

Shakespeare County Junior School



Written Methods of Calculation

At Shakespeare Junior School the children receive a daily maths lesson are set across three classes in each year group according to ability. Staff base their planning on the National Numeracy Strategy and the Primary Framework for Mathematics which outline what is expected of each child for each year group.

This booklet outlines the methods used by staff to aid the teaching and learning of written calculations.

The aim is that children use the most appropriate method for the calculation. This may be a mental method or a written method. There may be other models and visual aids used as bridging tools by the children.

Written Methods for Addition

The following examples show the developmental stages of methods the children will be taught in order to use an efficient written method for addition of whole numbers.

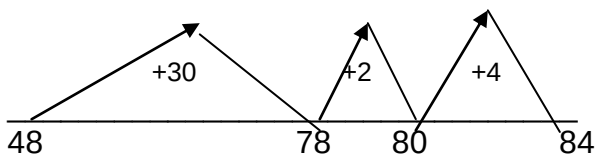
Informal Methods

Practical resources should be used to supplement the learning at all levels.

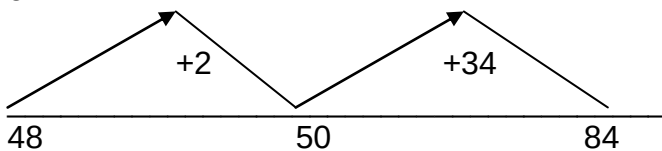
The empty number line

Steps in addition can be recorded using an unmarked number line to count on in multiples of 100, 10 or 1.

$$48 + 36 = 84$$



or



Partitioning

Steps in addition can be recorded using partitioning.

$$\begin{array}{l} 47 + 76 \\ 40 + 70 = 110 \\ 7 + 6 = 13 \end{array}$$

$$110 + 13 = 123$$

Expanded Column Method

Children will begin to set out addition in a column format where they will use partitioning, adding the least significant digit first, e.g. the unit in the first examples.

$$\begin{array}{r} 47 \\ + 76 \\ \hline 13 \\ \hline 110 \\ \hline 123 \end{array}$$

$$\begin{array}{r} 625 \\ + 48 \\ \hline 13 \\ 60 \\ \hline 600 \\ \hline 673 \end{array}$$

$$\begin{array}{r} 202 \\ + 176 \\ \hline 8 \\ 70 \\ \hline 300 \\ \hline 378 \end{array}$$

Children will then apply this method to larger numbers and decimals

$$\begin{array}{r}
 7587 \\
 + 675 \\
 \hline
 12 \\
 150 \\
 1100 \\
 7000 \\
 \hline
 8262
 \end{array}$$

$$\begin{array}{r}
 £5.75 \\
 + £3.18 \\
 \hline
 0.13 \\
 0.80 \\
 8.00 \\
 \hline
 8.93
 \end{array}$$

Standard Written Methods

The children move from an expanded method to the standard method where digits are 'carried'. 'Carried' digits are recorded below the line and described as 'carry 10' or 'carry 100' rather than 'carry one'.

$$\begin{array}{r}
 587 \\
 + 475 \\
 \hline
 1062 \\
 11
 \end{array}$$

$$\begin{array}{r}
 3587 \\
 + 675 \\
 \hline
 4262 \\
 111
 \end{array}$$

$$\begin{array}{r}
 6584 \\
 + 5848 \\
 \hline
 12432 \\
 111
 \end{array}$$

$$\begin{array}{r}
 £5.75 \\
 + £3.18 \\
 \hline
 £8.93 \\
 1
 \end{array}$$

Written Methods for Subtraction

Informal Methods

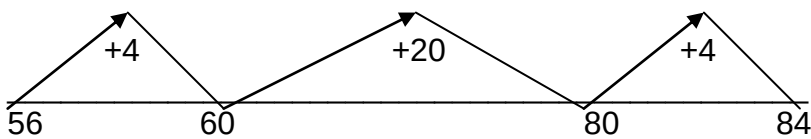
Practical resources should be used to supplement the learning at all levels.

Counting up from smallest to largest number

The children will use an unmarked number line to count up to the next multiple of ten and then on from there in order to find the difference between the two numbers. They then total all of the jumps that have taken place.

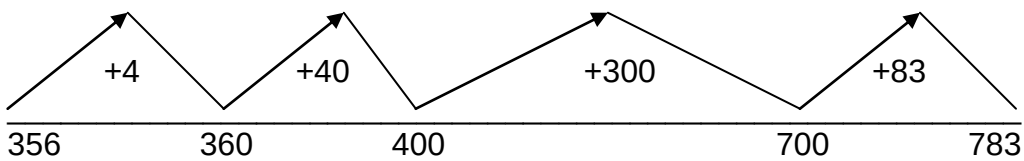
$$84 - 56 = 28$$

$$4 + 20 + 4 = 28$$



$$783 - 356 =$$

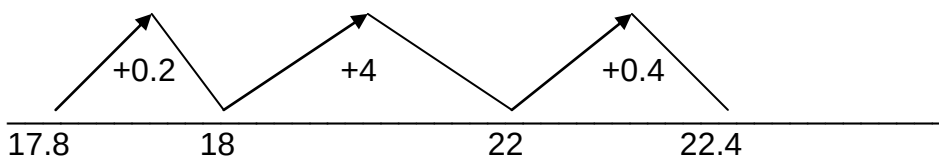
$$4 + 40 + 300 + 83 = 427$$



This method can also be used for subtracting decimals.

$$22.4 - 17.8 = 4.6$$

$$0.2 + 4.0 + 0.4 = 4.6$$



Standard Written Method

Expanded layout leading to contracted layout.

Practical resources should be used to supplement the learning at all levels.

Children should always start with the units, or smallest number.

$$83 - 21 = 62$$

$$275 - 163 = 112$$

$$24.8 - 13.2 = 11.6$$

$$\begin{array}{r} 80 + 3 \\ - 20 + 1 \\ \hline 60 + 2 \end{array} = 62$$

$$\begin{array}{r} 200 + 70 + 5 \\ - 100 + 60 + 3 \\ \hline 100 + 10 + 2 \end{array} = 112$$

$$\begin{array}{r} 20 + 4 + 0.8 \\ - 10 + 3 + 0.2 \\ \hline 10 + 1 + 0.6 \end{array} = 11.6$$

Leading to contracted layout:

$$\begin{array}{r} 83 \\ - 21 \\ \hline 62 \end{array}$$

$$\begin{array}{r} 275 \\ - 163 \\ \hline 112 \end{array}$$

$$\begin{array}{r} 24.8 \\ - 13.2 \\ \hline 11.6 \end{array}$$

Adjustment, or stealing, hundreds to tens and tens to ones.

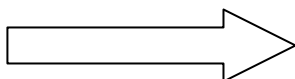
It must be remembered that children can only 'steal' one 'step' at a time.

This method is to be reinforced using concrete resources.

$$563 - 278 = 285$$

$$\begin{array}{r} 150 \\ 400 \quad 50 \quad 13 \\ - 500 + 60 + 3 \\ - 200 + 70 + 8 \\ \hline 200 + 80 + 5 \end{array}$$

Leading to the
contracted method



$$563 - 278 = 285$$

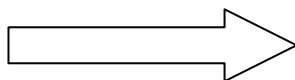
$$\begin{array}{r} 4 \ 15 \ 13 \\ 5 \ 6 \ 3 \\ - 2 \ 7 \ 8 \\ \hline 2 \ 8 \ 5 \end{array}$$

Adjustment, or 'stealing', from a zero

$$503 - 278 = 225$$

$$\begin{array}{r} 90 \\ 400 \quad 100 \quad 13 \\ - 500 + 0 + 3 \\ - 200 + 70 + 8 \\ \hline 200 + 20 + 5 \end{array}$$

Leading to the
contracted method



$$503 - 278 = 225$$

$$\begin{array}{r} 4 \ 9 \ 13 \\ 5 \ 0 \ 3 \\ - 2 \ 7 \ 8 \\ \hline 2 \ 2 \ 5 \end{array}$$

Written Methods for Multiplication

Practical resources should be used to supplement the learning at all levels.

The following examples show the developmental stages of methods the children will be taught in order to use an efficient written method for multiplication.

Informal Methods

It is important for children to understand multiplication as:

Repeated addition:

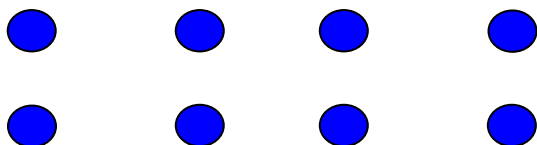
5 added together 3 times is $5 + 5 + 5$

3 lots of 5

3 times 5

5×3

Describing and array:



$$4 \times 2 = 8$$

$$2 \times 4 = 8$$

Scaling

A number of times as wide or tall ... e.g.

Take the blue ribbon. Find the ribbon that is 4 times as long. Make a red tower 5 cubes high.

Make a blue tower 3 times as high as the red tower.

The Grid Method

The grid method enables children to partition a number and then carry out the multiplication. This allows the children to have a clear understanding of the calculations involved in the problem.

$$23 \times 8$$

Estimate $20 \times 10 = 200$

X	20	3
8	160	24

$$\begin{array}{r} 160 \\ + 24 \\ \hline 184 \end{array}$$

$$346 \times 9$$

Estimate $300 \times 10 = 3000$

X	300	40	6
9	2700	360	54

$$\begin{array}{r} 2700 \\ 360 \\ + 54 \\ \hline 3114 \end{array}$$

4346 X 8
Estimate 4500 X 10 = 45000

X	4000	300	40	6
8	32000	2400	320	48

32000
2400
320
+ 48
34768

72 X 38
Estimate 70 X 40 = 2800

X	70	2
30	2100	60
8	560	16

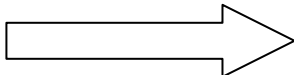
2100
560
60
+ 16
2736

Standard Written Methods

Short Multiplication (multiplying by Units)

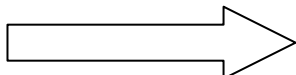
The children will use a more expanded version of vertical recoding based on the grid method. The recording is reduced further with carry digits recorded below the line. Any bracketed recording of the step will have the multiplier on the right.

23
X 7
21 (3 X 7)
140 (20 X 7)
161

Leading to the
contracted method


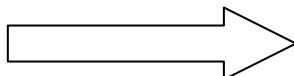
23
X 7
161
2

346
X 9
54 (6 X 9)
360 (40 X 9)
2700 (300 X 9)
3114

Leading to the
contracted method


346
X 9
3114
45

4.92
X 3
0.06 (0.02 X 3)
2.70 (0.90 X 3)
12.00 (4.00 X 3)
14.76

Leading to the
contracted method


4.92
X 3
14.76
2

Long Multiplication (TU X TU and HTU X TU)

$$72 \times 38$$

$$\text{estimate: } 70 \times 40 = 2800$$

$$\begin{array}{r} 72 \\ \times 38 \\ \hline 16 \text{ (} 2 \times 8 \text{)} \\ 560 \text{ (} 70 \times 8 \text{)} \\ 60 \text{ (} 2 \times 30 \text{)} \\ \underline{210} \text{ (} 70 \times 30 \text{)} \\ 2736 \\ 1 \end{array}$$

$$352 \times 27$$

$$\text{estimate: } 350 \times 30 = 10,500$$

$$\begin{array}{r} 352 \\ \times 27 \\ \hline 14 \text{ (} 2 \times 7 \text{)} \\ 350 \text{ (} 50 \times 7 \text{)} \\ 2100 \text{ (} 300 \times 7 \text{)} \\ 40 \text{ (} 2 \times 20 \text{)} \\ 1000 \text{ (} 50 \times 20 \text{)} \\ \underline{6000} \text{ (} 300 \times 20 \text{)} \\ 9504 \\ 1 \end{array}$$

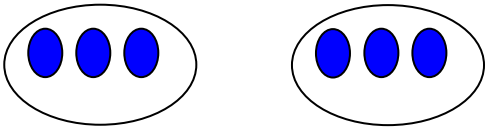
Written Methods for Division

Informal Methods

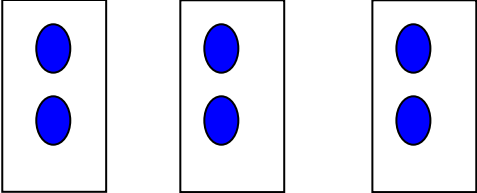
Practical resources should be used to supplement the learning at all levels. When learning written methods of division children are particularly encouraged to use a range of mental skills and times table knowledge in addition to tools such as Dienes and their fingers.

Sharing and Grouping

Sharing

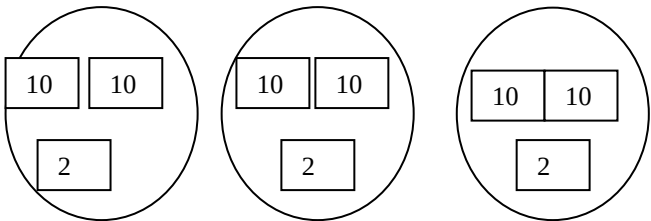
6 sweets are shared between 2 people. How many do they each have?	
--	--

Grouping

6 children get into groups of 2	
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Shared Chunking

When children are confident with sharing in 1's they can then progress into sharing chunks, this may be sharing out chunks of 10 or bigger if necessary.

66 sweets are shared between 3 people. How many do they each have?	
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Repeated Subtraction (Chunking)

This method is based on subtracting multiples of the divisor, or taking 'chunks' from the number to be divided. The number of 'chunks' are added up at the end to find the solution. Children need to be confident in written subtraction to use this method accurately.

Children should take 'easy big chunks' first, for example multiples of ten. When steps are bracketed the divisor is to be written on the right. When confident in the method the divisor part of the bracket can be left out, e.g. (10 X 5) becomes (10).

$$75 \div 5 = 15$$

$$\begin{array}{r} 15 \\ 5 \overline{) 75} \\ \underline{-50} \quad (10 \times 5) \\ 25 \\ \underline{-25} \quad (5 \times 5) \\ 00 \end{array}$$

$$256 \div 7 = 36 \text{ r}4$$

$$\begin{array}{r} 36 \text{ r}4 \\ 7 \overline{) 256} \\ \underline{-70} \quad (10 \times 7) \\ 186 \\ \underline{-140} \quad (20 \times 7) \\ 46 \\ \underline{-42} \quad (6 \times 7) \\ 4 \end{array}$$

This method can also be applied to decimals

$$87.5 \div 7 = 12.5$$

$$\begin{array}{r} 12.5 \\ 7 \overline{) 87.5} \\ \underline{-70.0} \quad (10 \times 7) \\ 17.5 \\ \underline{-14.0} \quad (2 \times 7) \\ 3.5 \\ \underline{-3.5} \quad (0.5 \times 7) \\ 0.0 \end{array}$$

Standard Written Method

Expanded Short Division

When children have a confident understanding of division they can begin to use expanded short division. Initially this is to be modelled and practiced alongside 'chunking' to provide clarity. The children record the carried numbers below.

$$291 \div 3 = 97$$

$$\begin{array}{r} 0 \quad 9 \quad 7 \\ 3 \overline{) 291} \\ \underline{29} \\ 21 \\ \underline{21} \\ 00 \end{array}$$

Standard Short Division

$$484 \div 4 = 121$$

$$\begin{array}{r} 1 \quad 2 \quad 1 \\ 4 \overline{) 484} \end{array}$$

$$291 \div 3 = 97$$

$$\begin{array}{r} 9 \quad 7 \\ 3 \overline{) 291} \end{array}$$

It is possible to apply this method to decimals:

$$12.7 \div 3 = 4.24$$

$$\begin{array}{r} 4 \quad . \quad 2 \quad 4 \\ 3 \overline{) 12.712} \end{array}$$