 40 + 1 = 41 \end{array}$$

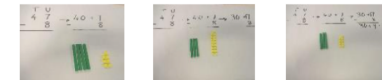


becomes

$$\begin{array}{r} \text{T} \quad \text{U} \\ 4 \quad 8 \\ - 7 \\ \hline 4 \quad 1 \end{array} \rightarrow \begin{array}{r} 40 + 7 \\ - 8 \\ \hline 30 + 17 \\ 30 + 9 = 39 \end{array}$$

becomes

$$\begin{array}{r} \text{T} \quad \text{U} \\ 4 \quad 7 \\ - 8 \\ \hline 4 \quad 1 \end{array} \rightarrow \begin{array}{r} 3 \quad 7 \\ - 8 \\ \hline 3 \quad 9 \end{array}$$



Vocabulary: Add, addition, plus, and, altogether, more, make, sum, total, increase, number line, count on, partition, inverse, how many more to make? How many more is ___ than ___? Hundreds, tens, units.

Vocabulary: subtract, subtraction, take away, minus, decrease, leave, less, left over, how many are left/left How many are gone? Inverse, decrease, difference, fewer than, more than, hundreds, tens, units, boundary much less is ___ than ___?

Borrowing should not be used as a term because it implies that the borrowed number needs to go back. It is included here as to be a common term.

Objectives:

- recall and use multiplication and division facts for the 2,3, 4, 5, 8 and 10 multiplication tables
- write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods
- solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.
- Pupils continue to practise their mental recall of multiplication tables when they are calculating mathematical statements in order to improve fluency.
- Through doubling, they connect the 2, 4 and 8 multiplication tables.
- Pupils develop efficient mental methods, for example, using commutativity and associativity (for example, $4 \times 12 \times 5 = 4 \times 5 \times 12 = 20 \times 12 = 240$) and multiplication and division facts (for example, using $3 \times 2 = 6$, $6 \div 3 = 2$ and $2 = 3$) to derive related facts (for example, $30 \times 2 = 60$, $60 \div 3 = 20$ and $20 = 60 \div 3$).
- Pupils develop reliable written methods for multiplication and division, starting with calculations of two-digit numbers by one-digit numbers and progressing to the formal written methods of short multiplication and division.
- Pupils solve simple problems in contexts, deciding which of the four operations to use and why. These include measuring and scaling contexts, (for example, four times as high, eight times as long etc.) and correspondence problems in which m objects are connected to n objects (for example, 3 hats and 4 coats, how many different outfits?; 12 sweets shared equally between 4 children; 4 cakes shared equally between 8 children).

Multiplication

Develop the use of x and = symbols to record calculations horizontally.

Use arrays and other practical apparatus to illustrate commutativity (that multiplication calculations can be carried out in any order) e.g. 2×5 arrives at the same product as 5×2 .
Begin to derive new facts from known facts

e.g. $3 \times 2 = 6$ (known fact)

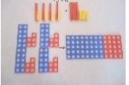
e.g. $3 \times 2 = 6$ (known fact)

$30 \times 2 = 60$

$300 \times 2 = 600$ etc.

Begin to use understanding of place value and partitioning to carry out multiplication of two-digit by one -digit numbers

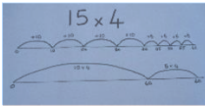
15×4



$10 \times 4 = 40$

$5 \times 4 = 20$

$40 + 20 = 60$

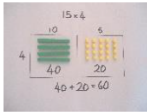



Begin to use grid approaches to illustrate as appropriate using practical apparatus to support.

$10 \quad 5$

40	20
----	----

4



Division

Develop the use of ÷ and = symbols to record calculations horizontally Use arrays and other practical apparatus to illustrate making of repeated groups Begin to derive new facts from known facts

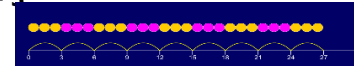
e.g. $6 \div 2 = 3$ (known

fact) $60 \div 2 = 30$

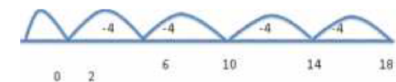
$600 \div 2 = 300$

Begin to carry out division of two- digit by one -digit numbers, first without remainders, then introducing remainders, illustrating this using informal methods first if required.

$27 \div 3$

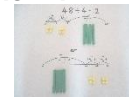


Numberline (with remainders)



Division using larger multiples of the divisor, first with no remainders, then with remainders

$48 \div 4$



$49 \div 4$



Four jumps of 4 with 2 left over
 $18 \div 4 = 4$ remainder 2

Vocabulary: lots of, groups, repeat, same size, times, multiply, jumps of, steps of, multiplied by, multiple of, array, row, column, double, repeated addition, product, grid method.

Vocabulary: sharing, equally, into groups, fairly, equal, halve, share, one each...two each...three each... etc. divided by, divided onto, left over, remainder, how many groups?

Year 4

Objectives:

- Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate
- Estimate and use inverse operations to check answers to a calculation
- Solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.
- Pupils continue to practise both mental methods and columnar addition and subtraction with increasingly large numbers to aid fluency

Addition

Expanded column method (units first)

$$215 + 133$$

$$\begin{array}{r} 215 \\ + 133 \\ \hline 8 \text{ (5 + 3 = 8)} \\ 40 \text{ (10 + 30 = 40)} \\ \hline 300 \text{ (200 + 100 = 300)} \\ \hline 348 \end{array}$$

Compact column

$$215 + 133 \quad \text{OR} \quad 226 + 193$$

$$\begin{array}{r} 215 \\ + 133 \\ \hline 348 \end{array} \quad \begin{array}{r} 226 \\ + 193 \\ \hline 419 \\ 1 \end{array}$$

Ensure that on the middle column, children are taught to say '20 + 90' as opposed to '2 + 9' and for the hundreds column '200 + 100' instead of '2 + 1'.

Vocabulary: add, addition, plus, make, more, sum, total, increase, inverse, altogether, how many more to make ? How many more is _____ than ____? Number line, partition, hundreds, tens, units, count on.

Subtraction

Expanded partitioning with borrowing

$$193 - 66$$

$$\begin{array}{r} 193 = 100 + 90 + 3 \\ - 66 = 60 + 6 \\ \hline 127 = 100 + 20 + 7 \end{array}$$

Compact column

$$193 - 66$$

$$\begin{array}{r} 193 \\ - 66 \\ \hline 127 \end{array}$$

Vocabulary: subtract, subtraction take away, minus, decrease, leave, how many are left/left over? More than, fewer than, difference, tens/hundreds boundary, how much more/less is ?, inverse.

Objectives:

- recall multiplication and division facts for multiplication tables up to 12×12
- use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers
- recognise and use factor pairs and commutativity in mental calculations
- 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.
- Pupils continue to practise recalling and using multiplication tables and related division facts to aid fluency.
- Pupils practise mental methods and extend this to three-digit numbers to derive facts, (for example $600 \div 3 = 200$ can be derived from $2 \times 3 = 6$).
- Pupils practise to become fluent in the formal written method of short multiplication and short division with exact answers (see Mathematics Appendix 1).
- Pupils write statements about the equality of expressions (for example, use the distributive law $39 \times 7 = 30 \times 7 + 9 \times 7$ and associative law $(2 \times 3) \times 4 = 2 \times (3 \times 4)$).
- They combine their knowledge of number facts and rules of arithmetic to solve mental and written calculations for example, $2 \times 6 \times 5 = 10 \times 6 = 60$.
- Pupils solve two-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This should include correspondence questions such as the numbers of choices of meal on a menu, or three cakes shared equally between 10 children.

Multiplication**Using the Grid Method for TU x TU**

23 x 28

$400 + 60 = 460$

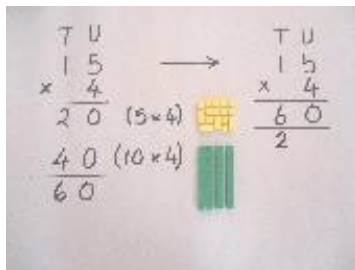
$160 + 24 = 184$

$460 + 184 = 644$

		20	8
20	400	60	
8	160	24	= 644

Develop expanded recording in columns and then move to formal written method, using practical apparatus to support as required.

T	U	T	U
1	5	1	5
x	4	x	4
		2	0 (5 x 4)
		4	0 (10 x 4)
		6	0

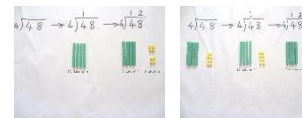
**Division****Moving into more formal vertical method**

$161 \div 7 =$

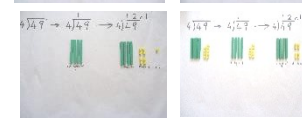
$$\begin{array}{r}
 23 \text{ e)} \\
 7 \overline{) 161} \\
 \underline{-70} \quad (10 \times 7) \\
 91 \\
 \underline{-70} \quad (10 \times 7) \\
 21 \\
 \underline{-21} \quad (3 \times 7) \\
 0 \text{ d)}
 \end{array}$$

Move to develop the standard method for short division, first with no remainders, then with remainders

$48 \div 4$



$49 \div 4$



Children will generally be moved on to the formal method of short division as soon as they are able. The other methods illustrated may be used as teaching tools to help children understand the basic concept.

Practical equipment may be used to introduce how short division works.

Vocabulary: lots of, groups, repeat, same size, times, multiply, jumps of, steps of, multiplied by, multiple of, array, row, column, double, repeated addition, product, grid method, short multiplication.

Vocabulary: sharing, share equally, into groups, fairly, equal, halve, share, divided by, divided into, left over, remainder, how many groups, factor, divisible by, chunking, inverse, quotient.

Objectives:

- add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)
- add and subtract numbers mentally with increasingly large numbers
- use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.
- Pupils practise using the formal written methods of columnar addition and subtraction with increasingly large numbers to aid fluency
- They practise mental calculations with increasingly large numbers to aid fluency (for example, $12\,462 - 2300 = 10\,162$).

In the KS2 tests at the end of Year 6, children are expected to use the formal methods for addition and subtraction.

Addition

Add larger numbers (including hundreds and thousands) or decimal amounts using partitioning and place value to support this.

$$\begin{aligned} 2.9 + 1.7 \\ 2 + 1 = 3 \\ 0.9 + 0.7 = 1.6 \\ 3 + 1.6 = 4.6 \end{aligned}$$

Formal (compact column)

$$\begin{array}{r} 2763 + 1438 \\ 2763 \\ + 1438 \\ \hline 4201 \\ 111 \end{array}$$

Extend to numbers with any number of digits and decimals with 1 and 2 decimal places.

e.g. $124.9 + 117.25 = 242.15$ (can use a number line also to support if necessary)

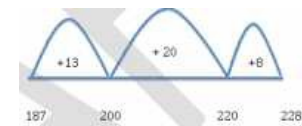
$$\begin{array}{r} 124.9 \\ + 117.25 \\ \hline 242.15 \\ 11 \end{array}$$

Revert to expanded methods if the children experience any difficulty.

Subtraction

Find the difference between the two numbers by adding from 187 to 228 (working left to right).

$$\begin{aligned} 187 + 13 &= 200 & 200 + 20 &= 220 & 220 + 8 &= 228 \\ 13 + 20 + 8 &= 41 \end{aligned}$$



Number line should always be used in favour of formal vertical methods when subtracting between close amounts e.g. $2008 - 1996$. You just need to jump from 1996 to 2000 (+4), then 2000 to 2008 (+8). $4 + 8 = 12$, therefore $2008 - 1996 = 12$.

Formal

$$\begin{array}{r} 228 \\ - 187 \\ \hline 041 \end{array}$$

Answer: **41**

Start with the units

$$8 - 7 = 1$$

Then the tens

$$2 \text{ (20)} - 8 \text{ (80)}. \text{ Take one group of hundred from 2 (200).}$$

$$120 - 80 = 40.$$

Finally, the hundreds column $1 \text{ (100)} - 1 \text{ (100)} = 0$

Leaving an answer of 41.

Vocabulary: add, addition, plus, make, more, sum, total, increase, inverse, altogether, how many more to make ? How many more is _____ than _____? Number line, partition, hundreds, tens, units, count on.

Vocabulary: subtract, subtraction take away, minus, decrease, leave, how many are left/left over? More than, fewer than, difference, tens/hundreds boundary, how much more/less is _____?

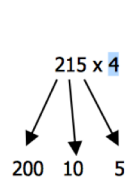
Objectives:

- Pupils practise to become fluent in the formal written method of short multiplication and short division with exact answers
- Pupils write statements about the equality of expressions (for example, use the distributive law $39 \times 7 = 30 \times 7 + 9 \times 7$ and associative law $(2 \times 3) \times 4 = 2 \times (3 \times 4)$).
- They combine their knowledge of number facts and rules of arithmetic to solve mental and written calculations for example, $2 \times 6 \times 5 = 10 \times 6 = 60$.
- Pupils solve two-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This should include correspondence questions such as the numbers of choices of a meal on a menu, or three cakes shared equally between 10 children.
- 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
- solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign
- solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates.
- Pupils practise and extend their use of the formal written methods of short multiplication and short division. They apply all the multiplication tables and related division facts frequently, commit them to memory and use them confidently to make larger calculations.
- They use and understand the terms factor, multiple and prime, square and cube numbers.
- Pupils 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 (for example, $98 \div 4 = 498 = 24 \text{ r } 2 = 2421 = 24.5 \approx 25$)
- Pupils use multiplication and division as inverses to support the introduction of ratio in year 6, for example, by multiplying and dividing by powers of 10 in scale drawings or by multiplying and dividing by powers of a 1000 in converting between units such as kilometres and metres.
- Distributivity can be expressed as $a(b + c) = ab + ac$.
- They understand the terms factor, multiple and prime, square and cube numbers and use them to construct equivalence statements (for example, $4 \times 35 = 2 \times 2 \times 35$; $3 \times 270 = 3 \times 3 \times 9 \times 10 = 92 \times 10$).
- Pupils use and explain the equals sign to indicate equivalence, including in missing number problems (for example, $13 + 24 = 12 + 25$; $33 = 5 \times \dots$).

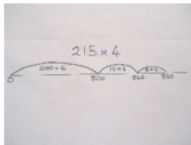
Multiplication

Extend written approaches to HTU x U, then to ThHTU x U

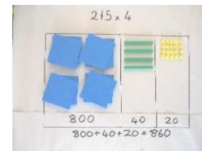
Illustrate using partitioning approaches or grid approaches as required



$$\begin{aligned} 200 \times 4 &= 800 \\ 10 \times 4 &= 40 \\ 5 \times 4 &= 20 \\ 800 + 40 + 20 &= 860 \end{aligned}$$



$$\begin{array}{r} 200 \quad 10 \quad 5 \\ 4 \quad \boxed{800} \quad \boxed{40} \quad \boxed{20} \\ 800 + 40 + 20 = 860 \end{array}$$



Division

Extend written calculation methods to more complex problems involving larger numbers, firstly with no remainders.

No carrying forward required
Example: $448 \div 4$ (as in Year 4, but with additional hundreds column)

No carrying forward required, but with remainders
 $449 \div 4$ (as in year 4, but with additional hundreds column)

Carrying forward required
 $536 \div 4$

Carrying forward required, but with remainders
 $539 \div 4$

Children will generally be moved on to the formal method of short division as soon as they are able. The other methods illustrated may be used as teaching tools to help children understand the basic concept.

Practical equipment may be used to introduce how short division works.

Multiplication (part 2)

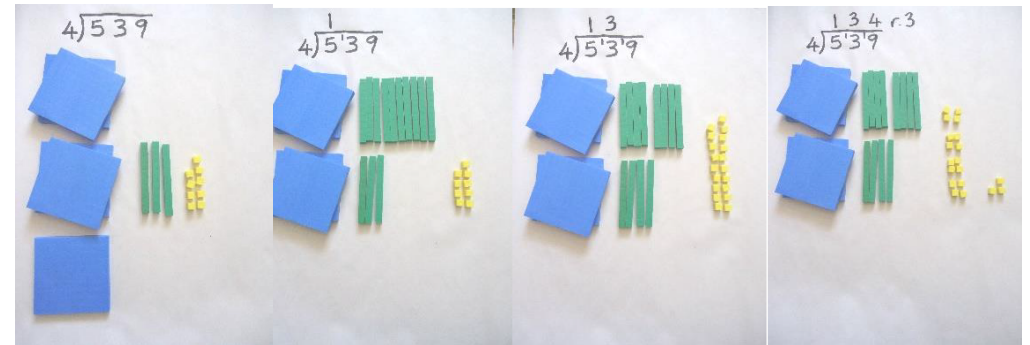
Division (part 2)

Develop expanded recording in columns and then move to formal written method, using practical apparatus to support as required.

Practical equipment may also be used to help children understand the process of division.

	H	T	U	
x	1	1	5	
	<u>4</u>			
	2	0		(5 x 4)
	4	0		(10 x 4)
	8	0	0	(200 x 4)
	8	6	0	

	H	T	U	
x	2	1	5	
	<u>4</u>			
	8	6	0	
		2		



Vocabulary: lots of, groups, repeat, same size, times, multiply, jumps of, steps of, multiplied by, multiple of, array, row, column, double, repeated addition, product, grid method, short multiplication.

Vocabulary: Sharing, share equally, into groups, fairly, equal, halve, share, divided by, divided into, left over, remainder, how many groups, factor, divisible by, divisibility, chunking, inverse, quotient.

Objectives:

- multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- divide numbers up to 4 digits by a two-digit whole number using the formal written method of 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
- perform mental calculations, including with mixed operations and large numbers
- identify common factors, common multiples and prime numbers use their knowledge of the order of operations to carry out calculations involving the four operations
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.
- 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.
- Pupils practise addition, subtraction, multiplication and division for larger numbers, using the formal written methods of columnar addition and subtraction, short and long multiplication, and short and long division (see Mathematics Appendix 1 in the national Curriculum).
- They undertake mental calculations with increasingly large numbers and more complex calculations.
- Pupils continue to use all the multiplication tables to calculate mathematical statements in order to maintain their fluency.
- Pupils round answers to a specified degree of accuracy, for example, to the nearest 10, 20, 50 etc., but not to a specified number of significant figures.
- Pupils explore the order of operations using brackets; for example, $2 + 1 \times 3 = 5$ and $(2 + 1) \times 3 = 9$.
- Common factors can be related to finding equivalent fractions.

In the KS2 tests at the end of Year 6, children are expected to use the formal methods for multiplication and division.

Multiplication	Division				
<p>Extend written approaches to HTU x TU and ThHTU x TU</p> <p>Illustrate using grid approaches as required</p> <p>26 x 13</p> <div><div>206</div><div>10<table><tr><td>200</td><td>60</td></tr></table></div><div>3<table><tr><td>60</td><td>18</td></tr></table></div></div> <p>200 + 60 + 60 + 18 = 338</p>	200	60	60	18	<p>Extend written approaches to the formal method of long division when dividing by two-digit numbers, illustrating this using informal methods first if required.</p> <div><div><div>28r12</div><div>15)432</div><div>-300(15x20)</div><div>132</div><div>-120(15x8)</div><div>12</div></div><div><div>28r12</div><div>15)432</div><div>30</div><div>132</div><div>120</div><div>12</div></div></div>
200	60				
60	18				

Multiplication (part 2)

Develop expanded recording in columns and then move to formal written method of long multiplication, using practical apparatus to support as required.

H T U	H T U
2 6 →	2 6
x <u>1 3</u>	x <u>1 3</u>
1 8 (6 x 3)	7 8
6 0 (20 x 3)	1
6 0 (6 x 10)	<u>2 6 0</u>
<u>2 0 0</u> (10 x 20)	<u>3 3 8</u>
<u>3 3 8</u>	1
1	

Vocabulary: lots of, groups, repeat, same size, times, multiply, jumps of, steps of, multiplied by, multiple of, array, row, column, double, repeated addition, product, grid method, short multiplication.

Develop expanded recording in columns and then move to formal method of long multiplication, using practical apparatus to support as required.

H T U	H T U
2 2 6	2 2 6
x <u>1 3</u>	x <u>1 3</u>
1 8 (6 x 3)	6 7 8
6 0 (20 x 3)	1
6 0 0 (200 x 3)	<u>2 2 6 0</u>
6 0 (6 x 10)	<u>2 9 3 8</u>
2 0 0 (20 x 10)	1
<u>2 0 0 0</u> (200 x 10)	
<u>2 9 3 8</u>	
1	

Children will generally be moved on to the formal method of short division as soon as they are able. The other methods illustrated may be used as teaching tools to help children understand the basic concept.

Practical equipment may be used to introduce how short division works.

Vocabulary: Sharing, share equally, into groups, fairly, equal, halve, share, divided by, divided into, left over, remainder, how many groups, factor, divisible by, divisibility, chunking, inverse, quotient.

