Purleigh Primary School Calculation Policy

LAYING THE FOUNDATIONS OF NUMBER AND CALCULATION:

Lots of early practical experiences, including:

- games – with toys, teddies, fingers
- Nursery rhymes – '5 currant buns'; '1 elephant came out to play'.
- Play experiences – ducks in the bath, sand castles, toy bricks/blocks.
- Opportunities to explore the understanding of number in a visual, hands-on way.

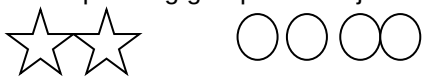
VOCABULARY

Lots of talking about number through play and real experiences including:

- Number language – more, less, lots of, less than, more than, bigger, smaller – in talking about practical activities such as play.
- Number names – in nursery rhymes like '1, 2, 3, 4, 5, once I caught a fish alive' and in general activities like helping to lay a table, cups, saucers, spoons for tea

SORTING

- Separating groups and objects-



stars moons

Comparing groups and objects- which is the bigger set?

or

- Attaching a number to a set

3 stars

COUNTING/NUMBER

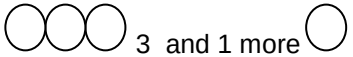
- Count reliably up to 10 everyday objects with careful finger/count matching:

1 2 3

- Find 1 more/less from up to 5 objects.
- Recognise numerals 1-9
- Order numbers to 10
- Read and write numbers to 10

ADDITION

- Say some number names in familiar contexts, e.g. nursery rhymes - 'One elephant came out to play'
- Practical: add one more to a set of objects:



3 and 1 more is 4

- In practical activities begin to use the vocabulary related to addition.
- Relate addition to combining two groups:

3 and 2 is 5

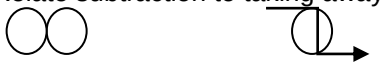
- Simple pictorial recording following the practical – 'draw what you have done.'

SUBTRACTION

- Number Rhymes: Say some number names in familiar contexts, e.g. nursery rhymes- '5 fat sausages frying in a pan'
- Practical subtraction, one less:

1 2 3 4

- Relate subtraction to taking away



1 2

- Crossing out pictures within 5, 10
- In practical activities begin to use the vocabulary related to subtraction.

MULTIPLICATION

- Counting repeated groups:

1 2 3 4 5 6

- Lots/sets of objects in twos to ten:

1 2 3 4 5 6

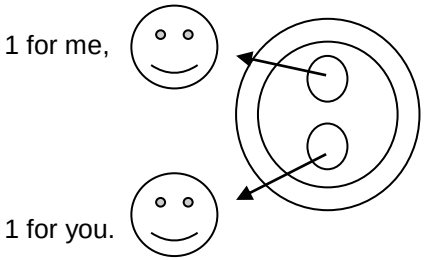
7 8 9 10

- Sorting pairs – socks, gloves
- Counting fingers, toes

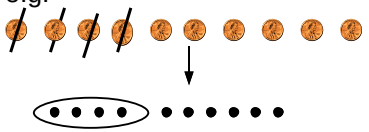
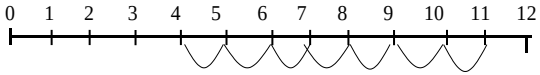
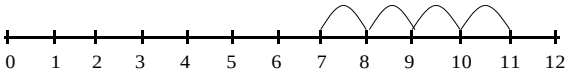
DIVISION

- Sharing as a practical activity – snacks, sweets etc (not necessarily recorded)
- Simple practical halving of things – apples, sandwiches, cakes.

Biscuits on a plate:



Purleigh Primary School Calculation Policy

Addition	Subtraction	Multiplication	Division
Using cubes of different kinds and other objects to 'count all'. Starting with add 1. Counting pictures – given, and drawn by child. Using cubes of different kinds and other objects to count on. 3+2 Say 3, 4, 5 <u>Recording addition</u> + and = signs used in horizontal recording e.g. 4 + 5 = Drawing jumps on prepared number lines. Solving simple word problems e.g. Two children are playing football. Another three want to join in. How many will there be playing football? Unknown number shown by a box or other shape. Solving missing number calculations e.g. 3+4=Δ 3+Δ=7 Δ+4=7 7=Δ+3 Δ=3+4 Initially by trial and improvement. Investigating 7=Δ+Δ Learn/know number bonds to 5 and 10	Initially using apparatus such as cubes. Recording using the – sign. Draw on paper or little whiteboards, and rub off or cross out to takeaway. e.g.  10 – 4 = 6 Counting back on number lines which are already numbered. e.g. 5 – 3 or 8 – 2 or 11 – 7  Physically jumping an object (such as a dinosaur model) along a line. Recording by drawing jumps on prepared lines, and writing the calculation. Relate to number bonds knowledge E.G. 3+2=5 Therefore 5-2=3 Finding the difference between numbers by counting up. e.g. Find the difference between 7 and 11.  	Introducing the concept of repeated addition, (not using the x sign) by using pictures and symbols as well as apparatus such as cubes. Using bead strings to model groups of beads e.g.  Two groups of 3 is 3+3 or 2 lots of three Counting in 2s, 5s and 10s.	Introducing the concept of division as sharing and doing it practically initially. Using structured worksheets with division (sharing) problems. Use the jotting of tally marks to solve. e.g 8 strawberries shared between 4 children.  physically sharing between children

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Addition

Continue using a range of equations but with appropriate, larger numbers.
Extend to
14 + 5 = 10 + Δ
and adding three numbers
32 + Δ + Δ = 40 35 = 1 + Δ + 5

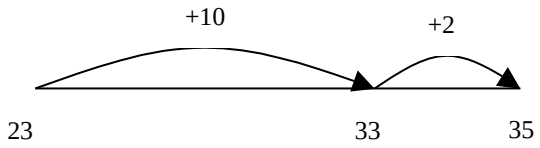
Adding on in tens E.G. 14 + 10 46 + 10

Partition into tens and ones and recombine

12 + 23 = 10 + 2 + 20 + 3
= 30 + 5
= 35

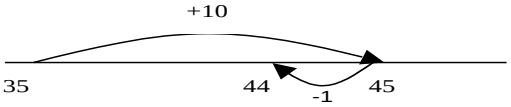
Refine to partitioning the second number only

23 + 12 = 23 + 10 + 2
= 33 + 2
= 35



Using partitioning to bridge over ten i.e 7+6 is 7+the amount of the 6 that will make the 7 into 10, which is 3, then adding the remaining part of the 6 which is 3.
So 7+6 = 7+3+3 =10+3 =13
Using Diennes apparatus to illustrate this (ten rods and unit cubes)

Add 9 or 11 by adding 10 and adjusting by 1
35 + 9 = 44

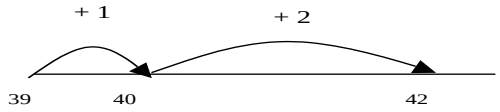


Numbers used will be up to 100 for Higher Attaining children.
Know addition number bonds to 20 by heart.

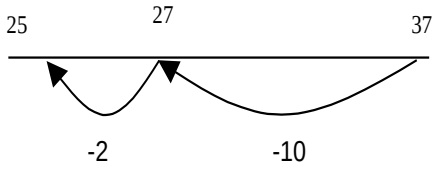
Subtraction

Find a small difference by counting up

42 – 39 = 3



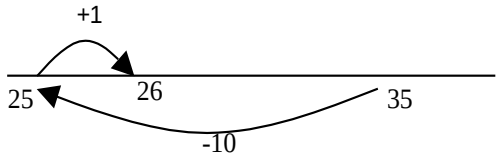
Use known number facts and place value to subtract (partition second number only)
37 – 12 = 37 – 10 – 2
= 27 – 2
= 25



Extend missing number equations to include minus sums.

Know subtraction number bonds to 20 by heart.

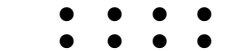
Subtract 9 or 11. Begin to add/subtract 19 or 21
35 – 9 = 26



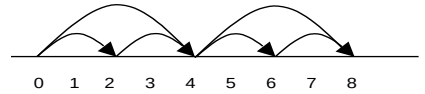
Multiplication

Use the x sign

Arrays and repeated addition



2 x 4
or repeated addition
2 + 2 + 2 + 2



Doubling multiples of 5 up to 50

15 x 2 = 30 2 X 15 = 30

Know 2x, 5x and 10 times tables by heart.

Multiplying three numbers e.g. 2x5x10

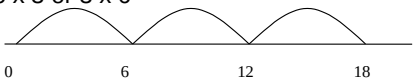
x = signs and missing numbers

7 x 2 = Δ	Δ = 2 x 7
7 x Δ = 14	14 = Δ x 7
Δ x 2 = 14	14 = 2 x Δ
Δ x ∇ = 14	14 = Δ x

Know 2, 3 & 10 times tables

x = signs and missing numbers
Continue using a range of equations as but with appropriate numbers.

Number lines
6 x 3 or 3 x 6



Division

÷ = signs and missing numbers

6 ÷ 2 = Δ	Δ = 6 ÷ 2
6 ÷ Δ = 3	3 = 6 ÷ Δ
Δ ÷ 2 = 3	3 = Δ ÷ 2
Δ ÷ ∇ = 3	3 = Δ ÷ ∇

Understand division as sharing and grouping

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

6 ÷ 2 can be modelled as:

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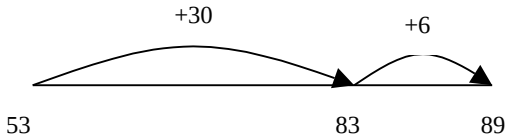
Addition

+ = signs and missing numbers
Continue using a range of equations but with appropriate, larger numbers.

Use own numberlines (informal drawings) as jottings to help work out calculations.

Partition into tens and ones and recombine
Partition both numbers and recombine. Refine to partitioning the second number only e.g.
36 + 53 = 53 + 30 + 6
= 83 + 6
= 89



Mental strategies
Add a near multiple of 10 to a two-digit number
Continue as in Year 2 but with appropriate numbers e.g. 35 + 19 is the same as 35 + 20 – 1.
Near doubles eg 9+8, as double 8 add one.

Pencil and paper procedures
83 + 42 = 125

80 + 3
+40 + 2
120 + 5 =125

Higher Attaining children:

83
+ 42
5
120
125

If there is no carrying then children may be able to do this mentally

Subtraction

- = signs and missing numbers

Continue using a range of equations but with appropriate numbers. Use the relationship between addition and subtraction to help solve them.

Find a small difference by counting up

33 – 17 33-10 = 23 23-7 split 7 into 3 & 4

23 – 3 = 20 20 – 4 = 16

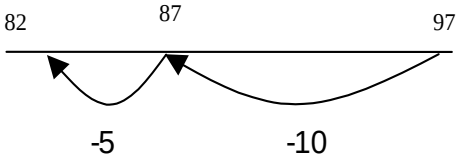
Continue with appropriate numbers for example bridging over 100 e.g. 102 – 97 = 5

Subtract mentally a 'near multiple of 10' to or from a two-digit number

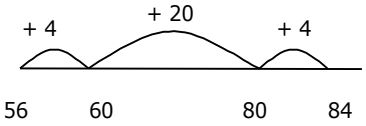
Continue but with appropriate numbers e.g. 78 – 49 is the same as 78 – 50 + 1

Use known number facts and place value to subtract

Continue but with appropriate numbers e.g.
97 – 15 = 72



Pencil and paper procedures
Count or jumping
84 – 56 = 28 leads to 56 + ?? = 84



Multiplication

Arrays and repeated addition
Continue to understand multiplication as repeated addition and continue to use arrays.

Understand multiplication can be done in any order (the Commutative Law)
Eg 5x7=7x5

Doubling multiples of 5 up to 50
35 x 2 = 70 2 x 35

Understand a number can be partitioned then multiplications carried out, then the numbers re-combined (Distributive Law):
35x2=30x2+5x2

x	30	5
2	60	10

∇Partition in order to multiply

15 x 2

20 + 10 = 30
2 X 10 = 20 2 X 5 = 10 20 + 10 = 30

OR

x	10	5
2	20	10

Use known facts and place value to carry out simple multiplications

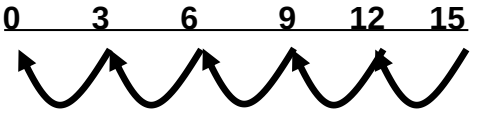
Use the same method as above (partitioning), e.g. 32 x 3 = 96

x	30	2
3	90	6

Division

Relate division to multiplication facts

Understand division as sharing and grouping
15 ÷ 3 can be modelled as:
Sharing – 15 shared into 3
OR



Or
18 ÷ 3 can be modelled as:
Sharing – 18 shared between
Grouping - How many 3's make 18?

Remainders
16 ÷ 3 = 5 r1
Sharing - 16 shared between 3, how many left over?
Grouping – How many 3's make 16, how many left over?
e.g.

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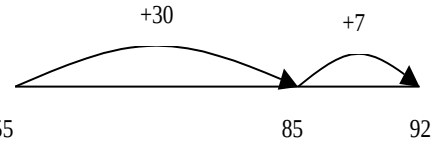
Addition

+ = signs and missing numbers
Continue using a range of equations but with appropriate numbers.

Partition into tens and ones and recombine, using own numberlines
Either partition both numbers and recombine or partition the second number only e.g.
55 + 37 = 55 + 30 + 7
= 85 + 7
= 92



Add the nearest multiple of 10, then adjust
Continue but with appropriate numbers e.g. 63 + 29 is the same as 63 + 30 - 1

Pencil and paper procedures
358 + 73 = 431
either **or**

300+50+8 358
\+ 70+3 73
300+120+11 = 431 11
120
and money 300
431

Later on
3 5 8
\+ 7 3
4 3 1
1 1

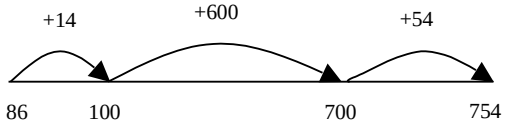
(Revert to expanded methods if the children experience any difficulty.)

Subtraction

- = signs and missing numbers
Continue using a range of but with appropriate numbers.
Eg. 63+Δ = 94
Find a small difference between 3-digit numbers by counting up
This can be modelled on an empty number line (see complementary addition below).

Subtract the nearest multiple of 10, then adjust.
Continue as in Year 2 and 3 but with appropriate numbers.

Pencil and paper procedures
Counting up:
754 – 86 = 668



Simple column subtraction (Vertical Subtraction/Decomposition) Only if this cannot be calculated mentally if appropriate. E.G. 48 - 26
Use of Diennes apparatus (cubes, rods and flat blocks to represent units, tens and hundreds) to illustrate

3 6
\- 1 7
——
——

say 6 – 7 leads to negative number, so borrow a ten

The 6 would have one ten added to it to make 16 and the 3 would have a strike through it and a 2 written instead.

Higher Attaining children would go on to work with 3-digit numbers.

Multiplication

x = signs and missing numbers
Continue using a range of equations but with appropriate numbers

Know 4 and 9 times tables

Understand X 10

Partition
23 x 4 = 92

23 x 4 = (20 x 4) + (3 x 4)
= (80) + (12)
= 92

Pencil and paper procedures
Grid method, checking with an approximation.
23 x 7 is approximately 20 x 10 = 200

x	20	3
7	140	21

Extend to HTU X U

understand X 100

Then:
34
x 4
——
16
120
——
136

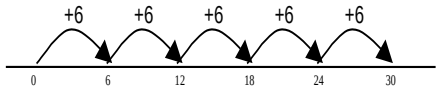
Higher Attainers:
3 4
x 4
——
136
1

Division

Know associated division facts for tables known

3 X 4 = 12 12 divided by 3 = 4
÷ = signs and missing numbers
Continue using a range of equations as in Year 2 but with appropriate numbers.

Sharing and grouping
30 ÷ 6 can be modelled as:
grouping – groups of 6 taken away and the number of groups counted e.g.



sharing – sharing among 6, the number given to each person

Remainders
41 ÷ 4 = 10 r1

41 = (10 x 4) + 1

Mental or spot easy division facts

120 divided by 3
3 X 4 = 12
12 divided by 3 = 4
3 X 40 = 120
120 divided 40 = 3

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Addition

+ = signs and missing numbers
Continue using a range of equations but with appropriate numbers.
Mental strategies:
Counting on with own drawn number lines, jottings of numbers to keep track of the calculation, imagining a number line and using it to complete the calculations or partition mentally or with jottings.
Add or subtract the nearest multiple of 10 or 100, then adjust
Continue but with appropriate numbers e.g. 458 + 79 = is the same as 458 + 80 - 1

Pencil and paper procedures
Leading to formal method, showing numbers carried underneath.

```
  358
+  73
  431
   11
```

Extend to numbers with at least four digits
3587 + 675 = 4262

```
  3587
+  675
  4262
   111
```

Revert to expanded methods if the children experience any difficulty.

Extend to decimals (same number of decimals places) and adding several numbers (with different numbers of digits).

0.3 + 0.7 = 1
4.8 + 5.2 = 10

Model negative numbers using a number line.

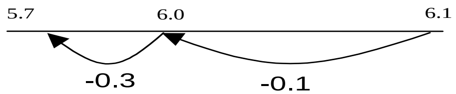
Subtraction

- = signs and missing numbers
Continue using a range of equations but with appropriate numbers.

Revise find a difference by counting up
e.g. 8006 – 2993 = 5013
This can be modelled on an empty number line (see complementary addition below).

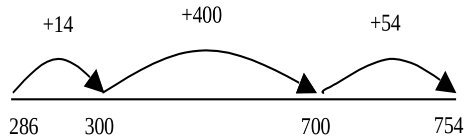
Subtract the nearest multiple of 10 or 100, then adjust.
Continue but with appropriate numbers.

Use known number facts and place value to subtract
6.1 – 0.4 = 5.7



Pencil and paper procedures

Complementary addition
754 – 286 = 468



Vertical Subtraction/Decomposition
Using Diennes apparatus when necessary to illustrate decomposition.

Multiplication

Know all times tables questions to 10 X 10
x = signs and missing numbers
Continue using a range of equations but with appropriate numbers.

Pencil and paper procedures

Use the grid method of multiplication (as below), checking with an approximation.
Continue to use this method for 2-digit times 2-digit calculations.

Grid method
72 x 38 is approximately 70 x 40 = 2800

x	70	2
30	2100	60
8	560	16

2100 + 560 + 60 + 16
Extend to simple decimals with one decimal place.

```
12.5
x  2
 1.0   (2.0 x 0.5 )
 4.0   (2.0 x 2.0 )
20.0   (2.0 x 10.0 )
25.0
```

Moving to formal methods of multiplication. Carrying numbers underneath. Initially writing out in an expanded calculation.

```
H T U
1 4 2
    5 x      (x 10 then halve)
_____
   1 0       Use mental strategies where
 2 0 0       appropriate
 5 0 0
_____
 7 1 0
```

Division

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

Sharing and grouping
Continue to understand division as both sharing and grouping (repeated subtraction).

Remainders
Mainly expressed as remainders but building towards understanding of remainders as fractions or decimals.

mental strategies where appropriate
E.G 240 divided by 4
Pencil and paper procedures

Short Division (Bus Stop method

```
     4  1
   ______
6 | 2 4 6
```

start with known times table facts

Short Division (Bus Stop method), using multiplication as a check (as a jotting), and predicting approximate answers.
249 ÷ 6 lies between 240 ÷ 6 = 40 and 300 ÷ 6 = 50

```
     4  1  rem 3
   ______
6 | 2 24 9
```

Dividing by single digit only.

Use inverse to check calculations

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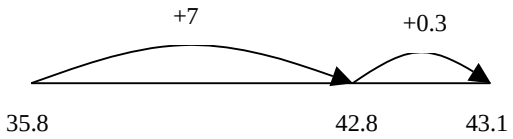
Addition

+ = signs and missing numbers
Continue using a range of but with appropriate numbers.

Mental strategies:
Partition into hundreds, tens, ones and decimal fractions and recombine
Either partition both numbers and recombine or partition the second number only e.g.
35.8 + 7.3 = 35.8 + 7 + 0.3
= 42.8 + 0.3
= 43.1



Add the nearest multiple of 10, 100 or 1000, then adjust
Continue as in Year 2, 3, 4 and 5 but with appropriate numbers including extending to adding 0.9, 1.9, 2.9 etc

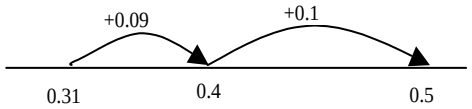
Pencil and paper procedures
Extend to numbers with any number of digits and decimals with 1 and 2 decimal places.
124.9 + 117.25 = 242.15

```
  124.9
+ 117.25
  242.15
   11
```

Subtraction

- = signs and missing numbers
Continue using a range of equations but with appropriate numbers.

Mental strategies:
Find a difference by counting up
e.g. 0.5 – 0.31 = 0.19
This can be modelled on an empty number line (see complementary addition below).



y the nearest multiple of 10, 100 or 1000, then adjust
Continue as in Year 2, 3, 4 and 5 but with appropriate numbers.
Use known number facts and place value to subtract

Pencil and paper procedures
Formal written method (Vertical subtraction), decomposing.

e.g. 342-168

```
   3  3(4) 12
-  1   6   8
_________
   1   8   4
```

(The 4 would be crossed out)

Use of addition to check the answer is correct.

Multiplication

x = signs and missing numbers
Continue using a range of equations but with appropriate numbers

Pencil and paper procedures

Use expanded method for Lower attaining children first, moving on to the standard algorithm for everyone.
Extend to decimals with up to two decimal places.

Expanded method:
12.5
x2.5
1.25 (2.5 x 0.5)
5.0 (2.5 x 2.0)
25.0 (2.5 x 10.0)
31.25

Standard algorithm:

```
    4 3 7
  X   4 2
  _______
    8 7 4
      1
  1 7 4 8 0
  1 2
  _________
  1 8 3 5 4
```

Division

÷ = signs and missing numbers
Continue using a range of equations but with appropriate numbers.

Sharing and grouping
Continue to understand division as both sharing and grouping (repeated subtraction).

Mental strategies

Pencil and paper procedures
Approximating first as a check

977 ÷ 36 is approximately 1000 ÷ 40 = 25

256 ÷ 7 lies between 210 ÷ 7 = 30 and 280 ÷ 7 = 40

Chunking is used as an alternative strategy

340 ÷ 17

10 x 17 = 170
340 – 170 = 170
10 x 17 = 170

10 x 17 + 10 x 17 = 340
so 20 X 17 = 340
Therefore the answer is 20

Short Division is used by most children

```
     0  2  3 rem 11
16 ) 3 37 59
```

Jottings like this may be needed: 16, 32, 48, 64

Chunking used as another strategy

Remainders as decimals and as fractions.