St Lawrence Church of England Primary School

'Achieving together † Learning for life'

Written Calculation Policy
Pencil and paper procedures
Key Stages 1 and 2

Children progress through each stage as and when they are ready. For 'Age Related Expectation' (ARE) purposes, stage 1 = year 1, stage 2 = year 2 etc.

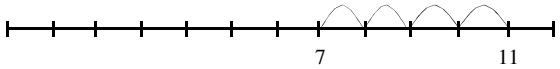
Addition

Stage 1

Number lines

Using objects and number lines to count on in ones

7 + 4 = 11



Progress from numbered lines to blank number lines (Teacher model number lines with missing numbers)

+ = signs and missing numbers

Use concrete objects and pictorial representations to solve problems such as:

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

Stage 2

Partition into tens and ones and recombine

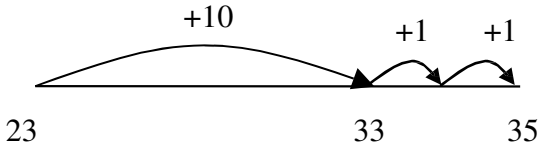
12 + 23 = 10 + 2 + 20 + 3
= 30 + 5
= 35

Also: **12 + 23**

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

refine to partitioning the second number only:

23 + 12 = 23 + 10 +1 + 1
= 33 + 1 + 1
= 35



+ = signs and missing numbers
Continue using a range of equations as in Stage 1 but with appropriate, larger numbers.

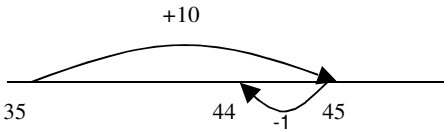
Extend to:
14 + 5 = 10 +

and adding three numbers:
32 + + = 100 35 = 1 + + 5

Mental Method

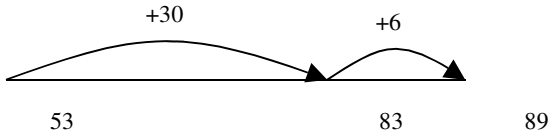
Add 9 or 11 by adding 10 and adjusting by 1

35 + 9 = 44



Stage 3

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



Add a near multiple of 10 to a two-digit number
Continue as in Stage 2 but with appropriate numbers
e.g. 35 + 19 is the same as 35 + 20 – 1.

+ = signs and missing numbers
Continue using a range of equations as in Stages1 and 2 but with appropriate, larger numbers

Pencil and paper procedures

83 + 42 = 125

Progress to units first:

80 + 3 to 8 3
+ 40 + 2 + 4 2
120 + 5 = 125 5
120
125

Addition

Stage 4

Pencil and paper procedures

358 + 73 = 431

either **or**

300 + 50 + 8
\+ 70 + 3
300 + 120 + 11 = 431

358
73
11
120
300
431

Lead to formal method, showing numbers carried underneath:

358
\+ 73
431
1 1

Extend to numbers with at least four digits:

3587 + 675 = 4262

3587
\+ 675
4262
1 1 1

Diagram format using number lines as in stage 3

Stage 5

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

Stage 6

Pencil and paper procedures

Practice and extend formal written methods of columnar addition with increasing large number to aid fluency.

Practice mental calculations with increasingly large numbers.

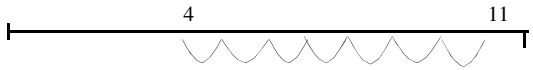
Subtraction

Stage1

Objects/Pictures / marks in Visual and practical activities

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

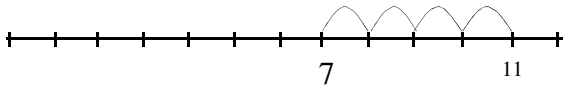
Number lines (numbered, progressing to empty)



11 – 7 = 4
Counting back

To reinforce concept: Practical strategies essential to see 'difference'.

Counting on to see the difference between 7 and 11



Recording by - drawing jumps on prepared lines
- constructing own lines

- = signs and missing numbers
Use concrete objects and pictorial representations to solve problems such as:

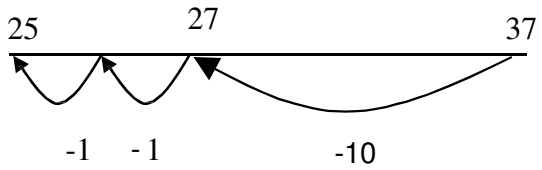
7 - 3 = = 7 - 3
7 - = 4 4 = - 3
- 3 = 4 4 = 7 -
- ∇ = 4 4 = - ∇

Stage2

Using concrete objects and pictorial representations

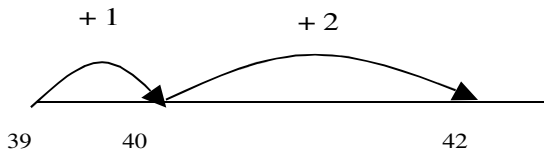
Use known number facts and place value to subtract
(partition second number only)

37 – 12 = 37 – 10 – 2
= 27 – 2
= 25



- = signs and missing numbers
Continue using a range of equations as in Stage1 but with appropriate numbers.
Extend to 14 + 5 = 20 -
Find a small difference by counting up

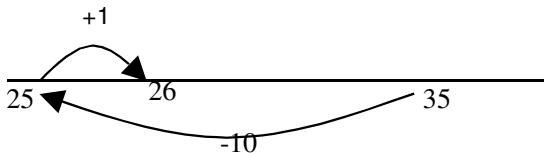
42 – 39 = 3



Mental Method

Subtract 9 or 11. Begin to add/subtract 19 or 21

35 – 9 = 26



Stage3

Find a small difference by counting up

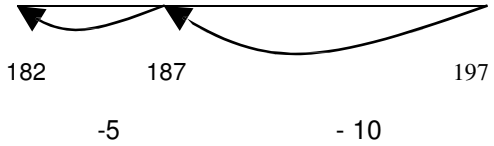
Continue as in Stage 2 but with appropriate numbers e.g.

102 – 97 = 5

Use known number facts and place value to subtract

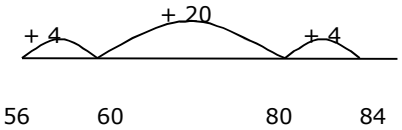
Continue as in Stage 2 but with appropriate numbers e.g. 3 digit number – 2 digit number:

197 – 15 = 182



Pencil and paper procedures
Complementary addition:

84 – 56 = 28



Use expanded method as an introduction to decomposition:

90 2 → 80 12
- 30 8 - 30 8
50 + 4 =54

Subtraction

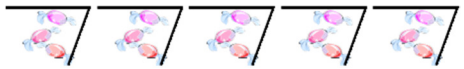
Stage 4	Stage 5	Stage 6
Find a difference by counting up: e.g. 8006 – 2993 = 5013 This can be modelled on an empty number line **Pencil and paper procedures** $\begin{array}{r} {}^{8}\not{9}\ {}^{1}2 \\ -\ 3\ 8 \\ \hline 5\ 4 \end{array}$	**Pencil and paper procedures** **Use decomposition** $\begin{array}{r} {}^{2}\not{3}\ {}^{14}\not{5}\ {}^{1}2 \\ -\ 1\ 7\ 8 \\ \hline 1\ 7\ 4 \end{array}$ Extend to numbers with any number of digits and decimals with 1 and 2 decimal places. Extend to decomposition using ‘0’ as a place holder	**Pencil and paper procedures** Practice and extend formal written methods of columnar addition with increasing large number to aid fluency. Practice mental calculations with increasingly large numbers.

Multiplication

Stage1

Pictures and symbols

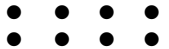
There are 3 sweets in one bag.
How many sweets are there in 5 bags?



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

Use of bead strings to model groups of numbers.

Arrays and repeated addition

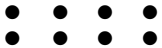


4 x 2 or 4 + 4

2 x 4

Stage 2

Arrays and repeated addition

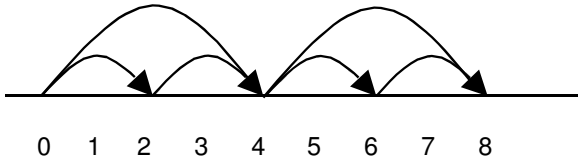


4 x 2 or 4 + 4

2 x 4

or repeated addition:

2 + 2 + 2 + 2



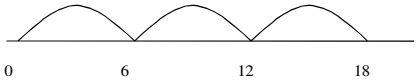
x = signs and missing numbers

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

Stage 3

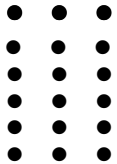
Number lines

3 x 6



Arrays

6 x 3



Partition

35 x 2 = 70

x	30	5
2	60	10

60 + 10 = 70

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.

Multiplication

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

x	T: 20	U: 3
7	140	21

140 + 21 = 161

HTU x U

123 x 3 = 369

X	H: 100	T: 20	U: 3
3	300	60	9

300 + 60 + 9 = 369

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

Move on to formal method when appropriate:

```
  1 2 5
x     7
-------
  8 7 5
  1 3
```

2741 × 6 becomes

```
  2 7 4 1
×       6
---------
1 6 4 4 6
  4 2
```

Answer: 16 446

TU x TU

Grid method:

72 x 38 is approximately 70 x 40 = 2800
72 x 38 = 2736

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

1

Estimate and check.

Stage 6

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

Pencil and paper procedures

'Carried' numbers to sit on top line of answer box

```
  2 5
x 1 7
-----
  1 7 5
+ 2 5 0
-------
  4 2 5
```

Grid method
Estimate and check

372 x 24 is approximately 400 x 20 = 8000

x	300	70	2	
20	6000	1400	40	= 7440
4	1200	280	8	= 1488 +
				8928

1

Move to formal multiplication method:

```
  3 7 2
x   2 4
-------
  7 1 4 4 0
  1 4 2 8 8
-----------
  8 9 2 8
-----------
    1
```

Division

Stage 1

Pictures / marks

12 children get into teams of 4 to play a game. How many teams are there?

Stage 2

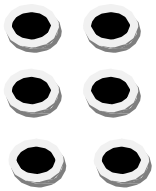
Understand division as sharing and grouping

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 2's make 6?)

Using objects in arrays -



Putting 6 objects into groups of two. How many groups?

÷ = signs and missing numbers

6 ÷ 2 =
6 ÷ = 3
÷ 2 = 3
÷ ∇ = 3

= 6 ÷ 2
3 = 6 ÷
3 = ÷ 2
3 = ÷ ∇

Stage 3

÷ = signs and missing numbers

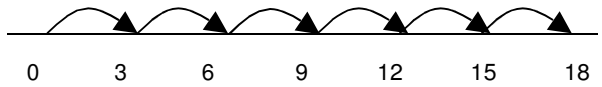
Continue using a range of equations as in Stage 2 but with appropriate numbers.

Understand division as sharing and grouping

18 ÷ 3 can be modelled as:

Sharing – 18 shared between 3 (see Stage 2 diagram)

Grouping - How many 3's make 18?



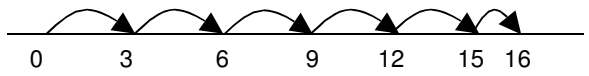
Also use arrays

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.



Division

Stage 4

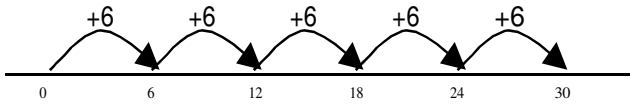
÷ = signs and missing numbers

Recall methods from Stage 2

Sharing and grouping

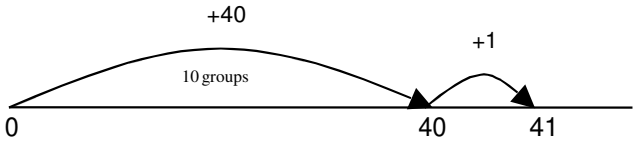
30 ÷ 6 can be modelled as:

grouping – groups of 6 taken away and the number of groups counted e.g.:



sharing – sharing among 4, the number given to each person

41÷ 4 = 10 r1



OR 41 = (10 x 4) + 1

Stage 5

÷ = signs and missing numbers

Recall methods from Stages 3 and 4

Remainders

Quotients expressed as fractions or decimal fractions:

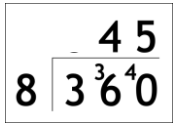
61 ÷ 4 = 15 ¼ or 15.25

Pencil and paper procedures

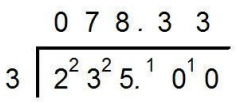
Use 'bus stop' method for division:

Estimate and check.

360 ÷8 is approximately 400 ÷8 = 50



Extend to division of decimal numbers by a single digit, up to two decimal places:



Stage 6

÷ = signs and missing numbers

Remainders

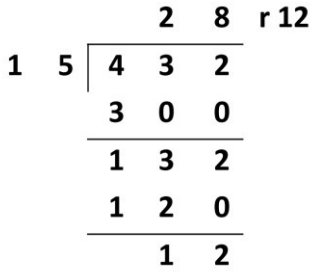
Quotients expressed as fractions or decimal fractions:

676 ÷ 8 = 84.5

Pencil and paper procedures

Estimate and check.

432 ÷ 15 is approximately 450 ÷ 15 = 30



Express remainders as fractions or as decimals: