Culcheth Primary School

Where Learning is Fun!

Maths Calculation Policy 2015

Culcheth Community Primary School
Maths Calculation Policy

Contained within this policy are the standards that we expect the **majority** of children at Culcheth Community Primary School to achieve in addition, subtraction, multiplication and division in each year group. However, some children will not be ready for the age related expectations and some will be working beyond these expectations. Class teachers are expected to evaluate the needs of individual children when considering which methods of calculation should be taught.

It is imperative that children develop a secure sense of '**number**' before attempting written methods, understanding place value and relative size of numbers when compared to others.

Children should not be made to go onto the next stage if:
a) they are not ready.
b) they are not confident.
As children move through the school a greater emphasis will be placed on:
- approximating answers before calculating.
- checking answers after completing calculations using an appropriate strategy.
- Considering if a mental calculation would be appropriate before using written methods.

As a staff, the following decisions have been made to ensure continuity in teaching throughout the school:

Children in Key Stage 1 will be taught the terms '**tens**' and '**ones**' when partitioning numbers. The term 'units' will be introduced as an alternative expression for 'ones' and in key Stage 2 the term units may be used more frequently. Once the children have a concrete understanding of the term 'ones' they may be introduced to the term 'units'.

When annotating the partitioning of numbers Key Stage 1 teachers will use the following:

100's	10's	1's
3	6	8

- In Key Stage 2, when children are secure in their understanding of the value of each digit in a number, they may move onto using the annotations of H T U in preparation for introducing tenths (Tth), hundredths (Hth) and thousandths (Thth).
- To ensure children make the link between subtraction and the term 'difference', difference will be taught by counting back from the larger number in Key Stage 1.
- As children move into Key Stage 2 and they have a concrete understanding between the term '*difference*' and '*subtraction*', children may be introduced to the method of '*counting on*' (for example when completing questions such as 'find the difference between 997 and 1007 – children will be taught to add 3 to make 100 and then add a further 7 to reach 1007 giving a difference of 10.

MENTAL CALCULATION SKILLS FOR ADDITION AND SUBTRACTION

Working mentally, with written jotting to support if necessary, children will be taught to:

Year1

- add or subtract a pair of single-digit numbers, e.g. 4 + 5, 8 – 3
- add or subtract a single-digit number to or from a teens number, e.g. 13 + 5, 17 – 3
- add or subtract a single-digit to or from 10, and add a multiple of 10 to a single-digit number, e.g. 10 + 7, 7 + 30
- add near doubles, e.g. 6 + 7
- represent and use number bonds and related subtraction facts within 20.

Year2

- add or subtract a pair of single-digit numbers, including crossing 10, e.g. 5 + 8, 12 – 7
- add any single-digit number to or from a multiple of 10, e.g. 60 + 5
- subtract any single-digit number from a multiple of 10, e.g. 80 – 7
- add or subtract a single-digit number to or from a two-digit number, including crossing the tens boundary, e.g. 23 + 5, 57 – 3, then 28 + 5, 52 – 7
- add or subtract 2, 2 digit numbers, e.g. 23 + 26
- add 3, 1 digit numbers, e.g. 6 + 2 + 5 =
- add or subtract a multiple of 10 to or from any two-digit number, e.g. 27 + 60, 72 – 50
- add 9, 19, 29, … or 11, 21, 31, …
- add near doubles, e.g. 13 + 14, 39 + 40
- recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100.

Year 3

- add and subtract numbers mentally including:
  - a three digit number and ones
  - a three digit number and tens
  - a three digit number and hundreds
- add or subtract a two-digit number to or from a multiple of 10, e.g. 50 + 38, 90 – 27
- add and subtract two-digit numbers e.g. 34 + 65, 68 – 35
- add near doubles, e.g. 18 + 16, 60 + 70

Year 4

- add or subtract any pair of two-digit numbers, including crossing the tens and 100 boundary, e.g. 47 + 58, 91 – 35
- add or subtract a near multiple of 10, e.g. 56 + 29, 86 – 38
- add near doubles of two-digit numbers, e.g. 38 + 37
- add or subtract two-digit or three-digit multiples of 10, e.g. 120 – 40, 140 + 150, 370 – 180

Year 5

- add or subtract a pair of two-digit numbers or three-digit multiples of 10, e.g. 38 + 86, 620 – 380, 350+ 360
- add or subtract a near multiple of 10 or 100 to any two-digit or three-digit number, e.g. 235 + 198
- find the difference between near multiples of 100, e.g. 607 – 588, or of 1000, e.g. 6070 – 4087
- add or subtract any pairs of decimal fractions each with ones (units) and tenths, e.g. 5.7 + 2.5, 6.3 – 4.8

Year 6

- add or subtract pairs of decimals with ones (units), tenths or hundredths, e.g. 0.7 + 3.38
- find doubles of decimals each with ones (units) and tenths, e.g. 1.6 + 1.6
- add near doubles of decimals, e.g. 2.5 + 2.6
- add or subtract a decimal with ones (units) and tenths, that is nearly a whole number, e.g. 4.3 + 2.9, 6.5 – 3.8

Children will continue to use and develop methods of counting on and back; partitioning and adjusting, and knowledge of place value to develop strategies for mental calculation throughout each year group (from Reception to Year 6).

MENTAL CALCULATION SKILLS FOR MULTIPLICATION AND DIVISION

Working mentally, with jottings if necessary, children will be taught to:

Year 1

- count on from and back to zero in ones, twos, fives & tens
- double the numbers 1 - 10

Year 2

- double any multiple of 5 up to 50, e.g. double 35
- halve any multiple of 10 up to 100, e.g. halve 90
- find half of even numbers to 40
- find the total number of objects when they are organised into groups of 2, 5 or 10
- have instant recall of the multiples of 2, 5 and 10 (including corresponding division facts e.g. 2 x 5 = 10 so children also know that 10 ÷ 5 = 2 or 10 ÷ 2 = 5).

Year 3

- double any multiple of 5 up to 100, e.g. double 35
- halve any multiple of 10 up to 200, e.g. halve 170
- multiply one-digit or two-digit numbers by 10 or 100, e.g. 7 × 100, 46 × 10, 54 x 100
- find unit fractions of numbers and quantities involving halves, thirds, quarters, fifths and tenths
- have instant recall of the multiples of 2, 5 and 10 (Y2 expectation) and 3 , 4 and 8 (including corresponding division facts).

Year 4

- double any two-digit number, e.g. double 39
- double any multiple of 10 or 100, e.g. double 340, double 800, and halve the corresponding multiples of 10 and 100
- halve any even number to 200
- multiply and divide numbers to 1000 by 10 and then 100 (whole-number answers), e.g. 325 × 10, 42 × 100, 120 ÷ 10, 600 ÷ 100, 850 ÷ 10
- multiply a multiple of 10 to 100 by a single-digit number, e.g. 40 × 3
- multiply numbers to 20 by a single-digit, e.g. 17 × 3
- identify the remainder when dividing by 2, 5 or 10
- give the factor pair associated with a multiplication fact, e.g. identify that if 2 x 3 = 6 then 6 has the factor pair 2 and 3
- have instant recall of the multiples of all times tables up to 12 x 12 (including corresponding division facts).

Year 5

- multiply and divide numbers mentally drawing upon known facts
- multiply two-digit numbers by 5 or 20, e.g. 320 × 5, 14 × 20
- multiply by 25 or 50, e.g. 48 × 25, 32 × 50
- double three-digit multiples of 10 to 500, e.g. 380 × 2, and find the corresponding halves, e.g. 760 ÷ 2
- find the remainder after dividing a two-digit number by a single-digit number, e.g. 27 ÷ 4 = 6 R 3
- multiply and divide whole numbers and decimals by 10, 100 or 1000, e.g. 4.3 × 10, 0.75 × 100, 25 ÷ 10, 673 ÷ 100, 74 ÷ 100
- multiply pairs of multiples of 10, e.g. 60 × 30, and a multiple of 100 by a single digit number, e.g. 900 × 8
- divide a multiple of 10 by a single-digit number (whole number answers) e.g. 80 ÷ 4, 270 ÷ 3
- find fractions of whole numbers or quantities, e.g. 2/3 of 27, 4/5 of 70 kg
- find 50%, 25% or 10% of whole numbers or quantities, e.g. 25% of 20 kg, 10% of £80
- identify multiples and factors and find factor pairs for numbers to 100, e.g. 30 has the factor pairs 1 × 30, 2 × 15, 3 × 10 and 5 × 6 and common factors of two numbers.
- know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers.
- recognise and use square numbers and cube numbers, and the notation for squared and cubed.
- establish whether a number up to 100 is prime and recall prime numbers up to 19.

Year 6

- continue to multiply and divide mentally drawing upon known facts
- multiply pairs of two-digit and single-digit numbers, e.g. 28 × 3
- divide a two-digit number by a single-digit number, e.g. 68 ÷ 4
- divide by 25 or 50, e.g. 480 ÷ 25, 3200 ÷ 50
- double decimals with units and tenths, e.g. double 7.6, and find the corresponding halves, e.g. half of 15.2
- multiply pairs of multiples of 10 and 100, e.g. 50 × 30, 600 × 20
- divide multiples of 100 by a multiple of 10 or 100 (whole number answers), e.g. 600 ÷ 20, 800 ÷ 400, 2100 ÷ 300
- multiply and divide two-digit decimals by a 1 digit number, such as 0.8 × 7, 4.8 ÷ 6
- find 10% or multiples of 10%, of whole numbers and quantities, e.g. 30% of 50 ml, 40% of £30, 70% of 200g
- simplify fractions by cancelling
- scale up and down using known facts, e.g. given that three oranges cost 24p, find the cost of four oranges
- identify common factors, multiples and prime numbers.

Children will continue to recognise, develop and use patterns of last digits; partitioning and adjusting; doubling and halving, and knowledge of multiplication and division facts to develop strategies of multiplication facts to develop strategies for mental calculation.

ADDITION

MENTAL CALCULATIONS (on going)

These are a **selection** of mental calculation strategies, many others will also be taught and explored. Children are encouraged to explain their own mental calculation strategies and to compare these to strategies used by others.

- **Mental recall of number bonds**

6 + 4 = 10 □ + 3 = 10

25 + 75 = 100 19 + □ = 20

- **Use near doubles**

6 + 7 = double 6 + 1 = 13

- **Addition using partitioning and recombining**

34 + 45 = (30 + 40 = **70**) + (4 + 5 = **9**) **70 + 9 = 79**

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

86 + 57 = 143 (by counting on in tens and then in ones)

460 - 300 = 160 (360, 260, 160 - by counting back in hundreds)

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

24 + 19 = 24 + 20 – 1 = 43

458 + 71 = 458 + 70 + 1 = 529

- **Use the relationship between addition and subtraction**

36 + 19 = 55 19 + 36 = 55

55 – 19 = 36 55 – 36 = 19

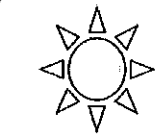
Many mental calculation strategies will continue to be used. They are not replaced by written methods, but written methods may be used when a calculation cannot be completed mentally due to the size of the numbers involved.

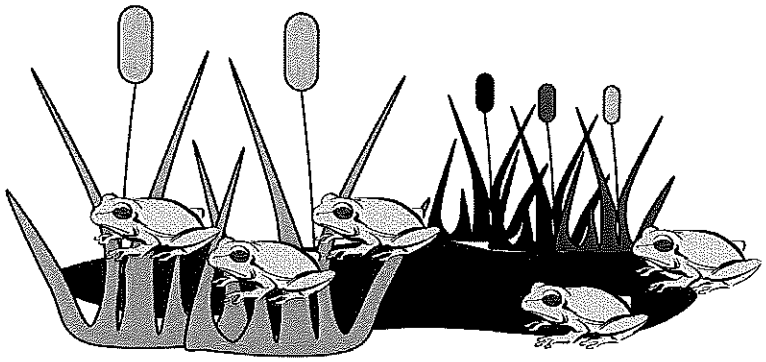
Reception

Children are encouraged to develop a mental picture of the number system to use for addition. Regular counting on and back as well as lots of practical work

and real life problems will contribute to developing the children's concrete understating of addition.

e.g There are 3 frogs in a pond and 2 more jump in, how many are there now?

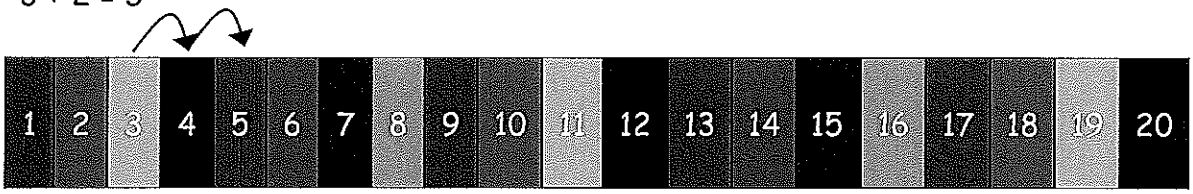




3 + 2 = 5

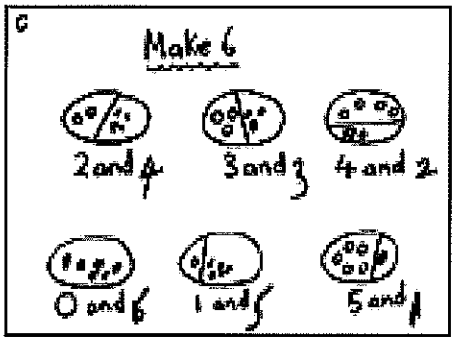
Teachers *demonstrate* and children use a number track to support addition

3 + 2 = 5



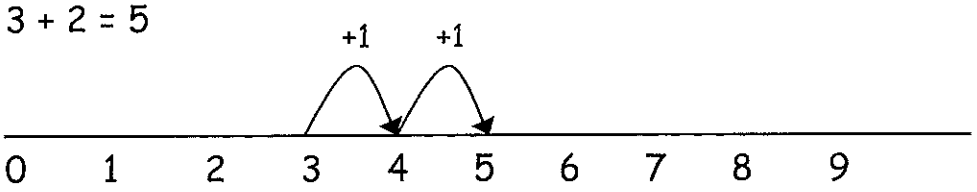
Year 1

- Children develop ways of recording calculations using pictures, etc.



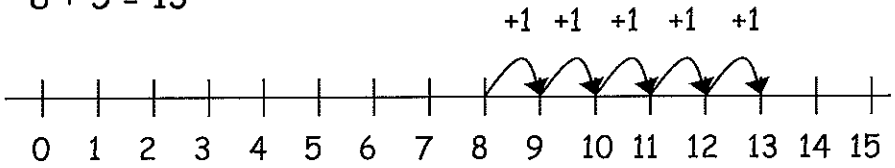
Addition is seen as counting total number of objects in two or more groups. Children move from using a number track, to using a numberline. They use numberlines and practical resources to support calculation and teachers ***demonstrate*** the use of the numberline.

3 + 2 = 5

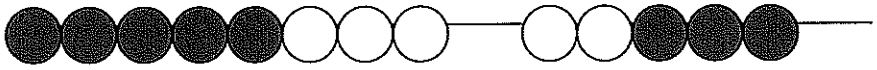


Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones.

8 + 5 = 13



Bead strings or bead bars can be used to illustrate addition including bridging through ten by counting on 2 then counting on 3.

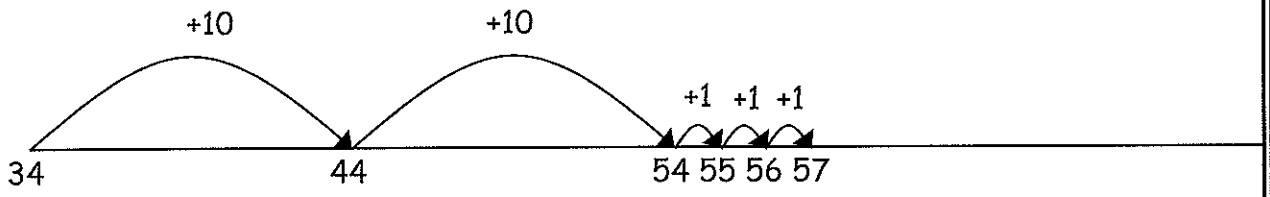


Year 2

Children will begin to use 'empty number lines' themselves starting with the larger number and counting on.

- First counting on in tens and ones.

34 + 23 = 57

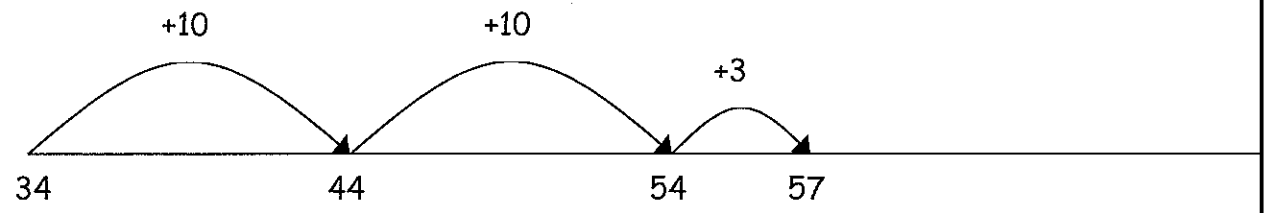


NOTE:

Children will make use of 100 squares to support addition of multiples of 10.

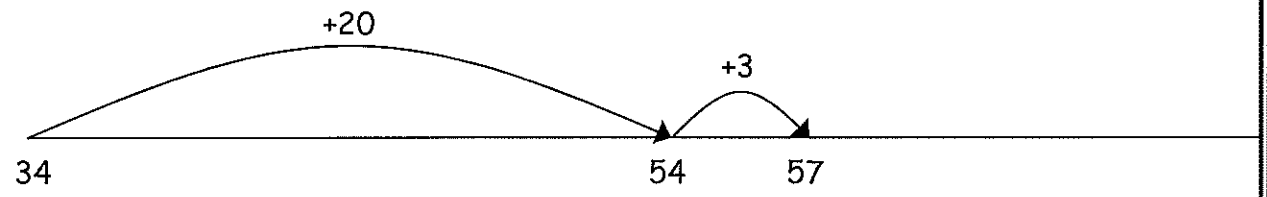
- Then helping children to become more efficient by adding the ones (units) in one jump (by using the known fact 4 + 3 = 7).

34 + 23 = 57



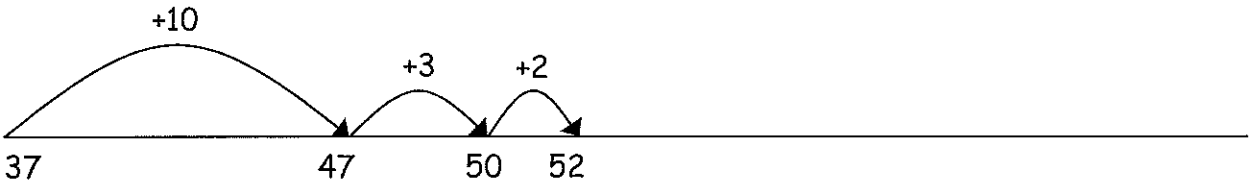
- Followed by adding the tens in one jump and the units in one jump.

34 + 23 = 57



- Children will then be expected to use their knowledge of number bonds to bridge through ten to become more efficient.

37 + 15 = 52

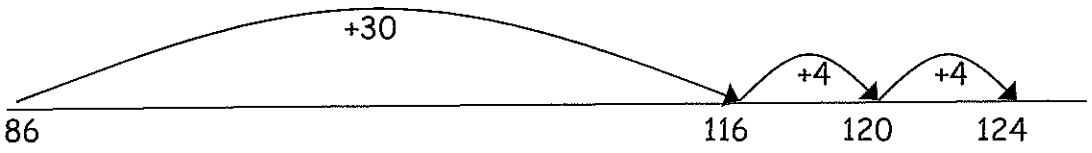


Year 3

Children will continue to use empty number lines with increasingly large numbers (up to 3 digits), including compensation where appropriate.

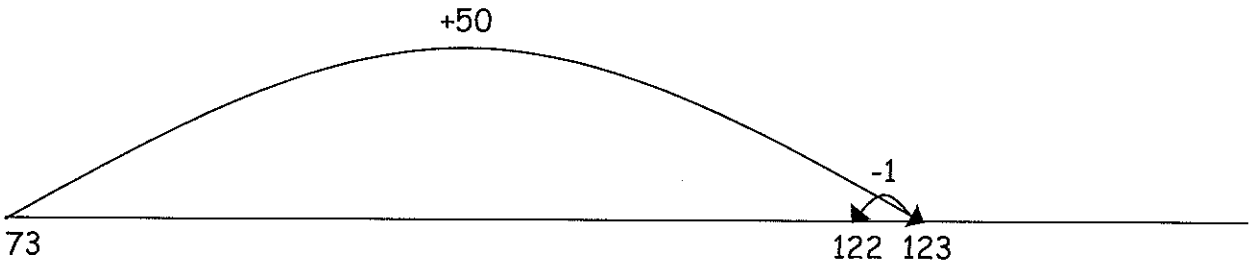
- Count on from the largest number irrespective of the order of the calculation.

38 + 86 = 124



- Compensation

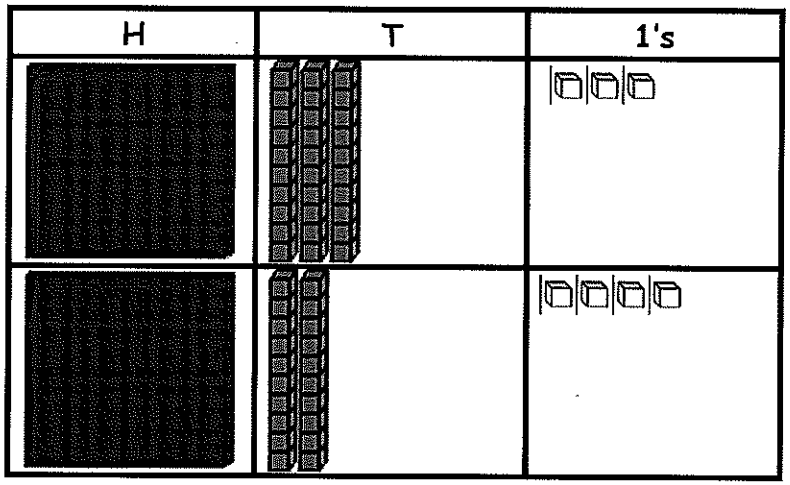
49 + 73 = 122



- Children will begin to use informal pencil and paper methods (jottings) to support, record and explain partial mental methods building on existing mental strategies.

- Use concrete resources (e.g. base 10) alongside written methods to develop concrete understanding of columnar addition, adding the least significant digit first.

```
  133
+ 124
-----
```



		7	(3+4)
	5	0	(30+20)
2	0	0	(100+100)
2	5	7	

- Adding the least significant digits first

```
  67
+ 24
  11 ( 7 + 4)
  80 (60 + 20)
  91
```

```
  267
+  85
   12 ( 7 + 5)
  140 (60 + 80)
  200
  352
```

Year 4

Children will revisit methods from Year 3, adding the least significant digits first and will then begin to carry below the line.

625	783	3673
+ 48	+ 42	+ 855
673	825	4528
1	1	11

Using similar methods, children will:

- ✓ *add several numbers with up to 4 digits.*
- ✓ *begin to add two or more three-digit sums of money, with or without adjustment from the pence to the pounds;*
- ✓ *know that the decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. £3.59 + 78p.*

Year 5

- Children should extend the short method to whole numbers with more than 4 digits.

58762	358725
+ 47545	+ 67523
106307	426248
1 11	1 1 1

Year 6

- Children should extend the short method to numbers with any number of digits, including decimal numbers.

7648	6584	62.89	42
+ 1486	+ 5848	+ 51.98	6432
9134	12432	114 .8 7	786
1 11	1 11	1 1	3
			+ 4681
			11944
			1 21

Using similar methods, children will

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

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

SUBTRACTION

MENTAL CALCULATIONS (on going)

These are a **selection** of mental calculation strategies:

- **Mental recall of addition and subtraction facts**

10 – 6 = 4 17 - □ = 11

20 - 17 = 3 10 - □ = 2

- **Find a small difference by counting back**

82 – 79 = 3

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

86 - 52 = 34 (by counting back in tens and then in ones)

460 - 300 = 160 (by counting back in hundreds)

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

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

458 - 71 = 458 - 70 - 1 = **387**

- **Use the relationship between addition and subtraction**

36 + 19 = 55 19 + 36 = 55

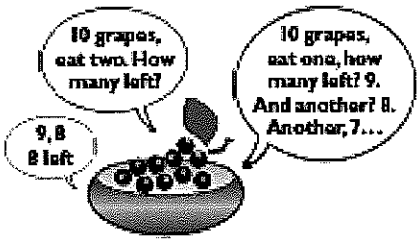
55 – 19 = 36 55 – 36 = 19

Many mental calculation strategies will continue to be used. They are not replaced by written methods, but written methods may be used when a calculation cannot be completed mentally due to the size of the numbers involved.

Reception

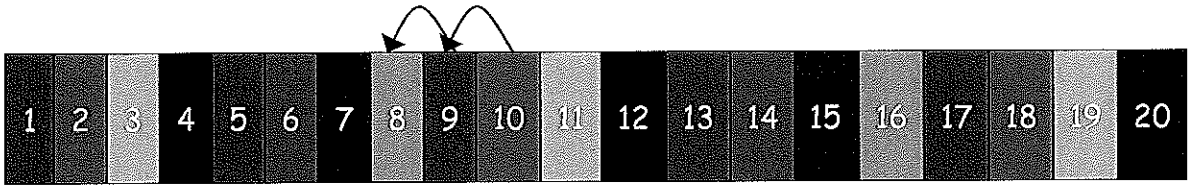
Children have regular experiences of counting back. They also explore the relative size of numbers by exploring for example, 3 cars in one hoop and 7 in another, and answering questions such as *'which hoop has the least number of cars in it?'*. Children use equipment and rhymes (such as 10 green bottles) to complete subtraction questions practically.

e.g.



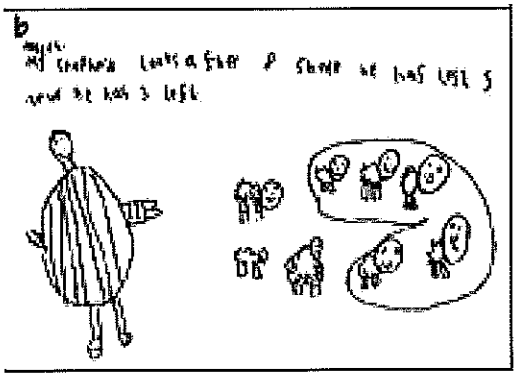
Children then begin to use number tracks to support their onw calculations, counting back in ones.

10 – 2 = 8



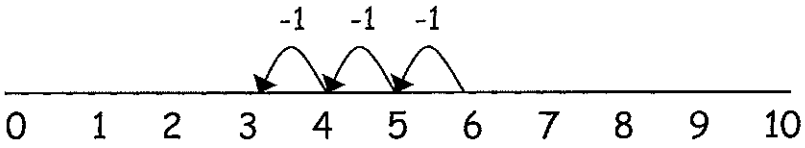
Year 1

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures etc.

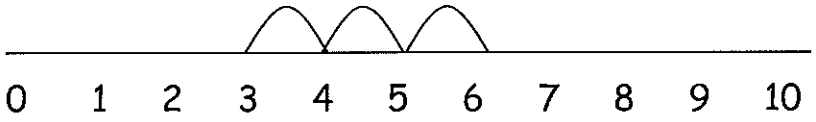


- Children remove one or a group of objects and count the number left. They use numberlines and practical resources to support calculation. Teachers ***demonstrate*** the use of the numberline.

6 - 3 = 3

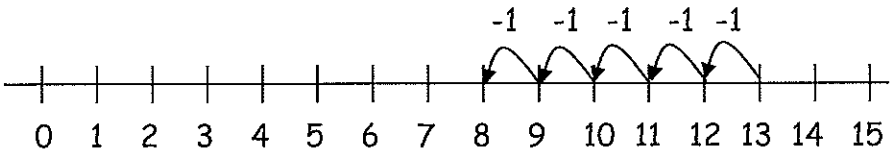


- The numberline should also be used to show that 6 - 3 means the 'difference between 6 and 3' or 'the difference between 3 and 6' and how many jumps they are apart.



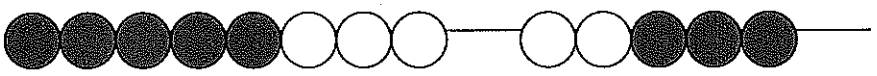
- Children then begin to use numbered lines to support their own calculations - using a numbered line to count back in ones.

13 - 5 = 8



- Bead strings or bead bars can be used to illustrate subtraction including bridging through ten by counting back 3 then counting back 2.

13 - 5 = 8



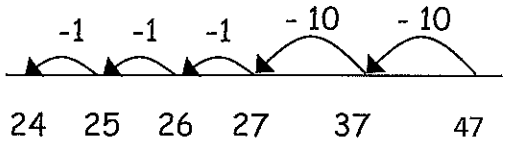
Year 2

- Children will begin to use empty number lines to support calculations.

Counting back

- First counting back in tens and ones.

47 – 23 = 24

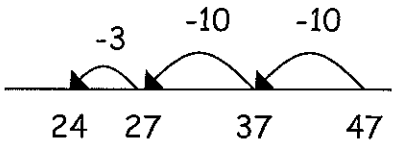


NOTE:

Children will make use of 100 squares to support subtraction of multiples of 10.

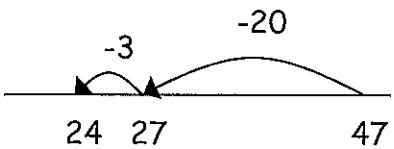
- Then helping children to become more efficient by subtracting the units in one jump (by using the known fact 7 – 3 = 4).

47 – 23 = 24



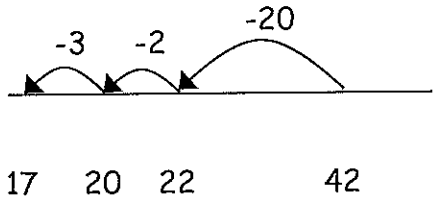
- Subtracting the tens in one jump and the units in one jump.

47 – 23 = 24



- Bridging through ten can help children become more efficient.

42 - 25 = 17



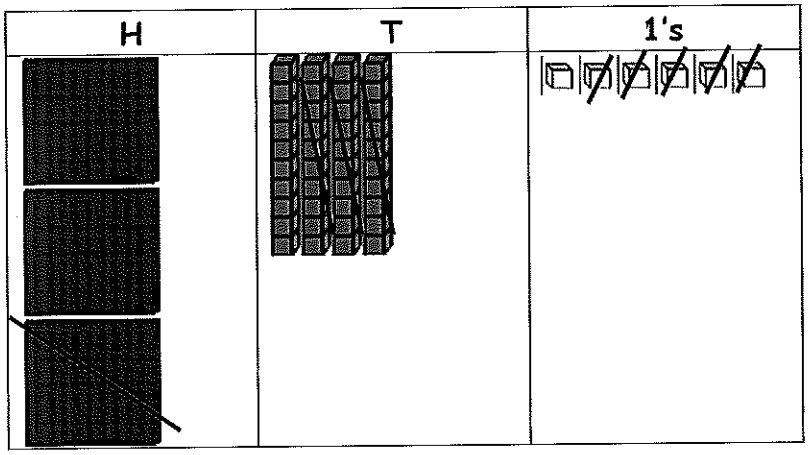
Year 3

- Children will continue to use empty number lines with increasingly large numbers.
- Children will begin to use formal written methods of columnar subtraction of numbers with up to 3 digits, building on existing mental strategies.

Partitioning and decomposition

- This process should be demonstrated using arrow cards to show the partitioning and physical pieces of apparatus (such as lolly sticks, base 10 materials) to show the decomposition of the number.

346
135
___



1. Partition the number using base 10 materials.
2. Subtract the 1's (e.g. 6 - 5)
3. Subtract the tens (40 - 30)
4. Subtract the hundreds (300-100)
5. Leaving the answer.

- **NOTE** When solving the calculation 346 - 135, children should know that 135 **does NOT EXIST AS AN AMOUNT** it is what you are subtracting

from the other number. Therefore, when using physical apparatus such as tens and ones, children would need to count out only the 346.

```
  389  =   300  +   80  +  9
- 157      100  +   50  +  7
           200  +   30  +  2  = 232
```

- ***Initially, the children will be taught using examples that do not need the children to exchange.***

From this the children will begin to exchange.

```
  71   =        =
- 46
```

This method should be modelled with base 10 materials, to demonstrate exchanging ones for tens etc.

```
Step 1    70  +  1
        - 40  +  6

Step 2    60  +  11
        - 40  +  6
          20  +  5  =  25
```

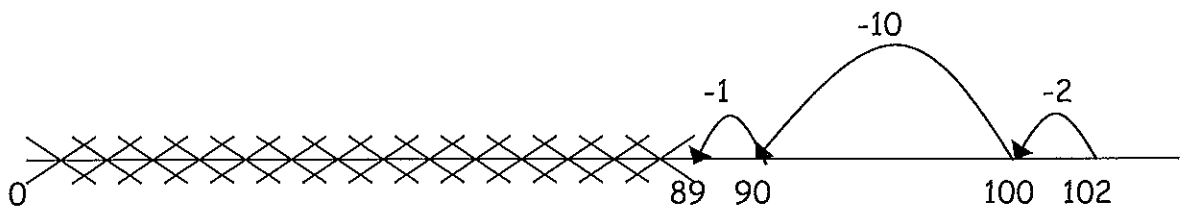
The calculation should be read as e.g. take 6 from 1.

- This would be recorded by the children as

```
    60
   ~~70~~  +  11
 - 40   +   6
   20   +   5   = 25
```

Children should know that ones line up under ones, tens under tens, and so on. Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line should be used. Children remain to be encouraged to count back until their understanding of '*difference*' is concrete enough to introduce '*counting on*'.

102 - 89 = 13



Year 4

Partitioning and decomposition

Children in Year 4 should be using increasingly formal column methods to record subtraction of numbers with up to 4 digits.

- Expanded decomposition method, including 'exchanging'

```
  754  =   700 + 50 + 4 = 600 + 150 + 4
- 182      100 + 80 + 2   100 + 80 + 2
                          500 + 70 + 2 = 572
```

```
  754  =
- 86
```

Step 1
```
  700 + 50 + 4
-       80 + 6
```

Step 2 *(adjust from T to U)*
```
  700 + 40 + 14
-       80 + 6
```

Step 3 *(adjust from H to T)*
```
  600 + 140 + 14
-       80 + 6
  600 + 60 + 8 = 668
```

This would be recorded by the children as

```
  600   140
  ~~700~~ + ~~50~~ + 14
-       80 + 6
  600 + 60 + 8 = 668
```

Decomposition

```
  614 1
  ~~7~~~~5~~4
- 86
  668
```

Children should:

✓ *be able to subtract numbers with different numbers of digits;*

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

For example:

£8.95 = 8 + 0.9 + 0.05
-£4.38 - 4 + 0.3 + 0.08

= 8 + 0.8 + 0.15 *(adjust from T to U)*
- 4 + 0.3 + 0.08
4 + 0.5 + 0.07

= £4.57

Leading to:

1
8.85
- 4.38
£4.57

Alternatively, children can set the amounts to whole numbers, i.e. 895 – 438 and convert to pounds after the calculation.

NB Once children have reached the concise stage they will then continue this method through into years 5 and 6. They will not go back to using expanded methods.

Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line should be used **(see notes on Year 3)**

Year 5

- Children should subtract numbers with more than 4 digits using formal written methods for subtraction.

Decomposition

```
  614 1
  7 5446
- 28624
  46822
```

Year 6

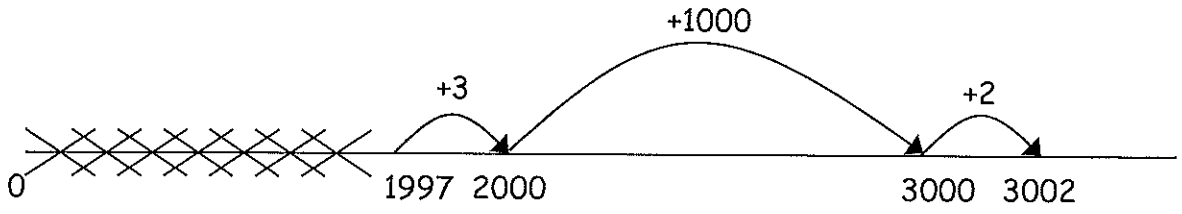
- Children's secure understanding of column subtraction, developed throughout years 4 and 5, should continue to be used to aid fluency and accuracy throughout Year 6 whilst solving problems.
- Decomposition should be used to record subtraction of whole and decimal numbers with 4 more digits.

Children should:

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

- Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line should be used. **(See note on year 3 about finding the difference).**

3002 - 1997 = 1005



MULTIPLICATION

MENTAL CALCULATIONS (on going)

These are a **selection** of mental calculation strategies:

- **Doubling and halving**

Applying the knowledge of doubles and halves to known facts.
e.g. 8 x 4 is double 4 x 4

- **Using multiplication facts**

Regular times tables practise should be planned for either through mental and oral starters, 5 minute 'filler' activities or through use of the times tables award cards.

Year 2
2 times table
5 times table
10 times table (including being able to derive division facts)

Year 3
2 times table
3 times table
4 times table
5 times table
6 times table
8 times table
10 times table (including being able to derive division facts)

Year 4 Derive and recall all multiplication and division facts up to 12 x 12

Years 5 & 6 Revise and maintain instant recall of multiplication and division facts up to 12 x 12 through regular practise.

- **Using and applying division facts**

Children should be able to utilise their tables knowledge to derive other facts.
e.g. If I know 3 x 7 = 21, what else do I know?
30 x 7 = 210, 300 x 7 = 2100, 3000 x 7 = 21 000, 0.3 x 7 = 2.1 etc

- **Use closely related facts already known**

13 x 11 = (13 x 10) + (13 x 1)
= 130 + 13
= 143

- **Multiplying by 10 or 100**

Knowing that the effect of multiplying by 10 is a shift in the digits one place to the left.
Knowing that the effect of multiplying by 100 is a shift in the digits two places to the left.

- **Partitioning**

23 x 4 = (20 x 4) + (3 x 4)
= 80 + 12
= 102

- **Use of factors**

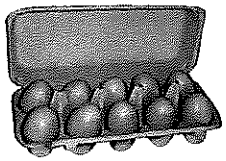
8 x 12 = 8 x 4 x 3

Many mental calculation strategies will continue to be used. They are not replaced by written methods.

Reception

- Before counting in sets of a given size, children should have a secure understanding of numbers. Children will experience equal groups of objects and will count in 2s and 10s and begin to count in 5s.

For example counting the following objects in 2's, 5's and 10's.


Year 1

- Children will experience equal groups of objects. They will be able to count objects in 2's, 5's and 10's. They will begin to work on practical problem solving activities involving equal sets or groups.

For example:
I have 5 pairs of socks on my washing line. How many socks are there?

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

Year 2

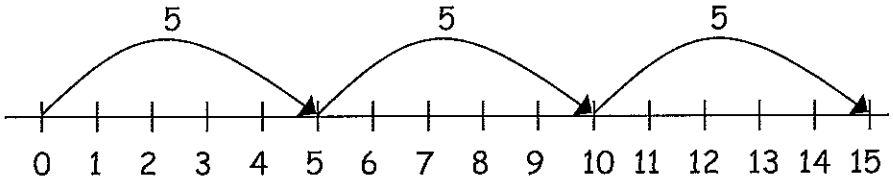
- Children will develop their understanding of multiplication and use jottings to support calculation:

Repeated addition

3 times 5 is 5 + 5 + 5 = 15 or 3 lots of 5 or 5 x 3

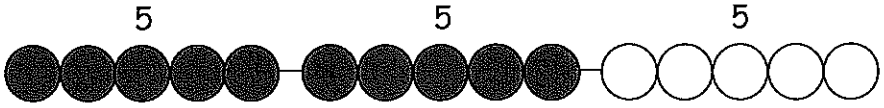
- Repeated addition can be shown easily on a number line:

5 x 3 = 5 + 5 + 5



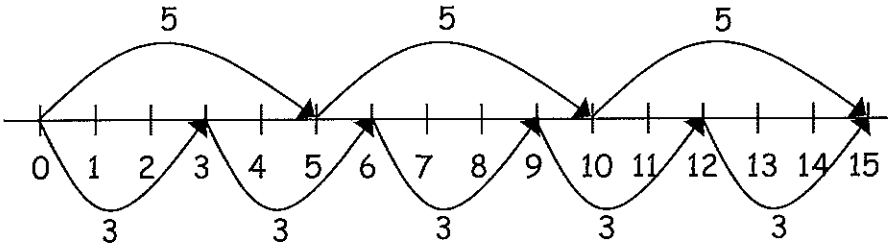
- and on a bead bar:

5 x 3 = 5 + 5 + 5



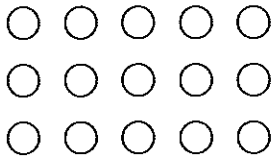
Commutativity

- Children should know that 3 x 5 has the same answer as 5 x 3. This can also be shown on the number line.



Arrays

- Children should be able to model a multiplication calculation using an array. This knowledge will support with the development of the grid method.



5 x 3 = 15

3 x 5 = 15

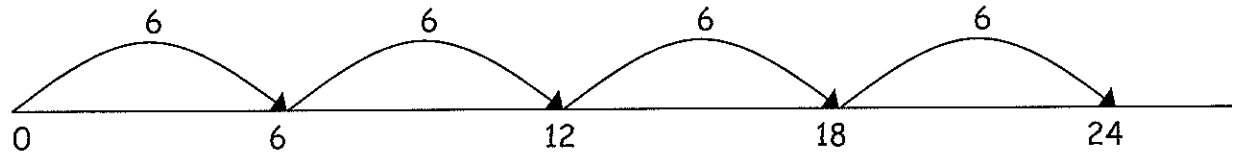
Year 3

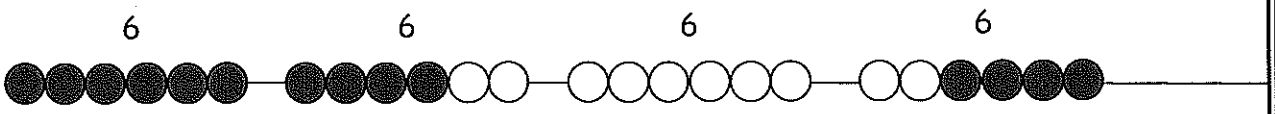
- Children will continue to use:

Repeated addition

4 times 6 is 6 + 6 + 6 + 6 = 24 or 4 lots of 6 or 6 x 4

Children should use number lines or bead bars to support their understanding.





Arrays

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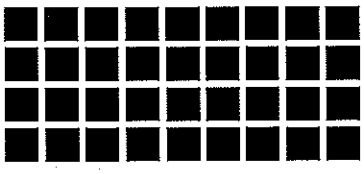


9 x 4 = 36

4 X 9 = 36

Children will also develop an understanding of

Scaling

- e.g. Find a ribbon that is 4 times as long as the blue ribbon

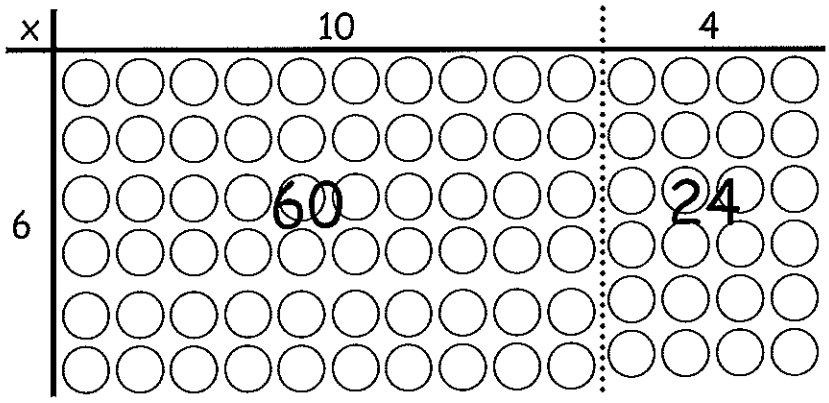
5 cm

20 cm

Using symbols to stand for unknown numbers to complete equations using inverse operations

□ x 5 = 20 3 x △ = 18 □ x ○ = 32

- Year 3 national curriculum requirements state that children should multiply 2 digit numbers by 1 digit numbers using mental and progressing to formal written methods.
- Children will continue to use arrays where appropriate leading into the grid method of multiplication.



(6 x 10) + (6 x 4)

60 + 24

84

Grid method

- Tens and ones x ones.

  (Short multiplication - multiplication by a single digit)

  23 x 8

- Children will approximate first

  23 x 8 is approximately 25 x 8 = 200

x	20	3
8	160	24

$$\begin{array}{r} 160 \\ +\ 24 \\ \hline 184 \end{array}$$

Note:
To support the development of formal written methods for multiplication, children should be encouraged to start with ones x ones and then ones x tens. For example, in the above calculation the first part, to be completed by children, should be 8 x 3 = 24 and then 8 x 20 = 160 as this is the order in which digits are multiplied in short multiplication.

- Make use of concrete resources to embed children's conceptual understanding of the grid method.

X	10	3
3		

Children should be encouraged to record the written method at the side.

```
  1 3
X 3
-----
    9
3 0
-----
3 9
```

Year 4

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

Grid method

- HTU x U

  (Short multiplication - multiplication by a single digit)

346 x 9

- Children will approximate first

  346 x 9 is approximately 350 x 10 = 3500

	300	40	6
9	2700	360	54

Calculate 1st

```
  2700
+  360
+   54
------
  3114
  1 1
```

Short Multiplication

- If children have a secure understanding of multiplication, place value and the grid method they should then move onto using formal short multiplication, using an expanded method.

X	10	3
3		

develops to..

x	10	3
3	30	9

Which then develops into:

$$\begin{array}{r} 15 \\ \times\ 3 \\ \hline 15 \\ 30 \\ \hline 45 \end{array}$$

And then into:

$$\begin{array}{r} 15 \\ \times\ 3 \\ \hline 45 \\ {\scriptstyle 1} \end{array}$$

Teachers should make use of the NCETM video 'moving from the grid to a compact method', to support their teaching of this calculation strategy.
(can be found on NCETM or you tube : https://www.youtube.com/watch?v=5ppOF53x_g0)

Year 5

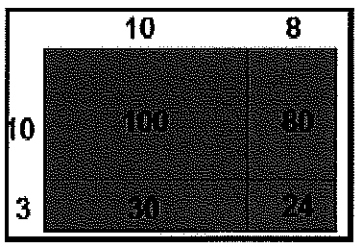
- Multiply up to 4-digits by 1 or 2 digits using short and long multiplication.

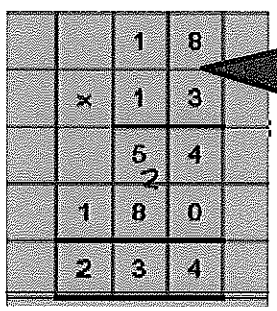
Short Multiplication

Revise short multiplication by 2-digit and 3-digit numbers as per year 4.

Long Multiplication

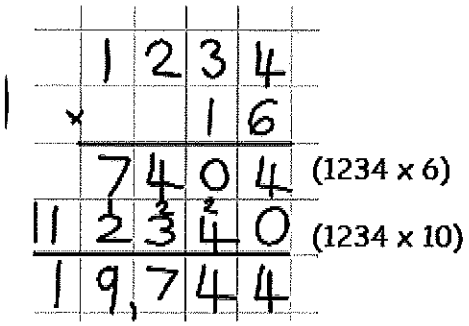
- 18 x 13

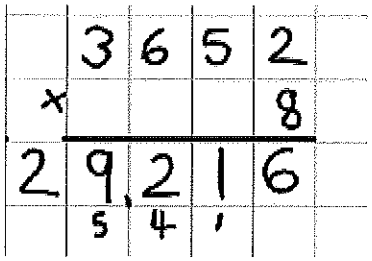




3 x 18 on the 1st row (8 x 3 = 24, carrying the 2 for twenty, then10 x 3). 10 x 18 on the 2nd row. 10 x 8 = 80 and then 10 x 10 = 100. Finally add the columns together.

- Short and Long Multiplication using larger numbers:





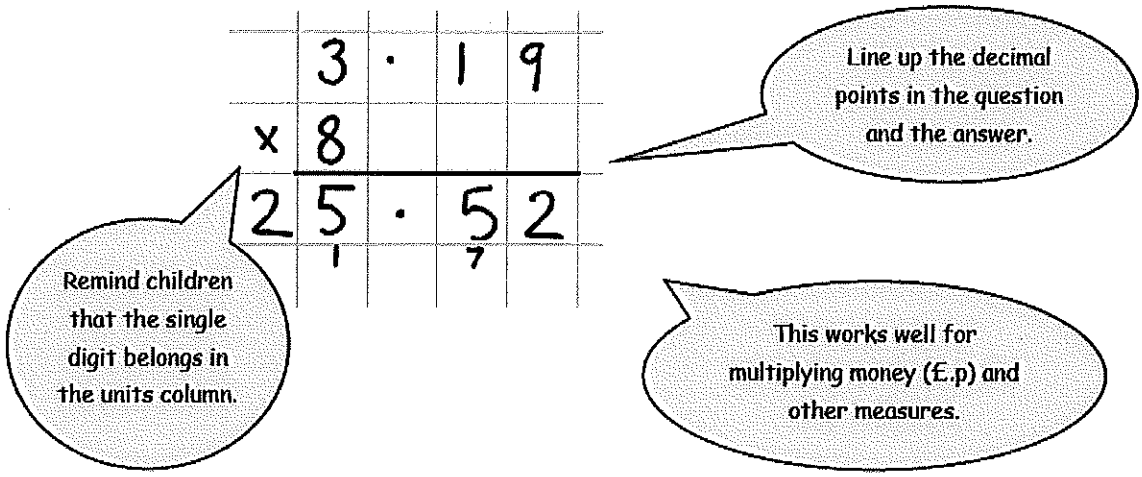
Year 6

- Multiply multi-digit numbers (up to 4 digits) by a 2 digit whole number using the formal written methods of long multiplication.
- Multiply one-digit numbers with up to 2 decimal places by whole numbers.

Long Multiplication

- See year 5 guidance from above.

Short multiplication involving decimal numbers



- Children should continue to be encouraged to estimate before calculation so that they can spot calculation errors when answers don't 'make sense'

DIVISION

MENTAL CALCULATIONS (on going)
These are a **selection** of mental calculation strategies:

- **Doubling and halving**

Knowing that halving is dividing by 2

- **Deriving and recalling division facts**

Regular times tables practise should be planned for either through mental and oral starters, 5 minute 'filler' activities or through use of the times tables award cards.

Year 2	2 times table	
	5 times table	
	10 times table	(including being able to derive division facts)
Year 3	2 times table	
	3 times table	
	4 times table	
	5 times table	
	8 times table	
	10 times table	(including being able to derive division facts)
Year 4	Derive and recall all multiplication and division facts up to 12 x 12	
Years 5 & 6	Derive and recall quickly all multiplication and division facts up to 12 x 12.	

- **Using and applying division facts**

Children should be able to utilise their tables knowledge to derive other facts.
e.g. If I know 3 x 7 = 21, what else do I know?
30 x 7 = 210, 300 x 7 = 2100, 3000 x 7 = 21 000, 0.3 x 7 = 2.1 etc

- **Dividing by 10 or 100**

Knowing that the effect of dividing by 10 is a shift in the digits one place to the right.
Knowing that the effect of dividing by 100 is a shift in the digits two places to the right.

- **Use of factors**

378 ÷ 21 378 ÷ 3 = 126 378 ÷ 21 = 18
126 ÷ 7 = 18

- **Use related facts**

Given that 1.4 x 1.1 = 1.54
What is 1.54 ÷ 1.4, or 1.54 ÷ 1.1?

Many mental calculation strategies will continue to be used. They are not replaced by written methods, but written methods may be used when a calculation cannot be completed mentally due to the size of the numbers involved.

Reception

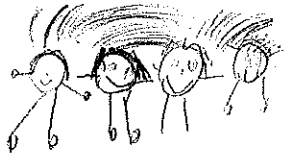
- Children need to have a secure understanding of number before beginning to calculate.
- Division is introduced to the children in terms of sharing fairly in play and practical problem solving situations.
- They will utilise their ability to count in 2's, 10's and later in 5's.

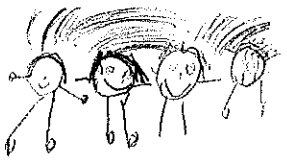
For example:
There are 8 sweets and 4 children. How many sweet are there for each child? (children are given experiences of practically sharing out objects between the number of children involved)

Year 1

- Children will understand equal groups and share items out in play and problem solving. They will count in 2s and 10s and 5s.
- Children will begin to record their working using pictures and symbols.

For example:
'*12 children get into teams of 4 to play a game. How many teams are there?*'
Children record their solution by drawing.



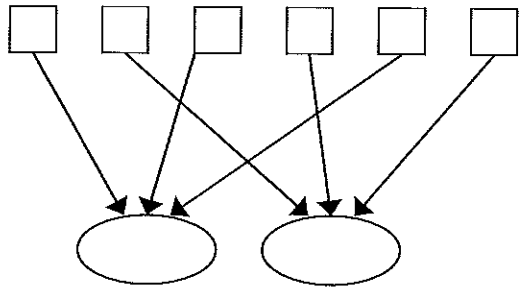


Year 2

- Children will develop their understanding of division and use jottings to support calculation

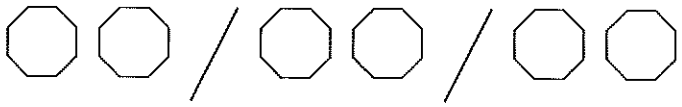
- **Sharing equally**

6 sweets shared between 2 people, how many do they each get?



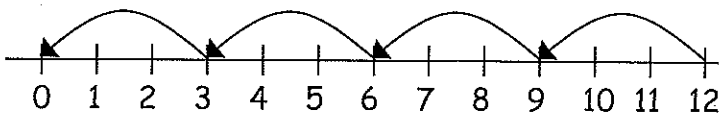
- **Grouping or repeated subtraction**

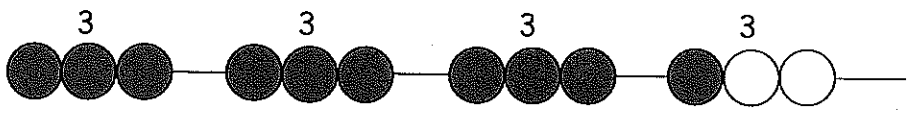
There are 6 sweets, how many people can have 2 sweets each?



- **Repeated subtraction using a number line or bead bar**

12 ÷ 3 = 4





The bead bar will help children with interpreting division calculations such as 10 ÷ 5 as 'how many 5s make 10?'

- **Using symbols to stand for unknown numbers to complete equations using inverse operations**

□ ÷ 2 = 4 20 ÷ △ = 4 □ ÷ △ = 4

Year 3

Ensure that the emphasis in Y3 is on grouping rather than sharing.

Children should use division facts for the tables they now have instant recall of

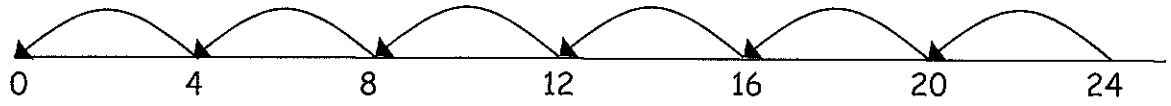
.

Children will continue to use:

- **Repeated subtraction using a number line**

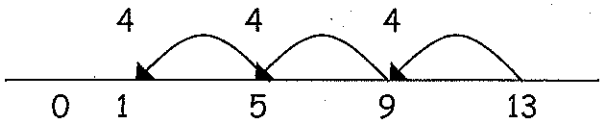
Children will use an empty number line to support their calculation.

24 ÷ 4 = 6



- Children should also move onto calculations involving remainders.

13 ÷ 4 = 3 r 1



- **Using symbols to stand for unknown numbers to complete equations using inverse operations**

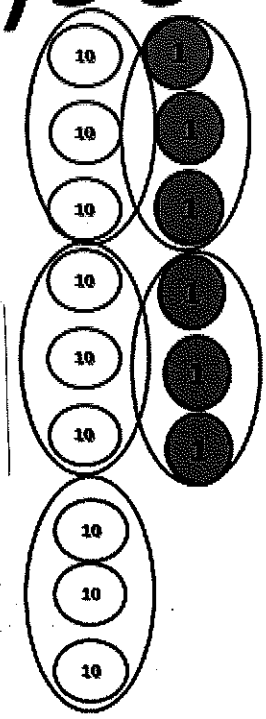
26 ÷ 2 = □ 24 ÷ △ = 12 □ ÷ 10 = 8

Once children are confident with division as grouping and they are able to show division using arrays and numberlines, then they can move on to more formal methods of calculation.

FOR SHORT DIVISION IN YEAR 3, CHILDREN SHOULD BE DIVIDING 2 DIGIT NUMBERS BY 1 DIGIT NUMBERS INVOLVING NO CARRYING OR REMAINDERS TO BEGIN WITH.

96 ÷ 3 =

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



Use of concrete resources to aid conceptual understanding should be made.

Examples:

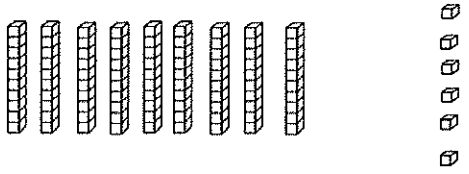
'How many groups of 3 tens can I make from 9 tens?'

'How many 3s go into 6?'

Year 4

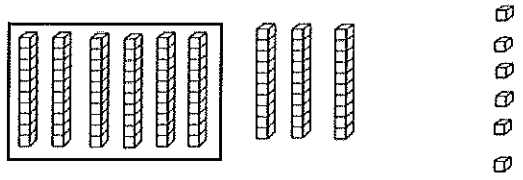
- As per year 3 children will continue to develop their understanding of division as grouping.
- They will use known facts to divide mentally and to support written calculations.
- Children should begin by dividing **2 digit** numbers **by a 1 digit number** which give whole number answers.
- Children should make use of concrete resources to support their understanding of exchanging when **remainders occur within the calculation.**

$$6\overline{)\,96}$$

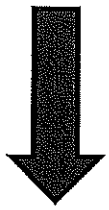


How many groups of 6 can we make with these 9 tens?

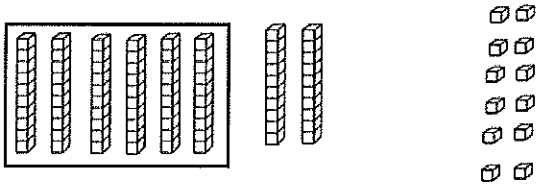
$$\begin{array}{r} 1 \\ \hline 6\overline{)\,9\,6} \end{array}$$



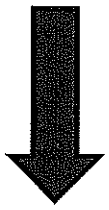
We can make 1 group of 6 tens and there will be 3 tens left over.



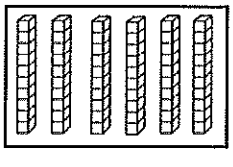
$$\begin{array}{r} 1 \\ \hline 6\overline{)\,9\,6} \end{array}$$

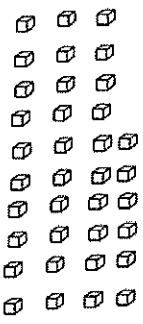


We can't make any more groups of 6 tens with the 3 tens so we will regroup them into ones.



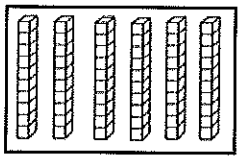
$$\begin{array}{r} 1 \\ \hline 6\overline{)\,9\,\overset{3}{6}} \end{array}$$

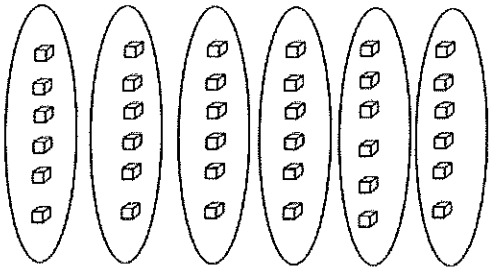




How many ones do we have altogether?

$$\begin{array}{r} 16 \\ \hline 6\overline{)\,9^{3}6} \end{array}$$





How many groups of 6 can we make with 36?

- Once secure, children can then move onto dividing numbers with 3 digits by a single digit however, problems and calculations ***should not result in a final answer with a remainder at this stage.***

Note:

$$\begin{array}{r} 037 \\ \hline 5\overline{)\,{}^{1}1\,{}^{3}8^{3}5} \end{array}$$

When the answer for the first column is zero (1 ÷ 5, as in example), children could initially write a zero above to acknowledge its place, and must always 'carry' the number (1) over to the next digit as a remainder.

Year 5

- Children should divide up to 4 digits by a 1 digit number using the formal method of short division and they should interpret remainders according to the context.

$$\begin{array}{r} 0663\text{ r }5 \\ \hline 8\overline{)\,5^{5}3^{5}0^{2}9} \end{array}$$

Short division with remainders: Now that pupils are introduced to examples that give rise to remainder answers, division needs to have a real life problem solving context, where **pupils consider the meaning of the remainder and how to express it,** ie. as a fraction, a decimal, or as a rounded number or value , depending upon the context of the problem.

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

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

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

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

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

Year 6

- Introduce long division e.g. 3 digits ÷ 2 digits using the chunking method.
- Where remainders occur, pupils should express them as fractions, decimals or use rounding depending on the context of the problem.

- HTU ÷ TU

972 ÷ 36

```
        27
    ------
36 ) 972
   - 720      (20) x 36
     252
   - 252      (7)  x 36
       0
```

Answer : 27

Find out how many 36's there are in 972 by subtracting 'chunks' of 36 until 0 is reached.

The key to this method is that children are choosing 'efficient' chunks. For example, for the above calculation children 'could' take repeated chunks of 36 off and still obtain the correct answer. However, this method would be labour intensive and inefficient.

- Children should be encouraged to consider 'useful' chunks to subtract e.g. 10x, 100x, 50x etc.

- Extend to decimals with up to two decimal places. Children should know that decimal points line up under each other.

87.5 ÷ 7

```
    12.5
7 ) 87.5
  - 70.0     (10) x 7
    17.5
  - 14.0     (2) x 7
     3.5
  -  3.5     (0.5) x 7
     0
```

↓

Answer : 12.5