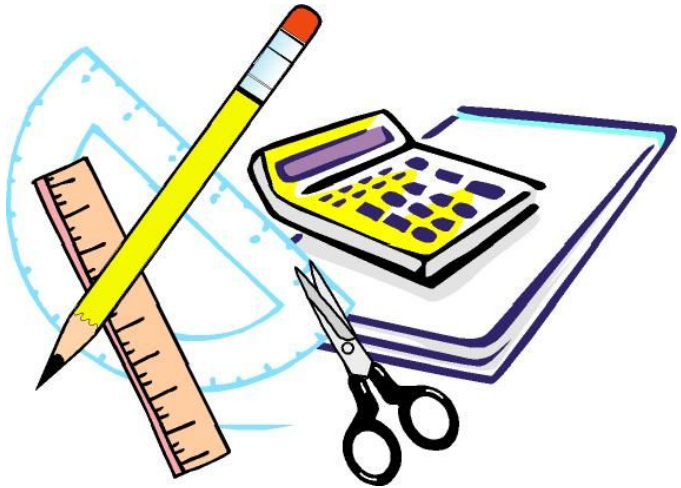
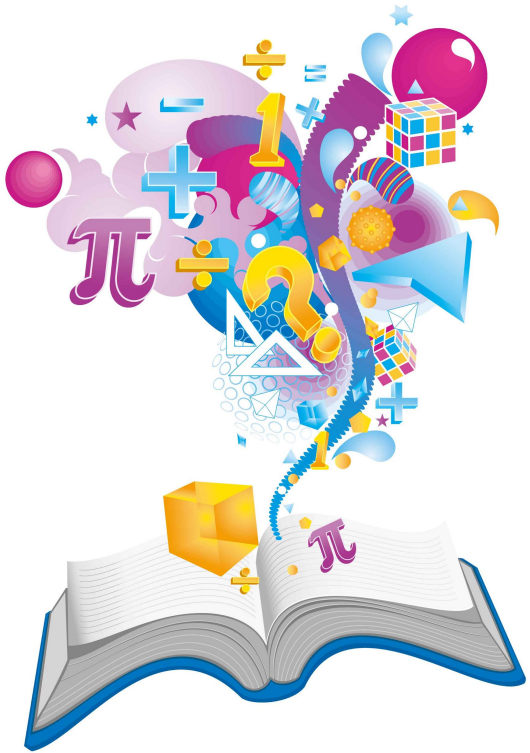
Maths at Stapleford





How do we teach maths at Stapleford Primary School?

Friday 18th January 2019

What do we mean by Mastery?

- **Deep** and sustainable learning – **for all**

  Depth is the key to avoiding the need to repeat teaching.

  It doesn't feel like we're starting again each term.

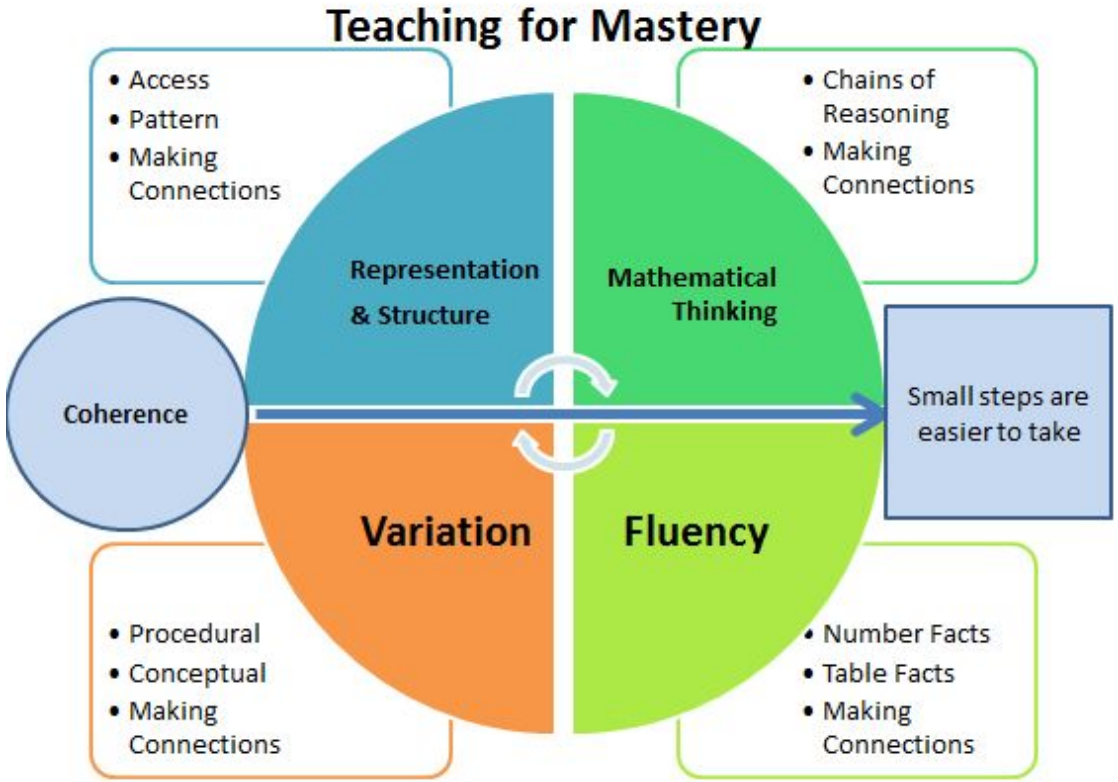
- The ability to build on something that has already been sufficiently mastered

  …for this stage of learning - Mastery is a continuum

What do we mean by Mastery?

- The ability to reason about a concept and make connections
  - Cuts down on the amount I need to learn
    eg relating concepts of division, fractions and ratio
  - Deepens conceptual understanding.
- Conceptual and procedural fluency
  - Move maths from one context to another. Recognise concepts in unfamiliar situations.
  - Know number facts and tables, have efficient procedures

The 5 Big Ideas



Coherence

- Connecting new ideas to concepts that have already been understood, and ensuring that, once understood and mastered, new ideas are used again in next steps of learning, all steps being small steps

Representation and structure

- Representations used in lessons expose the mathematical structure being taught, the aim being that students can do the maths without recourse to the representation

Mathematical Thinking

- If taught ideas are to be understood deeply, they must not merely be passively received but must be worked on by the student: thought about, reasoned with and discussed with others

Fluency

- Quick and efficient recall of facts and procedures and the flexibility to move between different contexts and representations of mathematics

Variation

- Varying the way a concept is initially presented to students, by giving examples that display a concept as well as those that don’t display it. Also, carefully varying practice questions so that mechanical repetition is avoided, and thinking is encouraged.

Year 6 – Yearly Overview

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	Number- Place Value		Number- Addition, Subtraction, Multiplication and Division				Fractions				Geometry- Position and Direction	Consolidation
Spring	Number- Decimals		Number- Percentages		Number- Algebra		Measurement Converting units	Measurement Perimeter, Area and Volume		Number- Ratio		Consolidation
Summer	Geometry- Properties of Shapes		Problem solving			Statistics		Investigations				Consolidation

Year 6 – Autumn Term

Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
<u>Number: Place Value</u> Read, write, order and compare numbers up to 10,000,000 and determine the value of each digit. Round any whole number to a required degree of accuracy. Use negative numbers in context, and calculate intervals across zero. Solve number and practical problems that involve all of the above.		<u>Number- addition subtraction, multiplication + division</u> Solve addition and subtraction multi step problems in contexts, deciding which operations and methods to use and why. Multiply multi-digit number up to 4 digits by a 2-digit number using the formal written method of long multiplication. Divide numbers up to 4 digits by a 2-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding as appropriate for the context. Divide numbers up to 4 digits by a 2-digit number using the formal written method of short division, interpreting remainders according to the context. Perform mental calculations, including with mixed operations and large numbers. Identify common factors, common multiples and prime numbers. Use their knowledge of the order of operations to carry out calculations involving the four operations. Solve problems involving addition, subtraction, multiplication and division. Use estimation to check answers to calculations and determine in the context of a problem, an appropriate degree of accuracy.			<u>Fractions</u> Use common factors to simplify fractions; use common multiples to express fractions in the same denomination. Compare and order fractions, including fractions > 1 Generate and describe linear number sequences (with fractions) Add and subtract fractions with different denominations and mixed numbers, using the concept of equivalent fractions. Multiply simple pairs of proper fractions, writing the answer in its simplest form [for example $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$] Divide proper fractions by whole numbers [for example $\frac{1}{3} \div 2 = \frac{1}{6}$] Associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example $\frac{3}{8}$] Recall and use equivalences between simple fractions, decimals and percentages, including in different contexts.			<u>Geometry- Position and Direction</u> Describe positions on the full coordinate grid (all four quadrants). Draw and translate simple shapes on the coordinate plane, and reflect them in the axes.	Consolidation

Small Steps

- Add and subtract whole numbers
- Multiply up to a 4-digit number by 1-digit
- Short division
- Division using factors
- Long division (1)
- Long division (2)
- Long division (3)
- Long division (4)
- Common factors
- Common multiples
- Primes
- Squares and cubes
- Order of operations
- Mental calculations and estimation
- Reason from known facts

NC Objectives

Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.

Multiply multi-digit number up to 4 digits by a 2-digit number using the formal written method of long multiplication.

Divide numbers up to 4 digits by a 2-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding as appropriate for the context.

Divide numbers up to 4 digits by a 2-digit number using the formal written method of short division, interpreting remainders according to the context.

Perform mental calculations, including with mixed operations and large numbers.

Identify common factors, common multiples and prime numbers.

Use their knowledge of the order of operations to carry out calculations involving the four operations.

Solve problems involving addition, subtraction, multiplication and division.

Use estimation to check answers to calculations and determine in the context of a problem, an appropriate degree of accuracy.

Supporting learning
Foundation Stage
Key Stage 1
Key Stage 2

Stapleford Community Primary School

A guide to helping your child with calculations

Calculation Policy

Aspire, Challenge, Discover

Aims of the Calculation Policy

- To support greater consistency in the teaching of written calculations across the school.
- To strengthen continuity and progression in children's understanding of the development of written calculations.
- To form a core set of methods which every children will experience and build upon.
- To build on models and images introduced to promote conceptual understanding.
- To provide reference and guidance on the teaching of calculation skills for teaching staff, teaching assistants and parents.

Multiplication

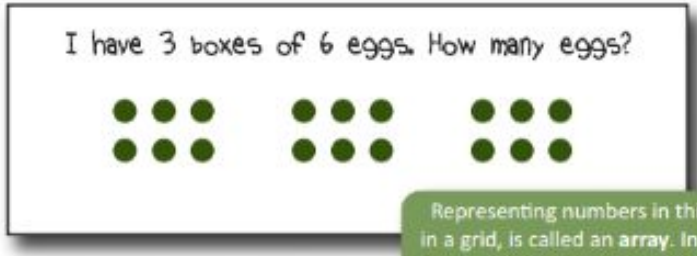
	Pupils should be taught to
Foundation Stage	• Count forwards and backwards in 5s and 10s • Investigate doubling
Year 1	• count in multiples of two, five and ten • double and halve numbers to 20, e.g. double 3 is 6, half of 10 is 5 • relate connections between arrays and number patterns • solve simple one-step problems involving multiplication, calculating the answer using concrete objects, pictorial representations and arrays
Year 2	• count in multiples of two, five and ten and recall the multiplication tables • calculate mathematical statements for multiplication within the multiplication tables and write them using the multiplication (×) and equals (=) signs • count in multiples of two, five and ten and recall the multiplication tables • show that multiplication of two numbers can be done in any order (commutative) e.g. 4 × 3 = 12 3 × 4 = 12 • solve problems involving multiplication and using materials, arrays, repeated addition, mental methods and multiplication facts, including problems in contexts E.g. I have 3 bags of apples. Do they contain 6 apples, how many apples altogether?
Year 3	• count from 0 in multiples of 4, 8, 50 and 100 • recall and use multiplication facts for the 3, 4 and 8 multiplication tables • write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods • using commutativity and associativity (for example 4 × 12 × 5 = 4 × 5 × 12 = 20 × 12 = 240) • solve problems, including missing number problems, involving multiplication, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects
Year 4	• Count in multiples of 6, 7, 9, 25, and 1000 • recall multiplication and division facts for multiplication tables up to 12 × 12 • use place value, known and derived facts to multiply mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers • recognise and use factor pairs and commutativity in mental calculations • multiply two-digit and three-digit numbers by a one-digit number using formal written layout • solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects
Year 5	• count on and use all multiplication tables up to 12 × 12 in order to maintain their fluency • identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers • know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers • establish whether a number up to 100 is prime and recall prime numbers up to 19 • multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers • multiply numbers mentally drawing upon known facts • multiply whole numbers and those involving decimals by 10, 100 and 1000 • recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3}) • solve problems involving multiplication including using their knowledge of factors and multiples, squares and cubes • solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign • solve problems involving multiplication, including scaling by simple fractions and problems involving simple rates
Year 6	• count on and use all multiplication tables up to 12 × 12 in order to maintain their fluency • multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication • perform mental calculations, including with mixed operations and large numbers • identify common factors, common multiples and prime numbers • use their knowledge of the order of operations to carry out calculations involving the four operations • solve problems involving addition, subtraction, multiplication and division • use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy
Vocabulary	divide, lots of, divide, array, altogether, multiply, count, rows, units groups of, lots of, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, product partition, grid method, multiple, product, inverse square, factor, integer, decimal, short/long multiplication,

Multiplication

Stage 1 (Foundation Stage - Year 1)

Early work on multiplication involves counting on in steps of 2 initially, then in steps of 5 and 10. The concept of multiplication at this stage is **entirely** practical - it involves exploring real-life examples of equal sets or groups.

Just as with addition and subtraction, children can begin to substitute symbols for real objects.



Representing numbers in this way, i.e. in a grid, is called an **array**. In this example you can also see that the array shows that 6 is 3 lots of 2 and also 2 lots of 3.

Stage 2/3 (Year 2)

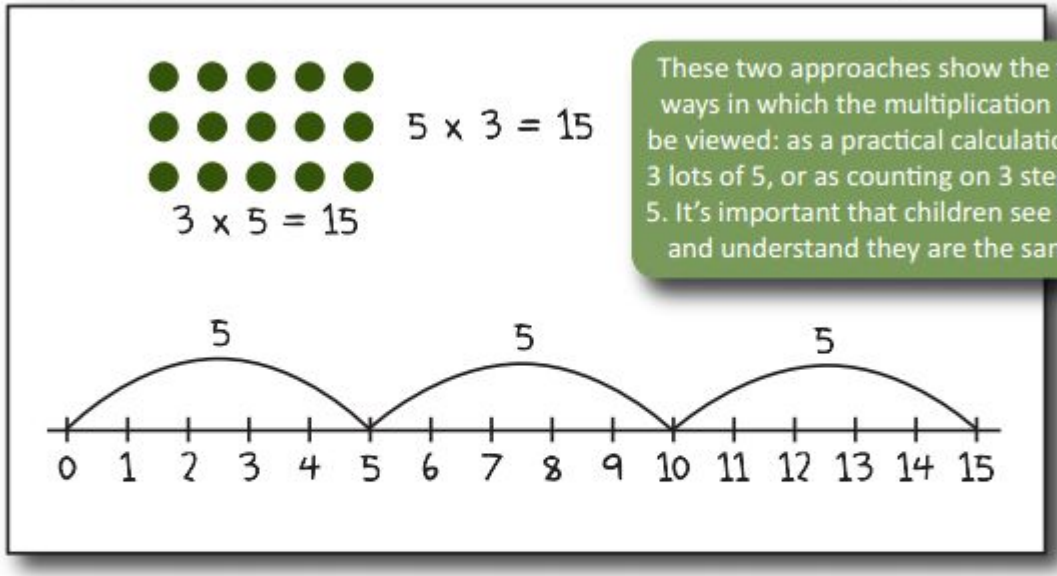
At stages 2 and 3 we represent multiplication as repeated addition. So, the following expressions all show the same calculation:

3 times 5 5 + 5 + 5 3 lots of 5 3 x 5

Multiplication (like addition) is commutative: that is, 3 x 5 is the same as 5 x 3. Children use this fact, with repeated addition, to calculate simple multiplications.

4 x 7	7 x 4
= 7 + 7 + 7 + 7	= 4 + 4 + 4 + 4 + 4 + 4 + 4
=28	= 28

Using a grid (**array**) or a numberline, we can calculate a multiplication:



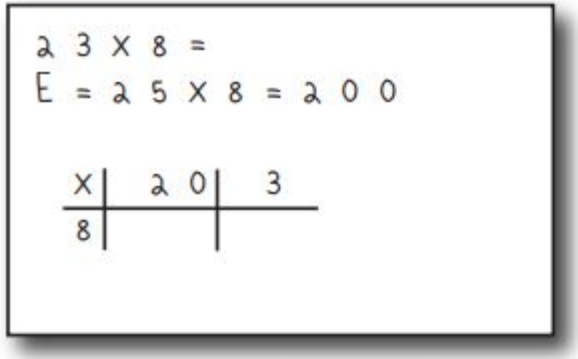
These two approaches show the two ways in which the multiplication can be viewed: as a practical calculation of 3 lots of 5, or as counting on 3 steps of 5. It's important that children see both and understand they are the same.

Both of these methods are used throughout stages 2 and 3 and are taught alongside the relevant tables in the following order:

- 2, 5 & 10 times tables (Year 2)
- 3, 4 & 8 times tables (Year 3)
- 6, 7, 9, 11 & 12 times tables (Year 4)

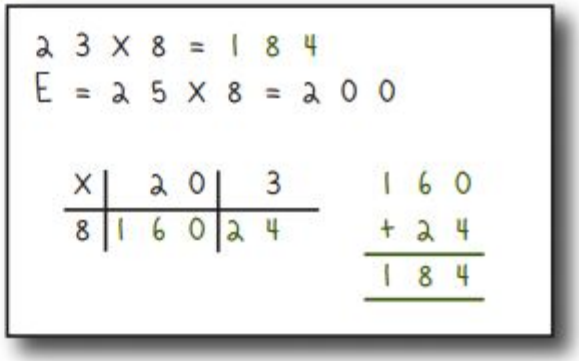
Stage 4 (Year 3 and 4)

This stage introduces the '**grid method**' for multiplication. We begin with a straightforward calculation with a two-digit number (TU) multiplied by a single-digit number (U). Children will also use the grid method for three-digit numbers (HTU) multiplied by single-digit (U) numbers.



We complete an estimate first so that we can check our answer. Then we partition the two-digit number into its tens (20) and units (3). Set the question out in a grid as shown.

Now calculate 8 x 20 and place the answer in the grid, following this with 8 x 3. Add the two answers together the complete the calculation and check with the estimate.



By the end of stage 4, children will be able to use a formal written method of calculation for two-digit (TU) and three-digit (HTU) multiplied by a single digit. This is taught alongside the grid method which most children find easier to understand.

350 x 7 = 2450

$$\begin{array}{r} 350 \\ \times \quad 7 \\ \hline 2450 \\ \hline 2\ 3 \end{array}$$

Stage 5 (Year 5/6)

Stage 5 builds on stage 4 by extending the grid method to a range of other possible calculations.

- ThHTU x U (eg 4346 x 8)
- TU x TU (eg 72 x 38) & HTU x TU (eg 372 x 24 - example 1 below)
- U.t x U (eg 4.9 x 3) & U.th x U (eg 6.73 x 7 - example 2 below)

In **example 1** there are two rows in the grid - one for the tens and one for the units.

372 X 24 =

E = 400 X 25 = 10,000

X	300	70	2
20	6000	1400	40
4	1200	280	8

A = 8,928

```
 6000
 1200
 1400
  280
   40
+   8
 8928
  1
```

6.73 X 7 =

E = 7 X 7 = 49

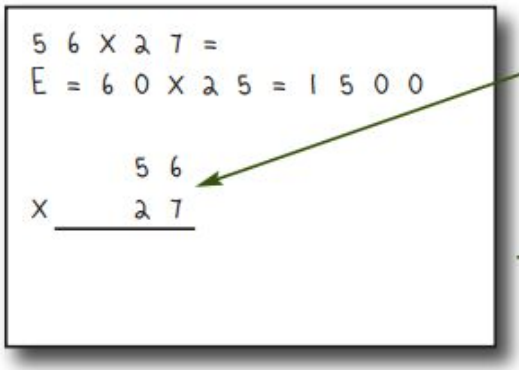
Example 2 requires a good understanding of decimals.

X	6	0.7	0.03
7	42	4.9	0.21

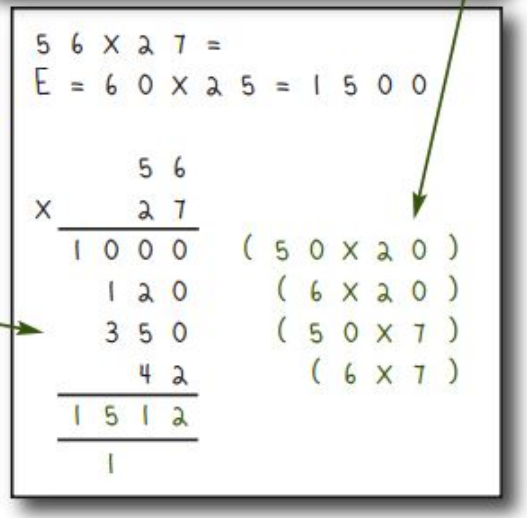
A = 47.11

```
 42
  4.9
+ 0.21
 47.11
  1
```

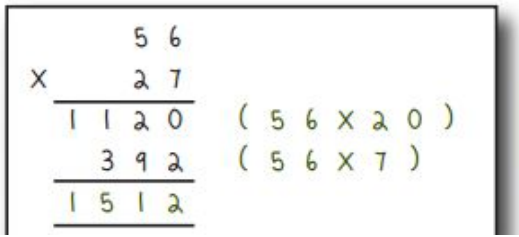
The final stage for this operation is the standard written method of long multiplication. It is easy to see how this method develops from the grid method as the processes are the same, with each section of the grid written in a column.



Remembering to estimate first, set out the calculation lining up the tens and units. There are four calculations: 50x20, 6x20, 50x7 & 6x7. Write each of these on a separate line.



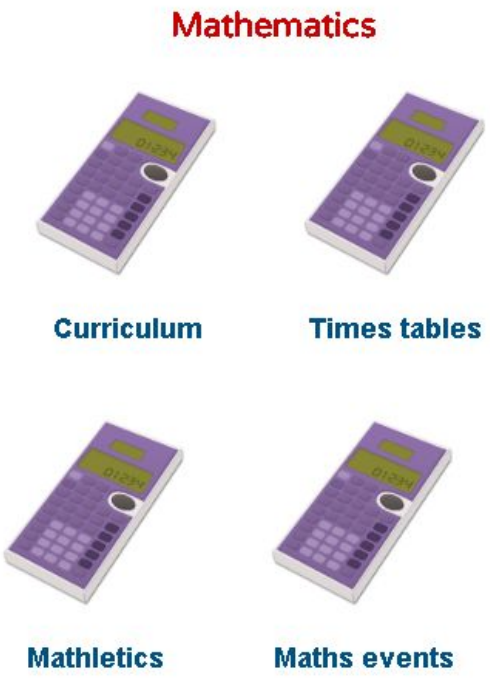
Now the simple process of totalling the four lines is all that is left to do. Then check the answer against the estimate.



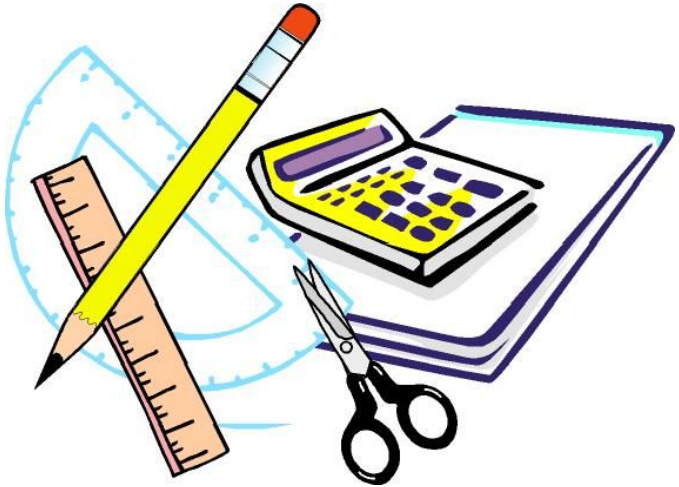
Once this method is understood, it can be further shortened and the four additions replaced by two

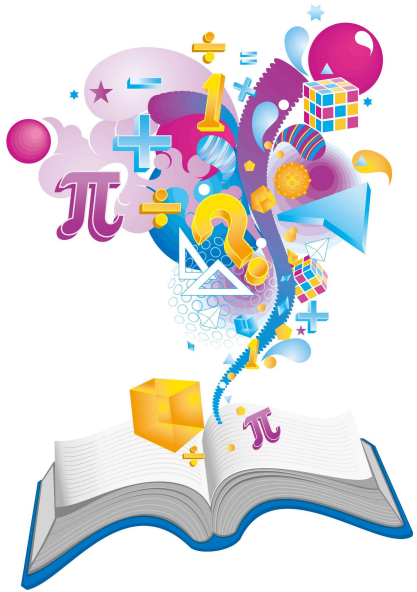
Additional information

https://stapleford-community-primary-school.secure-primarysite.net/curriculum/



Questions?





Learning Cafe

18. 1. 2019

Try out some activities!

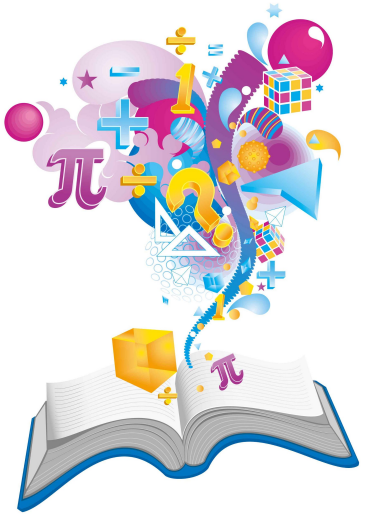


Table 1 - Year 2 - arrays
- Build it, draw it, write it, say it
- Building calculations in different ways

Table 2 - Year 3 - arrays, commutativity and associativity
- Building arrays
- Multiplication on a number line

Table 3 - Year 4 - grid method
- Progress from an array to the grid method

Table 4 - Year 5 - early stages of long multiplication and previous knowledge
- Grid method (from year 4)
- Current progression into long multiplication

Table 5 - Year 6 - long and short multiplication
- The method
- Application to reasoning problems
- Application to problem solving activities

Table 6 - application to contexts

Table 7 - SAT style questions relating to multiplication (and division)

Table 8 - Times table rockstars

Table 9 - Mathletics

Table 10 - handout

Learning Cafe

18. 1. 2019