St. Winefride's Catholic Primary School

Written Calculation Policy

Mission Statement
To provide excellence in all aspects of school life, embedded in the values and beliefs of the Catholic faith.

Vision Statement
To be an outstanding school where every member reaches their true potential and knows the joy of a personal relationship with Jesus Christ.

Date of issue	Review date	Date ratified by Governing Body
April 2015	December 2015	9 February 2016

St. Winefride's Primary School

The Fantastic Four

Whole School Calculation Policy for the Four Operations

PROGRESSION OF NUMBERLINES

Number track	Has the numbers inside the sections, rather than on the divisions
Calibrated, numbered numberline	Equal divisions marked on the numberline and each division is numbered
Calibrated, unnumbered numberline	Equal divisions are marked, but left unnumbered for children to add relevant numbers to
Blank numberline	No divisions or numbers marked for the children

NUMICON

Use Numicon to support the teaching and learning of mathematics.
Use Numicon to support the models and images for the 4 operations of number.

Addition

Stage 1

Combining two sets of objects.

Using pictures/models to show what I mean.

3 + 4 is the same as 7 as modelled using Numicon

To use Numicon to further understand the equivalence in a number sentence.

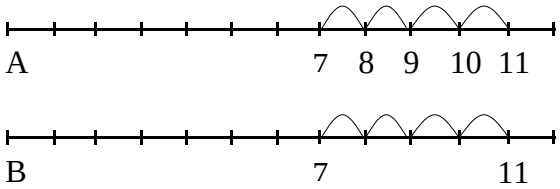
+ = signs and missing numbers
Promoting covering up of operations and numbers.

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

Number lines

Using numbered (A), partially numbered (B) and then blank number lines

7 + 4 = 11



Children go up in 1s.

Practice counting in 1s on stick, hoop, line etc forwards and backwards.

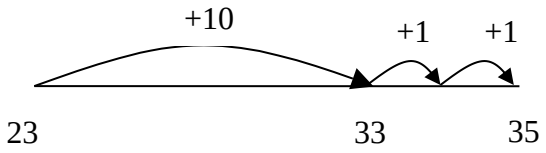
Stage 2

Partition into tens and ones and recombine (only when partitioning/place value understanding is secure)

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

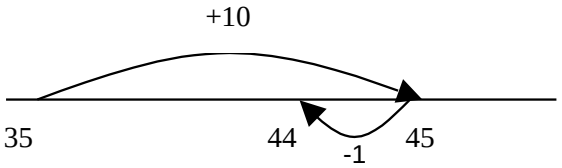


Begin with numberline and calculations
Progress to calculations only.

Use concrete models and drawing as appropriate (inc Diennes blocks)

+ = signs and missing 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

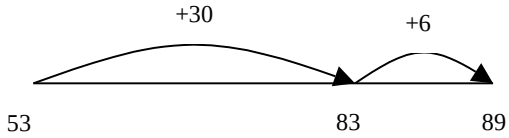


Practice accurate counting in 10s from any number and over boundaries using stick, hoop etc.

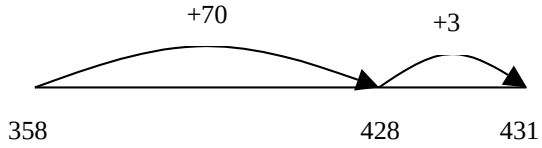
Stage 3

+ = signs and missing numbers
Continue

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



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



As Stage 2, remove numberline as appropriate.

Addition

Stage 4	Stage 5	Stage 6
Pencil and paper procedures (turn lined books on side for columns) 83 + 42 = 125 ones first 8 3 + 4 2 5 120 **125** **NB vocab: use 40 + 80, not 4+8** 358 + 73 11 120 300 431	**Pencil and paper procedures** **Leading 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 Extend to decimals (same number of decimals places) and adding several numbers (with different numbers of digits). *Model negative numbers using a number line.* Include counting in decimals in class.	**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

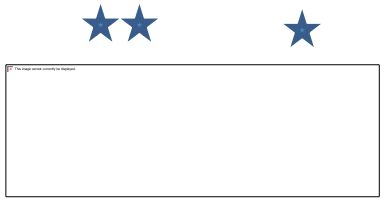
Progression			
a	No bridging	23+42=	315+624=
b	Extra digit in answer	94+73=	561+718=
c	Bridging ones to tens	47+25=	237+516=
d	Bridging tens to hundreds	371+485=	293+541=
e	Bridging ones to tens and tens to hundreds	376+485=	295+547=
f	More than two numbers to be added	35+62+24=	237+148+516=
g	Different numbers of digits	24+375+48=	546+1279+26=

Subtraction

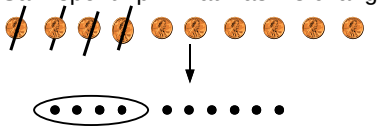
Stage 1

Pictures /marks /models

Taking away e.g. 3-1



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



- = signs and missing numbers

7 - 3 = □ □ = 7 - 3

7 - □ = 4 4 = □ - 3

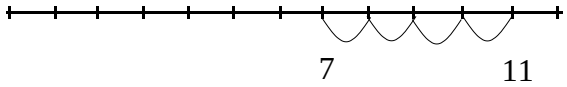
□ - 3 = 4 4 = 7 - □

□ - ∇ = 4 4 = □ - ∇

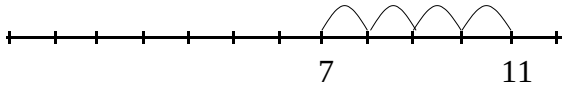
Visual / practical activities

Number lines (numbered, then partially, then blank)
- A leading to B

A - Taking away as counting back (under line)
(when subtracting small numbers only)



B - The difference between 7 and 11 (Counting on)
To reinforce concept. Practical strategies essential to see 'difference'.



(Teachers model jottings appropriate for larger numbers)

Continue counting from any number forwards and backwards.
Use practical equipment and include data handling experiences of 'how many more/less than' type questions.

Stage 2

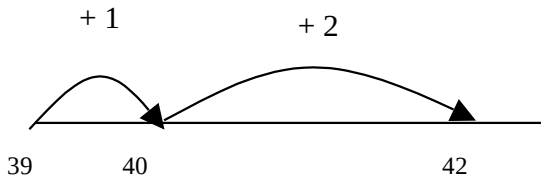
- = signs and missing numbers

Continue using a range of equations as in Stage 1 but with appropriate numbers.
Extend to 14 + 5 = 20 - □

Visual / practical activities

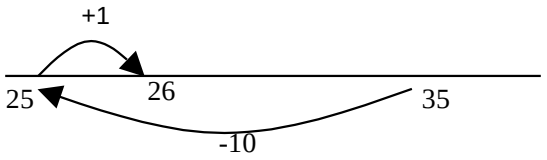
Find a small difference by counting up

42 – 39 = 3

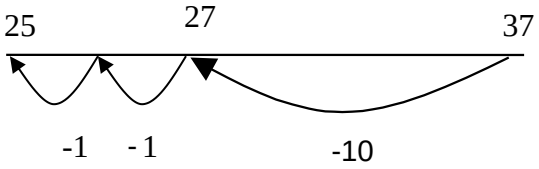


Mental Methods/jottings

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

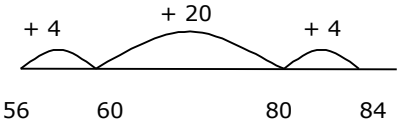
Find a small difference by counting up

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

Develop to larger numbers using number facts to reduce number of jumps whilst maintaining accuracy and efficiency (i.e, jump to next ten and then in multiples of tens).

Pencil and paper procedures

84 – 56 = 28



Mental Methods/jottings

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

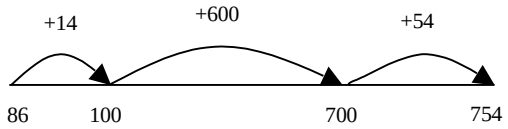
Estimate first….
197 – 15 = 182

Subtraction

Stage 4

Pencil and paper procedures

754 – 86 = 668



98
- 24
4 (8-4)
70 (90-20)
74

Use decomposition when appropriate (see stage 5)

92
- 38
54 (explain what happens…see below)

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

Stage 5

Find a difference by counting on

e.g. 8006 – 2993 = 5013
This can be modelled on an empty number line

Pencil and paper procedures

8 1
~~9~~ 2
- 3 8
5 4

Develop the stages of decomposition introducing 'zero'

2 4 1
~~3~~ ~~5~~ 2
- 1 7 8
1 7 4

4 9 9 1
~~5~~ 0 0 0
- 4 5 7
4 5 4 3

Stage 6

- = signs and missing numbers

Pencil and paper procedures

Develop the use decomposition

extend to up to 2 decimal places

48.42 – ~~37~~.61 =

4 ~~7~~ ~~8~~ . ~~1~~ 4 2
3 7 . 6 1
1 0 . 8 1

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

302.63 – 178.124 =

2 9 1
~~3~~ ~~0~~ 2 . 6 ~~2~~ ~~3~~ ~~1~~0
- 1 7 8 . 1 2 4
1 2 4 . 5 0 6

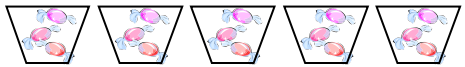
Progression			
A	Jumps in ones only	2 digits – 2 digits & 3 digits – 3 digits	65 – 58 & 185 - 178
B	Including jumps of 10	2 digits – 2 digits & 3 digits – 3 digits	55 – 38 & 165 - 133
C	Crossing a hundreds boundary	3d – 2d & 3d – 3d	134 – 84 & 423 - 376
D	Crossing more than one hundreds boundary	3d – 2d & 3d – 3d	523 – 42 & 921 – 345
E	Crossing more than one thousands boundary	As above including 4 digits	7356 – 4802 & 3429 - 217
F	Relate time to 60mins boundaries	Extend to decimals and time	465.15 -274.87 & 12:34 – 7hrs 50m

Multiplication

Stage 1

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.

Lots of counting in different sequences, forwards and backwards, from any number (use stick, hoop etc).

Stage 2

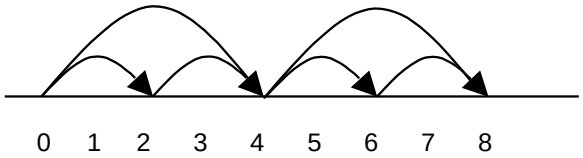
x = signs and missing numbers

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

Arrays and repeated addition

● ● ● ● 4 x 2 or 4 + 4
● ● ● ● 4 lots of 2

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



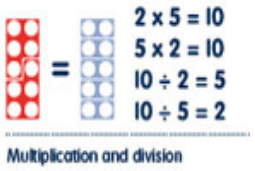
Use lots of different vocabulary (lots of, groups of etc)

Doubling multiples of 5 up to 50

15 x 2 = 30

Introduce partitioning
(10 x 2) + (5 x 2)
20 + 10 = 30

Concrete, physical experiences/models needed – wrapping paper, egg box arrays, creating arrays with counters etc.

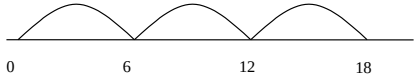


Stage 3

x = signs and missing numbers

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

Number lines
6 x 3



35 x 2 = 70

Grid Method.

Partitioning extended (only use with the times tables covered so far)

x	30	5
2	60	10

= 70

Multiplication

Stage 4

= signs and missing numbers

Pencil and paper procedures

Grid method

TU x U

23 x 7 is approximately 20 x 10 = 200 - estimation

23 x 7 = 161

	T	U
x	20	3
7	140	21

Add boxes using secure written or mental method e.g.

```
  140
+  21
 -----
  161
```

HTU x U

123 x 3 = 369

	H	T	U
X	100	20	3
3	300	60	9

Short multiplication can be introduced here for 2dx1d (grid method maintained for larger numbers)

.

	2	**4**
X		**3**
	1	2
	6	0
	7	2

Stage 5

x = signs and missing 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
			1

Estimate and check

1125 x 7 = 7875

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

Progress to formal compact method (long multiplication) as appropriate.

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

		7	**2**
	X	**3**	**8**
	5	6_1	6
2	1	6	0
2	7_1	3	6

Stage 6

x = signs and missing numbers

Pencil and paper procedures

Grid method

Estimate and check

372 x 24 is approximately 400 x 20 = 8000

x	300	70	2
20	6000	1400	40
4	1200	280	8

th	h	t	u	
	1			
6	0	0	0	
1	4	0	0	
1	2	0	0	
	2	8	0	
		4	0	
			8	+
8	9	2	8	

Long multiplication for 3digits x 2digits.

Eg. 124x26

	1	**2**	**4**
x		**2**	**6**
	6_1	2_2	4
2	4	8	0
3_1	2_1	2	4

Grid method for decimals

7.2 x 3.8

x	7	0.2	
3	21	0.6	= 21.60
0.8	5.6	0.16	= 5.76 +
			27.36
			1

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

Progression	In addition to quick times table recall.	
a	Teens x 1 digit	14 x 3
b	Any 2d x 1d	53 x 4
c	Any 3d x 1d	534 x 4
d	Teens x teens	14 x 13
e	Teens x 2 d	14 x 42
f	2d x 2d, 3d x 2d etc	24 x 35, 678 x 92
g	One number with one decimal place	24 x 3.2

Division

Stage 1

Pictures / marks

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

Lot of practical experience – using cubes etc.

Counting forwards and backwards in different intervals using hoop, stick etc.

Stage 2

÷ = signs and missing numbers

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

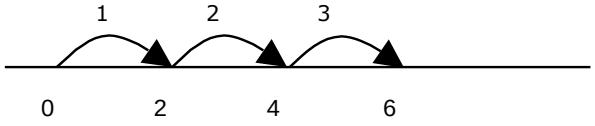
Understand division as sharing and grouping

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

6 ÷ 2 can be modelled as:

Use lots of different models and images, practical experience.

Grouping – There are 6 sweets. How many people can have 2 each? (How many 2's make 6?)



Use bead strings, grouping ITP etc. Link to arrays.
Vary the vocabulary used – groups of, lots of, sets of…

Stage 3

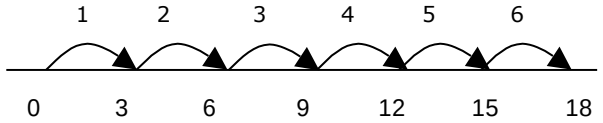
÷ = signs and missing numbers

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

Understand division as sharing and grouping

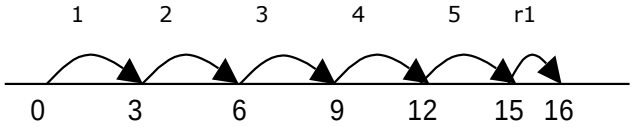
18 ÷ 3 can be modelled as:
Sharing – 18 shared between 3 (see Stage 2 diagram)

Grouping - How many 3's make 18?



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.



Discuss having 5 full groups of 3 (eg) and one remainder.

Use ITP with remainders also.

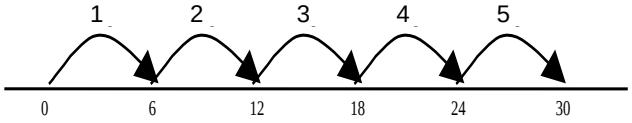
Division

Stage 4

÷ = signs and missing numbers

Sharing and grouping

30 ÷ 6 can be modelled as:



Intro to chunking when numbers are bigger. More effective method than single group grouping.

41÷ 4 = 10 r1
10 groups of 4 shown as one jump.

OR 41 = (10 x 4) + 1

Stage 5

÷ = signs and missing numbers

Remainders

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

Pencil and paper procedures

BUS STOP METHOD (short division)

Eg 861 ÷ 4 =

```
    2  1  5  .  2  5
  ┌──────────────────
4 │ 8  6 ²1  .  ¹0 ²0
```

Progress to this method - but only when children are secure in what is happening when dividing.

Stage 6

÷ = signs and missing numbers

Remainders

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

Pencil and paper procedures

977 ÷ 36 is approximately 1000 ÷ 40 = 25

Use chunking for division of larger number and dividing by 2-digit numbers (See e.g. in Stage 4) – then progress to:

BUS STOP METHOD (long division)

```
          0  2  7  .  1  3  8  8
       ┌──────────────────────────
3  6   │ 9  7  7  .  0  0  0  0
       │ 0
       │ 9  7
    -  │ 7  2
       │ 2  5  7
    -  │ 2  5  2
       │       ⁴5  .  ¹0
       │       3  .  6
       │       1  .  ³4  ¹0
       │       1  .  0  8
       │       0  .  ²3  ¹¹2  ¹0
       │             2  8  8
       │                3  2  0
```

Progression	In addition to quick division facts recall for appropriate times tables.	
a	No remainders (times tables based)	36 ÷ 3
b	With remainders	38 ÷ 3
c	Teens x up to 12x12 no remainders	85 ÷ 5
d	Teens x up to 12x12 with remainders	88 ÷ 5
e	Any whole number by any whole number	673 ÷ 7
f	Showing remainders as a fraction	