English Martyrs Catholic Primary School

"where everyone is special"

P16: Calculations Policy

Mission Statement 2012

With Christ at the heart of our Catholic community,
our mission is to:

✠ nurture the potential in each individual,
✠ celebrate achievement,
✠ and develop an awareness of service
to God and each other

Adopted by the school: July 2014

Review: As needed

Progression towards a standard written method of calculation

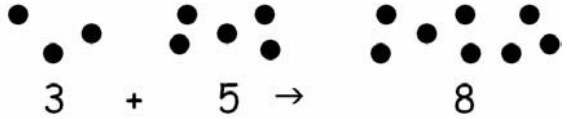
Our school calculation provides a structure and systematic approach to teaching number. The stages are progressive and each stage should be worked through before moving onto the next stage. Informal written recordings should take place regularly and is an important part of learning and understanding. Formal written methods should be encouraged as soon as possible. This will help communicate methods and solutions.

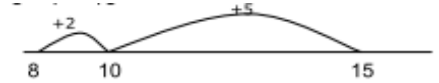
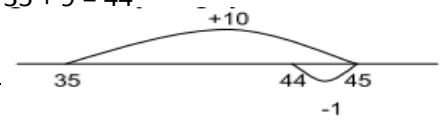
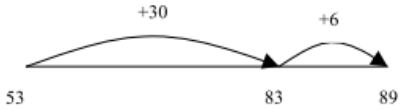
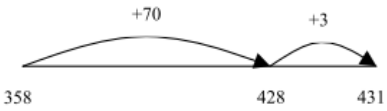
Why do we need this policy?

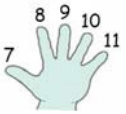
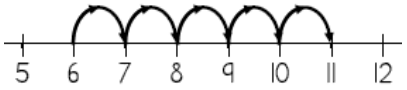
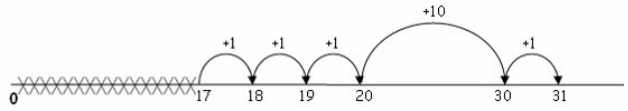
- Consistency in methods taught throughout the school
- Progression from informal / practical methods of recording to written methods for each of the four operations
- An aid to parent's understanding in their child's stages of learning

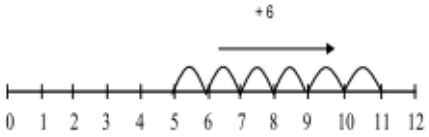
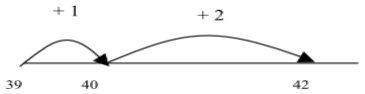
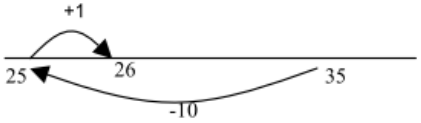
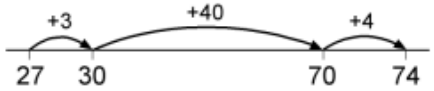
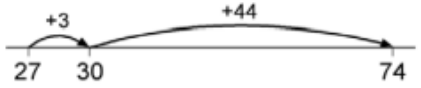
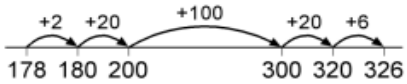
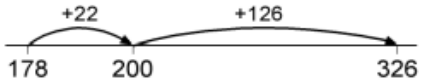
Things to remember

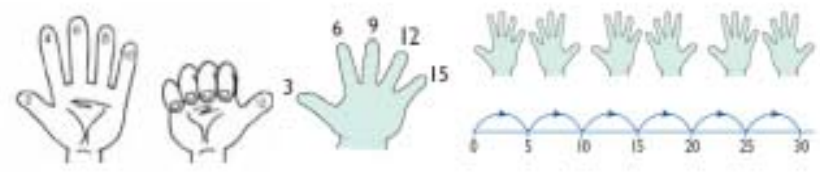
- Children should always estimate the answer first
- Always check the answer, preferably using a different method e.g. the inverse operation or rounding
- Always decide first whether a mental method is appropriate
- Pay attention to mathematical language
- Children need to know number and multiplication facts by heart e.g. 12 x 12 tables, number bonds to 10 and 20
- To reinforce concepts and understanding expanded methods can be used as a teaching tool
- Use practical equipment when introducing or reviewing or consolidating a concept e.g. division
- Children should be introduced to calculators from Foundation stage, developing skills to use them effectively.

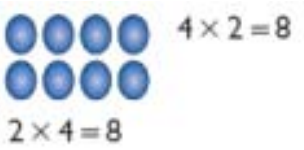
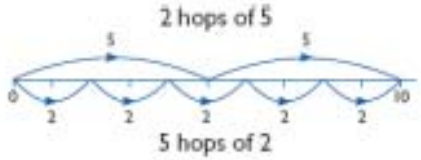
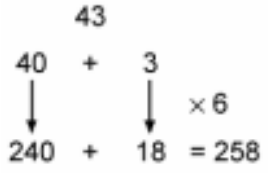
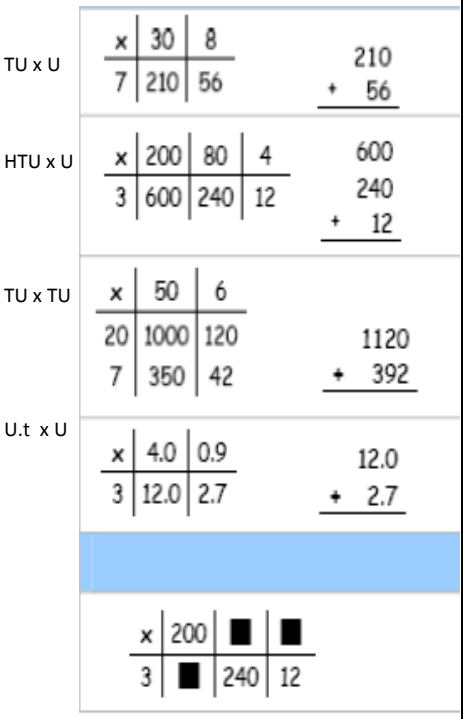
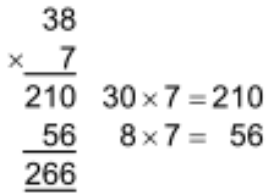
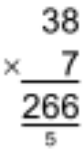
Addition
Early development: Informal counting methods: Counting songs/rhymes Story around structure – I have a set of 3 objects to start with and I get 5 more ‘How many altogether?’ Very practical addition with objects Often modelled with sets of “things” – using vocabulary ‘have’, ‘more’, ‘altogether’ Pictorial addition
Counting objects: A child working on 3 + 5 counts out three counters and then five counters and then finds the total by counting all the counters.   

Stage 1	Stage 2	Stage 3	Stage 4
Use of blank number lines: 3 + 5 Child counts from the first number adding on in ones. '3'   This develops towards the child selecting the larger number, even when it is not the first number and counts on from there. 3 + 5 = 8 '5'   	To add successfully, children need to: • Recall of addition pairs to 9 + 9 and complements in 10 • Add mentally a series of one-digit numbers, such as 5 + 8 + 4 • Add multiples of 10 or 100 using related addition facts and their knowledge of place value • Partition two-digit and three digit numbers into multiples of 100, 10 and 1 in different ways. **<u>Count on in tens and ones</u>**: 12 + 23 = 23 + 10 + 2 = 33 + 2 = 35  **<u>Partitioning and bridge through ten</u>**: The steps in addition often bridge through a multiple of 10 e.g. Children should be able to partition the 7 to relate adding the 2 and then the 5 e.g. 8 + 7 = 15  **<u>Adding 9 or 11 by adding 10 and adjusting by 1</u>** e.g. add 9 by adding 10 then adjusting by 1 35 + 9 = 44  	Use of partition: **<u>Partition into tens and ones</u>**: • Partition both numbers and recombine e.g. 27 + 32 = 30 + 20 = 50 7 + 2 = 9 50 + 9 = 59 • Count on by partitioning the second number only e.g. 36 + 53 53 + 30 + 6 83 + 6 = 89  358 + 73 358 + 70 + 3 428 + 3 = 431  	Pencil and paper vertical methods: 27 + 32 2 7 +3 2 9 5 0 5 9 367 +185 3 6 7 +1 8 5 1 2 1 4 0 4 0 0 5 5 2 This method can also be used for decimal calculations **<u>Compact method</u>** 47 + 26 4 7 +2 6 7 3 1 368 + 423 3 6 8 4 2 3 7 9 1 1 3 5 8 7 + 6 7 5 4 2 6 2 1 1 1 6 5 8 4 + 5 8 4 8 1 2 4 3 2 1 1 1 Column addition remains efficient when used with larger whole numbers and decimals. 7 2 . 8 3 + 5 4 . 6 8 1 2 7 . 5 1 1 1

Subtraction
Early development: Informal counting methods: Songs/rhymes Very practical with objects Often modelled with sets of “things” – essentially the story follows the same plot of ‘have’, ‘take away’, ‘have left’ Children encouraged to count back when working with sets of “things”. For example, when subtracting 4 from 10 counters, children will be encouraged to take away counters by saying: ten, nine, eight, seven, which leaves you with six.
Count up: A child finding 9 – 3, counts on from three to nine: four, five, six, seven, eight, nine ooooooøøø A child subtracting 11 – 6, counts up from 6 to 11, ‘seven, eight, nine, ten, eleven’, sometimes keeping a count of the spoken numbers using fingers.      
Early Number line – moving from marked to empty number lines Counting on 31 – 17 The number should still show 0 so children can cross out the section from 0 to the smallest number. They then associate this method with ‘taking away’. Count up from 17 to 20 (the next multiple of 10). Count up in tens to 30 (the multiple of ten before 31). Then count in ones to 31.   

Subtraction - Building towards an efficient written method			
Stage 1	**Stage 2**	**Stage 3**	**Stage 4**
• Understand subtraction as 'take away'  • Find a 'difference' by counting up The empty number line: • The empty number line helps to record or explain the steps in mental calculations • Either counting up will be used to record calculations • The empty number line is a useful way of modelling processes such as bridging through a multiple of ten <u>The counting up method</u>: Start with the smallest number 11 – 5 	Find small difference by counting up: 42 – 39 =  Subtract 9 or 11. Begin to add/subtract 19 or 21  Children make jumps to the next multiple of ten until they become more proficient and can combine steps: e.g. 74 – 27  or:  With three-digit numbers the number of steps can be reduced e.g. 326 – 178  	Expanded layout, leading to column method: Partitioned numbers are written under one another: e.g. 74 – 27 $70 + 4$ $-\ 20 + 7$ $\overset{60}{\cancel{70}} + \overset{14}{\cancel{4}}$ $-\ 20 + 7$ $40 + 7$ 741 - 367 $700 + 40 + 1$ $-\ 300 + 60 + 7$ $\overset{600}{\cancel{700}} + \overset{130}{\cancel{40}} + \overset{11}{\cancel{1}}$ $-\ 300 + 60 + 7$ $300 + 70 + 4$ **Note**: When partitioning numbers to subtract you may choose to use the symbol + or the word 'and'. However, the word 'and' should be replaced with the symbol when the children become more proficient with this method.	Compact method with whole numbers and decimals: 74 - 27 $\begin{array}{r} \overset{6}{\cancel{7}}\,\overset{14}{\cancel{4}} \\ -\ 2\ 7 \\ \hline 4\ 7 \end{array}$ 741 – 367 $\begin{array}{r} \overset{6}{\cancel{7}}\,\overset{13}{\cancel{4}}\,\overset{11}{\cancel{1}} \\ -\ 3\ 6\ 7 \\ \hline 3\ 7\ 4 \end{array}$ 503 – 278 $\begin{array}{r} \overset{4}{5}\,\overset{9}{\cancel{0}}\,\overset{1}{3} \\ -\ 2\ 7\ 8 \\ \hline 2\ 2\ 5 \end{array}$ 2362 – 548 $\begin{array}{r} \overset{1}{\cancel{2}}\,\overset{1}{3}\,\overset{5}{\cancel{6}}\,\overset{1}{2} \\ -\ 5\ 4\ 8 \\ \hline 1\ 8\ 1\ 4 \end{array}$ 72.5 – 45.7 $\begin{array}{r} \overset{6}{\cancel{7}}\,\overset{11}{\cancel{2}}.\,\overset{1}{5} \\ -\ 4\ 5.\ 7 \\ \hline 2\ 6.\ 8 \end{array}$

Multiplication
<u>Early development</u>: Multiplication is related to doubling and counting groups of the same size.      Counting in equal steps – '5, 10, 15, 20', or in twos or tens or other multiples Include practical activities and number rhymes and songs Often modelled with grouping "things" – counting in groups of twos, five and tens, e.g. socks, shoes, animal legs, fingers in gloves, toes etc. Use picture to show groupings
Leading to multiplication as repeated addition      Looking at columns 2 + 2 + 2 3 groups of 2 Looking at rows 3 + 3 2 groups of 3

Multiplication - Building towards an efficient written method			
Stage 1	**Stage 2**	**Stage 3**	**Stage 4**
Understanding multiplication as describing an array  Recognise that multiplication can be done in any order. For example, realising that 5 x 2 is the same as 2 x 5  	Informal recordings **Partitioning**:  Leading to: 43 x 6 40 x 6 = 240 3 x 6 = 18 240 + 18 = 258 Leading to: (40 x 6) + (3 x 6) 240 + 18 = 258	**Grid method**:  **Note**: It is important that children use a written addition method to add the sum of the products.	Expanded short multiplication: 38 x 7  Short multiplication: 38 x 7 

Division

Early development:

For children to understand division they need to experience two types of activity: **grouping** and **sharing**. Pupils should experience the different types of division in a wide range of practical, relevant contexts.

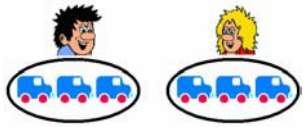
Children are generally introduced to division through practical activities that initially involve sharing, and later grouping, of objects.

Sharing

Equal sharing occurs when a quantity is shared out equally into a given number of portions, and we work out how many there are in each portion.

- When we share we know how many we have to share out and how many to share between but not how many they will each get.

6 toy cars are shared between 2 children. How many will they have each?



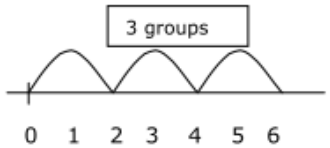
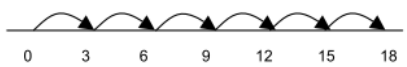
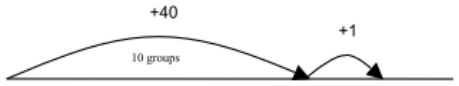
Grouping

Grouping occurs when we are asked to find how many groups of the divisor are in the original amount.

- We know how many we have and how many to put into each 'set' but not the number of 'sets' we will have.

There are 6 cars; each child can have 2 cars. How many children will get 2 cars?

15 beads put into groups of 3

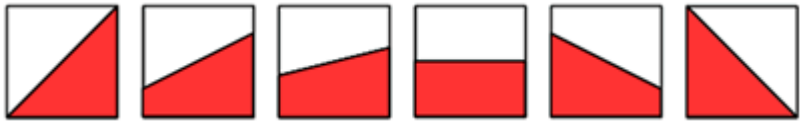
Division - Building towards an efficient written method			
Stage 1	**Stage 2**	**Stage 3**	**Stage 4**
Sharing Continue to develop practical activities involving sharing, distributing cards when playing a game, putting objects onto plates, into cups, hoops etc.  **Grouping** Sorting objects into 2s / 3s / 4s etc How many pairs of socks are there?  There are 12 crocus bulbs. Plant 3 in each pot. How many pots are there? Jo has 12 Lego wheels. How many cars can she make?	<u>Grouping</u> Link to counting and understanding number strand Count up to 100 objects by grouping them and counting in tens, fives or twos… Find one half, one quarter and three quarters of shapes and sets of objects 6 ÷ 2 can be modelled as: There are 6 strawberries. How many people can have 2 each? How many 2s make 6? 6 ÷ 2 can be modelled as  In the context of money, count forward and backwards using 2p, 5p and 10p coins Practical groupings e.g. in PE 12 children get into teams of 4 to play a game. How many teams are there? 	<u>Use of a number line</u>: Understanding division as sharing and grouping. 18 ÷ 3 can be modelled as: Sharing – 18 shared between 3 (see stage 1 model) OR 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.  Transition step to progression: Blank number lines are used and children recall times tables facts using larger jumps: Remainders 41 ÷ 4 = 10 r1  **Note**: Children are encouraged to estimate first.	<u>Expanded written methods</u>: Chunking (linked to repeated subtraction): TU ÷ U 97 ÷ 9 9) 97 - 90 x10 7 Answer: 10 r 7 HTU ÷ U 196 ÷ 6 6) 196 - 60 x10 136 - 60 x10 76 - 60 x10 16 - 12 x2 4 Answer: 32 r 4 Leading to multiplying 6 by multiples of 10, 20, 30 to reduce the number of steps: 6) 196 - 180 x30 16 - 12 x2 4 Answer: 32 r 4 HTU ÷T U 24) 560 - 480 x20 80 - 72 x3 8 Answer: 23 r 8 **Note: When chunking is secure, the more able will move to short division. However, this will not represent a whole year group.**

Fractions

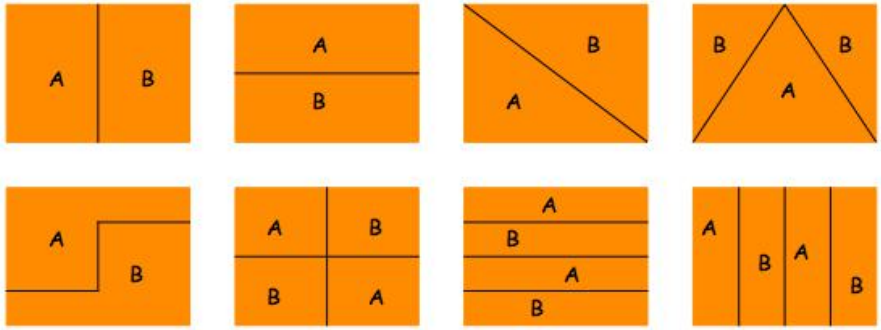
Early development:
Children will look at fractions in relation to halves, quarters and using fractions practically by cutting items and sharing items equally.

Equal Sharing

Recognise, find and name a half as one of two equal parts of an object, shape or quantity

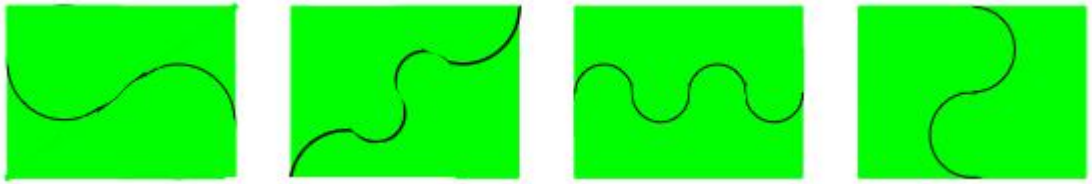


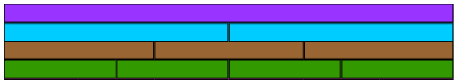
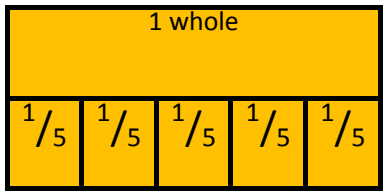
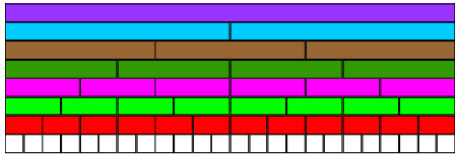
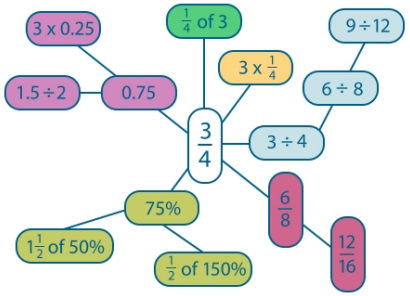
Recognise, find and name a quarter as one of four equal parts of an object, shape or quantity.



Begin to connect halves and quarters to the equal sharing and grouping of sets of objects and to measures as well as recognising and combining halves and quarters as parts of a whole.

The image shows halving in different ways, not just with straight lines.



Fractions - Building towards an efficient written method			
Stage 1	**Stage 2**	**Stage 3**	**Stage 4**
Adding and subtracting fractions with the same denominator $\frac{2}{4}+\frac{1}{4}=$ Use equivalent fraction wall to help  So $\frac{2}{4}+\frac{1}{4}=\frac{3}{4}$ $\frac{3}{5}-\frac{2}{5}=\frac{1}{5}$ 	Using fraction walls to support understanding.  Same as Stage 1 adding and subtracting with the same denominator but the fractions will be over 1 whole $\frac{1}{4}+\frac{5}{4}=\frac{6}{4}$ *or* $1\frac{2}{4}$ This will lead into proper fractions and mixed numbers	Adding and subtracting using the same denominators and denominators that are multiples of the same number $\frac{1}{4}+\frac{1}{8}=\frac{3}{8}$ Again use the fraction walls to demonstrate that a ¼ is equivalent to 2/8 and therefore 2/8 and 1/8 equals 3/8 Making the denominators the same(common denominators) $\frac{1}{4}+\frac{1}{8}=$ The simplest way is to multiply the denominators together but this can be advanced to least common denominators . Multiples of 4: 4, 8, 12, 16… Multiples of 8: 8, 16, 24… 8 is the least common denominator so the $\frac{1}{4}$ becomes $\frac{2}{8}$: $\frac{2}{8}+\frac{1}{8}=\frac{3}{8}$	Multiplying proper fractions and mixed numbers. 3 x $\frac{1}{4}=\frac{3}{4}$ ¼ + ¼ + ¼ 

NB there are many models and images using the ITPs online to help show equivalence, adding, subtracting and multiplying fractions