Priestley Primary School
Calculation Policy

Philosophy

'A feature of strong practice in the maintained schools is their clear, coherent calculations policies and guidance, which are tailored to the particular school's context. They ensure consistent approaches and use of visual images and models that secure progression in pupils' skills and knowledge lesson by lesson and year by year.'

Good Practice in Primary Mathematics

Principles

Priestley's calculation policy is set within the Maths Makes Sense Learning System. We use the recommended MMS 'toolkit' as the core of our principles of the teaching and learning of calculations:

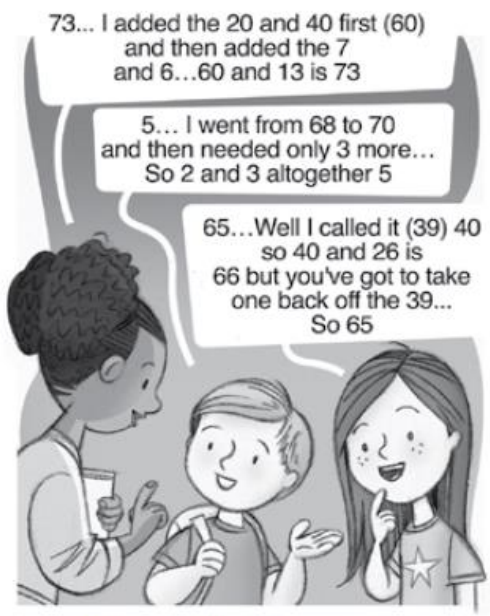

Figure 1: Pupils in Year 2 (age 6-7) use mental recall of addition and subtraction facts to 20 in solving problems involving larger numbers. They add and subtract numbers with two digits mentally

1. Efficient mental methods – likely to be used with numbers up to 100 or with easy larger numbers; for example, Year 3/4 pupils (age 7/8) should be able to rapidly and reliably mentally add three numbers such as 150 + 400 + 250 without reverting to a pencil and - paper algorithm or entering the numbers into a calculator as both these latter methods will take longer and are unnecessary (Figure 1).

2. Efficient written methods – for all four rules of number to be applied to whole numbers and to decimals.

3.Effective use of calculators – including interpreting the display according to the context and nature of the computation and required solution and knowing how to enter and interpret money calculations and simple fractions.

Procedures

Addition and subtraction

- recall key number facts instantly – for example, all addition and subtraction facts for each number to 10 then to 20, sums and differences of multiples of 10

- appreciate that the arithmetic operations of addition and subtraction are the inverse of each other

- recognise that addition can be done in any order and use this to add mentally a one-digit number or a multiple of 10 to a one-digit or two-digit number

- partition two-digit numbers in different ways including into multiples of ten and one and add the tens and ones separately and then recombine.

When these abilities are secure, children can be taught the efficient column method (see figure 2) for addition and subtraction and will be able to carry out vertical calculations efficiently and accurately.

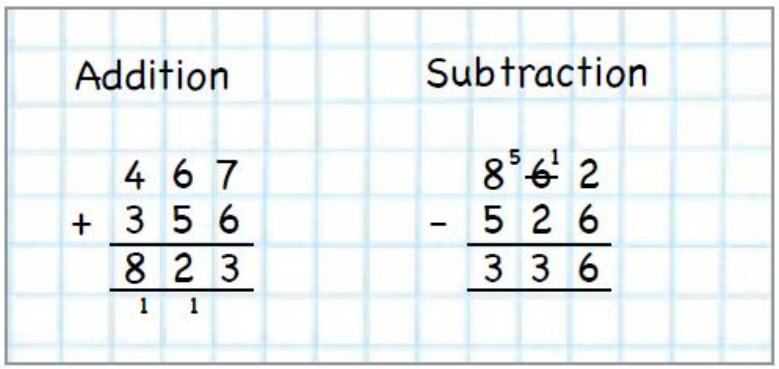

Figure 2: Example addition and subtraction calculations using the efficient column method

Multiplication

- recall all multiplication facts to 10 × 10

- partition numbers 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.

In order to prepare our children to be able to calculate multiplication using the written method, pupils will be given opportunities to:

- calculating the value of an unknown in a number sentence

- working out how many 2s make eight or how many 5s make 35

- mentally calculating doubles or remainders

- solving problems such as "There are 27 cubes. Make three towers the same height. How tall is each tower?

The grid method

The grid method (see figure 3) is used to allow pupils to see how the two forms of recording align before moving to the more efficient method of long multiplication. The advantages of the grid method are its use of multiplying decimals and for secondary mathematics topics such as multiplication of algebraic expressions such as $(2x + 3)(x - 6)$ and numerical expressions involving square roots, for example $(\sqrt{3} - 1)(2\sqrt{3} + 1)$.

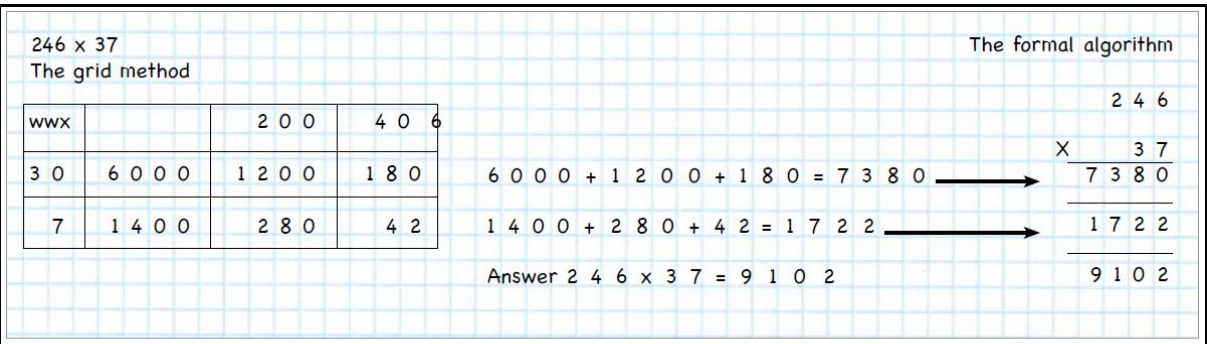

Figure 3: Long multiplication using the grid method and the formal algorithm

Division

- 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

- 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.

To carry out later written methods of division successfully, children also should be able to:

- understand division as sharing or repeated subtraction

- estimate how many times one number divides into another when there is a remainder – for example,

how many 6s there are in 47, how many 23s there are in 92 or how many 52s there are in 600

- multiply a two-digit number by a single-digit number mentally subtract numbers using the column method.

Progression in Multiplication and Division

For children to understand and use the efficient written method for long multiplication and division, we will first teach them to:

- represent repeated addition and arrays as multiplication, and sharing and repeated subtraction

(grouping) as division; calculate the value of an unknown in a number sentence (e.g. ÷ 2 = 6, 30 – = 24; lower Key Stage 2, ages 7–9)

- use practical and informal written methods and related vocabulary to support multiplication and division, including calculations with remainders; use practical and informal written methods to multiply and divide two-digit numbers (e.g. 13 × 3, 50 ÷ 4); round remainders up or down, depending on the context (lower Key Stage 2, ages 7–9)

- use the symbols ×, ÷ and = to record and interpret number sentences involving multiplication and division (lower Key Stage 2, ages 7–9)

- use understanding of place value to multiply and divide whole numbers and decimals by 10, 100 or 1000; refine and use efficient written methods to multiply and divide HTU × U, TU × TU, and HTU ÷ U (Year 5, age 9–10)

- use efficient written methods to:

1. multiply and divide integers and decimals by a one-digit integer

2. multiply three-digit and fourdigit integers by a two-digit integer

3. divide a three-digit integer by a two-digit integer (Year 6).

Problem solving and reasoning

Problem solving, reasoning and explaining lie at the heart of mathematics and in pupils' capacity to use their arithmetic skills in a variety of contexts.

We aim to capitalise on opportunities for problem solving within and beyond the daily mathematics lesson to develop learners' skills as problem solvers. Children need to solve problems to become problem solvers. Problem solving is an integrated part of mathematics teaching and learning, and is a regular part of the children's work through being embedded into everyday lessons.

As children acquire more number skills and understanding, the problems they are presented with will involve increasingly complex calculations set in wider-ranging contexts. As they progress into and through Key Stage 2, the problems presented move from one-step to multi-step problems that are more complex and where less routine approaches are needed to solve them.

We aim to the increase the development of pupils' problem solving abilities to:

- look for a pattern or structure in the context or problem

- translate the problem into a diagram, picture or concrete/ visual model (model-draw) g

- guess and check – trying a solution and improving

- make a systematic list to make sure all possible answers have been found

- use logical reasoning – exploring, predicting, testing and explaining

- work backwards.

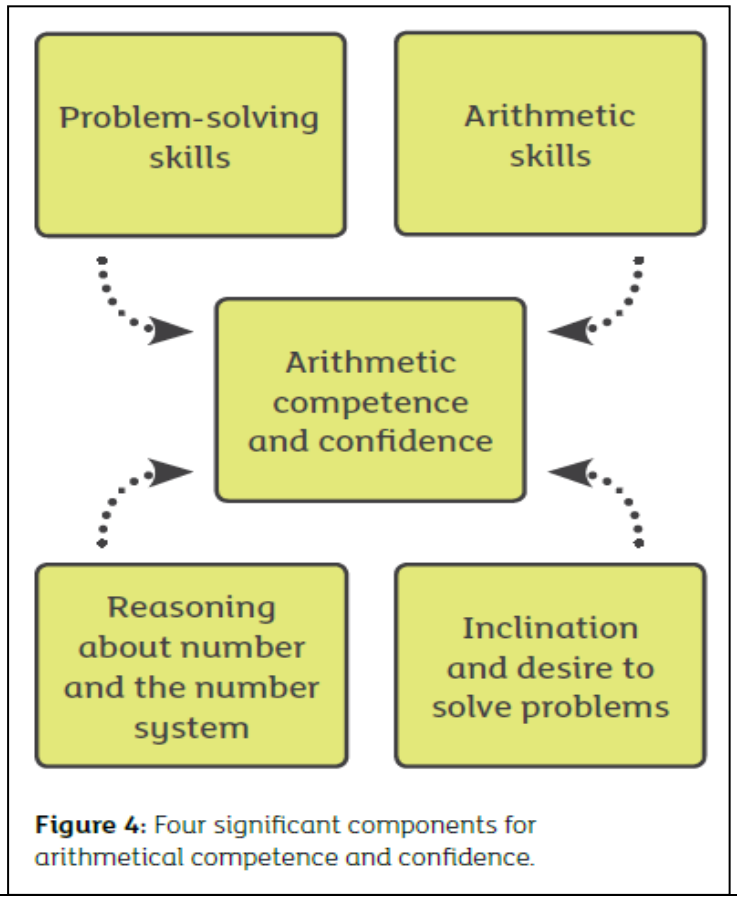

Figure 4: Four significant components for arithmetical competence and confidence.