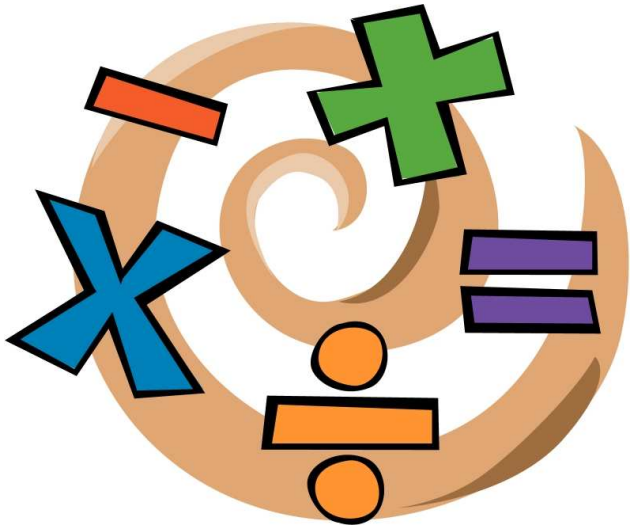
WYTON ON THE HILL PRIMARY SCHOOL

BUILDING YOUR FUTURE

Calculation Policy



National Curriculum Purpose of Study:

Mathematics is a creative and highly interconnected discipline that has been developed over centuries, providing the solution to some of history's most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity about the subject.

National Curriculum Aims of Study:

- Fluency 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.
- To reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof, using mathematical language.
- To 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.

Introduction

Children are introduced to the processes of calculation through practical, oral and mental activities. As children begin to understand the underlying ideas, they develop ways of recording to support their thinking and calculation methods, use particular methods that apply to special cases and learn to interpret and use the signs and symbols involved. Over time children learn how to use models and images to support their mental and informal written methods of calculation. At whatever stage in their learning, and whatever method is being used, calculation is underpinned by a secure and appropriate knowledge of number facts, along with those mental skills that are needed to carry out the process and judge if it was successful.

There is a considerable emphasis on teaching mental calculation strategies. Informal written recording takes place regularly and is an important part of learning and understanding. Some recording takes the form of jottings, which are used to support children’s thinking.

As children's mental methods are strengthened and refined, so too are their informal written methods. More formal written-methods follow only when the child is able to use a wide range of mental calculation strategies—these are usually introduced in Year 3. Informal written methods become more efficient and succinct and lead to efficient written methods that can be used more generally.

This policy contains the key pencil and paper procedures that will be taught within our school. It has been written to ensure consistency and progression throughout the school and reflects a whole school agreement.

Our Aims

Many everyday transactions and real-life problems, and most forms of employment, require confidence and competence in a range of mathematical skills and knowledge – such as measurement, manipulating shapes, organising space, handling money, recording and interpreting numerical and graphical data, and using ICT.

At Wyton on the Hill, we have a practical and positive 'CAN DO' approach to maths.

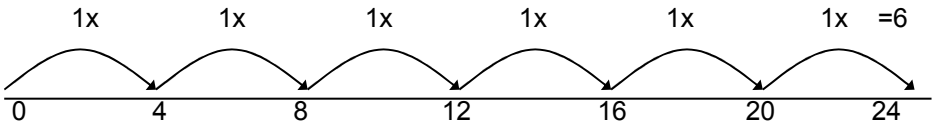
The overall aims are that when children leave Wyton on the Hill Primary School they:

- have a secure knowledge of number facts and a good conceptual understanding of the four operations
- are able to use this knowledge and understanding to carry out calculations mentally and to apply general strategies when using one-digit and two-digit numbers and particular strategies to special cases involving bigger numbers
- make use of diagrams and informal notes to help record steps and part answers when using mental methods that generate more information than can be kept in their heads
- have an efficient, reliable, compact written method of calculation for each operation that children can apply with confidence when undertaking calculations that they cannot carry out mentally;
- are able, when faced with a calculation, to decide which method is most appropriate and have strategies to check its accuracy. They will do this by always asking themselves: Can I do this in my head? Can I do this in my head using drawings or jottings? Do I need to use a pencil and paper procedure? Do I need a calculator?'

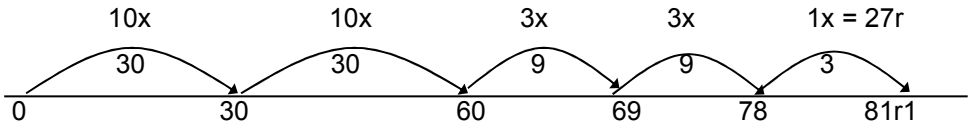
Step 3

Empty number line

24 ÷ 4 = 6



82 ÷ 3 = 27r1



Step 4

Chunking (Introduced in Year 3)

96 ÷ 6 = 16

6 | 96		
- 60	10x	
36		
- 36	6x	
0	= 16	

82 ÷ 3 = 27r1

3 | 82		
- 60	20x	
22		
- 21	7x	
1	= 27r1	

Chunking is inefficient if too many subtractions need to be carried out. Reduce the number of steps to encourage finding the largest possible multiples.

Step 5

Short division

98 ÷ 7 becomes

$$7\overline{)98} = 14$$

Answer: 14

432 ÷ 5 becomes

$$5\overline{)432} = 86 \text{ r } 2$$

Answer: 86 remainder 2

Step 6

Long division

432 ÷ 15 becomes

$$15\overline{)432} = 28 \text{ r } 12$$

		2	8 r 12
1	5 | 4	3	2
	3	0	0
	1	3	2
	1	2	0
		1	2

Answer: 28 remainder 12

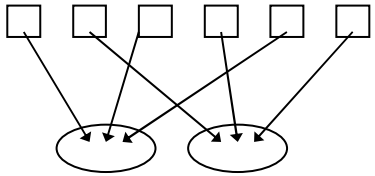
Step 1

Using apparatus Informal jottings

Sharing equally

6 ÷ 2 = 3

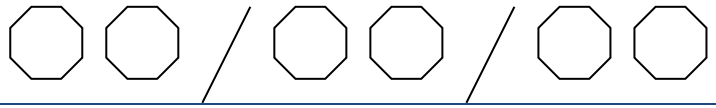
6 sweets shared between 2 people, how many do they each get?



Grouping or repeated subtraction

6 ÷ 2 = 3

There are 6 sweets, how many people can have 2 sweets each?

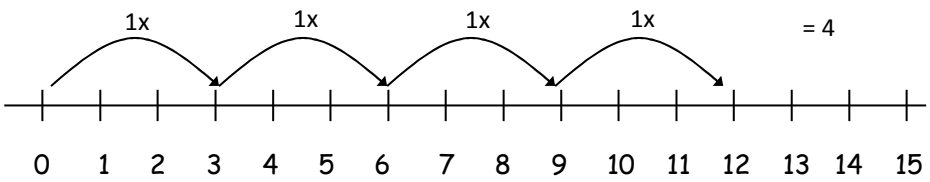


Step 2

Number line

12 ÷ 3 = 4

'How many 3s in 12?'



Written methods for addition

To add successfully, children need to be able to:

- recall all addition pairs to 9 + 9 and complements in 10 and 100;
- 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.

The models of addition explored are:

- Combining of sets (Aggregation)
- Adding on more (Augmentation)

add addition total plus

more than and altogether

increase equals make sum

Step 1

Using apparatus **Informal jottings** **Number tracks**

Combining groups

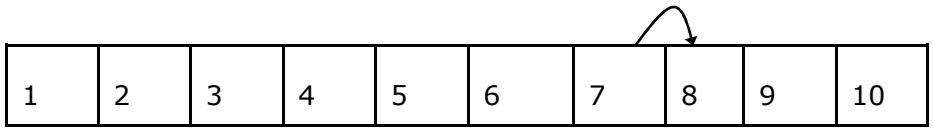
7 **add** 1 equals 8

Jen has seven oranges, Pete has 1 orange. How many do they have in total?

Adding on more

7 and 1 **more** is 8

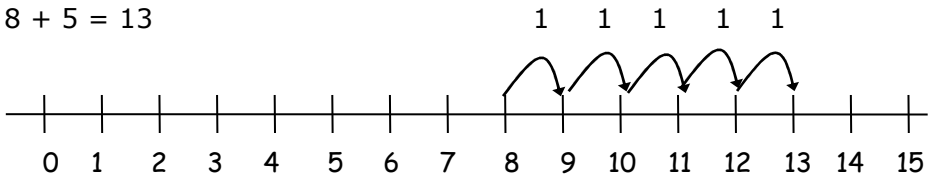
Jen has seven oranges, Pete gives her one more. How many oranges does she have now?



Step 2

Number line

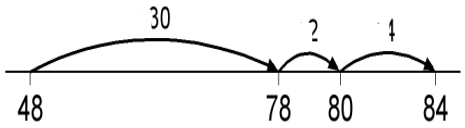
8 + 5 = 13



Step 3

Empty number line

48 + 36 = 84



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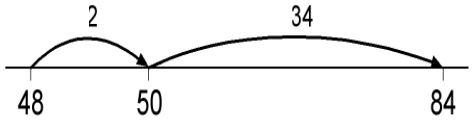


Written methods for division

To divide successfully, children need to be able to:

- partition two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways;
- recall multiplication and division facts to 12 × 12;
- 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.
- 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
-

The models of division explored are:

- Sharing equally
- Grouping

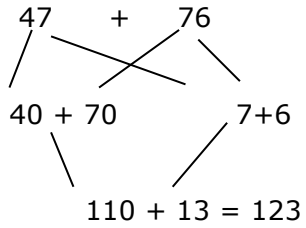
divide **division** **divided by**

share equally **equal**

sharing equally

Step 4

Partitioning



The tens and ones will be added to form partial sums and then these partial sums will be added together to find the total.

Step 5 (Introduced in Year 3)

Expanded column method

$$\begin{array}{r} 67 \\ +\ 24 \\ \hline 80 \\ 11 \\ \hline 91 \end{array} \qquad \begin{array}{r} 67 \\ +\ 24 \\ \hline 11 \\ 80 \\ \hline 91 \end{array}$$

Initially children add the most significant numbers first, then move on very quickly to the least significant first.

Step 6

Column method

$$\begin{array}{r} 258 \\ +\ 87 \\ \hline 345 \\ 11 \end{array}$$

Carry digits are recorded below the line, using the words 'carry ten' or 'carry one hundred'.

Children need to have number sense and make decisions about how to solve a calculation. 325 + 99 = may be best completed by adding 100 and subtracting 1.

Step 4 (Introduced in Year 3)

Grid method

14 x 6 = 84

x	10	4
6	60	24

60
+24
84

286 × 29 = 8294

x	200	80	6
20	4000	1600	120
9	1800	720	54

4000
1800
1600
720
120
+ 54
8294
2

Step 5

Expanded short multiplication / expanded long multiplica-

38
x 7
210
56
266

23
X12
6
40
30
200
276

Step 6

Short multiplication

342 × 7 becomes

$$\begin{array}{r} 3\ 4\ 2 \\ \times\quad\ 7 \\ \hline 2\ 3\ 9\ 4 \\ \scriptstyle 2\ 1\ \ \end{array}$$

Answer: 2394

2741 × 6 becomes

$$\begin{array}{r} 2\ 7\ 4\ 1 \\ \times\quad\ 6 \\ \hline 1\ 6\ 4\ 4\ 6 \\ \scriptstyle 4\ 2\ \ \ \ \end{array}$$

Answer: 16 446

Stage 7

Long multiplication

24 × 16 becomes

$$\begin{array}{r} \scriptstyle 2\ \ \ \\ 2\ 4 \\ \times\ 1\ 6 \\ \hline 2\ 4\ 0 \\ 1\ 4\ 4 \\ \hline 3\ 8\ 4 \end{array}$$

Answer: 384

124 × 26 becomes

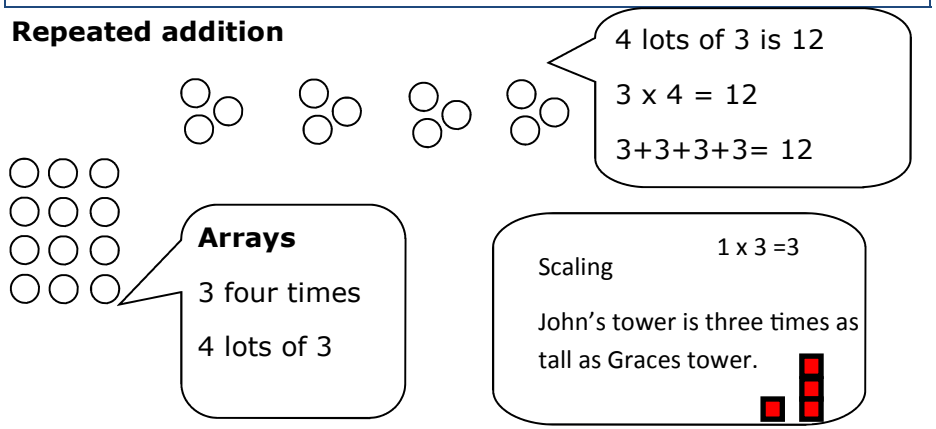
$$\begin{array}{r} \scriptstyle 1\ 2\ \ \\ 1\ 2\ 4 \\ \times\quad 2\ 6 \\ \hline 2\ 4\ 8\ 0 \\ 7\ 4\ 4 \\ \hline 3\ 2\ 2\ 4 \\ \scriptstyle 1\ 1\ \ \ \end{array}$$

Answer: 3224

Step 1

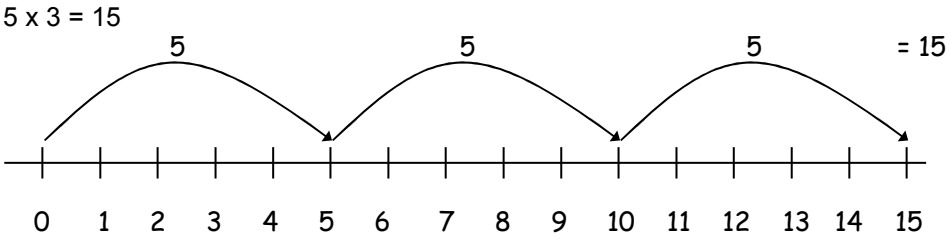
Using apparatus **Informal jottings**

Repeated addition



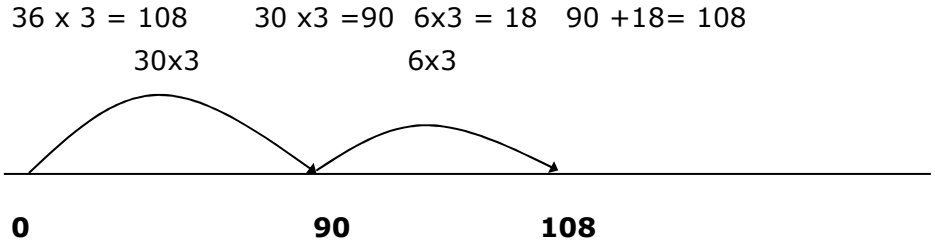
Step 2

Number line



Step 3

Empty number line / partitioning



Written methods for subtraction

To subtract successfully, children need to be able to:

- recall all addition and subtraction facts to 10, 100;
- 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).

The models of subtraction explored are:

- Taking away (physical removal or reduction)
- Finding the difference (comparison)
- Complements of a set structure (knowing the whole and one part of a set) E.g. 12 children in a class, 4 are boys , how many are girls.

subtract **subtraction**

take away **minus** **less than**

difference **decrease** **leave**

How many left?

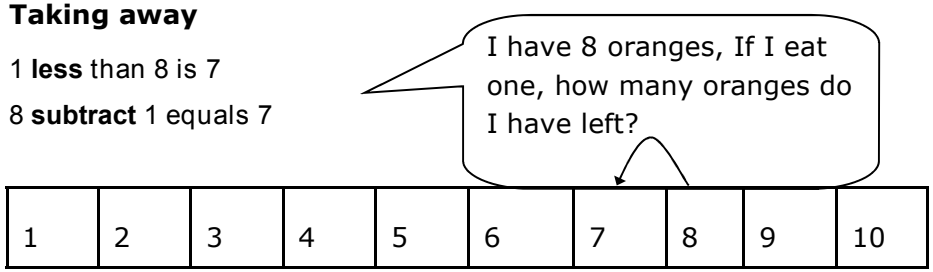
Step 1

Using apparatus **Informal jottings** **Number tracks**

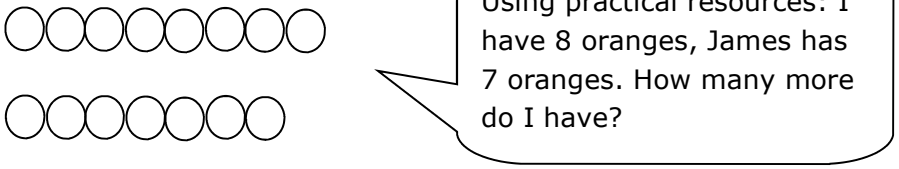
Taking away

1 **less** than 8 is 7

8 **subtract** 1 equals 7



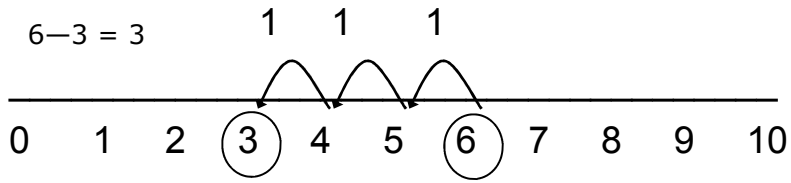
Finding the difference



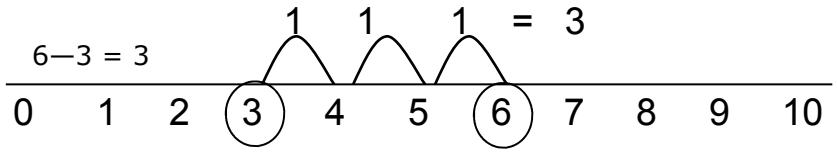
Step 2

Number line

Taking away



Finding the difference



Written methods for multiplication

To multiply successfully, children need to be able to:

- recall all multiplication facts to 12 × 12;
- 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

The models of multiplication explored are:

- Repeated addition
- Arrays
- Scaling

multiply **multiplication**

repeated addition **altogether**

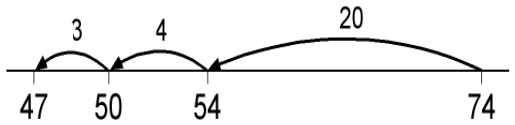
lots of **groups of** **array**

Step 3

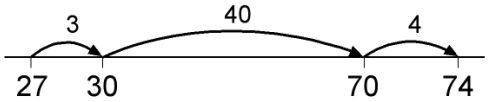
Empty number line

Counting back

74 – 27 = 47



Counting on



Where numbers are close together, calculations may best be solves by counting up.

E.g. 1007-993 = 14

Step 4 (Introduced in Year 3)

Expanded layout for decomposition

89—57 = 32

80 9

-50 7

30 2 =32

74—27 = 47

60 14

~~70~~ ~~4~~

– 20 7

40 7

Where numbers are close together, calculations may best be solved by counting up.

Step 5

Column method for decomposition

741—327 = 414

3 11

7 ~~4~~ ~~1~~

- 3 2 7

4 1 4

The terminology is exchanging or regrouping,

Calculations requiring a lot of exchanging would make the column method error prone. Number sense would suggest that a number line could still be used.