

## VISION STATEMENT

Our vision is to create a community based on Catholic faith and values where every child is empowered to be the best he or she can be, nurtured by outstanding teachers, staff and governors

## Calculation Policy 2022

## St Martha's Catholic Primary <br> School

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## Aims

The aim of this calculation policy is simple - to help children perform mental and written calculations fluently, accurately and consistently across the whole school. They should be ready for their next stage of learning and move fluidly from one phase to the next.

Embedded within this aim is the idea that we also need to develop children into good mathematicians who understand the concepts behind mathematical ideas (rather than follow a procedure) and can make connections between their calculation skills and other areas of mathematics.
The aims of the National Curriculum for mathematics will play a central role to this document with fluency, mathematical reasoning and problem solving playing a full part in developing secure calculation strategies.

## Rationale

Having conducted school based research into effective calculation strategies, based on the work of A. Borthwick and M. Harcourt-Heath (2007), it was clear that many of the methods children were using were not successful and that those used successfully by children should be built into this policy. The most successful strategies included a column method for addition, subtraction using a number line, multiplication using a grid and division using a number line or chunking.

Upon analysing a range of different methods used, it was recognised that the formal written methods set out in the 2014 National Curriculum for mathematics may ultimately lead to children being able to perform calculations with more speed; however it is believed that delaying their use will enable children to gain greater conceptual understanding and fluency when calculating. It was agreed that a smoother transition is needed when moving from concrete and representational methods to abstract methods.

In order to develop successful strategies pupils must develop a mastery and ownership of the mathematics they use and this develops best when children can fully understand mathematical concepts. To aid conceptual development this policy and the strategies outlined within will follow a C.P.A approach (Concrete, Pictorial/representational, Abstract) where children use concrete or physical apparatus and resources to develop underlying concepts, begin to represent calculations using pictures, diagrams and jottings before working on abstract calculations and written methods. Mental skills and calculation techniques will always work hand in hand with these methods.

## Links to mental maths

Laying the foundations for successful calculation strategies is rooted in developing a secure conceptual understanding of each operation. The use of practical resources and mental mathematics are the structures that written methods are built around.


Below is a range of models, images and resources than can support mental and written methods. These will be used in lessons at an appropriate age and ability to support children's learning.


## Addition

The process of finding the total of two or more amounts. It is the inverse of subtraction.

## Early learning and mental maths

Using a range of practical resources and real life contexts, pupils develop their understanding of the concept of addition through counting activities, singing songs, recalling number bonds etc. They then use pictures/diagrams to represent the calculation.
E.g. 4 cats play a game. 3 more join in. How many are playing altogether? 4+3=7


Children will progress to show this using a number track or number line. Number bonds to 10,20 and 100 will also be taught as a key mental maths skill.

$4+3=7$

Progress to empty number lines. A farmer has 12 sheep in one field and 16 in another. How many does he have in total?


Developing written methods
Children will still be able to use number lines if this is their preferred successful method however as children begin to add more complex numbers they will be taught to partition numbers into tens and ones or hundreds, tens and ones etc. and add the partitioned totals mentally.

$$
\begin{aligned}
& 78+23=101 \\
& 70+20=90 \\
& 8+3=11
\end{aligned}
$$

Children will still be able to use the partitioning method if this is their preferred successful method however to increase efficiency and to scaffold the transition towards statutory requirements children will begin to be taught the expanded column method (adding the largest numbers first). NB children must have
a secure understanding of partitioning before beginning to use any column method.


By the end of KS2 children will be shown the formal column method for addition.

$$
\begin{array}{r}
38 \cdot 46 \\
+\quad 29 \cdot 37 \\
\hline 67 \cdot 83 \\
\hline 1
\end{array}
$$

## Subtraction

The process of taking one number away from another number or finding the difference between two numbers. It is the inverse of addition.

## Early learning and mental maths

Using a range of practical resources and real life contexts, pupils develop their understanding of the concept of subtraction through counting activities, singing songs, recalling number bonds etc. They then use pictures/diagrams to represent the calculation.

There are $\mathbf{4}$ cats in the street. A dog scares $\mathbf{2}$ away. How many are left?


## $4-2=2$

Children will progress to showing this on a number track or number line.


Progress to counting backwards and forwards on empty number lines. Children are encouraged to add any jumps mentally. There are $\mathbf{2 5}$ birds in a tree and 11 fly away. How many are left in the tree? 25-11=14


## Developing written methods

Children will continue to count forwards and with with larger numbers and be expected to add jumps mentally.



By the end of KS2 children will be shown the decomposition method for subtraction.


## Multiplication

## The process of repeated addition or the product of two numbers. It is the inverse of

 division.
## Early learning and mental maths

Using a range of practical resources and real life contexts, pupils develop their understanding of the concept of multiplication by making sets or groups using a range of practical resources such as bead strings, Numicon, cubes etc. as well as objects from everyday life. Children will begin to link these to number line representations.
Outside a classroom there are 4 pairs of wellies. How many wellies are there altogether?

$2 \times 4=8$
Bill gives his 5 friends 4 sweets each. How many sweets does he give away?

$4 \times 5=20$

## Developing written methods

Using arrays is an important step in developing a conceptual understanding of multiplication and lays the foundations for developing the grid method which will be used later. A range of practical resources should also be used to represent arrays. The use of arrays can be shown in different ways, but it is crucial to children's understanding of multiplication. Children need to understand that it multiplication is lots of and that it is linked to addition, as it is repeated addition. When teaching multiplying by 10,100 and 1000 children will move the digits within a place value grid. It is important that they have a secure understanding of place value in order to do this susscessfully.

```
3\times6=18
\(4 \times 2=8\)
\(x \times \times \times\)
\(x \times \times x\)
```

The grid method should be used to organise more complex multiplication calculations (beyond multiplication table knowledge) and should be set out proportionally. Children should add up the partial products mentally but may use jottings when needed.


Children will still be able to use the grid method if this is their preferred successful method however by the end of KS2 (Year 5 and Year 6) children will be shown the column method of multiplication. Children must have a secure understanding of the grid method before moving on to this method.

$$
\begin{array}{r}
124 \times 26=3224 \\
124 \\
\times \quad 26 \\
\hline 744 \\
2480 \\
\hline 3224 \\
\hline 11
\end{array}
$$

## Division

The process of repeated subtraction or splitting a number into equal groups. It is the inverse of multiplication.

## Early learning and mental maths

Pupils should have many practical experiences of sharing objects e.g. sharing between 2 people, or finding $1 / 2$ of a group of objects.
Sarah has 10 stickers and shares them evenly with her friend. How many do they end up with each?


Pictures should be introduced as a next step to represent this.
Drawings and diagrams should be increasingly used to represent and demonstrate sharing.



## Developing written methods

Number lines should be introduced to help record grouping strategies. This would involve the principle of repeated subtraction (and repeated addition as an alternative strategy).


As pupils develop the concepts of repeated addition and subtraction they begin to look at making more efficient jumps. (Showing the remainder under the number line). Children should try to make the jumps proportional.
making more efficient jumps
$58 \div 8=7 r 2$


$$
222 \div 3=74
$$



Children will still be able to use a number line if this is their preferred successful method however by the end of KS2 (Year 5 and Year 6) children will be shown the short and long division method of division. Children must have a secure understanding of number lines before moving on to this method. When teaching dividing by 10,100 and 1000 children will move the digits within a place value grid. It is important that they have a secure understanding of place value in order to do this susscessfully.

$$
\begin{gathered}
432 \div 15=28 r 12 \\
15 \sqrt{432} \\
\frac{300}{132}(15 \times 20) \\
\frac{120}{12}(15 \times 8)
\end{gathered}
$$

|  | Addition + |
| :---: | :---: |
|  | Mental Maths <br> Counting forwards and backwards Understand addition is commutative <br> Partitioning <br> Recall number bonds <br> Use subtraction as the inverse of addition Using near doubles |
| Early experiences <br> 4 cats play a game. 3 more join in. How many are playing altogether? | Developing representations |
| Written methods Number lines $12+16=28$ | Partitioning $\begin{aligned} & 127+54=181 \\ & 100+0=100 \\ & 20+50=70 \\ & 7+4=11 \end{aligned}$ |
| Expanded column $\begin{array}{r} 568 \\ +493 \\ \hline 900 \\ 150 \\ 11 \\ \hline 1061 \\ \hline \end{array}$ | Contracted column $\begin{array}{r} 38 \cdot 46 \\ +\quad 29 \cdot 37 \\ \hline 67 \cdot 83 \\ \hline 11 \end{array}$ |



|  | Multiplication x |
| :---: | :---: |
|  | Mental Maths <br> - Counting forwards and backwards <br> - Repeated addition <br> - Rapid recall of facts <br> - Partitioning, doubling and halving <br> - Multiplying and dividing by 10, 100 and 1000 <br> - Use division as the inverse of multiplication |
| Early experiences <br> Outside a classroom there are 4 pairs of wellies. How many wellies are there altogether? $2 \times 4=8$ | Developing representations $2 \times 5=10$ $4 \times 5=20$ |
| Written methods <br> Begin to model using number lines | Develop arrays $\begin{array}{ll} 3 \times 6=18 & 4 \times 2=8 \\ \times \times \times & \times \times \times \times \\ \times \times \times & \times \times \times \times \\ \times \times \times & \\ \times \times \times & \\ \times \times \times & \\ x \times x & \end{array}$ |
| Using the Grid method$74 \times 28=2072$$x$ 70 4 <br> 20 1400 80 <br> 8 560 32 | Developing a column method $\begin{array}{r} 124 \times 26=3224 \\ 124 \\ \times \quad 26 \\ \hline 744 \\ 2480 \\ \hline 3224 \\ \hline 11 \end{array}$ |


|  | Division - |
| :---: | :---: |
|  | Mental Maths <br> - Counting forwards and backwards in equal steps. <br> - Rapid recall of multiplication facts. <br> - Multiplying and dividing by 10, 100 and 1000. <br> - Doubling and halving. <br> - Use multiplication as the inverse of division. |
| Early experiences <br> Bill and Dan collect 10 cubes and share them equally. How many do they have each? <br> 10 shared by $2=5$ | Developing representations Using sharing diagrams |
| $13 \div 2=6 r 1$ | Written methods <br> Developing number lines <br> repeated subtraction $28 \div 4=7$ |



Short Division

$$
\begin{gathered}
648 \div 3=216 \\
\text { 3) } 21648
\end{gathered}
$$

