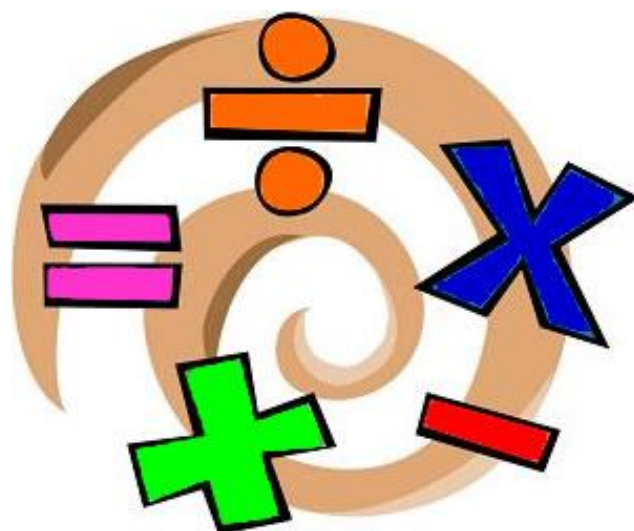


# St. Charles' R. C. Primary School

A guide to the progression through written calculations



Written methods of calculations are based on mental strategies. Each of the four operations builds on mental skills which provide the foundation for jottings and informal written methods of recording. Skills need to be taught, practised and reviewed constantly. These skills lead on to more formal written methods of calculation.

Strategies for calculation need to be supported by familiar models, images and practical activities to reinforce understanding. When teaching a new strategy it is important to start with numbers the child can easily manipulate so that they can understand the concept.

The transition between levels should not be hurried. Children should not be moved onto the next method until they are secure in their current method and are able to explain it. Previous levels should be revisited to consolidate understanding when introducing a new strategy.

A sound understanding of the number system is essential for children to carry out calculations efficiently and accurately.

# ADDITION

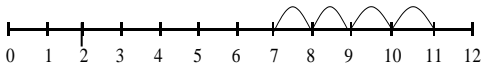
## 1. Grouping objects together

Begin to relate addition to combining two groups of objects.



## 2. Counting on using a number line

$$7 + 4 = 11$$



Recording by drawing jumps on prepared lines and then constructing their own lines.

The use of number lines will develop through:

- Counting on in tens and then ones, e.g.  $34 + 23 = 34 + 10 + 10 + 1 + 1 + 1$ ;
- Becoming more efficient by adding the units in one jump (using the known fact that  $4 + 3 = 7$ ), e.g.  $34 + 23 = 34 + 10 + 10 + 3$ ;
- Followed by adding the tens in one jump and the units in one jump;
- Applying mental strategies to using number lines through bridging through ten, e.g.
  - $37 + 15$
  - $37 + 10 = 47$
  - $47 + 3 = 50$
  - $50 + 2 = 52$
- Counting on from the largest number irrespective of the order of the calculation,
- Compensation, e.g.  $49 + 73 = 73 + 50 - 1$

## 3. Partitioning and adding most significant digits first

Children will be taught to partition the number based on the Place Value of each digit, add like values together and then recombine.

$$\begin{array}{l} 267 + 85 = 352 \\ 200 \quad = 200 \\ 60 + 80 = 140 \\ 7 + 5 = 12 \end{array} \quad \text{or} \quad 267 + 85 = 200 + (60 + 80) + (7 + 5) = 200 + 140 + 12 = 352$$

## 4. Vertical Addition

The children will be taught to set their columns out properly with each digit aligned accurately, then to add the digits starting with the digit with the smallest value (column on the right).

$$\begin{array}{r} 267 \\ + \quad 32 \\ \hline 299 \\ \hline \end{array}$$

When adding numbers involves carrying, the digit carried is placed under the column to the left. A line is then placed through when it has been added.

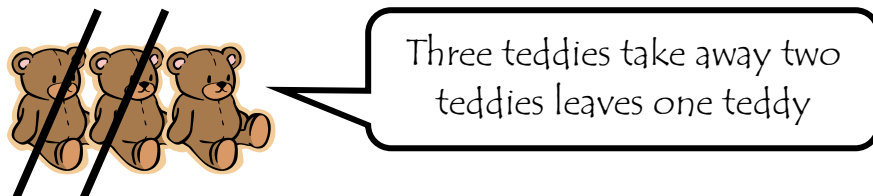
$$\begin{array}{r} 625 \\ + \quad 48 \\ \hline 673 \\ \hline \end{array}$$
$$\begin{array}{r} 3587 \\ + \quad 675 \\ \hline 4262 \\ \hline \end{array}$$

4                      4    4    4

# SUBTRACTION

## 1. Using pictures and objects

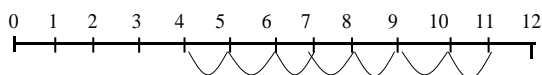
Begin to relate subtraction to taking away.



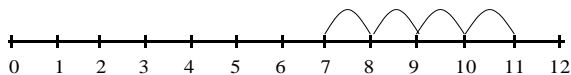
## 2. Counting on and back using a number line

$$11 - 7 = 4$$

11 take away 7 (counting back)



The difference between 7 and 11 (counting back)



Recording by drawing jumps on prepared lines and then constructing their own lines.

The use of number lines will develop through:

- Counting back when numbers are close together, e.g.  $42 - 39 = 42 - 1 - 1 - 1 = 39 \dots$  The answer is 3;
- Counting back in tens and then ones, e.g.  $34 - 23 = 34 - 10 - 10 - 1 - 1 - 1 = 11$
- Becoming more efficient by taking away the units in one jump (using the known fact that  $4 - 3 = 1$ ), e.g.  $34 - 23 = 34 - 10 - 10 - 3$ ;
- Followed by subtracting the tens in one jump and the units in one jump;
- Applying mental strategies to using number lines through bridging through ten, e.g.
  - $32 - 15$
  - $32 - 10 = 22$
  - $22 - 2 = 20$
  - $20 - 3 = 17$
- Compensation, e.g.  $73 - 49 = 73 - 50 + 1$

### 3. Partitioning and recombining

Children will be taught to partition the number based on the Place Value of each digit, subtract like values and then recombine.

$$\begin{array}{l} 89 - 57 = 32 \quad \text{or} \quad 89 - 57 = 32 \\ 80 - 50 = 30 \quad \quad 80 + 9 \\ 9 - 7 = 2 \quad \quad \quad \underline{-50 + 7} \\ \quad \quad \quad \quad \quad 30 + 2 = 32 \end{array}$$

### 4. Vertical Subtraction

The children will be taught to set their columns out properly with each digit aligned accurately, then to subtract the digits starting with the digit with the smallest value (column on the right).

$$\begin{array}{r} 267 \\ - \quad 32 \\ \hline 235 \end{array}$$

When subtracting involves taking from the next available column, the digit is crossed out and replaced with one less, the 1 taken is then placed in-front of the digit which has taken it.

$$\begin{array}{r} 61215 \\ - \quad 48 \\ \hline 7 \end{array} \quad \begin{array}{r} 561215 \\ - \quad 48 \\ \hline 587 \end{array}$$

# MULTIPLICATION

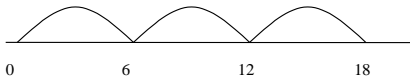
## 1. Grouping objects together

Children will begin to experience groups of objects and will group/count in 2s and 10s and move onto 5s.

## 2. Repeated Addition

Children will be taught to multiply through repeated addition, e.g.  $3 \times 5$  can be calculated by adding 5 lots of 3 or 3 lots of 5 ( $3 + 3 + 3 + 3 + 3$  or  $5 + 5 + 5 = 15$ ).

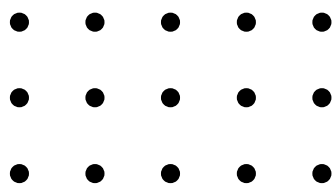
This strategy can also be shown easily on a number line, e.g. for  $6 \times 3$  you would do 3 jumps of 6 = 18



## 3. Arrays

Children should be able to model a multiplication calculation using an array. This knowledge will support with their understanding of multiplication.

$$5 \times 3 = 15 \text{ and } 3 \times 5 = 15$$



$$5 \times 3 = 15$$

(5 columns of 3 = 15)

$$3 \times 5 = 15$$

(3 rows of 5 = 15)

## 4. Partitioning

Children will be taught to partition the larger number down and then multiply each part separately before recombining. This will aid in the progression towards vertical multiplication.

$$\begin{aligned} 38 \times 5 &= (30 \times 5) + (8 \times 5) \\ &= 150 + 40 \\ &= 190 \end{aligned}$$



# DIVISION

## 1. Sharing equally

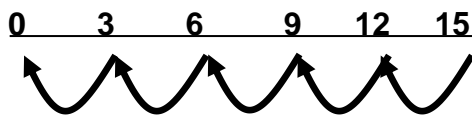
12 children get into teams of 4 to play a game. How many teams are there?



## 2. Repeated Subtraction

Children will be taught to divide through repeated subtraction, e.g.  $15 \div 3$  can be calculated by subtracting 3 until you get to 0 ( $15 - 3 - 3 - 3 - 3 - 3 = 0$ ). You have taken away 5 lots of 3 so the answer is 5.

This strategy can also be shown easily on a number line.



When using repeated subtraction to find remainders, children should be taught to repeat the subtraction until they can't take away any more (i.e. they are lower than the value of the number they are taking away), e.g.  $16 \div 3 = 16 - 3 - 3 - 3 - 3 - 3 = 1$ , can't take any more away because 1 is lower than 3 therefore the answer is 5 remainder 1.

## 3. Bus Stop Method

Children will be taught to solve division number sentences using the 'Bus Stop Method'. In using this method, children should be encouraged to use prior knowledge of number facts and to make additional jottings which will aid them in calculating the correct answer.

$243 \div 9$	Children taught to set out with number being divided going in the bus-stop and the number dividing by going in front of it.	$9 \overline{) 243}$
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The following steps will enable children to develop a consistent approach to dividing using this method. The method of inflating the numbers is to ensure the children understand the process by which their answer is created.



$$\begin{array}{r}
 0 \\
 \hline
 9 \overline{) \cancel{2} 4 3}
 \end{array}$$

How many 9s in 2? Can't do it so put a line through the 2, record a 0 above and then move the 2 (worth 200) in front of the next digit.

$$\begin{array}{r}
 0 \ 2 \\
 \hline
 9 \overline{) \cancel{2} 4 3}
 \end{array}$$

How many 9s in 24? It goes in 2 times ( $9 \times 2 = 18$  which leaves a remainder of 6). Therefore record a 2 above and then put a 6 in front of the 3 to make 63.

$$\begin{array}{r}
 0 \ 2 \ 7 \\
 \hline
 9 \overline{) \cancel{2} 4 3}
 \end{array}$$

How many 9s in 63? Yes it does, 7 times with 0 leftover. Therefore record a 7 above and you have answered the question.

The answer to  $243 \div 9 = 27$

This method can be extended to find remainders, solve division number sentences involving decimals and to divide by 2 digit numbers and more. See examples below.

$$832 \div 7 = 118r6$$

$$\begin{array}{r}
 1 \ 1 \ 8 \ r \ 6 \\
 \hline
 7 \overline{) 8 \ 3 \ 2}
 \end{array}$$

$$761.8 \div 5 = 152.36$$

$$\begin{array}{r}
 1 \ 5 \ 2 \ . \ 3 \ 6 \\
 \hline
 5 \overline{) 7 \ 6 \ 1 \ . \ 8 \ 0}
 \end{array}$$

$$935 \div 32 = 29 \ r \ 7$$

$$\begin{array}{r}
 0 \ 2 \ 9 \ r \ 7 \\
 \hline
 3 \ 2 \overline{) \cancel{9} 3 5}
 \end{array}$$