Cleveland Road Primary School Calculation Policy

Mental methods for calculation

At Cleveland Road Primary School, we teach children to use the following mental calculations:

Addition and subtraction skills and strategies:

Counting forwards and backwards

Reordering

Partitioning (i) Using multiples of 10 and 100

Partitioning (ii) Bridging through multiples of 10

Partitioning (iii) Compensating

Partitioning (iv) Using 'near' doubles

Partitioning (v) Bridging through numbers other than 10

Multiplication and division skills and strategies:

Knowing multiplication and division facts to 10

Multiplying and dividing by multiples of 10

Multiplying and dividing by single-digit numbers and multiplying by two-digit numbers

Doubling and halving

Fractions, decimals and percentages

Mental calculation expectations for each year:

	Rapid recall Children should be able to recall rapidly:	**Mental strategies** Children should be able to use the following strategies, as appropriate, for mental calculations:	**Mental calculations** Children should be able to use mental calculations to:
Year 1	<u>Recall:</u> • all pairs of numbers (including number bonds) with a total of up to 20, e.g. 13 + 7 • addition and subtraction facts for all numbers within 20 • addition doubles of all numbers to at least 10, e.g. 7 + 7 <u>Derive:</u> • multiples of 2, 5 and 10 (up to the twelfth multiple)	• count from 0 to and across 100, forward and backwards, beginning with 0 or 1, and from any given number • recognise place value in numbers beyond 20 by counting and comparing numbers up to 100. • reorder numbers in a calculation (see appendix 1) • begin to bridge through 10 and later 20 when adding a single-digit number (see appendix 2) • use number facts and place value to add or subtract pairs of single-digit numbers • add 9 to single-digit numbers by adding 10 then subtracting 1 • identify near doubles using doubles already known • use patterns of similar calculations • count in different multiples including ones, twos, fives and tens	• add or subtract a single-digit to or from a single-digit, without crossing 10, e.g. 4 + 5, 8 – 3 • add or subtract a single-digit to or from 10 • add or subtract a single-digit to or from a 'teens' number, without crossing 20 or 10, e.g. 13 + 5, 17 – 3 • add and subtract numbers to 20 in the three forms (e.g. 9 + 7 = 16; 16 – 7 = 9; 16 – 9 = 7) • double numbers to 10, e.g. 9 + 9 = 18

	Rapid recall Children should be able to	**Mental strategies** Children should be able to use the following strategies, as appropriate, for	**Mental calculations** Children should be able to use mental calculations to:

	recall rapidly: 2,5 and 10 times tables	mental calculations:	
Year 2	<u>Recall:</u> • addition and subtraction facts to 20 e.g. 13 + 7 or 12 + 6 • all pairs of multiples of 10, with a total of up to 100, e.g. 30 + 70 or 10 + 50 • multiplication facts for the 2, 5 and 10 times-tables and corresponding division facts • doubles of all numbers to 20 and the corresponding halves	• count on or back in ones or tens from any number up to 100 • recognise place value in numbers by counting and comparing numbers to at least 100. • practise addition and subtraction of number bonds to 20 using related facts to perform calculations (e.g. using 3 + 7 = 10, 10 - 7 = 3 and 10 – 3 = 7 to calculate 30 + 70 = 100, 100 - 70 = 30 and 100 – 30 = 70). • find a small difference by counting up from the smaller to the larger number • reorder numbers in a calculation (see appendix 1) • add three small numbers by putting the largest number first and/or finding a pair totalling 20 • partition additions into tens and units then recombine (see appendix 3) • bridge through 10 or 20 (see appendix 2) • use known number facts and place value to add or subtract pairs of numbers • partition into '5 and a bit' when adding 6, 7, 8 or 9 • add or subtract 9, 19, 11 or 21 by rounding and compensating (see appendix 4) • identify near doubles • use patterns of similar calculations • use the relationship between addition/subtraction • use knowledge of number facts and place value to multiply or divide by 2, 5 or 10 • practise recalling multiplication tables and related division facts • practise multiplying in any order (commutatively) • count in steps of 2, 3, 5 and 10 • use doubles and halves and halving as the inverse of doubling	• add or subtract any single-digit to or from any two-digit number, without crossing the tens boundary, e.g. 62 + 4, 38 – 7 • add or subtract any single-digit to or from a multiple of 10, e.g. 60 + 5, 80 – 7 • add or subtract any 'teens' number to any two-digit number, without crossing the tens boundary, e.g. 23 + 14, 48 – 13 • find what must be added to any two-digit multiple of 10 to make 100, e.g. 70 + ? = 100 • add or subtract a multiple of 10 to or from any two-digit number, without crossing 100, e.g. 47 + 30, 82 – 50 • subtract any two-digit number from any two-digit number when the difference is less than 10, e.g. 78 – 71 or 52 – 48 • doubles of all numbers to at least 20, e.g. double 19 • double any multiple of 5 up to 50, e.g. double 35 • halve any multiple of 10 up to 100, e.g. halve 50
	Rapid recall Children should be able to recall rapidly: 2, 5 and 10 times tables	**Mental strategies** Children should be able to use the following strategies, as appropriate, for mental calculations:	**Mental calculations** Children should be able to use mental calculations to:

Year 3	Recall: • sums and differences of multiples of 10, e.g. 70 + 20 or 80 – 30 • number pairs that total 100, e.g. 46 + 54 • multiplication facts for the 2, 3, 4, 5, 8 and 10 times tables and the corresponding division facts	• count on or back in hundreds, tens or ones up to 1000 • find difference by counting up from the smaller to the larger number • reorder numbers in a calculation (see appendix 1) • add three or four small numbers by putting the largest number first and/or by finding pairs totalling e.g. 19, 20 or 21 • partition into tens and units then recombine (see appendix 3) • bridge through a multiple of 10, 100, then adjust (see appendix 2) • use knowledge of number facts and place value to add or subtract pairs of numbers 2-digit numbers, where answers exceed 100. • partition into '5 and a bit' when adding 6, 7, 8 or 9 • add or subtract mentally a 'near multiple of 10' to or from a two-digit number • identify near doubles • use patterns of similar calculations • say or write a subtraction statement corresponding to a given addition statement • to multiply a number by 10/100, shift its digits one/two places to the left • use knowledge of number facts and place value to multiply or divide by 2, 5 or 10, 100 • use doubling or halving • say or write a division statement corresponding to a given multiplication statement • to practise regularly the mental recall of multiplication tables when calculating mathematical statements until confident. • count in multiples of 2, 3, 4, 5, 8, 10, 50 and 100 from 0 • develop efficient mental methods. For example, use commutativity (e.g. 4 x 12 x 5 = 4 x 5 x 12 = 20 x 12 = 240) and multiplication and division facts (e.g. using 3 x 2 = 6, 6 ÷ 3 = 2 and 2 = 6 ÷ 3 to calculate 30 x 2 = 60, 60 ÷ 3 = 20 and 20 = 60 ÷ 3).	• accurately add and subtract numbers mentally including: pairs of one- and 2-digit numbers; 3-digit numbers and ones; 3-digit numbers and tens; 3-digit numbers and hundreds • find what must be added to any multiple of 100 to make 1000, e.g. 300 + ? = 1000 • add or subtract any pair of two-digit numbers, without crossing a tens boundary or 100, e.g. 33 + 45, 87 – 2 • add or subtract any single-digit to any two-digit number, including crossing the tens boundary, e.g. 67 + 5, 82 – 7 • find what must be added to/subtracted from any two-digit number to make the next higher/lower multiple of 10. e.g. 64 + ? = 70, 56 - ? = 50 • subtract any three-digit number from any three-digit number when the difference is less than 10, e.g. 458 – 451, or 603 – 597 • find what must be added to/subtracted from any three-digit number to make the next higher/lower multiple of 10, e.g. 647 + ? = 650, 246 - ? = 240 • double any number to *at least* 20, e.g. double 18, and corresponding halves, e.g. halve 36; double 60, halve 120; double 35, halve 70; double 450, halve 900 • multiply single-digit numbers by 10 or 100, e.g. 6 x 100 • divide any multiple of 10 by 10, e.g. 60 ÷ 10, and any multiple of 100 by 100, e.g. 700 ÷ 100

	Rapid recall Children should be able to recall rapidly:	**Mental strategies** Children should be able to use the following strategies, as appropriate, for mental calculations:	**Mental calculations** Children should be able to use mental calculations to:

Year 4	Recall: • place value facts for each digit in a 4-digit number (thousands, hundreds, tens, and ones) Derive: • sums and differences of pairs of multiples of 10, 100 or 1000 • doubles of multiples of 10 and 100 and corresponding halves Recall: • multiplication facts up to 12 x 12 and the corresponding division facts • multiples of numbers to 12 up to the twelfth multiple	• count on or back in repeated steps of 1, 10 and 100 • count up through the next multiple of 10, 100 or 1000 • order and compare numbers up to 10,000 • reorder numbers in a calculation (see appendix 1) • add 3 or 4 numbers, finding pairs totalling 100 • add three two-digit multiples of 10 • partition into tens and units, adding the tens first (see appendix 3) • bridge through 100 and 1000 (see appendix 2) • use knowledge of number facts and place value to add or subtract any pair of two-digit and three digit numbers • add or subtract numbers e.g. 9, 19, 29, 11, 21 or 31 by rounding and compensating (see appendix 4) • add or subtract the nearest multiple of 10 then adjust • identify near doubles • continue to use the relationship between addition and subtraction • double any two-digit number by doubling tens first • use known number facts and place value to multiply or divide, including multiplying and dividing by 10 and then 100 • partition to carry out multiplication • use doubling or halving • use closely related facts to carry out multiplication and division • use the relationship between multiplication and division • count in multiples of 2, 3, 4, 5, 6, 7, 8, 9, 10, 25, 50, 100 and 1000 from any given number, and 10 or 100 more or less than a given number • practise recalling and using multiplication tables and related division facts on a regular basis until confident using them mentally. • practise multiplying using mental methods and extend this to 3-digit numbers to derive facts, for example 300 x 2 = 600 into 600 ÷ 3 = 200. • use the distributive law to derive facts, for example, 30 x 7 + 9 x 7= 39 x 7.	• find what must be added to any two-digit number to make 100, e.g. 37 + ? = 100 • add or subtract any pair of two-digit numbers, e.g. 38 + 85, 92 – 47 • find out what must be added to/subtracted from any two- or three-digit number to make the next higher/lower multiple of 100, e.g. 374 + ? = 400, 826 - ? = 800 • subtract any four-digit number from any four-digit number when the difference is small, e.g. 3641 – 3628, 6002 – 5991 • add and subtract multiples of 100 with increasingly large numbers, for example, 12,462 - 2,400 = 10,062 or 12,462 + 600 = 13,062. • double any whole number from 1 to 50, e.g. double 36, and find all the corresponding halves, e.g. 96 ÷ 2 • double any multiple of 10 and 100 to 1000, e.g. 380 x 2, and find all the corresponding halves, e.g. 760 ÷ 2, 130 ÷ 2 • double any multiple of 5 to 100, e.g. 65 x 2 • multiply any two-digit number by 10 and 100, e.g. 26 x 10 • divide a multiple of 100 by 10 or 100, e.g. 600 ÷ 10 • multiply any two-digit multiple of 10 by any single-digit number

	Rapid recall Children should be able to recall rapidly:	**Mental strategies** Children should be able to use the following strategies, as appropriate, for mental calculations:	**Mental calculations** Children should be able to use mental calculations to:
Year	Recall: • place value facts for	• count forwards or backwards in steps of 100, 1000 or 10,000 for any given number up to 1,000,000 • reorder numbers in a calculation (see appendix 1)	• add and subtract numbers mentally with increasingly large numbers. • add or subtract any pair of three-digit

5	numbers up to 1,000,000 <u>Derive:</u> • sums and differences of decimals, e.g. 6.5 ± 2.7 • doubles and halves of decimals, e.g. half of 5.6 <u>Recall:</u> • prime numbers up to 19	• practise reading and saying regularly the place value of each digit in up to six digit numbers, including decimals. • partition into thousands, hundreds, tens and units, adding the most significant digit first (see appendix 3) • use known number facts and place value to add or subtract pairs of three-digit multiples of 10 and two-digit numbers with one decimal place • add or subtract the nearest multiple of 10 or 100 then adjust • identify near doubles • add several numbers • develop further the relationship between addition and subtraction • practise fast responses for mental calculations with increasingly large numbers, for example: 12,462 – 2,300 = 10,162. • practise counting forwards and backwards using decimal fractions, and mental addition and subtraction of tenths and 1 digit whole numbers and tenths. • practise identify multiples including common multiples, and factors including common factors • use factors • partition to carry out multiplication • use doubling and halving • use closely related facts to carry out multiplication and division • use knowledge of number facts and place value to multiply or divide • practise and apply all the multiplication tables and related division facts to make larger calculations. • accurately multiply and divide numbers mentally drawing upon known facts • multiply and divide numbers by 10, 100 and 1000	multiples of 10, e.g. 570 + 250, 620 – 380 • find what must be added to a decimal fraction with units and tenths to make the next higher whole number, e.g. 4.3 + ? = 5 • add or subtract any pair of decimal fractions each with units and tenths, or each with tenths and hundredths, e.g. 5.7 + 2.5, 0.63 – 0.48 • subtract a four-digit number just less than a multiple of 1000 from a four-digit number just more than a multiple of 1000, e.g. 5001-1997 • subtract with increasing large numbers e.g. 12,462 – 2,300 = 10,162. • multiply any two- or three-digit number by 10 or 100, e.g. 79 x 100, 363 x 100 • divide a multiple of 100 by 10 or 100, e.g. 4000 ÷ 10, 3600 ÷ 100 • multiply any two-digit multiple of 10 by a single-digit, e.g. 60 x 7, 90 x 6 • double any whole number from 1 to 100, multiples of 10 to 1000, and find corresponding halves • find 50%, 25%, 10% of small whole numbers or quantities, e.g. 25% or £8
	Rapid recall Children should be able to recall rapidly:	**Mental strategies** Children should be able to use the following strategies, as appropriate, for mental calculations:	**Mental calculations** Children should be able to use mental calculations to:
Year 6	<u>Recall:</u> place value facts for numbers up to 10 million	• consolidate all strategies from previous years • use knowledge of number facts and place value to add or subtract pairs of three-digit multiples of 10 and two-digit numbers with one decimal place • add or subtract the nearest multiple of 10, 100 or 1000, then adjust • continue to use the relationship between addition and subtraction • use factors	• add and subtract negative integers • subtract with increasing large numbers e.g. 12,462 – 2,351 = 10, 111. • multiply any two-digit number by a single-digit, e.g. 34 x 6 • multiply any two-digit number by 50 or 25, e.g. 23 x 50, 47 x 25

	Derive: • multiplication and division facts involving decimals, e.g. 0.8 x 7 and 4.8 ÷ 6 • squares of numbers to 12 x 12 and the corresponding squares of multiples of 10 • recall place value facts for each digit to three decimal places and multiply and divide numbers up to three decimal place by 10, 100 and 1000 • recall and use equivalences between fractions, decimals and percentages.	• to practise fast responses for mental calculations with increasingly large numbers and more complex calculations. • practise mental calculations, including with mixed operations and large numbers • partition to carry out multiplication • use doubling and halving • use closely related facts to carry out multiplication and division • use the relationship between multiplication and division • use knowledge of number facts and place value to multiply or divide • to use all the multiplication tables to calculate mathematical statements to maintain fluency • to multiply decimals by whole numbers starting with the simplest cases, such as 0.4 x 2 = 0.8, and practical contexts, such as measures and money • practise division of decimal numbers initially in practical contexts involving measures and money and by single digit whole numbers. • to practise calculating and indentifying equivalent fractions of a percentage e.g. 62% is equivalent to 62/100 and 0.62	• multiply or divide any whole number by 10 or 100, giving any remainder as a decimal, e.g. 47 ÷ 10 = 4.7, 1763 ÷ 100 = 17.63 • find squares of multiples of 10 to 100 • find any multiple of 10% of a whole number or quantity, e.g. 70% of £20, 50% of 5kg, 20% of 2 metres

Written methods for calculation

Mental calculation is not at the exclusion of written recording and should be seen as complementary to and not as separate from it. In every written method there is an element of mental processing.

Pupils should be taught to use the most efficient written method, only using this when mental strategies and inefficient.

Written recording both helps children to clarify their thinking and supports and extends the development of more fluent and sophisticated mental strategies.

Although each method will be taught in the year group specified, children should not be discouraged from using previously taught methods with which they are secure, while the new concepts are becoming embedded.

The long-term aim is for children to be able to select an efficient method of their choice that is appropriate for a given task. They should do this by always asking themselves:

'Can I do this in my head?'

'Can I do this in my head using drawings or jottings?'

'Do I need to use a written method?

Written methods for addition of whole numbers

The aim is that children use mental methods when appropriate, but for calculations that they **cannot** do in their heads they use an efficient written method accurately and with confidence. Children are entitled to be taught and to acquire secure mental methods of calculation and one efficient written method of calculation for addition which they know they can rely on when mental methods are not appropriate.

To add successfully, children need to be able to:

- recall all addition pairs to 9 + 9 and complements in 10;
- add mentally a series of one-digit numbers, such as 5 + 8 + 4;
- add multiples of 10 (such as 60 + 70) or of 100 (such as 600 + 700) using the related addition fact, 6 + 7, and their knowledge of place value;
- partition two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways

Note: *It is important that children's mental methods of calculation are practised and secured alongside their learning and use of an efficient written method for addition.*

WRITTEN METHODS FOR ADDITION ~ PROGRESSION FROM Y1-Y3

Year One

O + O TO + O and TO + TO (numbers up to 20)

+ = signs and missing numbers

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'.

2 = 1 + 1
2 + 3 = 4 + 1
3 = 3
2 + 2 + 2 = 4 + 2

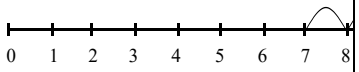
Missing numbers need to be placed in all possible places.

3 + 4 = □	□ = 3 + 4
3 + □ = 7	7 = □ + 4
□ + 4 = 7	7 = 3 + □
□ + ∇ = 7	7 = □ + ∇

The Number Line (counting in 1s)

Children use a numbered line to count on in ones. Children use number lines and practical resources to support calculation and teachers *demonstrate* the use of the number line.

7 + 4 = 11



7 + 4 = 11

Year Two

O + O TO + O TO + T O + O + O
TO + TO (Add with 2-digit numbers – no crossing over)

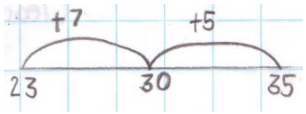
+ = signs and missing numbers

Continue using a range of equations as in Year 1 but with appropriate, larger numbers. Extend to:
14 + 5 = 10 + □ and 32 + □ + □ = 100 35 = 1 + □ + 5

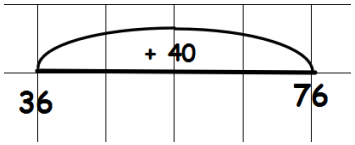
The Empty Number Line: Bridging through multiple of 10.

The steps in addition often bridge through a multiple of 10 e.g. Children should be able to partition the 7 to relate adding the 2 and then the 5.

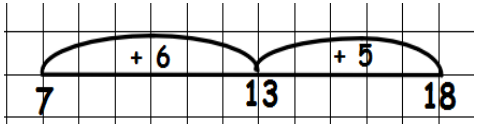
23 + 12 = 35



36 + 40 = 76



7 + 6 + 5 = 18



This method should be introduced in the Spring Term of Year 2:

Year Three

TO + TO, developing to HTO + TO or HTO + HTO
(Add numbers with up to 3-digits - Crossing the tens boundary, or hundreds boundary).

+ = signs and missing numbers

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

Column addition (carrying over)

$$\begin{array}{r} {\scriptstyle 1}\,29 \\ +135 \\ \hline 164 \end{array}$$

****Revert back to column addition which does not involve carrying over, if needed (See Yr 2).***

Partition into tens and ones and recombine

- Partition both numbers and recombine.

36 + 53

30 + 50 =80	30 + 6 + 50 + 3
6 + 3 =9	= 30 + 50 + 6 + 3
80 + 9 = 89	= 80 + 9 = 89

Expanded column addition (carrying over)

67 + 85

	60 + 7
	80 + 5
1	40+12

140 + 10 + 2 = 152

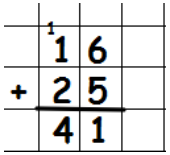
If children are unable to understand column method do the method below first, to explain place value.

Partition & Expanded column addition (carrying over)

e.g. 367 + 185 = 552

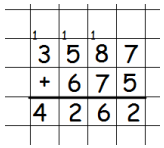
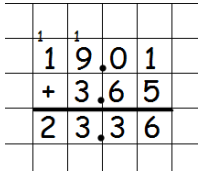
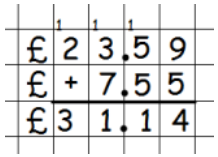
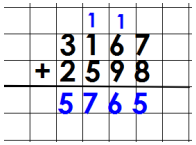
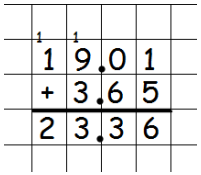
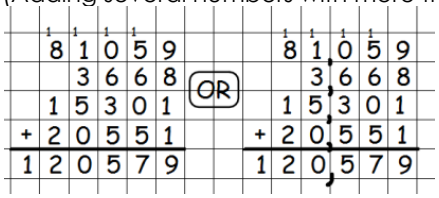
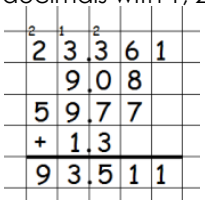
300	+ 60	+ 7
100	+ 80	+ 5
400	+140	+12

400 + 140 + 10 + 2 = 552

 (adding with pictorial support)	**<u>Column addition</u>** (questions which **do not** involve carrying over) 23 + 35 58 **<u>Non statutory:</u>** (questions which **do** involve carrying over) 16 + 25 = 41  If children are unable to understand column method do the methods below (partition & expanded) first to explain place value. **<u>Partition into tens and ones and recombine</u>** 12 + 23 = 10 + 2 + 20 + 3 10 + 20 + 2 + 3 = 35 = 30 + 5 = 35 **<u>Expanded column addition</u>** (questions which **do not** involve carrying over) **e.g.** 23 + 35 = 23 20 + 3 + 35 <u>30 + 5</u> 50 + 8 = 58	

WRITTEN METHODS FOR ADDITION ~ PROGRESSION FROM Y4 - Y6

<u>Year Four</u> ***Add up to 4 digits HTO + HTO/ ThHTO + HTO/ ThHTO + ThHTO and £.p (Crossing the tens boundary, or hundreds boundary, or both).***	**<u>Year Five</u>** ***Add up to 5 digits including using formal written methods and decimals with up to two places.***	**<u>Year Six</u>** ***ThHTU + ThHTU, then numbers with any number of digits and decimals (any decimal places)***
<u>+ = signs and missing numbers</u>	**<u>+ = signs and missing numbers</u>**	**<u>+ = signs and missing numbers</u>**

Continue using a range of equations **Column addition (carrying over)** **3587 + 675 = 4262**  Extend to numbers with up to four digits and decimals **in the context of money £.p** using line column method. (decimal point on the line and not in a separate box) 	Continue using a range of equations with appropriate numbers. **Column addition (carrying over)**   Extend to adding up to two places of decimals  Tenths and hundredths should be correctly aligned, with the decimal point lined up vertically including in the answer row. ***Revert back to column addition which does not involve carrying over or expanded column method (See Year 4), if needed.***	Continue using a range of equations with appropriate numbers. **Column addition (carrying over)** (Adding several numbers with more than 4 digits.)  Extend to numbers with any number of digits and decimals with 1, 2 and/or 3 decimal places.  Tenths, hundredths and thousandths should be correctly aligned, with the decimal point lined up vertically including in the answer row. ***Revert to expanded method if needed (see previous years)***

Written methods for subtraction of whole numbers

The aim is that children use mental methods when appropriate, but for calculations that they **cannot** do in their heads they use an efficient written method accurately and with confidence. Children are entitled to be taught and to acquire secure mental methods of

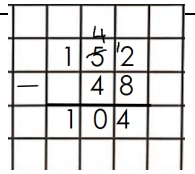
calculation and one efficient written method of calculation for subtraction which they know they can rely on when mental methods are not appropriate.

To subtract successfully, children need to be able to:

- recall all addition and subtraction facts to 20;
- subtract multiples of 10 (such as 160 – 70) using the related subtraction fact 16 – 7, and their knowledge of place value;
- partition two-digit and three-digit numbers into multiples of one hundred, ten and one in different ways (e.g. partition 74 into 70 + 4 or 60 + 14).

Note: *It is important that children's mental methods of calculation are practised and secured alongside their learning and use of an efficient written method for subtraction.*

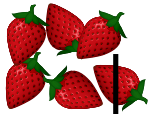
WRITTEN METHODS FOR SUBTRACTION ~ PROGRESSION FROM Y1 – Y3		
Year One ***O - O TO - O and TO - TO***	**Year Two** ***O - O TO - O TO - T TO – TO***	**Year Three** ***TO - TO, developing to HTO - TO or HTO - HTO***
- = signs and missing numbers 7 - 3 = □ □ = 7 - 3 7 - □ = 4 4 = □ - 3 □ - 3 = 4 4 = 7 - □ □ - ∇ = 4 4 = □ - ∇	**- = signs and missing numbers** Continue using a range of equations as in Year 1 but with appropriate numbers. Extend to 14 + 5 = 20 - □ **The Empty Number Line for finding difference by**	**- = signs and missing numbers** Continue using a range of equations as in Year 1 and 2 but with appropriate numbers. **Column method:**



Understand subtraction as 'take away'

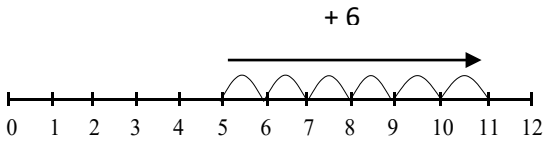
Use practical methods to support the subtraction of a one-digit number from a one digit or two-digit number and a multiple of 10 from a two-digit number.

6 – 1 = 5

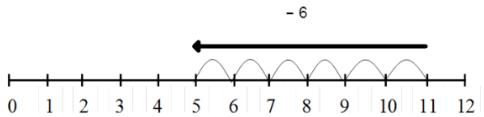


Number line: Find a 'difference' by counting up in 1s;
Use informal written methods to support the subtraction of a one-digit number from a one digit or two-digit number and a multiple of 10 from a two-digit number.

I have saved 5p. The socks that I want to buy cost 11p. How much more do I need in order to buy the socks?



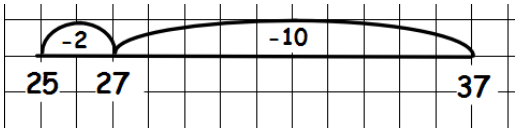
Additionally, use the number line showing subtraction.



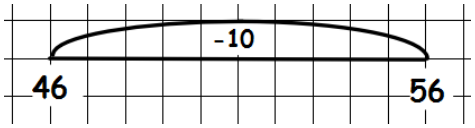
Use the vocabulary related to addition and subtraction and symbols to describe and record addition and subtraction number sentences.
Recording by:
- drawing jumps on number lines

counting back: Bridging through multiple of 10

37 – 12 = 25



56 – 10 = 46



Partitioning: Use known number facts and place value to subtract (partition number to be subtracted only)

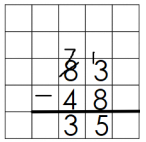
37 – 12 = 37 – 10 – 2
= 27 – 2
= 25

This method should be introduced latest by the Spring Term of Year 2:

Compact decomposition (For numbers which are not carried over)

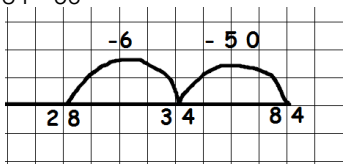
$$\begin{array}{r} 3\ 2 \\ -\ 1\ 1 \\ \hline 2\ 1 \end{array}$$

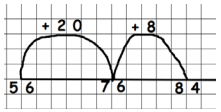
Column method: (For numbers which **do** involve



If children are unable to understand column method do the methods below first, to explain place value.

The Empty Number Line for finding difference by counting back: counting back in tens and ones e.g.
84 – 56 =



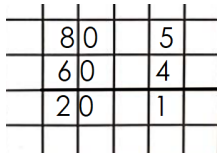


Counting up
84 – 56 = **28**

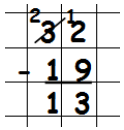
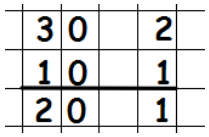
Partitioning: Use known number facts and place value to subtract

(partition number to be subtracted only)
77 – 12 = 77 – 10 – 2
= 67 – 2
= 65

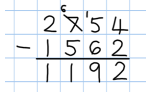
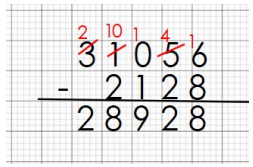
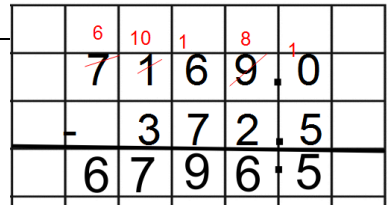
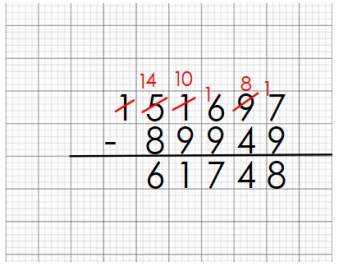
Expanded decomposition
Move to decomposition that does not involve exchanging: 85 – 64

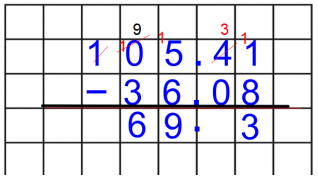


20 + 1 = 21

- drawing jumps on blank number lines	carrying over)  **If children are unable to understand column method do the method below first, to explain place value.** **<u>Expanded decomposition</u>** Move to decomposition that does not involve exchanging ; **32 – 11**  **20 + 1 = 21**	

WRITTEN METHODS FOR SUBTRACTION ~ PROGRESSION FROM Y4 - Y6

Year Four ***Subtract up to 4 digits HOU - TO/ HTO - HTO/ ThHTO - HTO/ ThHTO - ThHTO and £.p***	**Year Five** ***Subtract up to 5 digits including using formal written methods and decimals with up to two places.***	**Year Six** ***Subtract with increasingly large and more complex numbers and decimal values.***
5 **<u>Column method:</u>**  Extend to numbers with at least four digits and decimals **<u>in the context of money.</u>** 	**<u>Column Method</u>**  **<u>Column Method</u>** 	**<u>Column Method</u>** 

<u>Partitioning(to be used only when children are not secure on place value for a short period of time) :</u> **<u>Use known number facts and place value to subtract</u>** (partition number to be subtracted only) 277 – 192 = 277 - 100 - 90 - 2 = 177 – 90 -2 = 87 - 2 = 85 277 – 192 277 – 100 – 90 – 2 277 – 100 177 – 90 87 – 2 = 85 (If children are unable to understand column method do this first to explain place value.)	Subtract numbers with up to 5 digits: ***Revert back to expanded column subtraction if needed.***	 **** Revert back to expanded column subtraction if needed.***

Written methods for multiplication of whole numbers

The aim is that children use mental methods when appropriate, but for calculations that they **cannot** do in their heads they use an efficient written method accurately and with confidence. Children are entitled to be taught and to acquire secure mental methods of calculation and one efficient written method of calculation for multiplication which they know they can rely on when mental methods are not appropriate.

To multiply successfully, children need to be able to:

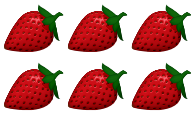
- recall all multiplication facts to 10 × 10;
- partition number into multiples of one hundred, ten and one;
- work out products such as 70 × 5, 70 × 50, 700 × 5 or 700 × 50 using the related fact 7 × 5 and their knowledge of place value;
- add two or more single-digit numbers mentally;
- add multiples of 10 (such as 60 + 70) or of 100 (such as 600 + 700) using the related addition fact, 6 + 7, and their knowledge of place value;
- add combinations of whole numbers using the column method.

Note: *It is important that children's mental methods of calculation are practised and secured alongside their learning and use of an efficient written method for multiplication.*

Year One

Multiply with concrete objects, arrays and pictorial representations.

Multiplication is related to doubling and counting groups of the same size.

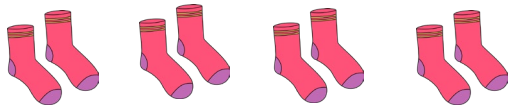


Looking at columns
2 + 2 + 2
3 groups of 2

Looking at rows
3 + 3
2 groups of 3

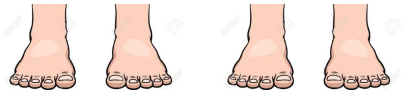
Counting using a variety of practical resources

Counting in 2s e.g. counting socks, shoes, animal's legs…



Counting in 5s e.g. counting fingers, fingers in gloves, toes…

Counting in 10s e.g. all fingers, toes…



Pictures / marks

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

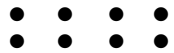
Year Two

(using 2, 5 and 10 times table facts)

x = signs and missing numbers

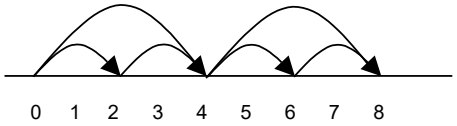
7 x 2 = □ □ = 2 x 7
7 x □ = 14 14 = □ x 7
□ x 2 = 14 14 = 2 x □
□ x ∇ = 14 14 = □ x ∇

Arrays and repeated addition



4 x 2 or 4 + 4
2 x 4 or 2 + 2 + 2 + 2

Grouping on number line:



Partitioning and grid method

Children need to be secure with partitioning numbers into 10s and 1s and partitioning in different ways: 6 = 5 + 1 so double 6 is the same as double five add double one.

AND double 15
10 + 5
↓ ↓
20 + 10 = 30

OR

x	10		5
2	20	10	

20 + 10 = 30

Year Three

(T0 x O)

x = signs and missing numbers

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

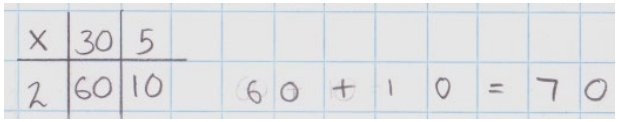
Arrays and repeated addition

Continue to understand multiplication as repeated addition and continue to use arrays (as in Year 2).

Grouping on number line:

Continue to understand multiplication as repeated addition on a number line (as in Year 2).

Partitioning and grid method



x	30	5
2	60	10

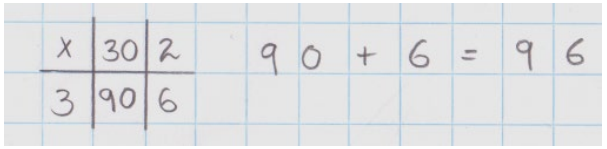
60 + 10 = 70

Use known facts and place value to carry out simple multiplications

Use the same method as above (partitioning), e.g.

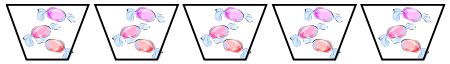
3 x 3 = 9, therefore 30 x 3 = 90

32 x 3 = 96

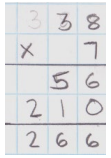
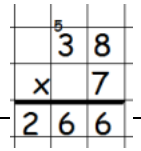
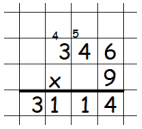
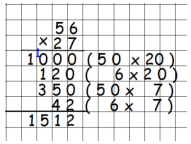
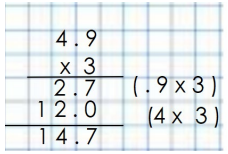
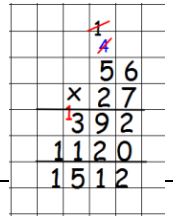
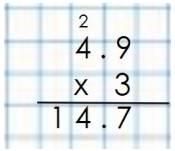
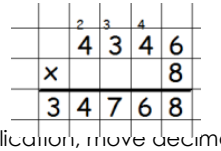
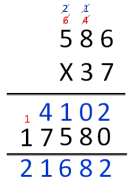


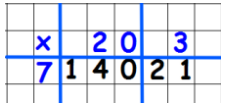
x	30	2
3	90	6

90 + 6 = 96



WRITTEN METHODS FOR MULTIPLICATION ~ PROGRESSION FROM Y4 - Y6

Year Four *(TO x O/ HTO X O)*	**Year Five** *(TO x O/ TO x TO/ HTO x O/ HTO x TO/ ThHTO x O/ ThHTO x TO)*	**Year Six** ***(Multiply numbers with at least 4-digits by a 2-digit numbers and 1 and 2 digit whole numbers with numbers with up to 2 decimals places)***
x = signs and missing numbers Continue using a range of equations with appropriate sized numbers **Expanded short multiplication** (multiplication by a single digit) Children should describe what they do by referring to the actual values of the digits in the columns. For example, the second step in 38 × 7 is 'thirty multiplied by seven', not 'three times seven', although the relationship 3 × 7 should be stressed.  **Column method for short multiplication** The recording is reduced further, with carry digits recorded above the multiplication. 	**x = signs and missing numbers** Continue using a range of equations with appropriate sized numbers **Expanded short multiplication:** (See year 4 example) **Column Method for short multiplication**  **Expanded long multiplication** (multiplication by 2 or more digits)   **Long multiplication:** 	**x = signs and missing numbers** Continue using a range of equations with appropriate sized numbers **Partitioning and grid method** Estimate an answer first: 372 x 24 is approximately 400 x 20 = 8000 Extend to decimals with up to two decimal places. **Expanded short multiplication** (See year 4 example) **Extend to decimals with up to 2dp**  **Short multiplication**  (with decimal multiplication, move decimal down to answer column) **Expanded long multiplication** (see year 5 example) Children who are already secure with column multiplication for TO × O and TO × TO should have little difficulty in using the same method for HT0 × TO or applying decimals. **Long multiplication** 

If children are unable to understand short multiplication method, please follow the method below. **<u>Partitioning and grid method</u>** Estimate an answer first: 23 x 7 is approximately 20 x 10 = 200  140 + 21 = 161	**Long multiplication should be introduced latest by summer term.**	(with decimal multiplication, move decimal down to answer column)

Written methods for division of whole numbers

The aim is that children use mental methods when appropriate, but for calculations that they **cannot** do in their heads they use an efficient written method accurately and with confidence. Children are entitled to be taught and to acquire secure mental methods of calculation and one efficient written method of calculation for division which they know they can rely on when mental methods are not appropriate.

To divide successfully in their heads, children need to be able to:

- understand and use the vocabulary of division – for example in 18 ÷ 3 = 6, the 18 is the dividend, the 3 is the divisor and the 6 is the quotient;
- partition two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways;
- recall multiplication and division facts to 10 × 10, recognise multiples of one-digit numbers and divide multiples of 10 or 100 by a single-digit number using their knowledge of division facts and place value;
- know how to find a remainder working mentally – for example, find the remainder when 48 is divided by 5;
- understand and use multiplication and division as inverse operations.

Note: *It is important that children's mental methods of calculation are practised and secured alongside their learning and use of an efficient written method for division.*

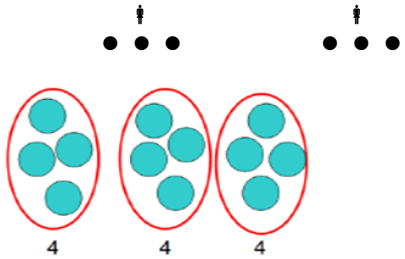
To carry out written methods of division successfully, children also need to be able to:

- understand division as repeated subtraction;
- estimate how many times one number divides into another – for example, how many sixes there are in 47, or how many 23s there are in 92;
- multiply a two-digit number by a single-digit number mentally;
- subtract numbers using the column method.

WRITTEN METHODS FOR DIVISION ~ PROGRESSION FROM Y1 – Y3		
Year One	**Year Two** *(using 2, 5 and 10 times table facts)*	**Year Three** ***(TO ÷ O)***
Sharing	**÷ = signs and missing numbers**	**÷ = signs and missing numbers**

Requires secure counting skills.
Use practical activities that involve sharing, distributing cards when playing a game, putting objects onto plates, into cups, hoops etc.

6 sweets are shared between 2 people. How many do they have each?



12 shared between 3 is 4

Grouping
Sorting objects into 2s / 3s/ 4s etc
How many pairs of socks are there?

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

There are 12 crocus bulbs. Plant 3 in each pot. How many pots are there?

Jo has 12 Lego wheels. How many cars can she make?

Five children share **15** ice creams into equal parts. How many ice creams will each child have?

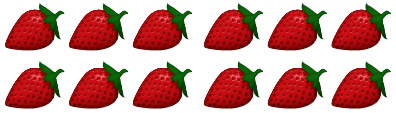
6 ÷ 2 = □ □ = 6 ÷ 2
6 ÷ □ = 3 3 = 6 ÷ □
□ ÷ 2 = 3 3 = □ ÷ 2
□ ÷ ∇ = 3 3 = □ ÷ ∇

Grouping and sharing
Practical grouping and sharing as Year 1 but with larger numbers.

20 cupcakes are shared between 5 children. How many cupcakes do they each get?

Count up to 100 objects by grouping them and counting in tens, fives or twos;

Sharing: *There are 12 strawberries. They are shared between 4 people. How many do they have each?*



Find one half, one quarter and three quarters of shapes and sets of objects.

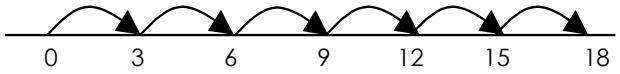
Continue using a range of equations as in Year 2 but with appropriate numbers.

Understand division as sharing and grouping

18 ÷ 3 can be modelled as:
Sharing – 18 shared between 3

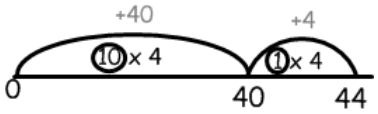
OR

Grouping - How many 3's make 18?



Grouping using a number line- forward jumps in multiples of the divisor:

44 ÷ 4 = 11



10 + 1 = 11

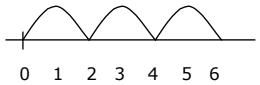
Chunking method:
64 ÷ 4 =

Grouping: *How many 2s make 6? How many 4s are there in 16?*

In PE, 30 children get into teams of 5 to play a game. How many teams are there?

Grouping using a number line

6 ÷ 2 can be modelled as:



In the context of money count forwards and backwards using 2p, 5p and 10p coins

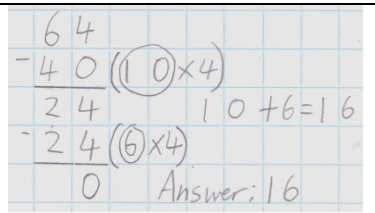
Half and double:

½ of 90
= 90 ÷ 2 = 45

¼ of 36
= 36 ÷ 4 = 9
or 36 ÷ 2 =18, 18 ÷ 2 = 9

double 45= 45 x 2 = 90

(This method should be introduced latest by the Spring Term)



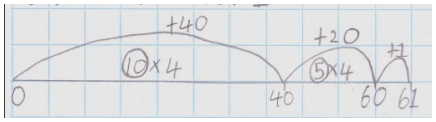
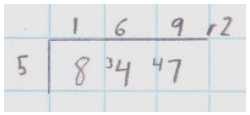
And with remainders:

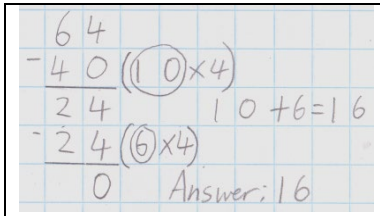
96 ÷ 7

96
- 70 (10 x 7)
26
21 (3 x 7)
5 Answer: 13 r. 5

(**This method should be introduced latest by the Summer Term**)

WRITTEN METHODS FOR DIVISION ~ PROGRESSION FROM Y4 - Y6

Year Four *(TO ÷ O/ HTO ÷ O)*	**Year Five** *(TO ÷ O/ TO ÷ TO/ HTO ÷ O/ HTO ÷ TO/ ThHTO ÷ O/ ThHTO ÷ TO)*	**Year Six** *(Divide numbers with at least 4-digits by a 2-digit whole number and decimals)*
÷ = signs and missing numbers Continue using a range of equations as in Year 2 but with appropriate numbers. **Chunking method:** 64 ÷ 4 =	**Grouping using a number line- forward jumps in multiples of the divisor: (including remainders)**  Quotients to be expressed as fractions or decimal fractions 61 ÷ 4 = 15 r 1 = 15 ¼ or 15.25	**Short Division Method**  **Long division** **425 ÷ 25 =**



And with remainders:

96 ÷ 7

96
- 70 (10 x 7)
26
- 21 (3 x 7)
5 Answer: 13 r. 5

Extend to division of 3 digits by 1 digit

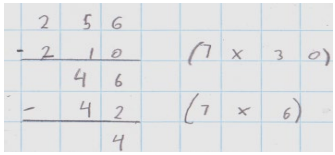
Chunking method

256 ÷ 7 =

Estimate first: 256 ÷ 7 lies between 210 ÷ 7 = 30 and 280 ÷ 7 = 40

* Partition the dividend (256) into multiples of the divisor (7):

e.g. **256 = 210 + 46**



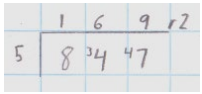
30 + 6 = 36 r4 **256 ÷ 7 = 36 r4**

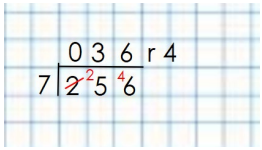
Short Division (when the divisor is a single digit)

quotient

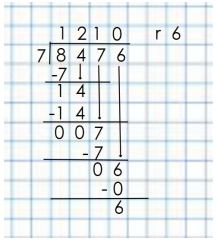
divisor 5 | 847 dividend

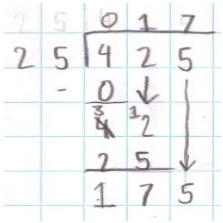
Considering each column starting from the left. Write down how many times your divisor goes into the first number of the dividend (8). If there is a remainder, that is okay. Write down your remainder to the left of the next digit in the dividend. Continue. Repeat steps 1-3 until you are done:



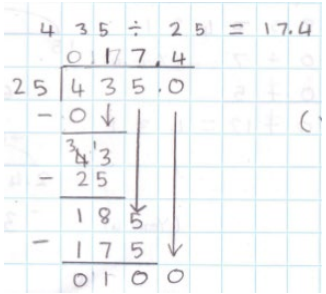


Long division: ((This method should be introduced latest in the Summer Term)





(Move on to remainders and decimals)



Appendix 1

Reordering

Sometimes a calculation can be more easily worked out by changing the order of the numbers. The way in which children rearrange numbers in a particular calculation will depend on which number facts they have instantly available to them.

It is important for children to know when numbers can be reordered (eg 2 + 5 + 8 = 8 + 2 + 5 or 15 + 8 – 5 = 15 – 5 + 8 or 23 – 9 – 3 = 23 – 3 – 9) and when they cannot (eg 8 – 5 ≠ 5 – 8).

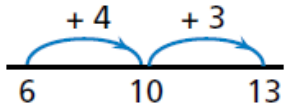
The strategy of changing the order of numbers only really applies when the question is written down. It is difficult to reorder numbers if the question is presented orally.

Appendix 2

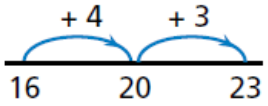
Partitioning – Bridging through multiples of 10

An important aspect of having an appreciation of number is to know when a number is close to 10 or a multiple of 10: to recognise, for example, that 47 is 3 away from 50, or that 96 is 4 away from 100. When adding or subtracting mentally, it is often useful to make use of the fact that one of the numbers is close to 10 or a multiple of 10 by partitioning another number to provide the difference. The use of an empty number line where the multiples of 10 are seen as 'landmarks' is helpful and enables children to have an image of jumping forwards or backwards to these 'landmarks'. For example:

$6 + 7 = 6 + 4 + 3$



In the case of subtraction, bridging through the next 10 or multiple of 10 is a very useful method (often termed 'shopkeeper's subtraction'; it is the method used almost universally with money). So the change from £1 for a purchase of 37p is carried out thus: '37 and 3 is 40 and 10 is 50 and 50 is £1'. The use of actual coins, or the image of coins, helps to keep track of the subtraction. The empty number line can provide an image for this method when the subtraction does not involve money. The calculation 23 – 16 can be built up as an addition:



Appendix 3

Partitioning - Using multiples of 10 and 100

It is important for children to know that numbers can be partitioned into, for example, hundreds, tens and ones, so that 326 = 300 + 20 + 6. In this way, numbers are seen as wholes, rather than as a collection of single-digits in columns. This way of partitioning numbers can be a useful strategy for addition and subtraction. Both numbers involved can be partitioned in this way, although it is often helpful to keep the first number as it is and to partition just the second number:

30 + 47 = 30 + 40 + 7

25 + 14 = 20 + 5 + 10 + 4

= 20 + 10 + 5 + 4

68 – 32 = 60 + 8 – 30 – 2

= 60 – 30 + 8 – 2

Appendix 4

<u>Partitioning – Compensating</u>

This strategy is useful for adding numbers that are close to a multiple of 10, for adding numbers that end in 1 or 2, or 8 or 9. The number to be added is rounded to a multiple of 10 plus a small number or a multiple of 10 minus a small number. For example, adding 9 is carried out by adding 10 and then subtracting 1 (34 + 9 = 34 + 10 –1), and subtracting 18 is carried out by subtracting 20 and adding 2 (84 – 18 = 84 – 20 + 2). A similar strategy works for decimals, where numbers are close to whole numbers or a whole number of tenths. For example, 1.4 + 2.9 = 1.4 + 3 – 0.1 or 2.45 – 1.9 = 2.45 – 2 + 0.1