



THE PIGGOTT SCHOOL
Charvil Piggott Primary School

'Go and do Likewise' Luke 10:25-37, The Parable of the Good Samaritan
We live with love and compassion, seeking help in times of need

Calculation Procedures

The following calculation procedures has been devised to meet requirements of the National Curriculum 2014 for the teaching and learning of mathematics, and is also designed to give pupils a consistent and smooth progression of learning in calculations across the school. Please note that early learning in number and calculation in Foundation follows the Development Matters EYFS document, and these calculation procedures are designed to build on progressively from the content and methods established in the Early Years Foundation Stage.

Age stage expectations

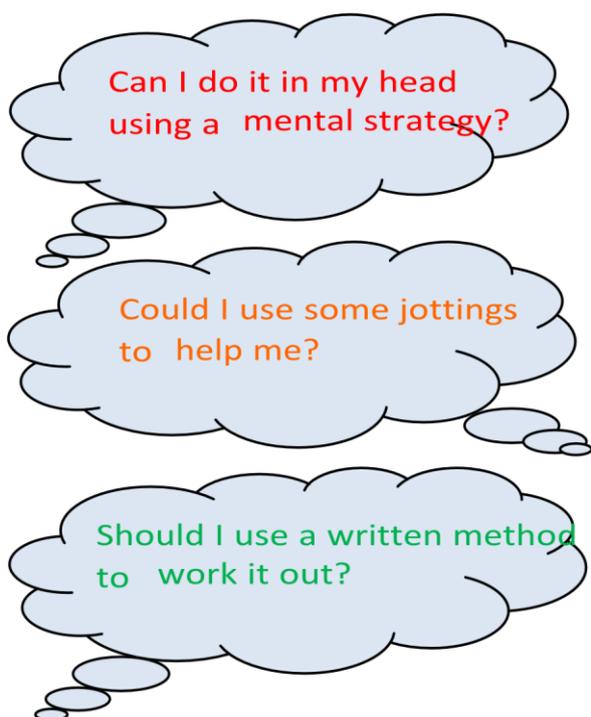
The calculation procedures are organised according to age stage expectations as set out in the National Curriculum 2014.

Providing a context for calculation:

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

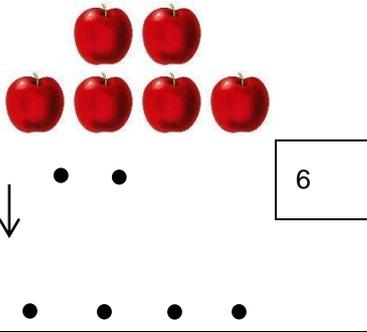
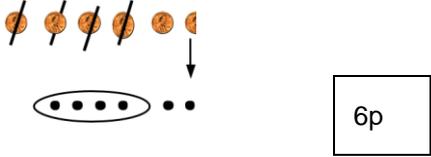
Choosing a calculation method:

Children need to be taught and encouraged to use the following processes in deciding what approach they will take to a calculation, to ensure they select the most appropriate method for the numbers involved:



To work out a tricky calculation:
Approximate
Calculate
Check it mate!

Mathematics Calculation: Year 1

Addition with numbers up to 20	Subtraction with numbers up to 20
<p>Use of concrete objects, pictures and marks to solve one-step problems:</p> <p>David had 2 apples and picked 4 more. How many does he have now?</p> 	<p>Use of concrete objects, pictures and marks to solve one-step problems:</p> <p>Eloise spent 4p. What was his change from 10p?</p> 
<p>The + and = signs and missing numbers</p>	<p>The - and = signs and missing numbers</p>
<p>Children need to understand the concept of equality before using the '=' sign. Calculations should be written either side of the equality sign so that the sign is not just interpreted as 'the answer'.</p>	

Example

$2 = 1 + 1$

$2 + 3 = 4 + 1$

$3 = 3$

$2 + 2 + 2 = 4 + 2$

Missing numbers need to be placed in all possible places.

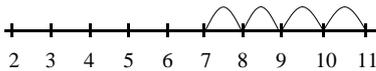
$3 + 4 = \quad = 3 + 4$

$3 + = 7 \quad 7 = + 4$

$+ 4 = 7 \quad 7 = 3 +$

Use of prepared number lines and concrete objects to solve one-step problems:

$7 + 4 =$



Children are encouraged to record by drawing jumps on prepared lines.

Example

$4 - 1 = 3$

$3 = 4 - 1$

$3 = 3$

Missing numbers need to be placed in all possible places.

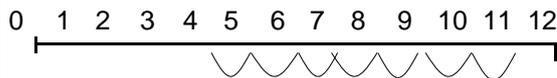
$7 - 3 = \quad = 7 - 3 \quad 7 - = 4 \quad 4 = -$

3

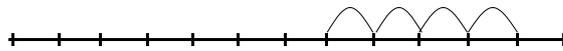
Use of prepared number lines and concrete objects to solve one-step problems:

Example- Counting Back/Down

$11 - 7 =$



Example- Counting On/Up



The difference between 7 and 11



Children are encouraged to record by drawing jumps on prepared lines and then constructing their own lines.

Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, place value (hundreds, tens, ones)

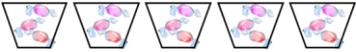
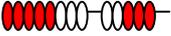
Key skills for addition at Y1:

- 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.
- Know what each digit represents in a 3 digit number.

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 and pictures.
- Solve missing number problems.
- Read and write numbers from 0 to 20 in numerals and words.

Multiplication	Division
<p>Use of objects, pictures and marks for one-step problems:</p> <p>There are 3 sweets in one bag.</p> <p>How many sweets are there in 5 bags?</p>  <p>Count in multiples of one, two, five and ten Counting steps using bead string and on prepared number lines.</p>  <p>Counting in multiples using a range of objects, e.g. pairs of legs on animals; fingers in gloves etc.</p> <p>Use of arrays</p> <p>Counting in rows and columns</p>  <p>Two groups of three is six</p> <p>Three groups of two is six</p> <p>So $6 = 2 + 2 + 2$ or $6 = 3 + 3$</p>	<p>Use of objects, pictures and marks for one-step problems:</p> <p>12 children get into teams of 4 to play a game. How many teams are there?</p>  <p>Sharing</p> <p>6 sweets are shared between 3 people. How many do they have each?</p>   <p>Make use of practical activities involving sharing, e.g. distributing cards when playing a game, putting objects onto plates, into cups, hoops etc.</p>
<p>Key vocabulary: groups of, lots of, times, array, altogether, multiply, count, double, half.</p> <p>Key skills for multiplication at Y1:</p> <ul style="list-style-type: none"> 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 and halving using concrete objects and pictorial representations. 	<p>Key vocabulary: share, share equally, one each, two each ..., group, groups of, lots of, array.</p> <p>Key skills for division at Y1:</p> <ul style="list-style-type: none"> Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays, with support of the teacher. Through grouping and sharing small quantities, pupils begin to understand division and simple fractions (half) of objects, numbers and quantities. They make connections between arrays, number patterns and counting in twos, fives and tens.

Addition with two digit numbers

The + and = signs and missing numbers

Continue using a range of equations (See Year 1) but with appropriate, larger numbers

i.e. extend to $14 + 5 = 10 + ?$ and $32 + ? + ? = 100$

$35 = 1 + ? + 5.$

Partition into tens and ones and recombine

$12 + 23 = 10 + 2 + 20 + 3$

$= 30 + 5$

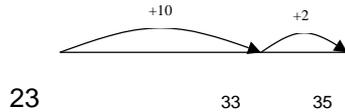
$= 35$

Partitioning the second number only

$23 + 12 = 23 + 10 + 2$

$= 33 + 2$

$= 35$



Subtraction with two digit numbers

The - and = signs and missing numbers

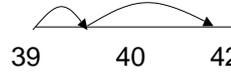
Continue using a range of equations (See Year 1) but with appropriate numbers

i.e. extend to $14 + 5 = 20 - ?.$

Find a small difference by counting up

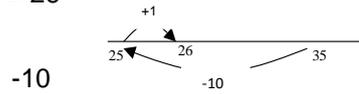
$42 - 39 = 3$

+ 1 + 2



Example: Subtract 9 or 11 & begin to add/subtract 19 or 21

$35 - 9 = 26$



Use known number facts and place value

to subtract (Partition second number only) 37

$- 12 = 37 - 10 - 2 = 27 - 2 = 25$

25

27

37



-10

-2

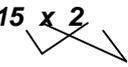
Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, ones, partition, addition, column, tens boundary **Key skills for addition at Y2:**

- Solve word problems with addition, using concrete objects, pictorial representations, involving numbers, quantities and measures, and applying mental and written methods.
- Solve problems with addition, using concrete objects, pictorial representations, involving numbers, quantities and measures, and applying mental and written methods.
- 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. $5 + 9 + 7$).
- Add 9 or 11 by adding 10 and adjusting by 1, $35 + 9 = 44$
- 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.

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, ones.

Key Skills for Subtraction at Y2:

- Recognise the place value of each digit in a two-digit number and read and write numbers to at least 100 in numerals and words.
- 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. This should include TO-O, TOT, TO-TO.
- Show that subtraction of one number from another cannot be done in any order.
- Recognise and use inverse relationships 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 representations, and also applying their increasing knowledge of mental and written methods.

Multiplication	Division						
<p>The x and = signs and missing numbers</p> <p>$7 \times 2 = ?$ $? = 2 \times 7$</p> <p>$7 \times ? = 14$ $14 = ? \times 7$</p> <p>$? \times 2 = 14$ $14 = 2 \times ?$</p>	<p>The ÷ and = signs and missing numbers</p> <p>$6 \div 2 = ?$ $? = 6 \div 2$</p> <p>$6 \div ? = 3$ $3 = 6 \div ?$</p> <p>$? \div 2 = 3$ $3 = ? \div 2$</p>						
<p>Use materials, arrays, repeated addition (including solving problems in context)</p>	<p>Use materials, arrays, repeated addition (including solving problems in context)</p>						
<p>□□ 4 x 2 or 2 x 4</p> <p>□□□</p> <p>□□□</p> <p>□□</p>	<p>Use of sharing and grouping</p> <p>Sharing</p> <p>6 sweets are shared between 2 people. How many do they have each?</p>						
 <p>0</p> <p>0</p> <p>1 2 3 4 5 6 7 8</p>	 <p>Arrays</p>  						
<p>Or repeated addition</p> <p>□□□ □□ □□ □□</p> <p>□□□□□□□□</p> <p>$2 + 2 + 2 + 2$ $4 + 4$</p>	<p>Grouping</p> <p>There are 6 sweets.</p> <p>How each?  many people can have 2 (How many 2's make 6?)</p> <p>0 2 4 6</p>						
<p>Partitioning</p> <p>15×2 OR</p>  <p><u>$20 + 10 = 30$</u></p> <table border="1" data-bbox="383 1344 622 1456"> <tr> <td>x</td> <td>10</td> <td>5</td> </tr> <tr> <td>2</td> <td>20</td> <td>10</td> </tr> </table>	x	10	5	2	20	10	<p>Find and name fractions of length, shape and sets of objects and quantities</p> <p>Use of diagrams- count all equal parts to determine denominator. Link to division into equal groups/parts.</p> <p>e.g. What is half of 6? Divide a group of balls in half. Draw a line halfway through the group of balls, finding that $\frac{1}{2}$ of 6 balls = 3 balls.</p> 
x	10	5					
2	20	10					

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

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.
- Children use a variety of language to discuss and describe multiplication.

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

Key skills 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 correct signs for multiply, divide and equals.
- 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.

Addition

Subtraction

The + and = signs and missing numbers

Continue using a range of equations as in Year 1 and Year 2 but with appropriate larger numbers.

Progression in mental calculations with larger numbers

Calculate HTO + O

Calculate HTO + TO

Calculate HTO + HTO

Progress from no crossing of boundaries to crossing of boundaries.

Partition into tens and ones and recombine Develop from Year 2- partitioning both numbers and recombining.

Refine to partitioning the second number only:

$$\begin{aligned}
 36 + 53 &= 53 + 30 + 6 \\
 &= 83 + 6 \\
 &= 89
 \end{aligned}$$

Add a near multiple of 10 to a two-digit number

Continue work from Year 2 but with appropriate numbers: 35 + 19 is the same as 35 + 20 - 1.

Formal methods of columnar addition to add numbers with up to three digits

$$\begin{array}{r}
 285 \\
 +73 \\
 \hline
 8 \\
 150 \quad \underline{200} \\
 358
 \end{array}$$

In order to carry out this method of addition:

- Children need to recognise the value of the hundreds, tens and ones without recording the partitioning.
- Pupils need to be able to add in columns.

Extend to decimals in the context of money

£ 2.50 + £ 1.75

£ 2.50

+ £ 1.75

£ 4.25

1

The expanded method should be used if children experience persisting difficulties.

The - and = signs and missing numbers

Continue using a range of equations as in Year 1 and Year 2 but with appropriate larger numbers.

Find a small difference by counting up

Continue from Year 2 but with appropriate numbers, e.g. 102 - 97 = 5

Subtract mentally a 'near multiple of 10' to or from a two-digit number, extending to three digit numbers Continue as in Year 2 but with appropriate numbers e.g. 78 - 49 is the same as 78 - 50 + 1

Progression in mental calculations with larger numbers

Calculate HTO - U

Calculate HTO - T

Calculate HTO - H

Progress from no crossing of boundaries to crossing of boundary.

Subtract with no exchanging is required 89

- 35 :

80 + 9

- 30 + 5

50 + 4 = 54



Exchanging through practical subtraction

Make the larger number with Dienes blocks then subtract the smaller number from it e.g. 72- 74

Before subtracting '7' from the 72 blocks, they will need to exchange a row of 10 for ten ones. Then subtract 7 ones and 4 tens.

Exchanging using written methods eg 72-47

60 1

~~70~~ + 2

- 40 + 7

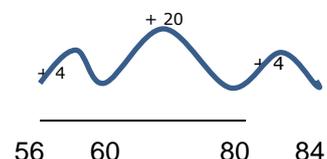
20 + 5 = 25

Partitioned column method to subtract any 2 HTO numbers

	2	3	8	-	1	4	6	=	9	2
	1	0	0	+	1	3	0	+	8	
-	1	0	0	+	4	0	+	6		
				0	+	9	0	+	2	

Complementary addition

84 - 56 = 28



Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, ones, 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, including 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 the inverse to check answers.
- Solve problems, including missing number problems, using number facts, place value, and more complex addition.
- Recognise place value of each digit in 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, 1000 and adjusting, using near doubles, partitioning and recombining.

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, ones, 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 hundreds.
- Estimate answers and use inverse operations to check.
- Solve problems, including missing number problems.
- Find 10 and 100 more or less than a given number.
- Counting up differences as a mental strategy when numbers are close together or near multiples of 10
- 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.

Multiplication

The x and = signs and missing numbers Continue using a range of equations as in Year 2 but with appropriate numbers in relation to grade-level standards.

Use known facts x3, x4, x8, x2, x5 and x10

Multiply 2-digits by a single digit number

TO x O

Introduce the grid method for multiplying 2-digit by single digit:

Eg 32 x 3

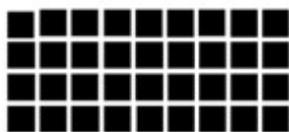
Initially show as array:

x	30	2
3	oooooooooooooooooooooooooooo	oo
	oooooooooooo	oo
	oooooooooooooooooooooooooooo	oo
	oooooooooooo	
	oooooooooooooooooooooooooooo	
	oooooooooooo	

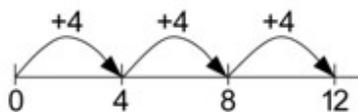
$$\begin{array}{r} x \quad 30 \quad 2 \\ 3 \quad 90 \quad 6 \\ \hline 90 + 6 = 96 \end{array}$$

To use the grid method, children must be able to:

- Partition numbers into tens and ones.
- Multiply multiples of ten by a single digit (e.g. 20 x 4) using their knowledge of multiplication facts and place value, i.e. 2 x 4 = 8, 20 x 4 = 80
- Recall and work out multiplication facts in the 2, 3, 4, 5, 8 and 10 times tables.
- Work out multiplication facts not known by repeated addition or other taught mental strategies (e.g. by commutative law, working out near multiples and adjusting, using doubling, etc). Strategies to support this are repeated addition using a number line, bead bars and arrays.



$$9 \times 4 = 36$$



Division

The ÷ and = signs and missing numbers Continue using a range of equations as in Year 2 but with appropriate numbers.

TO are divided by O by 'chunking' or 'grouping'.

TO ÷ U Grouping (no remainder)



How many 3s make 18? 0 3 6 9 12 15 18
6

Divide 2-digit numbers by a single digit (with remainder)

There are 16 sweets shared between 3, how many left over?

$$16 \div 3 =$$

Ask – How many 3s make 16, how many left over?



0 3 6 9 12 15 16

Answer: 5 r1

-Continue to work out unknown division facts by grouping on a number line from zero.

- Teach the concept of remainders, as shown in the example. Introduce practically and with arrays, as well as being translated to a number line.

- Work towards calculating some basic division facts with remainders mentally for the 2s, 3s, 4s, 5s, 8s and 10s, ready for 'carrying' remainders across within the short division method.

Short division for larger 2-digit numbers (with no remainders)

$$\begin{array}{r} 32 \\ 3 \overline{) 96} \end{array}$$

'How many 3's in 9?' = 3, and record it above the 9 tens.

'How many 3's in 6?' = 2, and record it above the 6

Short division for larger 2-digit numbers (with internal remainder)

$$\begin{array}{r} 18 \\ 4 \overline{) 732} \end{array}$$

If needed, children should use the number line to work out individual division facts that occur.

Real-life problems to practise methods

Key vocabulary: groups of, lots of, times, array, altogether, multiply, count, double, half, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times ..., **partition, grid method, multiple, product, tens, ones, value** **Key skills for multiplication at Y3:**

- 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 and for missing number problems e.g. $? \times 5 = 20$, $3 \times ? = 18$.

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

Key skills for division at Y3:

- Recall and use multiplication and division facts for the 2, 3, 4, 5, 8 and 10 multiplication tables (through doubling for 2, 4 and 8)
- Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including 2-digit numbers times 1-digit numbers, using mental methods and progressing to formal written methods.
- Solve problems in contexts, including missing number problems involving multiplication and division.
- Children develop efficient mental methods, for example, using multiplication and division facts to derive related facts.
- Children 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.

Addition

The + and = signs and missing numbers

Continue using a range of equations but with appropriate larger numbers.

Progression in mental calculations with larger numbers

Calculate HTO + TO

Calculate HTO + HTO

Calculate ThHTO + HTO

Progress from no crossing of boundaries to crossing of boundaries.

Add a near multiple of 10 to a two-digit number

Continue work from Year 2 but with appropriate numbers:
35 + 19 is the same as 35 + 20 - 1.

Formal methods of columnar addition to add numbers with up to four digits

Move from expanded addition to the compact column method, adding ones first, and 'carrying' numbers underneath the calculation.

E.g. $3517 + 396 = 3913$

$$\begin{array}{r} 3517 \\ + 396 \\ \hline 3913 \end{array}$$

Add ones

'Carry' numbers underneath the bottom line

Subtraction

The - and = signs and missing numbers

Continue using a range of equations but with appropriate larger numbers.

Find 1000 more or less than a given number.

Children given a number and asked to subtract 1000 or add 1000. Children to also solve missing number problems around this subject.

Subtract by counting on where numbers are close together or they are near to multiples of 10, 100, etc.

Continue as in Year 3 but with appropriate numbers e.g. $178 - 99$ is the same as $78 - 100 + 1$

Subtract with up to 4 digits

Calculate HTO - O

Calculate HTO - T

Calculate HTO - H

Progress from no crossing of boundaries to crossing of boundary.

Exchanging through practical subtraction

Make the larger number with Dienes blocks then subtract the smaller number from it e.g. $72 - 74$



Before subtracting '7' from the 72 blocks, they will need to exchange a row of 10 for ten ones. Then subtract 7 ones and 4 tens.

Partitioned column method to subtract any 2 ThHTO numbers (Developing the Year 3 method)

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

Reinforce correct place value by reminding them that the actual value is 5 hundreds add 3 hundreds, not 5 add 3, for example

Use and apply this method to money and measurement values.

$$\begin{array}{r} 2754 \\ - 1562 \\ \hline 1192 \end{array}$$

To introduce the compact method, ask children to perform a subtraction calculation with the familiar partitioned calculation with familiar partitioned column subtraction then display the compact version for the calculation they have done. Ask pupils to consider how it relates to the method they know, what is similar and what is different, to develop an understanding of it.

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

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 to a calculation.
- 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.

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, ones, 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.
- 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 larger positive numbers.

Multiplication

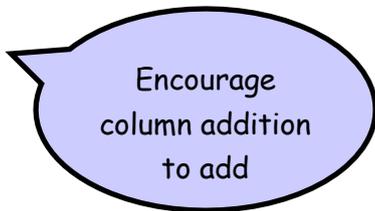
The x and = signs and missing numbers Continue using a range of equations as in Year 2 but with appropriate numbers in relation to grade-level standards.

Multiply 2 and 3-digits by a single digit using all multiplication tables up to 12 x 12

Eg. $136 \times 5 = 680$

X	100	30	6	500
5	500	150	30	150
				+ 30
				680

Develop the grid method for 3-digit numbers



When the children are confidently and accurately multiplying 2 and 3-digit numbers by a single digit this way, move on to **short multiplication** (see Year 5 multiplication). The children also need to be confident with **exchanging** in written addition methods to help them understand **short multiplication**.

Children should be able to:

- **Approximate before they calculate**, and make this a regular part of their calculating, going back to the approximation to check the reasonableness of their answer, e.g:
' 346×9 is approximately $350 \times 10 = 3500$ '

The children should record their approximation so that they can check their final answer against it.
- Multiply multiples of ten and one hundred by a single digit, using their multiplication table knowledge.
- Recall all times tables up to **12 x 12**.

Division

The ÷ and = signs and missing numbers

Continue using a range of equations as in Year 2 but with appropriate numbers.

TO are divided by O by 'chunking' or 'grouping'.

Divide up to 3-digit numbers by a single digit (without remainders initially)

$$\begin{array}{r} 18 \\ 4 \overline{) 72} \end{array}$$

Step 1: Children must be secure with the process of short division for dividing 2-digit numbers by a single digit (those that do not result in a final remainder-see Year 3), but must understand how to calculate remainders, using this to 'carry' remainders within the calculation process.

Step 2: Children move on to dividing numbers with up to 3 digits by a single digit. The problems and calculations provided should not result in a final answer with a remainder at this stage. Children who exceed this expectation may progress to Y5 level.

Step 3: When the answer for the first column is zero, children could initially write a zero above to acknowledge its place, and must always 'carry' the number over to the next digit as a remainder.

Real life contexts:

These need to be used routinely to help children gain full understanding, and the ability to recognise the place of division and how to apply it to problems,

Key vocabulary: groups of, lots of, times, array, altogether, multiply, count, double, half, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times ..., partition, grid method, multiple, product, tens, ones, value, 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 x 12.
- Recognise place value of digits in up to 4-digit numbers (thousands, hundreds, tens and ones).
- 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.

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

Key skills for division at Y4:

- Recall multiplication and division facts for all numbers to 12 x 12.
- Use place value and known and derived facts to multiply and divide mentally, including multiplying and dividing by 10 and 100.
- Children practise to become fluent in the formal written method of short division with exact answers when dividing by a one digit number.
- Children practise mental methods and extend this to three digit numbers using derived facts.
- Children solve two step problems in context, choosing the appropriate operation and working with increasingly harder numbers.

Addition

The + and = signs and missing numbers

Continue using a range of equations but with appropriate larger numbers.

Progression in mental calculations with larger numbers

Calculate HTO + TO

Calculate HTO + HTO

Calculate TthThHTO + TthThHTO

Progress from no crossing of boundaries to crossing of boundaries.

Formal methods of columnar addition to add numbers with more than 4 digits

This should include money, measures and decimals with different numbers of decimal places.

E.g.

£	2	3	.	5	9
+	£	7	.	5	5
£	3	1	.	1	4

The decimal point should be aligned in the same way as the other place value columns, and must be in the same column in the answer.

	2	3	,	4	8	1
+		1		3	6	2
	2	4		8	4	3

Numbers should exceed 4 digits.

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

Empty decimal places can be filled with zero to show the place value in each column.

Say '6 tenths add 7 tenths' to reinforce place value.

Subtraction

The - and = signs and missing numbers

Continue using a range of equations but with appropriate larger numbers.

Find 1000 more or less than a given number.

Children given a number and asked to subtract 1000 or add 1000. Children to also solve missing number problems around this subject.

Subtract by counting on where numbers are close together or they are near to multiples of 10, 100, etc.

Continue as in Year 3 but with appropriate numbers e.g. $178 - 99$ is the same as $78 - 100 + 1$

Subtract with at least 4-digit numbers

Calculate ThHTO - O

Calculate ThHTO - T

Calculate ThHTO - H

Progress from no crossing of boundaries to crossing of boundary.

Continue with the compact column subtraction method with exchanging.

2	8	0	8	6
-	2	1	2	8
	2	8	9	2

Children who are still not secure with number facts and place value need to remain on the partitioned column method until ready for the compact method.

Children should also subtract with decimal values, including mixtures of integers and decimals, making sure they align the decimal point.

7	6	9	.	0
-	3	7	2	.5
	6	7	9	6.5

Fill place holders with a 'zero' in any empty decimal places to help with the understanding of what to subtract in that column.

Pupils should be able to add more than two values, carefully aligning place value columns.

Children should:

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

Key Vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, ones, 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 Y5:

· Add numbers mentally with increasingly large numbers, using and practising a range of mental strategies ie. add the nearest multiple of 10, 100, 1000 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.

Allow the children lots of opportunities for subtracting and finding differences in different contexts, such as money and measures.

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, ones, exchange, decrease, hundreds, value, digit, inverse, tenths, hundredths, decimal point, decimal.

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 and 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.

Multiplication

The \times and $=$ signs and missing numbers

Multiply up to 4-digit numbers by 1 or 2 digits

Introducing column multiplication:

- Introduce by comparing a grid method calculation to a short multiplication method, to see how the steps are related, but notice how there are less steps involved in the column method.
- Children need to continue to approximate first, e.g. for 72×38 they will use rounding so 72×38 is approximately $70 \times 40 = 2800$, and use the approximation to check the reasonableness of their answer.

Children could be asked to work out a calculation using the grid method and then compare it to 'your' column method. What are the similarities and differences? Unpick the steps and show how it reduces the steps.

Short multiplication for multiplying by a single digit

\times	300	20	7
4	1200	80	28



	3	2	7
\times			4
	1	3	0
		1	2

Introduce long multiplication for multiplying by 2 digits

		10	8
10	100	80	
3	30	24	



		1	8
\times		1	3
		5	4
		2	
	1	8	0
	2	3	4

Then move on to more complicated numbers

	1	2	3	4
\times			1	6
	7	4	0	4
	1	2	3	4
	1	9	7	4

(1234×6)
(1234×10)

	3	6	5	2
\times				8
	2	9	2	1
		5	4	

Children should:

- Understand the place value of **tenths** and **hundredths** and use this to align numbers with different numbers of decimal places.
- Be provided with missing number problems for them to solve by working backwards.

Division

The \div and $=$ signs and missing numbers

Continue using a range of equations but with appropriate larger numbers.

Divide up to 4-digit numbers by a single digit, including those with remainders

Short division with remainders:

	0	6	6	3	r	5
8)	5	3	0	2	9

Now that children are introduced to examples that give rise to remainder answers, division needs to have a real life problem solving context, where children consider the meaning of the remainder and how to express it, i.e. as a fraction, a decimal, or as a rounded number or value, depending upon the context of the problem.

Include money and measure contexts

The answer to the above question could be expressed as 663 and 5 eighths, 663r5 as a decimal, or rounded as appropriate to the problem involved.

If children are confident and accurate:

Introduce long division for pupils who are ready to divide any number by a 2-digit number. This is a Year 6 expectation (see Year 6)

Children should:

- Be provided with missing number problems for them to solve by working backwards.

Key Vocabulary: groups of, lots of, times, array, altogether, multiply, count, double, half, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times ..., partition, grid method, multiple, product, tens, ones, value, inverse, square, factor, integer, decimal, short/long multiplication, 'carry' or 'exchange'.

Key skills for multiplication at Y5:

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

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

Key skills for division at Y5: □

- Recall multiplication and division facts for all numbers to 12×12 .
- Multiply and divide numbers mentally, drawing upon known facts.
- Identify multiples and factors, including finding all factor pairs of a number and common factors of two numbers.
- 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 interpret remainders appropriately for the context.
- Use multiplication and division 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.
- Solve problems involving combinations of all four operations.

Addition

Year 6 Add several numbers of increasing complexity

$$\begin{array}{r}
 23.361 \\
 9.080 \\
 59.770 \\
 + 1.300 \\
 \hline
 93.511 \\
 \begin{array}{cccc}
 2 & 1 & & 2
 \end{array}
 \end{array}$$

Empty decimal places can be filled with zero to show the place value in each column.

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

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

$$\begin{array}{r}
 81,059 \\
 3,668 \\
 15,301 \\
 + 20,551 \\
 \hline
 120,579 \\
 \begin{array}{cccc}
 1 & 1 & 1 & 1
 \end{array}
 \end{array}$$

Adding several numbers with more than 4 digits.

Children should also be provided with missing number problems for them to solve by working backwards.

Subtraction

Year 6 Subtracting with increasingly large and more complex numbers and decimal values.

$$\begin{array}{r}
 \cancel{9}^9 \cancel{5}^9 \cancel{10}^9,699 \\
 - 89,949 \\
 \hline
 60,750
 \end{array}$$

The children should use the compact column method to subtract more complex integers.

$$\begin{array}{r}
 \cancel{10}^5 \cancel{15}^5 \cdot \cancel{3}^4 \cancel{11}^4 \text{ kg} \\
 - 36 \cdot 080 \text{ kg} \\
 \hline
 69 \cdot 339 \text{ kg}
 \end{array}$$

They should also use it to subtract money and measures, including decimals with different numbers of decimal places.

Empty decimal places can be filled with zero to show the place value in each column.

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

Children should also be provided with missing number problems for them to solve by working backwards.

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

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, ones, 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.
- 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 subtraction strategies, jottings and written methods before choosing how to calculate.

Multiplication

Short and long multiplication as in Y5, and multiply decimals up to 2 decimal places by a single digit

$$\begin{array}{r} 3.19 \\ \times 8 \\ \hline 25.52 \end{array}$$

Remind the children that the single digit belongs in the ones column.

Line up the decimal points in the question and the answer.

This works well for multiplying money and other measures.

Children will be able to:

- Use rounding and place value to make approximations before calculating and use these to check answers against.
- Use **short multiplication (see Year 5 for method)** to multiply numbers with more than 4 digits by a single digit number, to multiply money and measures, and to multiply decimals with up to 2 decimal places by a single digit number.
- Use **long multiplication** (see Year 5 for method) to multiply numbers with at least 4 digits by a 2 digit number.

Division

Divide at least 4-digits by both single digit and 2-digit numbers (including decimal numbers and quantities)

$$\begin{array}{r} 0812.125 \\ 8 \overline{)6497.000} \end{array}$$

Short division with remainders: Children should continue to use this method, but with numbers to at least 4 digits, and understand how to express remainders as fractions, decimals, whole number remainders or rounded numbers. Real life problem solving contexts need to be the starting point, where children have to consider the most appropriate way to express the remainder.

Calculating a decimal remainder: In this example, rather than expressing the remainder as r1, a decimal point is added after the ones because there is still a remainder, and the one remainder is carried onto zeros after the decimal point (to show there was no decimal value in the original number). Keep dividing to an appropriate degree of accuracy for the problem being solved.

Introduce the formal method of long division

$$\begin{array}{r} 2 \\ 15 \overline{)3640} \\ \underline{-30} \\ 6 \end{array}$$

Find out 'How many 15s are in 3640?'. 15 in to 3 doesn't go so 15 into 36. It goes twice (30). This leaves 6.

$$\begin{array}{r} 24 \\ 15 \overline{)3640} \\ \underline{-30} \\ 64 \\ \underline{-60} \\ 4 \end{array}$$

Bring down the 4 and see how many 15s are in 64. The answer is 4 times (60). This leaves 4.

$$\begin{array}{r} 242 \\ 15 \overline{)3640} \\ \underline{-30} \\ 64 \\ \underline{-60} \\ 40 \\ \underline{-30} \\ 10 \end{array}$$

Bring down the 0 and see how many 15s go into 40. The answer is twice (30). This leaves a remainder of 10.

The answer would be 242 r 10. As children progress with this method, they would begin to write the remainder as a fraction and then a decimal.

Real life contexts:

These need to be used routinely to help children gain full understanding, and the ability to recognise the place of division and how to apply it to problems,

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

Key skills for multiplication at Y6:

- Recall multiplication facts for all times tables up to 12 x 12 (as in Year 4 and Year 5).
- Multiply multi-digit numbers, up to 4-digits x 2-digits, 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 rounding and approximation and determine levels of accuracy.
- Round any integer to a required degree of accuracy.

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

Key skills for division at Y6:

- Recall multiplication and division facts for all numbers to 12 x 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.