



Trinity Church of England/Methodist Primary School

— BUCKSHAW VILLAGE —

Headteacher: Mrs Jill R Wright

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Maths Calculation Policy 2022

Trinity is a Christian school with a caring environment in which each individual is valued as special and is encouraged to reach their full potential while enjoying life in all its fullness. You should have gone home. what

PROGRESSION THROUGH CALCULATIONS FOR ADDITION

MENTAL CALCULATIONS

These are a selection of mental calculation strategies:

Mental recall of number bonds

$$6 + 4 = 10$$

$$25 + 75 = 100$$

$$\square + 3 = 10$$

$$19 + \square = 20$$

Use near doubles

$$6 + 7 = \text{double } 6 + 1 = 13$$

Addition using partitioning and recombining

$$34 + 45 = (30 + 40) + (4 + 5) = 79$$

Counting on or back in repeated steps of 1, 10, 100, 1000

$$86 + 57 = 143 \text{ (by counting on in tens and then in ones)}$$

$$460 - 300 = 160 \text{ (by counting back in hundreds)}$$

Add the nearest multiple of 10, 100 and 1000 and adjust

$$24 + 19 = 24 + 20 - 1 = 43$$

$$458 + 71 = 458 + 70 + 1 = 529$$

Use the relationship between addition and subtraction

$$36 + 19 = 55$$

$$55 - 19 = 36$$

$$19 + 36 = 55$$

$$55 - 36 = 19$$



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THE FOLLOWING ARE STANDARDS THAT WE EXPECT THE MAJORITY OF CHILDREN TO ACHIEVE.

PROGRESSION THROUGH CALCULATIONS FOR ADDITION

- These standards are age-related expectations and therefore we expect the majority of children to achieve them.
- New learning is likely to be taught to groups rather than the whole class to acknowledge the different learning stages of the children.
- Children should understand that addition is commutative and therefore calculations can be rearranged, e.g. $4 + 13 = 17$ is the same as $13 + 4 = 17$.
- Ensure that children understand the $=$ sign means is the same as, not makes, and that children see calculations where the equals sign is in a different position, e.g. $3 + 2 = 5$ and $5 = 3 + 2$.
- Children should be encouraged to approximate before calculating and check whether their answer is reasonable.

YR

Early Learning Goal:

Number: Automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts

Numerical Patterns: Explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They should experience practical calculation opportunities using a wide variety of equipment, e.g. small world play, role play, counters, cubes etc. They develop ways of recording calculations using pictures, etc.



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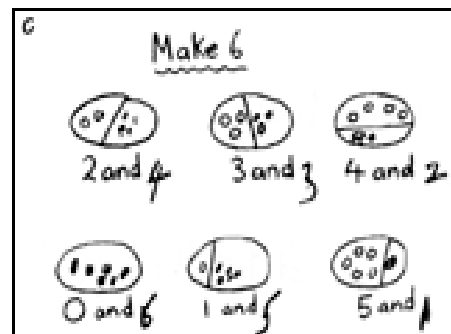
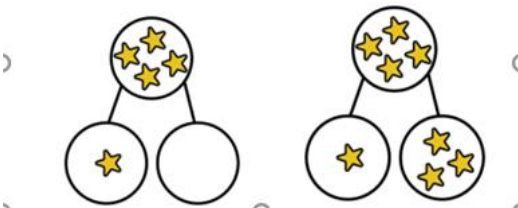
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To solve addition and subtraction problems, they may know familiar calculations such as $5 + 5$ or $10 - 1$, but for other calculations, they may use either a counting all or counting on strategy for addition and a taking away strategy for subtraction. They will subtract by using practical equipment to count out the first number and then remove or take away the second number to find the solution by counting how many are left.

How many stars should you put in the missing part?



Y1:

End of Year Objective Mental:

Add and subtract one-digit and two-digit numbers to 20, including zero.

End of Year Objective Written:

Add one-digit and two-digit numbers to 20, including zero (using concrete objects and pictorial representations.)

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



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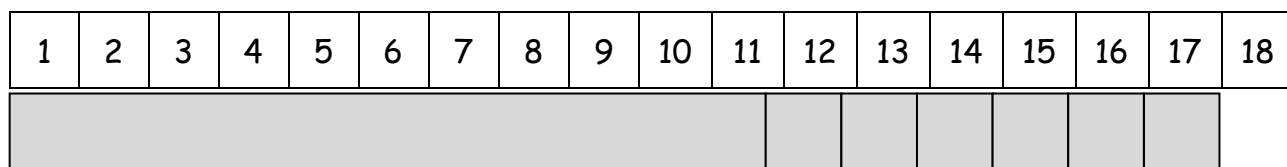
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Key skills for addition at Y1:

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

Children will initially use practical equipment to combine groups of objects to find the total. They will move on to the use of number tracks and Base 10 equipment to support their developing understanding of addition.

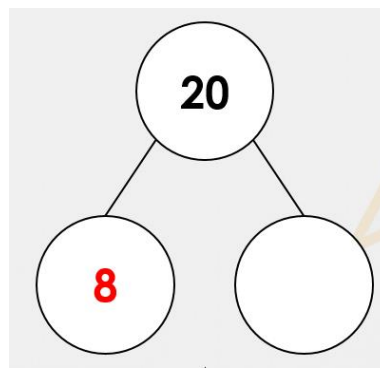
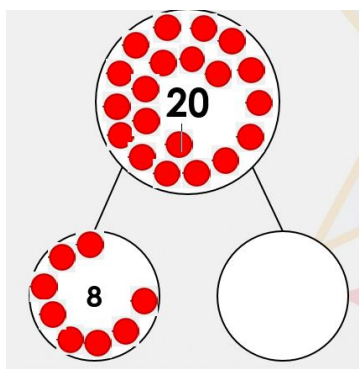
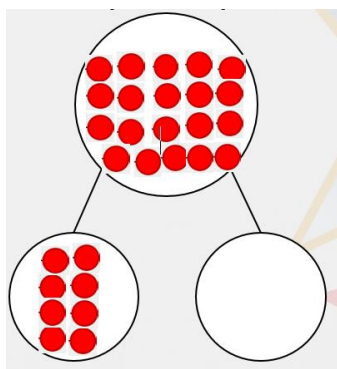
$$11 + 5 =$$



$$11 + 5 = 16$$

Model of Base 10 equipment

Children will continue to use part-part-whole models to support their calculations and understanding.





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Y2:

End of Year Objective Mental:

Add and subtract numbers mentally, including: a two-digit number and ones; a two-digit number and tens; two two-digit numbers; three one-digit numbers.

End of Year Objective Written:

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; three one-digit numbers.

Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, addition, column, tens boundary

Key skills for addition at Y2:

- Add a 2-digit number and ones (e.g. $27 + 6$)
- Add a 2-digit number and tens (e.g. $23 + 40$)
- Add pairs of 2-digit numbers (e.g. $35 + 47$)
- Add three single-digit numbers (e.g. $5 + 9 + 7$)
- Show that adding can be done in any order (the commutative law).
- Recall bonds to 20 and bonds of tens to 100 ($30 + 70$ etc.)
- Count in steps of 2, 3 and 5 and count in tens from any number.
- Understand the place value of 2-digit numbers (tens and ones)
- Compare and order numbers to 100 using $<$ $>$ 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.



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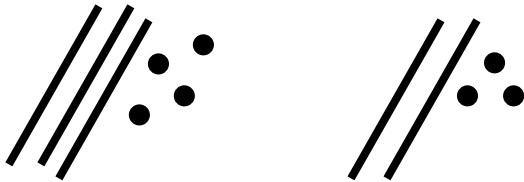
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Children will continue to use the Base 10 equipment to support their calculations. They will record the calculations using their own drawings of the Base 10 equipment (as lines for the 10 rods and dots for the unit blocks)

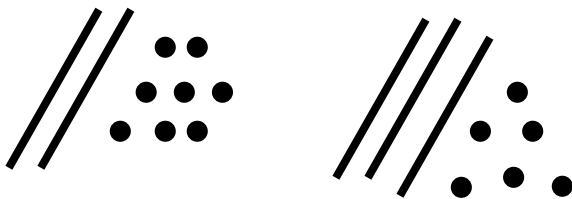
e.g. $34 + 23 =$



$$34 + 23 = 57$$

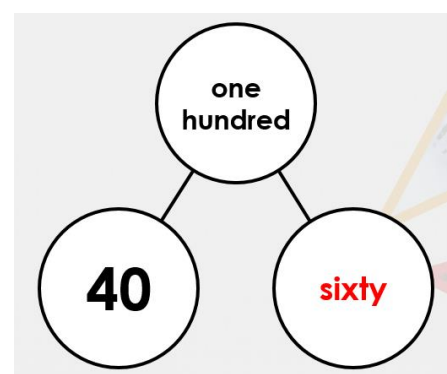
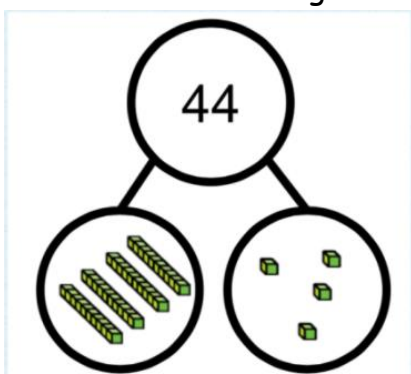
They would add the tens first and then count on the units.

e.g. $28 + 36 =$



$$28 + 36 = 64$$

Children will continue to use part-part-whole models to support their calculations and understanding.





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Y3

End of Year Objective Mental:

Add and subtract numbers mentally, including: a three-digit number and ones; a three-digit number and tens; a three-digit number and hundreds.

End of Year Objective Written:

Add numbers with up to three digits, using formal written method of columnar addition.*

**Although the objective suggests that children should be using formal written methods, the National Curriculum document states "The programmes of study for mathematics are set out year-by-year for key stages 1 and 2. Schools are, however, only required to teach the relevant programme of study by the end of the key stage. Within each key stage, schools therefore have the flexibility to introduce content earlier or later than set out in the programme of study." p4*

Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, vertical, carry, expanded, compact

Key skills for addition at Y3:

- Read and write numbers to 1000 in numerals and words.
- Add 2-digit numbers mentally, incl. those exceeding 100.
- Add a three-digit number and ones mentally ($175 + 8$)
- Add a three-digit number and tens mentally ($249 + 50$)
- Add a three-digit number and hundreds mentally ($381 + 400$)
- Estimate answers to calculations, using 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 3-digit numbers (hundreds, tens, ones.)
- Continue to practise a wide range of mental addition strategies, ie. number bonds, adding the nearest multiple of 10, 100, 100 and adjusting, using near doubles, partitioning and recombining.



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Children will build on their knowledge of using Base 10 equipment from Y2 and continue to use this to support with the transition into a vertical method.

Children should add the least significant digits first as preparation for the compact method.

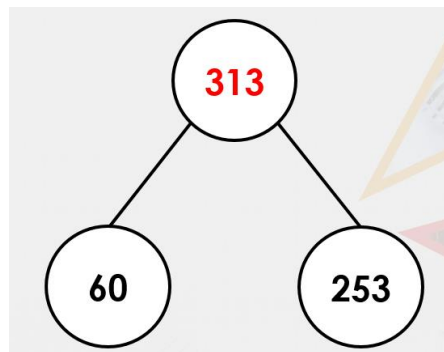
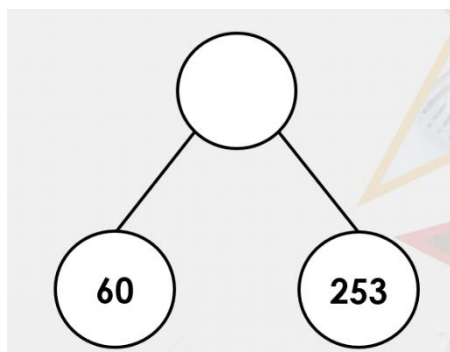
$$\begin{array}{r}
 \text{TU} \\
 67 \\
 + 24 \\
 \hline
 11 \text{ (} 7 + 4 \text{)} \\
 \underline{80} \text{ (} 60 + 20 \text{)} \\
 \underline{91}
 \end{array}$$


$$\begin{array}{r}
 \text{HTU} \\
 267 \\
 + 85 \\
 \hline
 12 \text{ (} 7 + 5 \text{)} \\
 140 \text{ (} 60 + 80 \text{)} \\
 \underline{200} \\
 \underline{352}
 \end{array}$$

The Base 10 equipment should be used alongside to model the transition to the vertical method.

NB The text in *italics* is modelled by the teacher but should not be written by pupil in their answer.

Children will continue to use part-part-whole models to support their calculations and understanding.





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Y4

End of Year Objective Mental:

Add and subtract numbers mentally, including: a three-digit number to or from a three-digit multiple of tens; two three-digit numbers (where there is no carrying or exchange involved)

End of Year Objective Written:

Add numbers with up to 4 digits and decimals with one decimal place using the formal written method of columnar addition where appropriate.

Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, vertical, „carry“, expanded, compact, thousands, hundreds, digits, inverse

Key skills for addition at Y4:

- Select most appropriate method: mental, jottings or written and explain why.
- Recognise the place value of each digit in a four-digit number.
- Round any number to the nearest 10, 100 or 1000.
- Estimate and use inverse operations to check answers.
- Solve 2-step problems in context, deciding which operations and methods to use and why.
- Find 1000 more or less than a given number.
- Continue to practise a wide range of mental addition strategies, ie. number bonds, add the nearest multiple of 10, 100, 1000 and adjust, use near doubles, partitioning and recombining.
- Add numbers with up to 4 digits using the formal written method of column addition
- Solve 2-step problems in contexts, deciding which operations and methods to use and why.
- Estimate and use inverse operations to check answers to a calculation.



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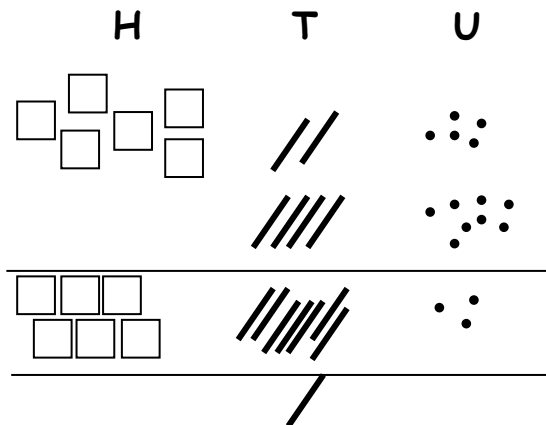
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Based on their experiences in Y3, children will then begin to carry below the line.
The best way to model this would be using Base 10 equipment to show how units would transfer to tens.

$$\begin{array}{r} \text{HTU} \\ 625 \\ + 48 \\ \hline 673 \\ 1 \end{array}$$



Teacher model

$$\begin{array}{r} 783 \\ + 42 \\ \hline 825 \\ 1 \end{array}$$

$$\begin{array}{r} 367 \\ + 85 \\ \hline 452 \\ 11 \end{array}$$

$$\begin{array}{r} 321 \\ + 7 \\ + 48 \\ \hline 376 \\ 1 \end{array}$$

$$\begin{array}{r} £3.48 \\ + £0.78 \\ \hline £4.26 \\ 11 \end{array}$$

Using similar methods, children will:

- add several numbers with different numbers of digits;
- begin to add two or more three-digit sums of money, with or without adjustment from the pence to the pounds;



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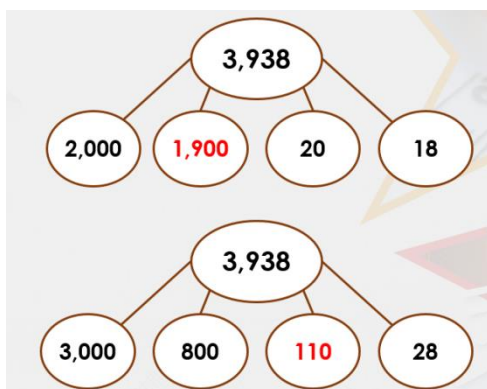
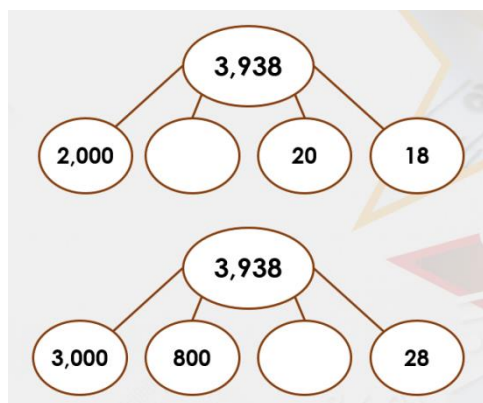
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- know that the decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. £3.59 + 78p.

Children will continue to use part-part-whole models to support their calculations and understanding.



Y5

End of Year Objective Mental:

Add and subtract numbers mentally, including: two three-digit numbers where one or both are multiples of 10 or 100; two or three-digit numbers to or from a four digit number; two four-digit numbers (where there is no carrying or exchange involved); pairs of decimals to one decimal place

End of Year Objective Written:

Add whole numbers with more than 4 digits and decimals with two decimal places, including formal written methods (columnar addition).

Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, „carry“, expanded, compact, vertical, thousands, hundreds, digits, inverse & decimal places, decimal point, tenths, hundredths, thousandths.



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Key skills for addition at Y5:

- Add numbers mentally with increasingly large 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 re-combining; 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.
- Round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000.
- Add numbers with more than 4 digits using formal written method of columnar addition.

Children should extend the carrying method to numbers with at least four digits.

$$\begin{array}{r} 587 \\ + 475 \\ \hline 1062 \\ 11 \end{array}$$

$$\begin{array}{r} 3587 \\ + 675 \\ \hline 4262 \\ 111 \end{array}$$

$$\begin{array}{r} 3121 \\ + 37 \\ + 148 \\ \hline 3306 \\ 11 \end{array}$$

$$\begin{array}{r} 3.20 \\ + 2.88 \\ \hline 6.08 \\ 1 \end{array}$$



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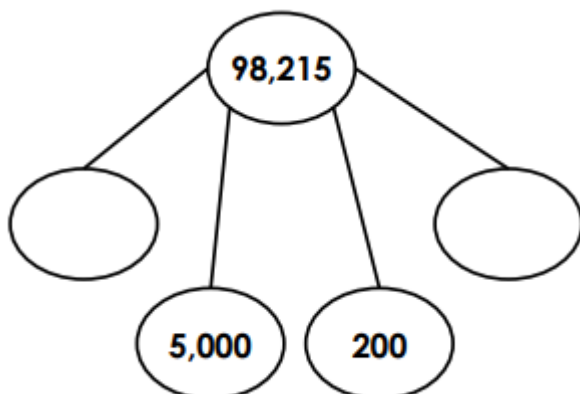
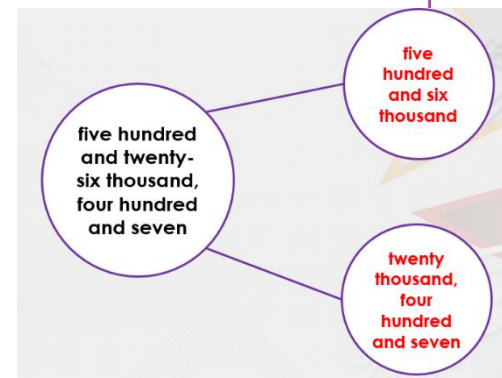
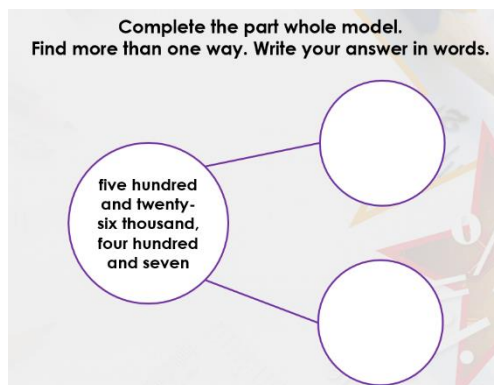
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Using similar methods, children will:

- add several numbers with different numbers of digits;
- begin to add two or more decimal fractions with up to three digits and the same number of decimal places;
- know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. 3.2 m + 280 cm.

Children will continue to use part-part-whole models to support their calculations and understanding.





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Y6

End of Year Objective Mental:

Add and subtract numbers mentally, including: two three-digit numbers where one or both are multiples of 10 or 100; two or three-digit numbers to or from a four digit number; two four-digit numbers (where there is no carrying or exchange involved); pairs of decimals to one decimal place

End of Year Objective Written:

Add whole numbers and decimals using formal written methods (columnar addition).

Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, „carry“, expanded, compact, vertical, thousands, hundreds, digits, inverse, decimal places, decimal point, tenths, hundredths, thousandths

Key skills for addition at Y6:

- Perform mental calculations, including with mixed operations and large numbers, 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 determine the value of each digit.
- Round any whole number to a required degree of accuracy.
- Pupils understand how to add mentally with larger numbers and calculations of increasing complexity.



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Children should extend the carrying method to number with any number of digits.

$$\begin{array}{r} 7648 \\ + 1486 \\ \hline 9134 \\ 1 \ 11 \end{array}$$

$$\begin{array}{r} 6584 \\ + 5848 \\ \hline 12432 \\ 1 \ 11 \end{array}$$

$$\begin{array}{r} 42 \\ 6432 \\ 786 \\ 3 \\ + 4681 \\ \hline 11944 \\ 1 \ 2 \ 1 \end{array}$$

$$\begin{array}{r} 401.20 \\ + 26.85 \\ + 0.71 \\ \hline 428.76 \\ 1 \end{array}$$

Using similar methods, children will

- add several numbers with different numbers of digits;
- begin to add two or more decimal fractions with up to four digits and either one or two decimal places;
- know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. $401.2 + 26.85 + 0.71$.

Children will continue to use part-part-whole models to support their calculations and understanding.



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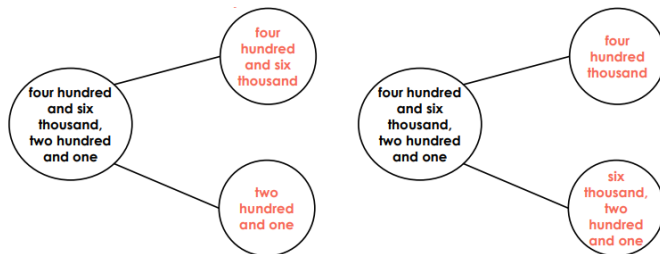
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By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved.

Children should not be made to go onto the next stage if:

- 1) they are not ready.
- 2) they are not confident.



Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.



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PROGRESSION THROUGH CALCULATIONS FOR SUBTRACTION

MENTAL CALCULATIONS

(ongoing)

These are a selection of mental calculation strategies:

Mental recall of addition and subtraction facts

$$10 - 6 = 4 \qquad 17 - \square = 11$$

$$20 - 17 = 3 \qquad 10 - \square = 2$$

Find a small difference by counting up

$$82 - 79 = 3$$

Counting on or back in repeated steps of 1, 10, 100, 1000

$$86 - 52 = 34 \text{ (by counting back in tens and then in ones)}$$

$$460 - 300 = 160 \text{ (by counting back in hundreds)}$$

Subtract the nearest multiple of 10, 100 and 1000 and adjust

$$24 - 19 = 24 - 20 + 1 = 5$$

$$458 - 71 = 458 - 70 - 1 = 387$$

Use the relationship between addition and subtraction

$$36 + 19 = 55 \qquad 19 + 36 = 55$$

$$55 - 19 = 36 \qquad 55 - 36 = 19$$

PROGRESSION THROUGH CALCULATIONS FOR SUBTRACTION

- These standards are age-related expectations and therefore we expect the majority of children to achieve them.
- New learning is likely to be taught to groups rather than the whole class to acknowledge the different learning stages of the children.



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- Children should understand that subtraction is the removing or taking away one quantity from another (not necessarily the smaller number from the larger one).
- Children should understand that, unlike addition, subtraction is **not** commutative.
- Ensure that children understand the = sign means is the same as, not makes, and that children see calculations where the equals sign is in a different position, e.g. $9 - 5 = 4$ and $4 = 9 - 5$.

Children should be encouraged to approximate before calculating and check whether their answer is reasonable.

YR

Early Learning Goal:

Number: Automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts

Numerical Patterns: Explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They should experience practical calculation opportunities using a wide variety of equipment, e.g. small world play, role play, counters, cubes etc. They develop ways of recording calculations using pictures, etc.





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Y1

End of Year Objective Mental:

Add and subtract one-digit and two-digit numbers to 20, including zero.

End of Year Objective Written:

Subtract one-digit and two-digit numbers to 20, including zero (using concrete objects and pictorial representations).

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_?

Key skills for subtraction at Y1:

- Given a number, say **one more or one less**.
- Count to and over 100, **forward and back**, from any number.
- Represent and use **subtraction facts to 20 and within 20**.
- Subtract with **one-digit and two-digit** numbers to 20, including zero.
- Solve one-step problems that involve addition and subtraction, using concrete objects (ie bead string, objects, cubes) and pictures, and missing number problems.
- Read and write numbers from 0 to 20 in numerals and words.

Children will use practical equipment for subtraction by taking away (counting back).

$$13 - 5 =$$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

Count out 13 cubes along the number track followed by removal of 5 cubes to give answer:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----



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$$13 - 5 = 8$$

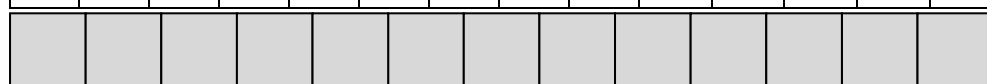
Subtraction as finding the difference

In preparation for understanding how to find the difference by counting up, children should be shown that finding the difference is linked to subtraction and the teacher should ensure the children know that it is an appropriate strategy to use when the numbers are close together.

e.g. $13 - 9$



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----



Children should use the Base 10 unit cubes and count out the correct amounts, placing one set above the number track and one below.

To find the difference, children need to identify what is the same for each amount and remove those cubes, i.e. the 9 cubes and the first 9 cubes of the 13.



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----



Children can then count how many are left, e.g. $13 - 9 = 4$ (the difference between 13 and 9 is 4).



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Y2

End of Year Objective Mental:

Add and subtract numbers mentally, including: a two-digit number and ones; a two-digit number and tens; two two-digit numbers; three one-digit numbers.

End of Year Objective Written:

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.

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_? difference, count on, strategy, partition, tens, units

Key skills for subtraction at Y2:

- Recognise the place value of each digit in a two-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 squares and mentally, including: a two-digit number and ones, a two-digit number and tens, and two two-digit numbers.
- Show that subtraction of one number from another cannot be done in any order.
- Recognise and use inverse relationship between addition and subtraction, using this to check calculations and missing number problems.
- Solve simple addition and 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.



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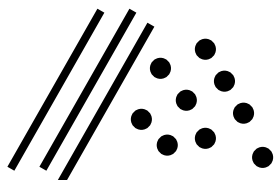
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Children will move on to using the Base 10 equipment to support their calculations. They need to understand that the number being subtracted does not appear as an amount on its own, but rather as part of the larger amount.

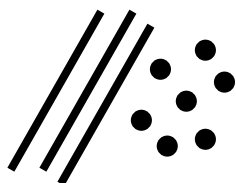
e.g. $39 - 17 =$



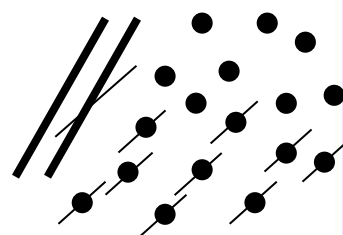
Children would count out 39 using the Base 10 equipment (3 tens and 9 units) and would remove 7 units and then one ten, counting up the answer of 2 tens and 2 units to give 22.

When exchange is required:

$37 - 19 =$



Children can see that they cannot subtract 9 units from 7 units so they need to exchange a ten for ten units. This will become:



Children would count out how many tens and units are left to give the answer (18).

At the end of Y2, children will be encouraged to record this by drawing representations of the Base 10 material and crossing out those pieces that they are subtracting. If children are representing exchange, they should be encouraged to cross out a 10 rod line in a different colour (to avoid confusion between the exchange and the subtraction) and replace with 10 unit dots.



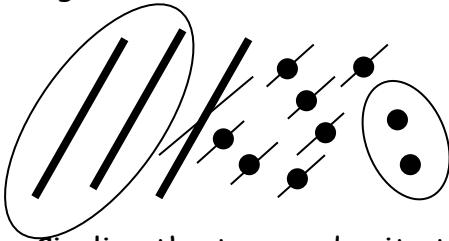
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e.g. $39 - 17 =$



Circling the tens and units that remain will be modelled by the teacher but does not have to be written by pupil in their answer.

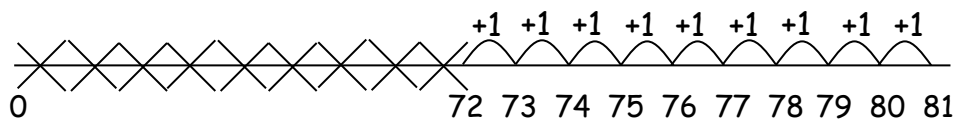
Subtraction as finding the difference

If the numbers involved in the calculation are close together or near to multiples of 10, 100 etc, children should be encouraged to recognise that it is more efficient to find the difference by counting up.

e.g. $81 - 72$

The number line should still show 0 so children can cross out the section from 0 to the smallest number. They then associate this method with subtraction or 'taking away'.

$81 - 72$



Help children to become more efficient with counting on by:

- Subtracting the units in one jump.



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Y3

End of Year Objective Mental:

Add and subtract numbers mentally, including: a three-digit number and ones; a three-digit number and tens; a three-digit number and hundreds.

End of Year Objective:

Subtract numbers with up to three digits, using formal written method of columnar subtraction.*

**Although the objective suggests that children should be using formal written methods, the National Curriculum document states "The programmes of study for mathematics are set out year-by-year for key stages 1 and 2. Schools are, however, only required to teach the relevant programme of study by the end of the key stage. Within each key stage, schools therefore have the flexibility to introduce content earlier or later than set out in the programme of study." p4*

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_? difference, count on, strategy, partition, tens, units exchange, decrease, hundreds, value, digit

Key skills for subtraction at Y3:

- Subtract mentally a 3-digit number and ones, 3-digit number and tens, 3-digit number and hundred.
- Estimate answers and use 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 3-digit number.
- Counting up differences as a mental strategy when numbers are close together or near multiples of 10 (see examples above)
- Read and write numbers up to 1000 in numerals and words.
- Practise mental subtraction strategies, such as subtracting near multiples of 10 and adjusting (e.g. subtracting 19 or 21), and select most appropriate methods to subtract, explaining why.



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Children should begin the method of expanded decomposition with, initially, TU - TU calculations. This process should be demonstrated using arrow cards to show the partitioning and Base 10 materials to show the decomposition of the number.

When solving the calculation $89 - 57$, children need to understand that the number being subtracted (57) does not appear as an amount on its own, but rather as part of the larger amount. Therefore, when using Base 10 materials, children would need to count out only the 89.

$$\begin{array}{r}
 89 \\
 - 57 \\
 \hline
 \end{array}
 =
 \begin{array}{r}
 80 \\
 - 50 \\
 \hline
 30
 \end{array}
 \rightarrow
 \begin{array}{r}
 9 \\
 - 7 \\
 \hline
 2
 \end{array}
 = 32$$

The calculation should be read as subtract 7 from 9 or 9 subtract 7.

Children should use the Base 10 materials to represent the first number and remove the units and tens as appropriate (as with the more informal method in Y2).

Initially, the children will be taught using examples that do not need the children to exchange. Emphasise that the bottom number is being subtracted from the top number rather than the smaller number from the bigger.

From this the children will begin to solve problems which involve exchange:

$$\begin{array}{r}
 71 \\
 - 46 \\
 \hline
 \end{array}$$

Step 1

$$\begin{array}{r}
 70 \\
 - 40 \\
 \hline
 30
 \end{array}
 \rightarrow
 \begin{array}{r}
 1 \\
 - 6 \\
 \hline
 \end{array}$$

The calculation should be read as subtract 6 from 1 or 1 subtract 6.



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Children can see that they cannot subtract 6 units from the 1 unit so they need to exchange a ten for ten units. This will become:

Step 2

		
60	→	11
- 40	→	6
20	→	5 = 25

This would be recorded by the children as

60	→	¹ 1
- 40	→	6
20	→	5 = 25

Children should know that units line up under units, tens under tens, and so on.

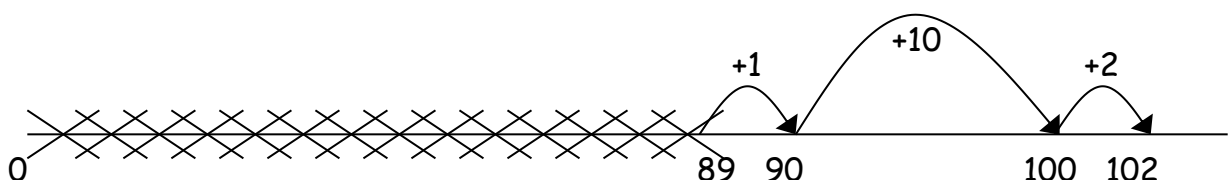
Subtraction as finding the difference

If the numbers involved in the calculation are close together or near to multiples of 10, 100 etc, children should be encouraged to recognise that it is more efficient to find the difference by counting up.

e.g. $102 - 89 = 13$

The number line should still show 0 so children can cross out the section from 0 to the smallest number. They then associate this method with subtraction or 'taking away'.

$102 - 89 = 13$





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Help children to become more efficient with counting on by:

- Subtracting the units in one jump; Subtracting the tens in one jump and the units in one jump

Y4

End of Year Objective Mental:

Add and subtract numbers mentally, including: a three-digit number to or from a three-digit multiple of tens; two three-digit numbers (where there is no carrying or exchange involved)

End of Year Objective Written:

Subtract numbers with up to 4 digits and decimals with one decimal place using the formal written method of columnar subtraction where appropriate.

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_? difference, count on, strategy, partition, tens, units exchange, decrease, hundreds, value, digit, inverse

Key skills for subtraction at Y4:

- Subtract by counting on where numbers are close together or they are near to multiples of 10, 100 etc.
- Children select the most appropriate and efficient methods for given subtraction calculations.
- Estimate and use inverse operations to check answers.
- Solve addition and subtraction 2-step problems, choosing which operations and methods to use and why.
- Solve simple measure and money problems involving fractions and decimals to two decimal places.
- Find 1000 more or less than a given number.
- Count backwards through zero, including negative numbers.



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- Recognise place value of each digit in a 4-digit number Round any number to the nearest 10, 100 or 1000
- Solve number and practical problems that involve the above, with increasingly large positive numbers.

$$\begin{array}{r} 754 = \\ - 86 \\ \hline \end{array}$$

$$\begin{array}{lcl} \text{Step 1} & 700 & \rightarrow 50 \rightarrow 4 \\ & - & \underline{80 \rightarrow 6} \end{array}$$

$$\begin{array}{lcl} \text{Step 2} & 700 & \rightarrow 40 \rightarrow 14 \quad (\text{adjust from T to U}) \\ & - & \underline{80 \rightarrow 6} \end{array}$$

$$\begin{array}{lcl} \text{Step 3} & 600 & \rightarrow 140 \rightarrow 14 \quad (\text{adjust from H to T}) \\ & - & \underline{80 \rightarrow 6} \\ & 600 & \rightarrow 60 \rightarrow 8 = 668 \end{array}$$

This would be recorded by the children as

$$\begin{array}{lcl} & 600 & 140 \\ & \cancel{700} & \rightarrow \cancel{50} \rightarrow 14 \\ & - & \underline{80 \rightarrow 6} \\ & 600 & \rightarrow 60 \rightarrow 8 = 668 \end{array}$$

When children are ready, this leads on to the compact method of decomposition:

$$\begin{array}{r} 614 \ 1 \\ \cancel{7} \cancel{5} 4 \\ - 86 \\ \hline 668 \end{array}$$



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Children should:

- be able to subtract numbers with different numbers of digits;
- using this method, children should also begin to find the difference between two three-digit sums of money, with or without 'adjustment' from the pence to the pounds;
- know that decimal points should line up under each other.

For example:

$$\begin{array}{rcll}
 \text{£}8.95 & = & 8 \rightarrow 0.9 \rightarrow 0.05 & \\
 \text{leading to} & & & \\
 \text{£}4.38 & - & 4 \rightarrow 0.3 \rightarrow 0.08 & \\
 \hline
 & = & 8 \rightarrow 0.8 \rightarrow 0.15 & \text{(adjust from T to U)} \\
 & - & 4 \rightarrow 0.3 \rightarrow 0.08 & \\
 & & 4 \rightarrow 0.5 \rightarrow 0.07 & \\
 & = & \text{£}4.57 &
 \end{array}$$

Subtraction as finding the difference

If the numbers involved in the calculation are close together or near to multiples of 10, 100 etc, children should be encouraged to recognise that it is more efficient to find the difference by counting up.

e.g. 511 - 197

The number line should still show 0 so children can cross out the section from 0 to the smallest number. They then associate this method with subtraction or 'taking away'.

$$511 - 197 = 314$$

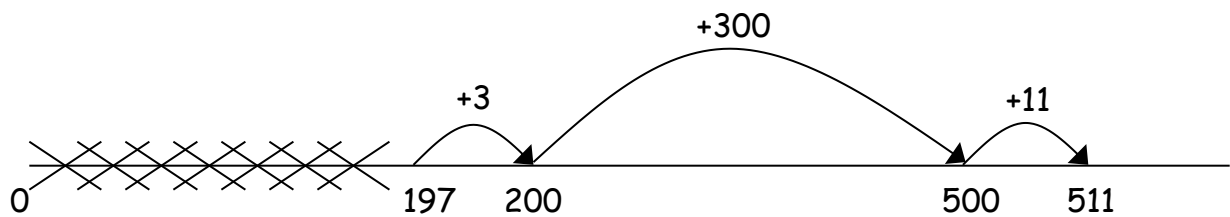


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Help children to become more efficient with counting on by:

- Subtracting the units in one jump;
- Subtracting the tens in one jump and the units in one jump;
- Subtracting the hundreds in one jump, the tens in one jump and the units in one jump.

Y5

End of Year Objective Mental:

Add and subtract numbers mentally, including: two three-digit numbers where one or both are multiples of 10 or 100; two or three-digit numbers to or from a four digit number; two four-digit numbers (where there is no carrying or exchange involved); pairs of decimals to one decimal place

End of Year Objective Written:

Subtract whole numbers with more than 4 digits and decimals with two decimal places, including formal written methods (columnar subtraction).

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_? difference, count on, strategy, partition, tens, units exchange, decrease, hundreds, value, digit, inverse, tenths, hundredths, decimal point, decimal



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Key skills for subtraction at Y5:

- 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 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, 10 000 and 100 000.

NB: *If children have not reached the stage of compact method of decomposition then they will continue at this point with the expanded method.*

$$\begin{array}{r} \overset{6}{7} \overset{6}{10} \overset{6}{7} \overset{1}{2} \\ - 3 \ 2 \ 2 \ 6 \\ \hline 3 \ 8 \ 4 \ 6 \end{array}$$

$$\begin{array}{r} \overset{2}{3} \overset{13}{4} \overset{1}{2} \\ - 1 \ . \ 7 \ 6 \\ \hline 1 \ . \ 6 \ 6 \end{array}$$

Children should:

- *be able to subtract numbers with different numbers of digits;*
- *begin to find the difference between two decimal fractions with up to three digits and the same number of decimal places;*
- *know that decimal points should line up under each other.*

If the numbers involved in the calculation are close together or near to multiples of 10, 100 etc, children should be encouraged to recognise that it is more efficient to find the difference by counting up.



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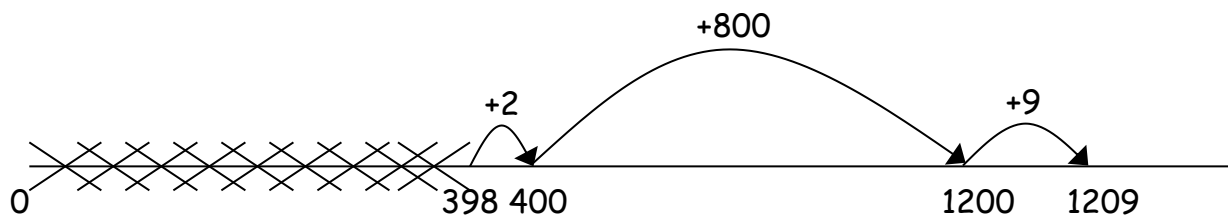
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e.g. $1209 - 398 =$

The number line should still show 0 so children can cross out the section from 0 to the smallest number. They then associate this method with subtraction or 'taking away'.

$1209 - 398 = 811$



Y6

End of Year Objective Mental:

Add and subtract numbers mentally, including: two three-digit numbers where one or both are multiples of 10 or 100; two or three-digit numbers to or from a four digit number; two four-digit numbers (where there is no carrying or exchange involved); pairs of decimals to one decimal place

End of Year Objective Written:

Subtract whole numbers and decimals using formal written methods (columnar subtraction).

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_? difference, count on, strategy, partition, tens, units exchange, decrease, hundreds, value, digit, inverse, tenths, hundredths, decimal point, decimal

Key skills for subtraction at Y6:

- Solve addition and subtraction multi-step problems in context, deciding which operations and methods to use and why.



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- Read, write, order and compare numbers up to 10 million and determine the value of each digit
- Round any whole number to a required degree of accuracy
- Use negative numbers in context, and calculate intervals across zero.
- Children need to utilise and consider a range of mental and written strategies.

$$\begin{array}{r} \begin{array}{cc} 5 & 13 \\ 6 & 4 \\ - & 4 \\ \hline 1 & 7 & 5 & 1 \end{array} \end{array}$$

$$\begin{array}{r} \begin{array}{cccc} 3 & 6 & 11 & \\ 4 & 7 & 2 & 0 \\ - & 3 & 4 & 7 \\ \hline 3 & 8 & 2 & 4 & 9 \end{array} \end{array}$$

When subtracting decimals with different numbers of decimal places, children should be taught and encouraged to make them the same through identification that 2 tenths is the same as 20 hundredths, therefore, 0.2 is the same value as 0.20.

Children should:

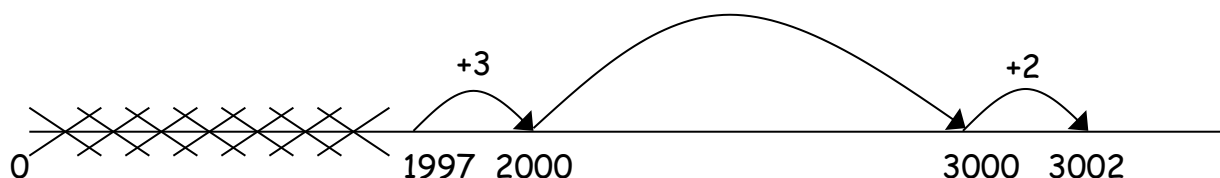
- be able to subtract numbers with different numbers of digits;
- be able to subtract two or more decimal fractions with up to three digits and either one or two decimal places;
- know that decimal points should line up under each other.

If the numbers involved in the calculation are close together or near to multiples of 10, 100 etc, children should be encouraged to recognise that it is more efficient to find the difference by counting up.

e.g. $3002 - 1997 =$

The number line should still show 0 so children can cross out the section from 0 to the smallest number. They then associate this method with subtraction or 'taking away'.

$$3002 - 1997 = 1005$$





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By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved.

Children should not be made to go onto the next stage if:

- 1) they are not ready.**
- 2) they are not confident.**

Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.



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PROGRESSION THROUGH CALCULATIONS FOR MULTIPLICATION

MENTAL CALCULATIONS

(ongoing)

These are a selection of mental calculation strategies.

In developing a progression through mental calculation strategies for multiplication, it is important that children understand the relevant concepts, in that multiplication is:

- repeated addition
- scaling

Doubling and halving

Applying the knowledge of doubles and halves to known facts.

e.g. 8×4 is double 4×4

Using multiplication facts

Tables should be taught every day from Y2 onwards, either as part of the mental oral starter or other times as appropriate within the day.

Year 2 2 times table
 5 times table
 10 times table

Year 3 2 times table
 3 times table
 4 times table
 5 times table
 8 times table
 10 times table

Year 4 Derive and recall all multiplication facts up to 12×12 .



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Years 5 & 6 Derive and recall quickly all multiplication facts up to 12×12 .

Using and applying division facts

Children should be able to utilise their tables knowledge to derive other facts.

e.g. If I know $3 \times 7 = 21$, what else do I know?

$30 \times 7 = 210$, $300 \times 7 = 2100$, $3000 \times 7 = 21\,000$, $0.3 \times 7 = 2.1$ etc

Use closely related facts already known

$$\begin{aligned} 13 \times 11 &= (13 \times 10) + (13 \times 1) \\ &= 130 + 13 \\ &= 143 \end{aligned}$$

Multiplying by 10 or 100

Knowing that the effect of multiplying by 10 is a shift in the digits one place to the left.

Knowing that the effect of multiplying by 100 is a shift in the digits two places to the left.

Partitioning

$$\begin{aligned} 23 \times 4 &= (20 \times 4) + (3 \times 4) \\ &= 80 + 12 \\ &= 92 \end{aligned}$$

Use of factors

$$8 \times 12 = 8 \times 4 \times 3$$



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- These standards are age-related expectations and therefore we expect the majority of children to achieve them.
- New learning is likely to be taught to groups rather than the whole class to acknowledge the different learning stages of the children.
- Children need to understand that multiplication is commutative and use this information to rearrange calculations knowing that $4 \times 6 = 24$ gives the same answer as $6 \times 4 = 24$.
- Children need to understand that multiplication is repeated addition.
- Ensure that children understand the = sign means is the same as, not makes, and that children see calculations where the equals sign is in a different position, e.g. $3 \times 5 = 15$ and $15 = 3 \times 5$.
- Children should be encouraged to approximate before calculating and check whether their answer is reasonable.



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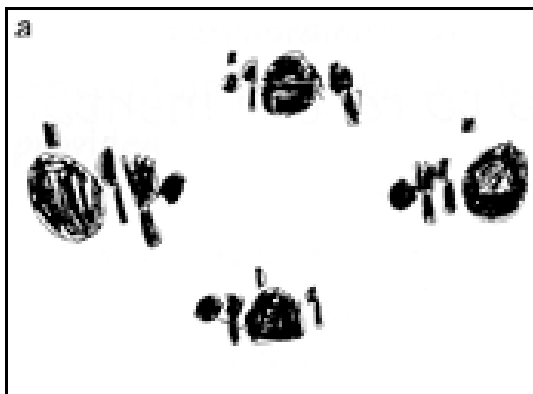
YR

Early Learning Goal:

Number: *Automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts*

Numerical Patterns: *Explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally*

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They should experience practical calculation opportunities involving equal sets or groups using a wide variety of equipment, e.g. small world play, role play, counters, cubes etc. They develop ways of recording calculations using pictures, etc.



Y1

End of Year Objective Mental:

Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with support.

End of Year Objective Written:



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Solve one-step problems involving multiplication by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

Key vocabulary: groups of, lots of, times, array, altogether, multiply, count

Key skills for multiplication at Y1:

- Count in multiples of 2, 5 and 10.
- Solve one-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 twos, fives and tens.
- Begin to understand doubling using concrete objects and pictorial representations.

Children will use practical equipment to make groups of objects to represent multiplication. They should see everyday versions of arrays, e.g. egg boxes, baking trays, ice cube trays, wrapping paper etc and use this in their learning answering questions such as 'How many eggs would we need to fill the egg box? How do you know?'

Y2

End of Year Objective Mental:

Calculate mathematical statements for multiplication and division within the multiplication tables.

End of Year Objective Written:

Calculate mathematical statements for multiplication (using repeated addition) and write them using the multiplication (x) and equals (=) signs.

Key vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times...



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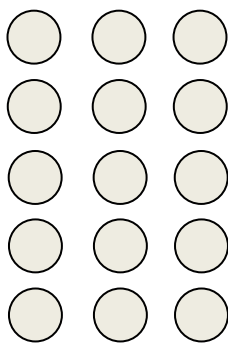
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Key skills for multiplication at Y2:

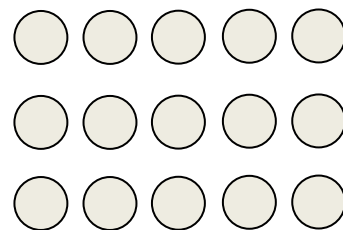
- Count in steps of 2, 3 and 5 from zero, and in 10s from any number.
- Recall and use multiplication facts from the **2, 5 and 10** multiplication tables, including recognising odds and evens.
- Write and calculate number statements **using the x and = signs**.
- Show that multiplication can be done in any order (commutative).
- 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.

Children should utilise multiplication as repeated addition - linked to arrays (**as this knowledge will support with the development of the grid method**). They should also use jottings to support their calculation. These should be supported by the use of counters/cubes.

e.g. 3×5 can be represented as an array in two forms (as it has commutativity):



$$3 + 3 + 3 + 3 + 3 = 15$$



$$5 + 5 + 5 = 15$$

Y3

End of Year Objective Mental:

Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including two-digit numbers times one-digit numbers.



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End of Year Objective Written:

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.*

**Although the objective suggests that children should be using formal written methods, the National Curriculum document states “The programmes of study for mathematics are set out year-by-year for key stages 1 and 2. Schools are, however, only required to teach the relevant programme of study by the end of the key stage. Within each key stage, schools therefore have the flexibility to introduce content earlier or later than set out in the programme of study.” p4*

It is more beneficial for children’s understanding to go through the expanded methods of calculation as steps of development towards a formal written method.

Key vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times, _times as big as, once, twice, three times..., partition, grid method, multiple, product, tens, units, value

Key skills for multiplication:

- Recall and use multiplication facts for the **2, 3, 4, 5, 8 and 10** multiplication tables, and multiply multiples of 10.
- Write and calculate number statements using the multiplication tables they know, including **2-digit x single-digit**, drawing upon mental methods, and progressing to reliable written methods.
- Solve multiplication problems, including missing number problems.
- Develop mental strategies using commutativity (e.g. $4 \times 12 \times 5 = 4 \times 5 \times 12 = 20 \times 12 = 240$)
- Solve simple problems in contexts, deciding which operations and methods to use.
- Develop efficient mental methods to solve a range of problems e.g using commutativity ($4 \times 12 \times 5 = 4 \times 5 \times 12 = 20 \times 12 = 240$) and for missing number problems $\times 5 = 20$, $3 \times = 18$, $\times = 32$



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Children should continue to utilise multiplication as repeated addition linked to arrays (**as this knowledge will support with the development of the grid method**) and use jottings to support their calculation. These should be supported by the use of crosses on squared paper, e.g.

$$4 \times 7 =$$

x	x	x	x	x	x	x	
x	x	x	x	x	x	x	
x	x	x	x	x	x	x	
x	x	x	x	x	x	x	

$$4 \times 7 = \quad 7 + 7 + 7 + 7 = \quad 28$$

(For mathematical accuracy the above example is actually $7 \times 4 \rightarrow$ Seven, four times, however, because we use terms such as 'groups of' or 'lots of', children are more familiar with the initial notation. Once children understand the commutative order of multiplication the order is irrelevant).

Y4

End of Year Objective Mental:

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

End of Year Objective Written:

Multiply two-digit and three-digit numbers by a one-digit number using formal written layout.



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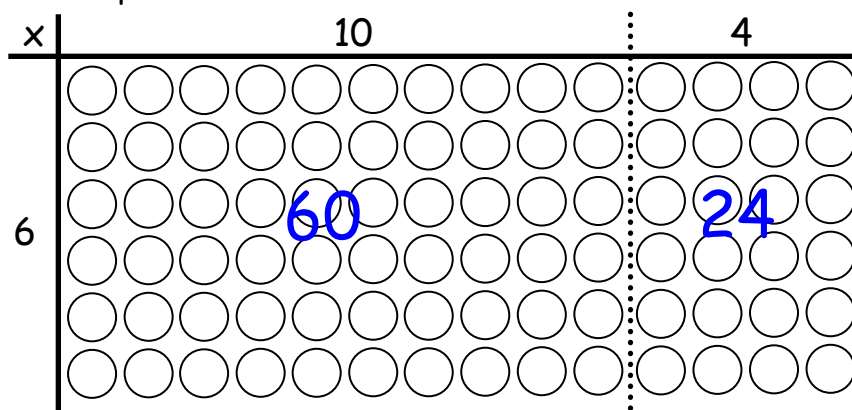
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Key vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, array, column, row, commutative, groups of, sets of, lots of, equal groups, times, multiply, times as big as, once, twice, three times... partition, grid method, total, multiple, product, sets of, inverse

Key skills for multiplication at Y4:

- Count in multiples of 6, 7, 9, 25 and 1000
- Recall multiplication facts for **all multiplication tables up to 12×12** .
- Recognise place value of digits in up to 4-digit numbers
- Use place value, known facts and derived facts to multiply mentally, e.g. multiply by 1, 10, 100, by 0, or to multiply 3 numbers.
- Use commutativity and other strategies mentally $3 \times 6 = 6 \times 3$, $2 \times 6 \times 5 = 10 \times 6$, $39 \times 7 = 30 \times 7 + 9 \times 7$.
- Solve problems with increasingly complex multiplication in a range of contexts.
- Count in multiples of 6, 7, 9, 25 and 1000
- Recognise the place value of each digit in a four-digit number (thousands, hundreds, tens, and ones)

Children will continue to use arrays where appropriate leading into the grid method of multiplication.



$$(6 \times 10) + (6 \times 4)$$

$$60 + 24$$

$$84$$



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TU x U (Short multiplication - multiplication by a single digit)

$$\begin{array}{r} 23 \times 8 \\ \times \quad 20 \quad 3 \\ 8 \quad \boxed{160} \quad \boxed{24} \\ \hline 160 \\ + \quad 24 \\ \hline 184 \end{array}$$

Y5

End of Year Objective Mental:

Multiply and divide numbers mentally drawing upon known facts

End of Year Objective Written:

Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers.

Key vocabulary groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, _times as big as, once, twice, three times..., partition, grid method, total, multiple, product, inverse, square, factor, integer, decimal, short/long multiplication, 'carry'

Key skills for multiplication at Y5:

- Identify multiples and factors, using knowledge of **multiplication tables to 12x12**.
- Solve problems where larger numbers are decomposed into their factors



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- Multiply and divide integers and decimals 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.
- Recall related tables facts for multiples of 10 ($70 \times 6 = 420$ because $7 \times 6 = 42$)
- Using times tables, identify related unit fractions, e.g. $7 \times 9 = 63$ so one-ninth of 63 is 7 and one-seventh of 63 is 9
- Use partitioning to double or halve any number, including decimals to two decimal places
- Recall prime numbers up to 19
- Recall square (2) numbers up to 12×12

HTU $\times$ U (Short multiplication - multiplication by a single digit)

$$346 \times 9$$

$\times$	300	40	6
9	2700	360	54

	2700
+	360
+	54
	<u>3114</u>
	11

$$4.9 \times 3$$

$\times$	4	0.9
3	12	2.7

	12.0
+	2.7
	<u>14.7</u>



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During Year 5, the transition from the grid method into the formal vertical method for multiplication should take place. The traditional vertical compact method of written multiplication is a highly efficient way to calculate, but it has a very condensed form and needs to be introduced carefully.

It is most effective to begin with the grid method, moving to an expanded vertical layout, before introducing the compact form. This allows children to see, and understand, how the processes relate to each other and where the individual multiplication answers come from e.g.

$$368 \times 6$$

x	300	60	8	
6	1800	360	48	$\begin{array}{r} 1800 \\ + 360 \\ + 48 \\ \hline 2208 \end{array}$

Th	H	T	U
3	6	8	
x 6			
	4	8	(8 × 6)
	3	6	0 (60 × 6)
+	1	8	0 0 (300 × 6)
<u>2 2 0 8</u>			

Th	H	T	U
3	6	8	
x 6			
	4	8	(8 × 6)
	3	6	0 (60 × 6)
+	1	8	0 0 (300 × 6)
<u>2 2 0 8</u>			

becomes

Th	H	T	U
3	6	8	
x 6			
<u>2 2 0 8</u>			



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Long multiplication could also be introduced by comparing the grid method with the compact vertical method. Mentally totalling each row of answers is an important step in children making the link between the grid method and the compact method.

x	600	90	3	
20	12000	1800	60	= 13 860
4	2400	360	12	= 2 772 +
				<u>16 632</u>

Step 1

$$\begin{array}{r}
 \text{TTh Th H T U} \\
 6 \ 9 \ 3 \\
 \times \ 2 \ 4 \\
 \hline
 2 \ 7 \ 7 \ 2 \quad (693 \times 4)
 \end{array}$$

Step 2

$$\begin{array}{r}
 \text{TTh Th H T U} \\
 6 \ 9 \ 3 \\
 \times \ 2 \ 4 \\
 \hline
 2 \ 7 \ 7 \ 2 \quad (693 \times 4) \\
 + \ 1 \ 3 \ 8 \ 6 \ 0 \quad (693 \times 20) \\
 \hline
 1 \ 3 \ 8 \ 6 \ 0
 \end{array}$$

Step 3

$$\begin{array}{r}
 \text{TTh Th H T U} \\
 6 \ 9 \ 3 \\
 \times \ 2 \ 4 \\
 \hline
 2 \ 7 \ 7 \ 2 \quad (693 \times 4) \\
 + \ 1 \ 3 \ 8 \ 6 \ 0 \quad (693 \times 20) \\
 \hline
 1 \ 6 \ 6 \ 3 \ 2
 \end{array}$$

Y6

End of Year Objective Mental:

Perform mental calculations, including with mixed operations and large numbers

End of Year Objective Written:

Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication.

Multiply one-digit numbers with up to two decimal places by whole numbers.

Key vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, array, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times... partition, grid method, total, multiple, product, inverse, square, factor, integer, decimal, short/long multiplication, "carry", tenths, hundredths, decimal



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Key skills for multiplication at Y6:

- Recall multiplication facts for all times tables up to 12×12 (as Y4 and Y5).
- Multiply multi-digit numbers, up to 4-digit $\times$ 2-digit using long multiplication.
- Perform mental calculations with mixed operations and large numbers.
- Solve multi-step problems in a range of contexts, choosing appropriate combinations of operations and methods.
- Estimate answers using round and approximation and determine levels of accuracy.
- Round any integer to a required degree of accuracy.
- Recall related tables facts decimal numbers ($0.7 \times 6 = 4.2$ because $7 \times 6 = 42$)
- Use partitioning to double or halve any number
- Recall prime numbers up to 100
- Recall squares of the corresponding multiples of 10 (i.e. 40^2 is 1600)

ThHTU $\times$ U

(Short multiplication - multiplication by a single digit)

$$4346 \times 8$$

$\times$	4000	300	40	6
8	32000	2400	320	48

$$\begin{array}{r}
 32000 \\
 + 2400 \\
 + 320 \\
 + 48 \\
 \hline
 34768
 \end{array}$$



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$$4.92 \times 3$$

×	4	0.9	0.02
3	12	2.7	0.06

$$\begin{array}{r}
 12 \\
 + 0.7 \\
 + 0.06 \\
 \hline
 12.76
 \end{array}$$

TU × TU (Long multiplication - multiplication by more than a single digit)

TU × TU (Long multiplication - multiplication by more than a single digit)

$$72 \times 38$$

×	70	2
30	2100	60
8	560	16

$$\begin{array}{r}
 2100 \\
 + 560 \\
 + 60 \\
 + 16 \\
 \hline
 2736 \\
 1
 \end{array}$$

By the end of year 6, children should be able to use the grid method and the compact method to multiply any number by a two-digit number. They could also develop the method to be able to multiply decimal numbers with up to two decimal places, but having been introduced to expanded and compact vertical methods in Year 5, it may be appropriate to use the expanded vertical method when introducing multiplication involving decimals.



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$$4.92 \times 3$$

$ \begin{array}{r} \text{T U . t h} \\ 4.92 \\ \times \quad 3 \\ \hline 0.06 \quad (0.02 \times 3) \\ 2.7 \quad (0.9 \times 3) \\ + 12 \quad (4 \times 3) \\ \hline 14.76 \end{array} $	becomes
---	---------

$$\begin{array}{r}
 \text{T U . t h} \\
 4.92 \\
 \times \quad 3 \\
 \hline
 14.76
 \end{array}$$

Children should also be using this method to solve problems and multiply numbers, including those with decimals, in the context of money or measures, e.g. to calculate the cost of 7 items at £8.63 each, or the total length of six pieces of ribbon of 2.28m each.

When mathematically ready, children can progress onto HTU $\times$ TU.

By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved.

Children should not be made to go onto the next stage if:

- 1) they are not ready.
- 2) they are not confident.

Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.



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PROGRESSION THROUGH CALCULATIONS FOR DIVISION

MENTAL CALCULATIONS

These are a selection of mental calculation strategies.

In developing a progression through mental calculation strategies for division, it is important that children understand the relevant concepts, in that division is:

- repeated subtraction (grouping)
- related to finding a fraction of a number (sharing)

Doubling and halving

Knowing that halving is dividing by 2

Deriving and recalling division facts

Tables should be taught every day from Y2 onwards, either as part of the mental oral starter or other times as appropriate within the day.

Year 2 2 times table
 5 times table
 10 times table

Year 3 2 times table
 3 times table
 4 times table
 5 times table
 8 times table
 10 times table

Year 4 Derive and recall division facts for all tables up to 12x12

Year 5 & 6 Derive and recall quickly division facts for all tables up to 12x12



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Using and applying division facts

Children should be able to utilise their tables knowledge to derive other facts.

e.g. If I know $3 \times 7 = 21$, what else do I know?

$30 \times 7 = 210$, $300 \times 7 = 2100$, $3000 \times 7 = 21\,000$, $0.3 \times 7 = 2.1$ etc

Dividing by 10 or 100

Knowing that the effect of dividing by 10 is a shift in the digits one place to the right.

Knowing that the effect of dividing by 100 is a shift in the digits two places to the right.

Use of factors

$$378 \div 21 \quad 378 \div 3 = 126$$

$$126 \div 7 = 18$$

$$378 \div 21 = 18$$

Use related facts

Given that $1.4 \times 1.1 = 1.54$

What is $1.54 \div 1.4$, or $1.54 \div 1.1$?

- These standards are age-related expectations and therefore we expect the majority of children to achieve them.
- New learning is likely to be taught to groups rather than the whole class to acknowledge the different learning stages of the children.
- Children need to understand that division is repeated subtraction.
- Children should understand that, unlike multiplication, division is **not** commutative.
- Ensure that children understand the $=$ sign means is the same as, not makes, and that children see calculations where the equals sign is in a different position, e.g. $12 \div 3 = 4$ and $4 = 12 \div 3$.



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- Children should be encouraged to approximate before calculating and check whether their answer is reasonable.

YR

Early Learning Goal:

Number: Automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts

Numerical Patterns: Explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They should experience practical calculation opportunities involving equal groups and sharing items using a wide variety of equipment, e.g. small world play, role play, counters, cubes etc. They develop ways of recording calculations using pictures, etc.



Y1

End of Year Objective Mental:

Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with support.

End of Year Objective Written:

Solve one-step problems involving division by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.



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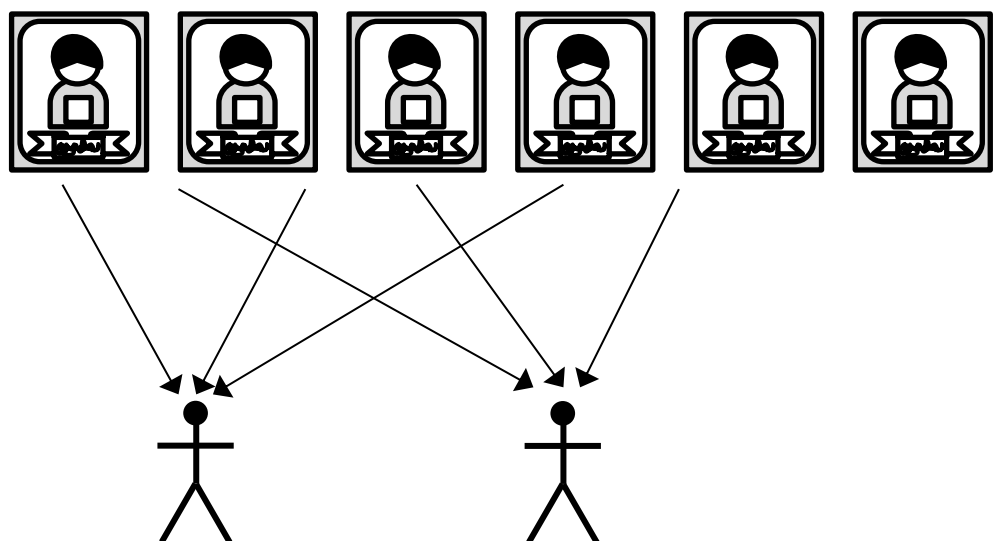
Key Vocabulary: share, share equally, one each, two each..., group, groups of, lots of, array

Key number skills needed for division at Y1:

- Solve one-step problems involving multiplication and 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 twos, fives and tens.

In problem solving contexts, children will use practical equipment to share out objects equally and to group objects to represent division.

6 football stickers are shared between 2 people, how many do they each get?
Children may solve this by using a 'one for you, one for me' strategy until all of the cards have been given out.



Children should find the answer by counting how many cards **1 person** has got.

There are 6 football stickers, how many people can have 2 stickers each?



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Children should find the answer by counting how many **groups of 2** there are.

The teacher can model the link between sharing and grouping in the following way by relating back to the first football sticker question:

Placing the football stickers in a bag or box, the teacher can ask the children how many stickers would need to be taken out of the box to give each person one sticker each (i.e. 2) and exemplify this by putting the cards in groups of 2 until all cards have been removed from the bag.

Y2

End of Year Objective Mental:

Calculate mathematical statements for multiplication and division within the multiplication tables.

End of Year Objective Written:

Calculate mathematical statements for division within the multiplication tables and write them using the division ($\div$) and equals ($=$) signs.

Key Vocabulary: share, share equally, one each, two each..., group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over

Key number skills needed for division at Y2:

- Count in steps of 2, 3, and 5 from 0
- 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 $\times$, $\div$ and $=$ signs.



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- 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.

Children will utilise practical equipment to represent division calculations as grouping (repeated subtraction) and use jottings to support their calculation, e.g.

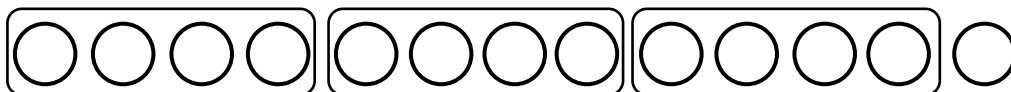
$$12 \div 3 =$$



Children need to understand that this calculation reads as 'How many groups of 3 are there in 12?'

Children should also move onto calculations involving remainders.

$$13 \div 4 =$$



$$13 \div 4 = 3 \text{ remainder } 1$$

Y3

End of Year Objective Mental:

Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including two-digit numbers times one-digit numbers.

End of Year Objective Written:



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Write and calculate mathematical statements for division using the multiplication tables that they know, including for two-digit numbers divided by one-digit numbers, progressing to formal written methods.*

**Although the objective suggests that children should be using formal written methods, the National Curriculum document states “The programmes of study for mathematics are set out year-by-year for key stages 1 and 2. Schools are, however, only required to teach the relevant programme of study by the end of the key stage. Within each key stage, schools therefore have the flexibility to introduce content earlier or later than set out in the programme of study.” p4*

It is more beneficial for children’s understanding to go through the expanded methods of calculation as steps of development towards a formal written method.

Key Vocabulary: share, share equally, one each, two each..., group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, carry, remainder, multiple

Key number skills needed for division at Y3:

- Recall and use multiplication and division facts for the 2, 3, 4, 5, 8 and 10 multiplication tables (through doubling, connect the 2, 4 and 8s).
- 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, in contexts, and including missing number problems, involving multiplication and division.
- Pupils develop efficient mental methods, for example, using multiplication and division facts (e.g. using $3 \times 2 = 6$, $6 \div 3 = 2$ and $2 \times 3 = 6$) to derive related facts ($30 \times 2 = 60$, so $60 \div 3 = 20$ and $20 \times 3 = 60$).
- Pupils develop reliable written methods for division, starting with calculations of 2-digit numbers by 1-digit numbers and progressing to the formal written method of short division.

Children will continue to use grouping (repeated subtraction) to represent their calculations, answering questions such as:



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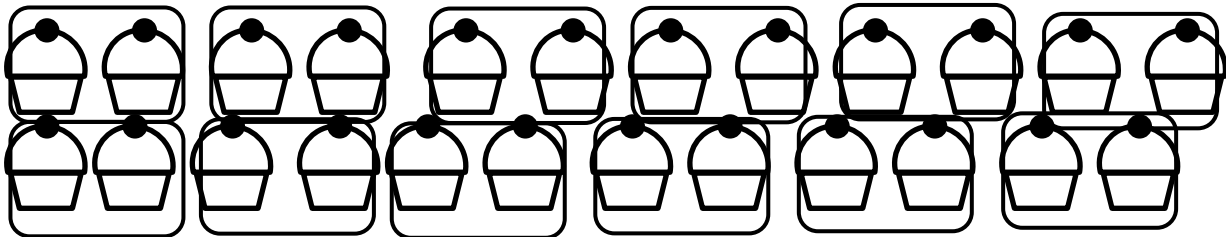
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$$24 \div 2 =$$

or

There are 24 cupcakes, how many people can have 2 cupcakes each?



Children need to be able to decide what to do with remainders after division and round up or down accordingly. They should make sensible decisions about rounding up or down after division. For example, $62 \div 8$ is 7 remainder 6, but whether the answer should be rounded up to 8 or rounded down to 7 depends on the context.

e.g. I have 62p. Sweets are 8p each. How many can I buy?

Answer: 7 (the remaining 6p is not enough to buy another sweet)

Apples are packed into boxes of 8. There are 62 apples. How many boxes are needed?

Answer: 8 (the remaining 6 apples still need to be placed into a box)

Y4

End of Year Objective Mental:

Use place value, known and derived facts to multiply and divide mentally, including:



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- multiplying by 0 and 1
- dividing by 1
- multiplying together three numbers

End of Year Objective Written:

Divide numbers up to 3 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context.

Key Vocabulary: share, share equally, one each, two each..., group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, carry, remainder, multiple, divisible by, factor

Key number skills needed for division at Y4:

- Recall multiplication and division facts for all numbers up to 12×12 .
- Use place value, known and derived facts to multiply and divide mentally, including: multiplying and dividing by 10 and 100 and 1.
- Pupils practise to become fluent in the formal written method of short division with exact answers when dividing by a one-digit number
- Pupils practise mental methods and extend this to three-digit numbers to derive facts, for example $200 \times 3 = 600$ so $600 \div 3 = 200$
- Pupils solve two-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This should include correspondence questions such as three cakes shared equally between 10 children.

Children will develop their use of grouping (repeated subtraction) to be able to subtract multiples of the divisors, developing the use of the 'chunking' method.

Short division ($TU \div U$)

$$72 \div 3$$

$$\begin{array}{r} 24 \\ 3 \overline{) 72} \\ \underline{- 30} \\ 42 \\ \underline{- 30} \end{array}$$

10x
10x

1x	3
2x	6
5x	15
10x	30

Children should write key facts in a menu box. This will help them in identifying the largest group they can subtract in



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$$\begin{array}{r}
 12 \\
 - \quad 6 \\
 \hline
 6 \\
 - \quad 6 \\
 \hline
 0
 \end{array}
 \begin{array}{l}
 2x \\
 2x \\
 \downarrow \\
 24
 \end{array}$$

Answer :

Children should write their answer above the calculation to make it easy for them and the teacher to distinguish.

Any remainders should be shown as integers, i.e. 14 remainder 2 or 14 r 2.

By the end of year 4, children could be able to use the chunking method to divide a three-digit number by a single digit number. To make this method more efficient, the key facts in the menu box should be extended to include 4x and 20x, e.g.

196 ÷ 6

$$\begin{array}{r}
 32r4 \\
 3 \overline{) 196} \\
 \underline{120} \quad 20x \\
 76 \quad 10x \\
 \underline{60} \quad 2x \\
 16 \\
 \underline{12} \\
 4
 \end{array}$$

Key facts box

1x	6
2x	12
4x	24
5x	30
10x	60
20x	120

Y5

End of Year Objective Mental:

Multiply and divide numbers mentally drawing upon known facts

End of Year Objective:

Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context.



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Key number skills needed for division at Y5:

- Recall multiplication and division facts for all numbers up to 12×12 (as in Y4).
- 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 number.
- Solve problems involving multiplication and division where larger numbers are decomposed into their factors.
- Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000.
- Use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers.
- Work out whether a number up to 100 is prime and recall prime numbers to 19.
- Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and inter-pret remainders appropriately for the context
- Use multiplication and division as inverses.
- 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 (e.g. $98 \div 4 = 24 \text{ r } 2 = 24\frac{1}{2} = 24.5 \approx 25$).
- Solve problems involving combinations of all four operations, including understanding



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Children may continue to use the key facts box for as long as they find it useful. Using their knowledge of linked tables facts, children should be encouraged to use higher multiples of the divisor. **During Year 5, children should be encouraged to be efficient when using the chunking method and not have any subtraction steps that repeat a previous step. For example, when performing $347 \div 8$ an initial subtraction of 160 (20×8) and a further subtraction of 160 (20×8) should be changed to a single subtraction of 320 (40×8).**

Also, any remainders should be shown as integers, e.g.

$$523 \div 8$$

$$\begin{array}{r} 65\text{r}3 \\ 8 \overline{) 523} \\ - 320 \quad 40\times \\ \hline 203 \\ - 160 \quad 20\times \\ \hline 43 \\ - 40 \quad 5\times \\ \hline 3 \end{array}$$

Children need to be able to decide what to do after division and round up or down accordingly. They should make sensible decisions about rounding up or down after division.

E.g. $240 \div 52$ is 4 remainder 32, but whether the answer should be rounded up to 5 or rounded down to 4 depends on the context.

Children should be able to use the chunking method to divide a four-digit number by a single digit number. If children still need to use the key facts box, it can be extended to include 100x.

$$2458 \div 7$$

$$\begin{array}{r} 351\text{r}1 \\ 7 \overline{) 2458} \\ - 2100 \quad 300\times \\ \hline 358 \\ - 350 \quad 50\times \\ \hline 8 \\ - 7 \quad 1\times \\ \hline 1 \end{array}$$



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During Year 5, the transition from the chunking into the formal short method for division should take place. The traditional short method of written division is a highly efficient way to calculate, but it has a very condensed form and needs to be introduced carefully.

It is most effective to begin with the chunking method, moving to a short division layout, before introducing the long-division form if ready. This allows children to see, and understand, how the processes relate to each other and where the individual division answers come from e.g.



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Short division

$98 \div 7$ becomes

$$\begin{array}{r} 14 \\ 7 \overline{) 98} \\ \underline{7 } \\ 28 \\ \underline{28} \\ 0 \end{array}$$

Answer: 14

$432 \div 5$ becomes

$$\begin{array}{r} 86 \text{ r } 2 \\ 5 \overline{) 432} \\ \underline{40 } \\ 32 \\ \underline{30} \\ 2 \end{array}$$

Answer: 86 remainder 2

$496 \div 11$ becomes

$$\begin{array}{r} 45 \text{ r } 1 \\ 11 \overline{) 496} \\ \underline{44 } \\ 56 \\ \underline{55} \\ 1 \end{array}$$

Answer: $45 \frac{1}{11}$

Long division

$432 \div 15$ becomes

$$\begin{array}{r} 28 \text{ r } 12 \\ 15 \overline{) 432} \\ \underline{30 } \\ 132 \\ \underline{120} \\ 12 \end{array}$$

Answer: 28 remainder 12

$432 \div 15$ becomes

$$\begin{array}{r} 28 \\ 15 \overline{) 432} \\ \underline{30 } \\ 132 \\ \underline{120} \\ 12 \end{array}$$

15×20
 15×8

$$\frac{12}{15} = \frac{4}{5}$$

Answer: $28 \frac{4}{5}$

$432 \div 15$ becomes

$$\begin{array}{r} 28.8 \\ 15 \overline{) 432.0} \\ \underline{30 } \\ 132 \\ \underline{120} \\ 120 \\ \underline{120} \\ 0 \end{array}$$

Answer: 28.8

Y6

End of Year Objective Mental:

Perform mental calculations, including with mixed operations and large numbers

End of Year Objective Written:

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.

Use written division methods in cases where the answer has up to two decimal places.



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Key Vocabulary: share, share equally, one each, two each..., group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, carry, remainder, multiple, divisible by, factor, inverse, quotient, prime number, prime factors, composite number (non-prime) common factor

Key number skills needed for division at Y6:

- Recall and use multiplication and division facts for all numbers to 12×12 for more complex calculations
- 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. Use short division where appropriate.
- Perform mental calculations, including with mixed operations and large numbers.
- Identify common factors, common multiples and prime numbers.
- Solve problems involving all 4 operations.
- Use estimation to check answers to calculations and determine accuracy, in the context of a problem.
- Use written division methods in cases where the answer has up to two decimal places.
- Solve problems which require answers to be rounded to specified degrees of accuracy.

Children may still use the menu box if required but would also be expected to use larger multiples of the divisor (e.g. 20x, 30x, 40x).

Long division (HTU $\div$ TU)

$$972 \div 36$$

$$\begin{array}{r} 27 \\ 36 \overline{) 972} \\ \underline{- 720} \end{array}$$

20x



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$$\begin{array}{r}
 252 \\
 - 252 \\
 \hline
 0
 \end{array}
 \quad
 \begin{array}{l}
 7x \\
 \downarrow \\
 27
 \end{array}$$

Answer :

Any remainders should be shown as fractions, i.e. if the children were dividing 32 by 10, the answer should be shown as $3 \frac{2}{10}$ which could then be written as $3 \frac{1}{5}$ in its lowest terms.

To develop the chunking method further, it should be extended to include dividing a four-digit number by a two-digit number, e.g.

$$6367 \div 28$$

$$\begin{array}{r}
 227r11 \\
 28 \overline{) 6367} \\
 - 5600 \quad 200x \\
 \hline
 767 \\
 - 560 \quad 20x \\
 \hline
 207 \\
 - 140 \quad 5x \\
 \hline
 67 \\
 - 56 \quad 2x \\
 \hline
 11
 \end{array}$$

This method should be extended to be used with decimals with up to two decimal places. Children should know that decimal points line up under each other.

e.g. $87.5 \div 7$

$$\begin{array}{r}
 12.5 \\
 7 \overline{) 87.5} \\
 - 70.0 \quad 10x \\
 \hline
 17.5 \\
 - 14.0 \quad 2x \\
 \hline
 3.5
 \end{array}$$



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$$\begin{array}{r} - \underline{3.5} \\ 0 \\ 12.5 \end{array} \quad \begin{array}{l} 0.5x \\ \downarrow \end{array}$$

Answer :

During Year 6, the transition from the chunking into the formal short method for division should continue. The traditional short method of written division is a highly efficient way to calculate, but it has a very condensed form and needs to be introduced carefully.

It is most effective to begin with the chunking method, moving to a short division layout, before introducing the long-division form when ready. This allows children to see, and understand, how the processes relate to each other and where the individual division answers come from e.g.



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Answer: $45 \frac{1}{11}$

Long division

$432 \div 15$ becomes

$$\begin{array}{r} 28 \text{ r } 12 \\ 15 \overline{) 432} \\ \underline{30} \\ 132 \\ \underline{120} \\ 12 \end{array}$$

Answer: 28 remainder 12

$432 \div 15$ becomes

$$\begin{array}{r} 28 \\ 15 \overline{) 432} \\ \underline{30} \\ 132 \\ \underline{120} \\ 12 \end{array} \quad \begin{array}{l} 15 \times 20 \\ 15 \times 8 \end{array}$$

$$\frac{12}{15} = \frac{4}{5}$$

Answer: $28 \frac{4}{5}$

$432 \div 15$ becomes

$$\begin{array}{r} 28.8 \\ 15 \overline{) 432.0} \\ \underline{30} \\ 132 \\ \underline{120} \\ 120 \\ \underline{120} \\ 0 \end{array}$$

Answer: 28.8

By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved.

Children should not be made to go onto the next stage if:

- 1) they are not ready.
- 2) they are not confident.

Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

Policy written by: Gillian Smith & Kerry Johnson (KS1/KS2 Maths Subject Leaders)

Policy was correct as at: March 2022