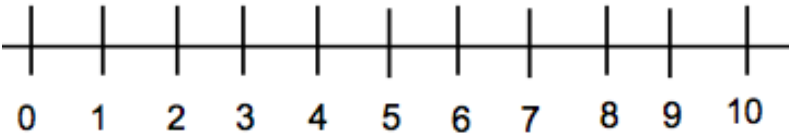# St Paul's CE Primary School
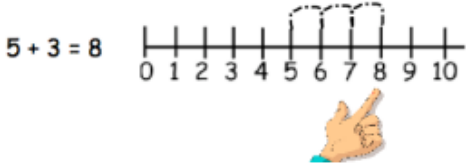
New NC Whole School Written Calculation Policy
Pencil and Paper Procedures
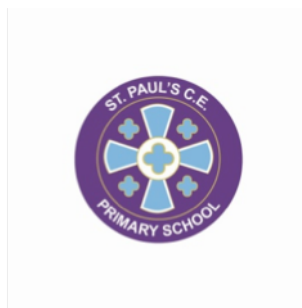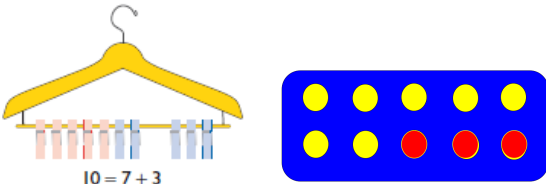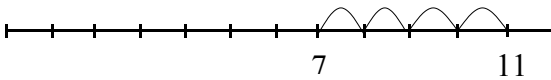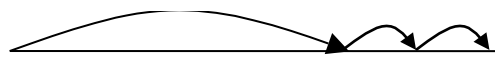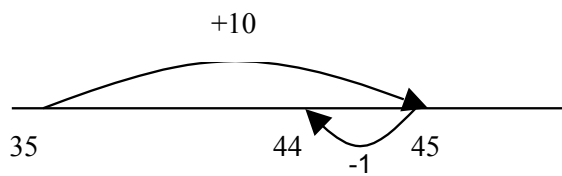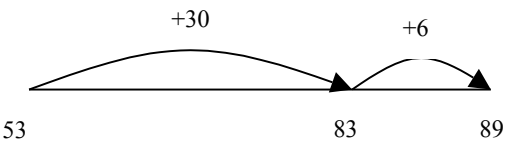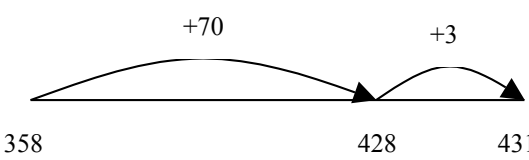
PROGRESSION OF NUMBERLINES

Pre-national curriculum level	**Number track**	Has the numbers inside the sections, rather than on the divisions	
Low Stage 1	**Calibrated, numbered numberline**	Equal divisions marked on the numberline and each division is numbered	
Secure Stage 1	**Calibrated, unnumbered numberline**	Equal divisions are marked, but left unnumbered for children to add relevant numbers to	
Stage 2	**Blank numberline**	No divisions or numbers marked for the children	

Calculation Guidelines for Foundation Stage			
ADDITION	SUBTRACTION	MULTIPLICATION	DIVISION
Children begin to record in the context of play or practical activities and problems.			
Begin to relate addition to combining two groups of objects

• Make a record in pictures, words or symbols of addition activities already carried out.
• Construct number sentences to go with practical activities
• Use of games, songs and practical activities t o begin using vocabulary
Solve simple word problems using their fingers

$5 + 1 = 6$

Can find one more to ten.

Higher Ability/ Gifted and Talented children progress to using a number line. They jump forwards along the number line using finger.

$5 + 3 = 8$ | Begin to relate subtraction to 'taking away'
• Make a record in pictures, words or symbols of subtraction activities already carried out
• Use of games, songs and practical activities to begin using vocabulary
• Construct number sentences to go with practical activities
• Relate subtraction to taking away and counting how many objects are left.

$5 - 1$ $= 4$

● ● ● ● ✖

$5 - 1 = 4$

Can find one less to ten.

Higher Ability/ Gifted and Talented Progression:

$8 - 3 = 5$

Counting backwards along a number line using finger. | Real life contexts and use of practical equipment to count in repeated groups
of the same size:
• Count in twos; fives; tens

Also chanting in 2s, 5s and 10s.

10, 20
30, 40
50, 60, 70
80, 90
100 | Share objects into equal groups
Use related vocabulary
Activities might include:
·   Sharing of milk at break time
·   Sharing sweets on a child's birthday
·   Sharing activities in the home corner
·   Count in tens/twos
·   Separate a given number of objects into two groups (addition and subtraction objective in reception being preliminary to multiplication and division)

Count in twos, tens
How many times?
How many are left/left over?
Group
Answer
Right, wrong
What could we try next?
How did you work it out?
Share out
Half, halve |

Addition		
Stage 1	**Stage 2**	**Stage 3**

+ = signs and missing numbers

3 + 4 =	= 3 + 4
3 + ☐ = 7	7 = ☐ + 4
☐ + 4 = 7	7 = 3 + ☐
☐ + ∇ = 7	7 = ☐ + ∇

10 is the same as 7 + 3 as modelled pictorially

10 = 7 + 3

To use concrete models and images to further understand the equivalence in a number sentence.

Promoting covering up of operations and numbers.

Number lines (blank)

Using blank number lines

(Teacher model number lines with missing numbers)

7 + 4 = 11

7   11

Children go up in 1s

+ = signs and missing numbers

Extend to
14 + 5 = 10 +
and adding three numbers
32 + ☐ + ☐ = 100   35 = 1 + ☐ + 5

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 +1 + 1
	= 33 + 1 + 1
	= 35

Mental Method

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

+10

35   44 45
       -1

+ = signs and missing numbers

Continue using a range of equations as in Stage1 and 2 but with appropriate numbers.

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

+30   +6

53   83   89

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

Partition into hundreds, tens and ones and recombine
Either partition both numbers and recombine or partition the second number only e.g.

358 + 73	= 358 + 70 + 3
	= 428 + 3
	= 431

+70   +3

358   428   431

Addition		
Stage 4	**Stage 5**	**Stage 6**

+ = signs and missing numbers
 	
Continue using a range of equations as in Stage1 and 2 but with appropriate numbers.
 	
Pencil and paper procedures (turn lined books on side for columns)
 	
83 + 42 = 125
 	
units first
 	
    8 3
   + 4 2
      5
   120
  125
 	
NB vocab: use 40 + 80, not 4+8
 	
 358
+ 73
  11
 120
 300
 431
	+ = signs and missing numbers
	
	Continue using a range of equations as in Stage1 and 2 but with appropriate numbers.
	
	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
	
	Extend to decimals (same number of decimals places) and adding several numbers (with different numbers of digits). *Model negative numbers using a number line.*
		+ = signs and missing numbers
		
		Continue using a range of equations as in Stage1 and 2 but with appropriate numbers.
		
		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
		
		 124.90 *add in a zero to keep the place value*
		+ 117.25
		 242.15
		  1 1

Subtraction

Stage 1	Stage 2	Stage 3

Stage 1

Pictures / marks

Sam spent 4p. What was his change from 10p?

- = signs and missing numbers

7 - 3 =   = 7 - 3
7 -   = 4   4 =   - 3
  - 3 = 4   4 = 7 -
  - ∇ = 4   4 =   - ∇

Visual / practical activities
Number lines

The difference between 7 and 11
(Counting on)
To reinforce concept. Practical strategies essential to see 'difference'.
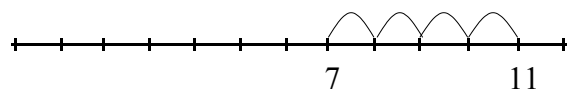
Recording by - drawing jumps on prepared lines
               - constructing own lines, if appropriate

(Teachers model jottings appropriate for larger numbers)
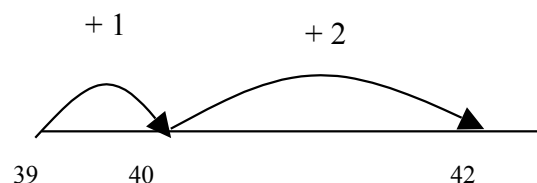
Stage 2

- = signs and missing numbers

Continue using a range of equations as in Stage 1 but with appropriate numbers.
Extend to 14 + 5 = 20 -
Find a small difference by counting up

42 – 39 = 3
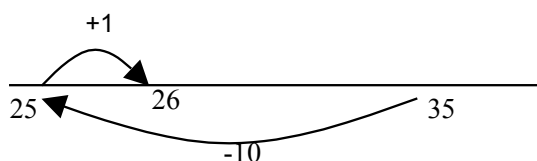

Mental Method

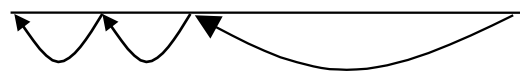*Subtract 9 or 11. Begin to add/subtract 19 or 21*
35 – 9 = 26

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

Stage 3

- = signs and missing numbers

Continue using a range of equations as in Stage1 and 2 but with appropriate numbers.
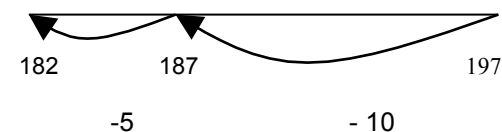
Find a small difference by counting up

Continue as in Level 2 but with appropriate numbers e.g. 102 – 97 = 5

Use known number facts and place value to subtract

Continue as in Level 2 but with appropriate numbers e.g. 3 digit number – 2 digit number
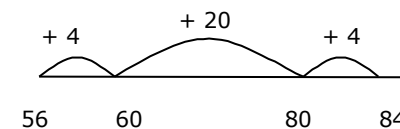
Estimate first….
197 – 15 = 182

Pencil and paper procedures
Complementary addition
84 – 56 = 28

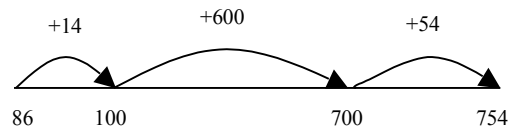| Subtraction		
Stage 4	**Stage 5**	**Stage 6**

- = signs and missing numbers

Continue using a range of equations as in Stage1 and 2 but with appropriate numbers.

Pencil and paper procedures

Complementary addition
754 – 86 = 668

+14   +600   +54

86   100   700   754

```
  98
-  24
   4   (8-4)
  70   (90-20)
  74
```
Use decomposition with top set when appropriate

```
  9 2
-  3 8
  5 4   (explain what happens…see below)
```

90 + 2 ⟶ 80 + 12
30 + 8 - 30 + 8
              50 + 4

- = signs and missing numbers

Continue using a range of equations as in Stage1 and 2 but with appropriate numbers.

Find a difference by counting on
e.g. 8006 – 2993 = 5013
This can be modelled on an empty number line

Pencil and paper procedures

```
   ⁸9 ¹2
-   3 8
    5 4
```

Develop the stages of decomposition introducing 'zero'

```
  ²3 ⁴5 ¹2        ⁴5 ⁹0 ⁹0 ¹0
-   1 7 8       -    4 5 7
    1 7 4            4 5 4 3
```

- = signs and missing numbers

Continue using a range of equations as in Stage1 and 2 but with appropriate numbers.

Pencil and paper procedures

Develop the use decomposition

extend to up to 2 decimal places

48.42 – 37.61 =
```
  4 ⁷8 . ¹4 2
  3 7 .  6 1
  1 0 .  8 1
```

extend to up to 3 decimal places if appropriate (New NC)

302.63 – 178.124 =

```
  ²3 ⁹0 ¹2 . 6 ²3 ¹0
- 1 7 8 . 1 2 4
  1 2 4 . 5 0 6
```

Multiplication

Stage 1	Stage 2	Stage 3

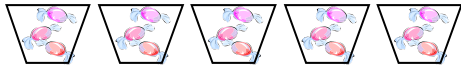**Pictures and symbols**
There are 3 sweets in one bag.
How many sweets are there in 5 bags?

(Recording on a number line modelled by the teacher when solving problems)

Use of bead strings to model groups of.

---

x = signs and missing numbers
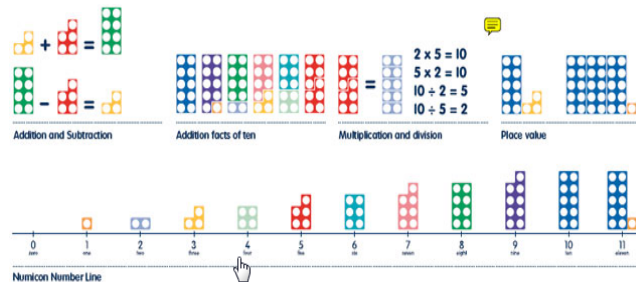
$7 \times 2 = \qquad\qquad = 2 \times 7$
$7 \times \quad = 14 \qquad\qquad 14 = \quad \times 7$
$\quad \times 2 = 14 \qquad\qquad 14 = 2 \times$
$\quad \times \triangledown = 14 \qquad\qquad 14 = \quad \times \triangledown$

Arrays and repeated addition

● ● ● ●   4 x 2 or 4 + 4
● ● ● ●

2 x 4
or repeated addition

2 + 2 + 2 + 2

0 1 2 3 4 5 6 7 8
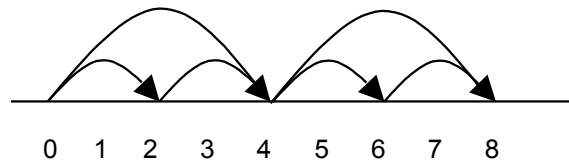
Doubling multiples of 5 up to 50

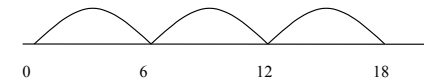15 x 2 = 30

Partition
(10 x 2) + (5 x 2)
     20 +   10 = 30

---

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

Number lines
6 x 3

0   6   12   18

35 x 2 = 70

Partition

x	30	5
2	60	10

     = 70

Multiplication		
Stage 4	**Stage 5**	**Stage 6**

Stage 4

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

Pencil and paper procedures
Grid method
TU x U
23 x 7 is approximately 20 x 10 = 200

23 x 7 = 161

	T	U
x	20	3
7	140	21

HTU x U
123 x 3 = 369

	H	T	U
X	100	20	3
3	300	60	9

Change orientation

Stage 5

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

Pencil and paper procedures
Grid method
72 x 38 is approximately 70 x 40 = 2800

x	70	2	
30	2100	60	= 2160
8	560	16	= 576 +
			2736

Estimate and check

Moving on to formal method when appropriate.
'Carried' numbers to sit on top line of answer box

1125 x 7 = 7875

	Th	H	T	U
X	1000	100	20	5
7	7000	700	140	35

Accept formal compact method for the individual pupils that it works for

$$\begin{array}{cccc} & & 7 & 2 \\ \times & & 3 & 8 \\ \hline & 5 & 7^1 & 6 \\ & 2 & 1 & 6 & 0 \\ \hline 2 & 7_1 & 3 & 6 \end{array}$$

Stage 6

x = signs and missing numbers

Pencil and paper procedures

Grid method for decimals - **Only for children who already know this method (and are accurate with it).**

Short Column Multiplication

The recording is reduced further, with carry digits recorded below the line.

$$\begin{array}{r} 38 \\ \times \quad 7 \\ \hline 266 \\ \scriptstyle 5 \end{array}$$

Long Multiplication

$$\begin{array}{r} 286 \\ \times \quad 29 \\ \hline 2574 \\ 5720 \\ \hline 8294 \\ \scriptstyle 1 \end{array}$$

(9 x 286 = 2574)
(20 x 286 = 5720)

Division		
Stage 1	**Stage 2**	**Stage 3**
Pictures / marks 12 children get into teams of 4 to play a game. How many teams are there? 	**÷ = signs and missing numbers** $6 ÷ 2 =$ $= 6 ÷ 2$ $6 ÷ \ = 3$ $3 = 6 ÷$ $÷ 2 = 3$ $3 = \ ÷ 2$ $÷ \nabla = 3$ $3 = \ ÷ \nabla$ **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: **Grouping** – There are 6 sweets. How many people can have 2 each? (How many 2s make 6?) 	**÷ = signs and missing numbers** Continue using a range of equations as in Stage 2 but with appropriate numbers. **Understand division as sharing and grouping** $18 ÷ 3$ can be modelled as: Sharing – 18 shared between 3 (see Level 2 diagram) Grouping - How many 3s make 18? *Remainders* $16 ÷ 3 = 5$ r1 Sharing - 16 shared between 3, how many left over? Grouping – How many 3s make 16, how many left over? e.g.
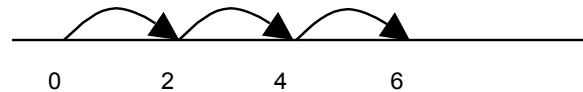
Division		
Stage 4	**Stage 5**	**Stage 6**

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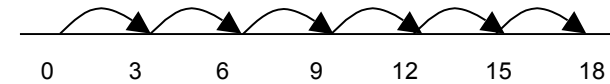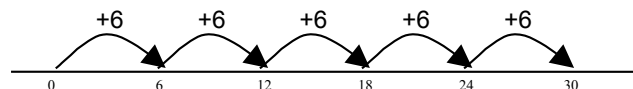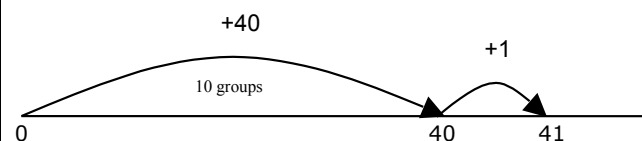Continue using a range of equations as in Stage 2 but with appropriate numbers.

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

$$+6 \quad +6 \quad +6 \quad +6 \quad +6$$
0   6   12   18   24   30

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

41 ÷ 4 = 10 r1

+40
10 groups
+1
0   40   41

OR   41 = (10 x 4) + 1

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

Remainders

Quotients expressed as fractions or decimal fractions
61 ÷ 4 = 15 ¼ or 15.25

Quotients expressed as fractions or decimal fractions
676 ÷ 8 = 84.5

Pencil and paper procedures

 BUS STOP METHOD

$$\begin{array}{c c c c c c}
 & 2 & 1 & 5 & . & 2 & 5 \\
\hline
4 & 8 & 6 & ^2 & . & ^1 & ^2 \\
 & & & 1 & & 0 & 0
\end{array}$$

Chunking

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

∗ Partition the dividend into multiples of the divisor:
e.g.   256 = 210 + 46
                   210 ÷ 7 = 30
                   46 ÷ 7 = 6r4 → 30 + 6r4 = 36r4

                        OR
                    256
              -    210   (30 groups)
                    46
              -     42   (6 groups)
                     4

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

Remainders

Pencil and paper procedures

Long Division

To calculate 748 divided by 51:

51)748   We work out 74 divided by 51, and write the answer (1) above the 4.

     1
51)748
   -51   1 × 51 = 51, so we write this underneath 74.
    23   Subtract 51 from 74 to get the remainder (23).

     1
51)748   We now bring down the next digit (8) and write it on the end of the 23.
   -51
   238

    14
51)748   We now work out 238 divided by 51, and write the answer (4) above the 8. You use
   -51   estimation skills here: 51 is roughly 50 and 4 × 50 = 200.
   238   You can work out 51 × 4 = 204 separately.
  -204
    34   We write 204 underneath the 238 and subtract to find the remainder.
               There are no more digits to bring down and 51 cannot go into 34, so we have our
               answer: **14 remainder 34.**