Blakesley C of E Primary School
Calculation Policy for the New Curriculum

"Aims The national curriculum for mathematics aims to ensure that all pupils:
♣ become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.
♣ reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language
♣ can solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions." National Curriculum for Mathematics 2013

Our aim is that pupils at Blakeley C of E Primary School use mental methods where appropriate, but for calculations that they cannot do in their heads they use an efficient written method accurately and with confidence.

As reasoning is so embedded in the new curriculum it is essential that our pupils have a secure grasp of why they are doing a mental or written calculation in a particular way. This is why each calculation has been broken down into different stages. If pupils were to begin by using the formal written methods (usually introduced in Years 5 or 6) then the understanding behind each step of the calculation is lost, and the pupil is purely learning by rote. This could limit their ability to progress further in Mathematics in the future.

Addition - Written methods for addition of whole numbers

These notes show the stages in building up to using an efficient written method for addition of whole numbers by the end of Year 4. To add successfully, children need to be able to: recall all 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 (such as 60 + 70) or of 100 (such as 600 + 700) using the related addition fact, 6 + 7, and their knowledge of place value; partition two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways.

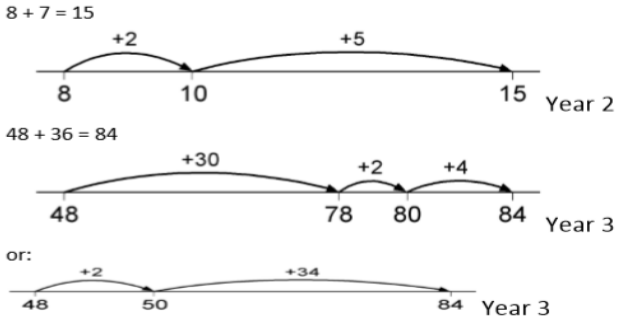
Note: It is important that children's mental methods of calculation are practised on a regular basis and secured alongside their learning and use of an efficient written method for addition.

Using and Applying Skills
(In the new curriculum this is not regarded as a separate area as it was before, but an essential part of all Mathematics learning.)
Before children move onto the next stage in written calculation it is important that their skills are broadened through their use and application in a range of contexts (including money, time and other measures)

ADDITION: Following on from number line/number track work

Stage 1: The empty number line

Steps in addition can be recorded on a number line. The steps often bridge through a multiple of 10.



Stage 2: Partitioning

Record steps in addition using partitioning: 76 + 47 = 76 + 40 + 7 = 116 + 7 = 123 76 + 47 = 70 + 40 + 6 + 7 = 110 + 13 = 123 Partitioned numbers are then written under one another:

Year 3

$$\begin{array}{rcl} 47 & = & 40 + 7 \\ +\,76 & & 70 + 6 \\ \hline & & 110 + 13 \end{array} = 123$$

or in a grid

40	7
70	6
110	13

Stage 3: Column method efficient

Ask the children to estimate first.

Year 2

$$\begin{array}{r} 47 \\ +\ 76 \\ \hline 123 \\ \hline 11 \end{array}$$

Year 3

$$\begin{array}{r} 258 \\ +\ 87 \\ \hline 345 \\ \hline 11 \end{array} \qquad \begin{array}{r} 366 \\ +458 \\ \hline 824 \\ \hline 11 \end{array}$$

Children need to have experience of adding more than two numbers.

Column addition remains efficient when used with larger whole numbers and decimals. Once learned, the method is quick and reliable.

Subtraction - Written methods for subtraction with whole numbers

Pupils need methods they can rely on when mental methods are not appropriate. These notes show the stages in building up to using an efficient method for subtraction of up to 5 whole numbers by the end of Year 5.

To subtract successfully, children need to be able to:

- recall all addition and subtraction facts to 20;
- subtract multiples of 10 (such as 160 – 70) using the related subtraction fact,16 – 7, and their knowledge of place value;
- partition two-digit and three-digit numbers into multiples of one hundred, ten and one in different ways (e.g. partition 74 into 70 + 4 or 60 + 14).

Note: It is important that children's mental methods of calculation are practised and secured alongside their learning and use of an efficient written method for subtraction.

Using and Applying

Before children move onto the next stage in written calculation it is important that their skills are broadened through their use and application in a range of contexts (including money, time and other measures).

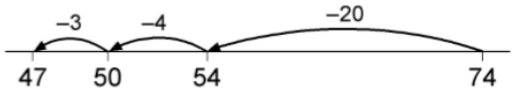
SUBTRACTION: Following on from number line/number track work

Stage 1: Using the empty number line

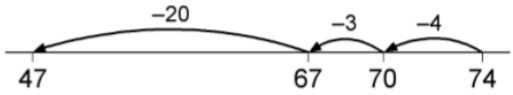
(To be introduced before counting-up) Steps in subtraction can be recorded on a number line. The steps often bridge through a multiple of 10

15 – 7 = 8

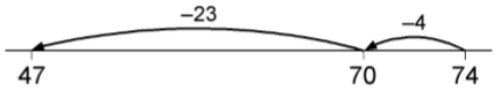
74 – 27 = 47 worked by counting back:



The steps may be recorded in a different order:



or combined:



Year 2 and Year 3

Building on mental strategies of:

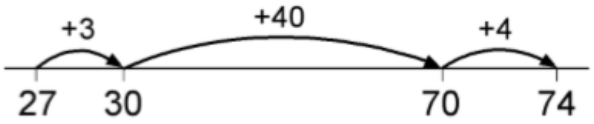
Counting **back to**

and

Counting **back from**

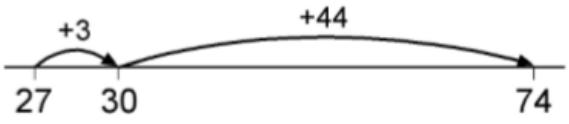
Either order is acceptable

The counting up method



2 2/3 digits

or:



Year 2/Year 3/Year 4/Year 5 – 3/4 digit numbers

With practice, children will need to record less information and decide whether to count back or forward. It is useful to ask children whether counting up or back is the more efficient for calculations such as 57 – 12, 86 – 77 or 43 – 28.

Stage 2: Partitioning

Using the 'Jump' strategy. Retain the first number and partition the second 74 – 27 = 74 – 20 – 7 = 54 – 7 = 47 This requires children to subtract a single-digit number or a multiple of 10 from a two-digit number mentally. The method of recording links to counting back on the number line.

Stage 3: Expanded layout, leading to column method

Partitioned numbers are then written under one another: 563 – 241

500	60	3
200	40	1
300	20	2

322 → leads to

$$\begin{array}{r} 563 \\ -\,241 \\ \hline 322 \end{array}$$

up to 3 digits Year 3. Year 5 up to 5 digits

Example: 74 – 27

70	4
20	7

→

60

~~70~~	14
20	7
40	7

leads to

$$\begin{array}{r} {}^{6}\cancel{7}\,{}^{1}\cancel{4} \\ -\,27 \\ \hline 47 \end{array}$$

Stage 4: Column method (efficient)

Year 3 onwards

Ask children to estimate first.

$$\begin{array}{r} {}^{5}5\,{}^{1}\cancel{6}3 \\ -\,248 \\ \hline 315 \end{array}$$

Year 5 up to five digits

Multiplication- Written methods for Multiplication with whole numbers

These notes show the stages in building up to using an efficient method for by the end of Year 4, two-digit by two-digit multiplication by the end of Year 5, and three-digit by two-digit multiplication by the end of Year 6.

To multiply successfully, children need to be able to:

- recall all multiplication facts to 12 × 12; by the end of Year 4
- partition number into multiples of one hundred, ten and one;
- work out products such as 70 × 5, 70 × 50, 700 × 5 or 700 × 50 using the related fact 7 × 5 and their knowledge of place value;
- add two or more single-digit numbers mentally;
- add multiples of 10 (such as 60 + 70) or of 100 (such as 600 + 700) using the related addition fact, 6 + 7, and their knowledge of place value;
- add combinations of whole numbers using the column method (see above).
- Using short multiplication to multiply a 1 digit number bu a number with up to four digits
- And use long multiplication to multiply 3 digit and four digit numbers by a number between 11 – 20 by the end of Year 5.
- Use long multiplication to multiply a two digit number with up to four digits
- Use short multiplication to multiply a one digit number by a number with one or two decimal places including money.

Note: It is important that children's mental methods of calculation are practised and secured alongside their learning and use of an efficient written method for multiplication.

Using and Applying
Before children move onto the next stage in written calculation it is important that their skills are broadened through their use and application in a range of contexts (including money, time and other measures).

Multiplication- Written methods for Multiplication with whole numbers

Stage 1: Mental multiplication using partitioning

Year 2, for example when they use their knowledge of the 2, 5 and 10 times tables to work out multiples of 7:

$$7 \times 3 = (5+2) \times 3 = (5 \times 3) + (2 \times 3) = 15 + 6 = 21$$

Year 2

This would be done through questioning during practical activities with counting equipment

"You have shown me 5 lots of 3. If I needed to know what 7 lots of 3 is, what could I do?"

Stage 2: The grid method partitioning

38 x 7 =

x	7
30	210
8	56
	266

Year 4

56 x 27 =

x	20	7	
50	1000	350	1350
6	120	42	162
			1512

Year 4

Year 3:

2+3 digits by 3, 4, 5, 6

Stage 3: Efficient multiplication

Ask children to estimate first.

38 x 7 is approximately

40 x 7 = 280

$$\begin{array}{r} 38 \\ \times \quad 7 \\ \hline 266 \\ 5 \end{array}$$

Up to 4 digits

Year 5

56 × 27 is approximately

60 × 30 = 1800

$$\begin{array}{r} 56 \quad \boxed{3+4} \\ \times \ 27 \quad \boxed{11-20} \\ \hline 1120 \\ 392 \\ \hline 1512 \\ 1 \end{array}$$

56×20

56×7

or

$$\begin{array}{r} 56 \\ \times \ 27 \\ \hline 392 \\ 1120 \\ \hline 1512 \\ 1 \end{array}$$

56 x 7

56 x 20

Discuss order as with column addition.

Division - Written methods for division with whole numbers

These notes show the stages in building up to long division through Years 3 to 6 – first long division TU ÷ U, extending to HTU ÷ U, then HTU ÷ TU, and then short division HTU ÷ U.

To divide successfully in their heads, children need to be able to:

- understand and use the vocabulary of division – for example in 18 ÷ 3 = 6, the 18 is the dividend, the 3 is the divisor and the 6 is the quotient;
- understand the use of the dividing line and recognise $\frac{1}{2}$ as readily as 1÷2=□. To enable this, teachers must teach both formats simultaneously from the introduction of division.
- partition two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways;
- recall multiplication and division facts to 10 × 10, recognise multiples of one-digit numbers and divide multiples of 10 or 100 by a single-digit number using their knowledge of division facts and place value;
- know how to find a remainder working mentally – for example, find the remainder when 48 is divided by 5;
- understand and use multiplication and division as inverse operations.

Note: It is important that children's mental methods of calculation are practised and secured alongside their learning and use of an efficient written method for division.

To carry out written methods of division successful, children also need to be able to:

- understand division as repeated subtraction;
- estimate how many times one number divides into another – for example, how many sixes there are in 47, or how many 23s there are in 92;
- multiply a two-digit number by a single-digit number mentally;
- subtract numbers using the column method.

Using and Applying

Before children move onto the next stage in written calculation it is important that their skills are broadened through their use and application in a range of contexts (including money, time and other measures).

Division - Written methods for division with whole numbers

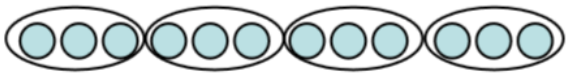
Stage 1 Sharing

Sharing 12 cakes equally between 3

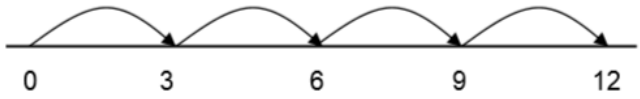
Year 1/Year 2

Stage 2 : Grouping

Children work practically in grouping activities, moving onto representing this using a number line



How many threes are there in12?



Year 2

Stage 3: 'Expanded method thorough chunking

97 ÷ 9

Year 3

$9\overline{)97}$

$-\ 90$ 9×10

7

Answer: 10 R 7

196 ÷ 6

Year 4

$6\overline{)196}$

$-\ 60$ 6×10

136

$-\ 60$ 6×10

76

$-\ 60$ 6×10

16

$-\ 12$ 6×2

4 32

Answer: 32 R 4

Stage 4: Long division

$$\begin{array}{rrl} 24\overline{)\,560} & & \\ 20 & -480 & 24\times 20 \\ & 80 & \\ 3 & 72 & 24\times 3 \\ & 8 & \end{array}$$

Year 5/Year 6

Answer: 23 R 8

In effect, the recording above is the long division method, though conventionally the digits of the answer are recorded above the line as shown below.

$$\begin{array}{r} 23 \\ 24\overline{)\,560} \\ -480 \\ \hline 80 \\ -72 \\ \hline 8 \end{array}$$

Answer: 23 R 8

Stage 5: Short division

The short division method is recorded like this:

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

The carry digit '2' represents the 2 tens that have been exchanged for 20 ones

$$\begin{aligned} 291 \div 3 &= (270 + 21) \quad 3 \\ &= (270 \div 3) + (21 \div 3) \\ &= 90 + 7 \\ &= 97 \end{aligned}$$

Year 5
4 digits ≤ 12

Year 6
Four digits any 1 or 2 digits

This is then shortened to:

$$\begin{array}{r} 9\ 7 \\ 3\overline{)2\ 9\ {}^{2}1} \end{array}$$

Reviewed:
Agreed:
Review Date:

Calculation Policy