SHIREMOOR PRIMARY SCHOOL CALCULATION POLICY

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The aim of this calculation policy is to ensure teachers and pupils understand the progression through the Key Stages of the four operations in Maths.

This policy aims to provide a clear structure for progression and consistency across school. It should be used alongside Big Maths to ensure high quality planning.

Big Maths brings the idea of core number being key to underpinning strong Numeracy teaching and in turn strong Numeracy learning. Across the school CLIC is used to engage and support learning and has now developed, alongside SAFE into a consistent and engaging method of teaching. Throughout all of our Calculation teaching the Big Maths characters are used to support pupils' understanding of challenging concepts allowing them to develop a stronger understanding. The Counting, Learn Its and It's Nothing New within Numeracy lessons are purposeful and linked to the intended learning outcomes of the session or sequence of sessions.

Pim

Pim is an alien from the planet CLIC. He can be used to support one of th important mathematical realisations that pupils ever have to make. Pim has 3 arms on one side and 4 arms on the other side. He therefore has 7 arms altogether. Anyone that has learnt that '3 add 4 equals 7' can soon realise that this applies to all 'things'. In other words 3 things and 4 things are 7 things. Furthermore, it doesn't matter what those things are. Pim also has 3 legs and 4 legs, so he must have 7 legs. He has 3 ears and 4 ears, 3 nostrils and 4 nostrils, Pim.

Pim and Calculation

Pim is key from the earliest teaching of calculation as pupils use physical objects and soon learn that it doesn't matter if you have 3 dinosaurs + 4 dinosaurs or 3 apples + 4 apples, the answer is 7 no matter what the thing is.

This principle then extends to abstract number as pupils soon learn that the 'thing' can be tens, hundreds or thousands, very quickly they can go from 3 x 2= 6 to 30 x 2 = 60.

Pim's principle then extends to outer numeracy when considering amounts or time, knowing that 5 minutes + 5 minutes is 10 minutes.

The numbers are the same it's only the 'thing' that changes.

Mully

'Where's Mully?' is a Big Maths game that's played as part of the 'It's Nothing New' phase of a CLIC session. As a game, the objective is to find where Mully is hiding. As an activity to significantly enhance numeracy, it is about extending pupils' knowledge of multiples and how known multiples can be added to other known multiples to find new multiples. Pupils are asked to find Mully by identifying the largest multiple of a given number yet staying in the parameters of a limited maximum number.

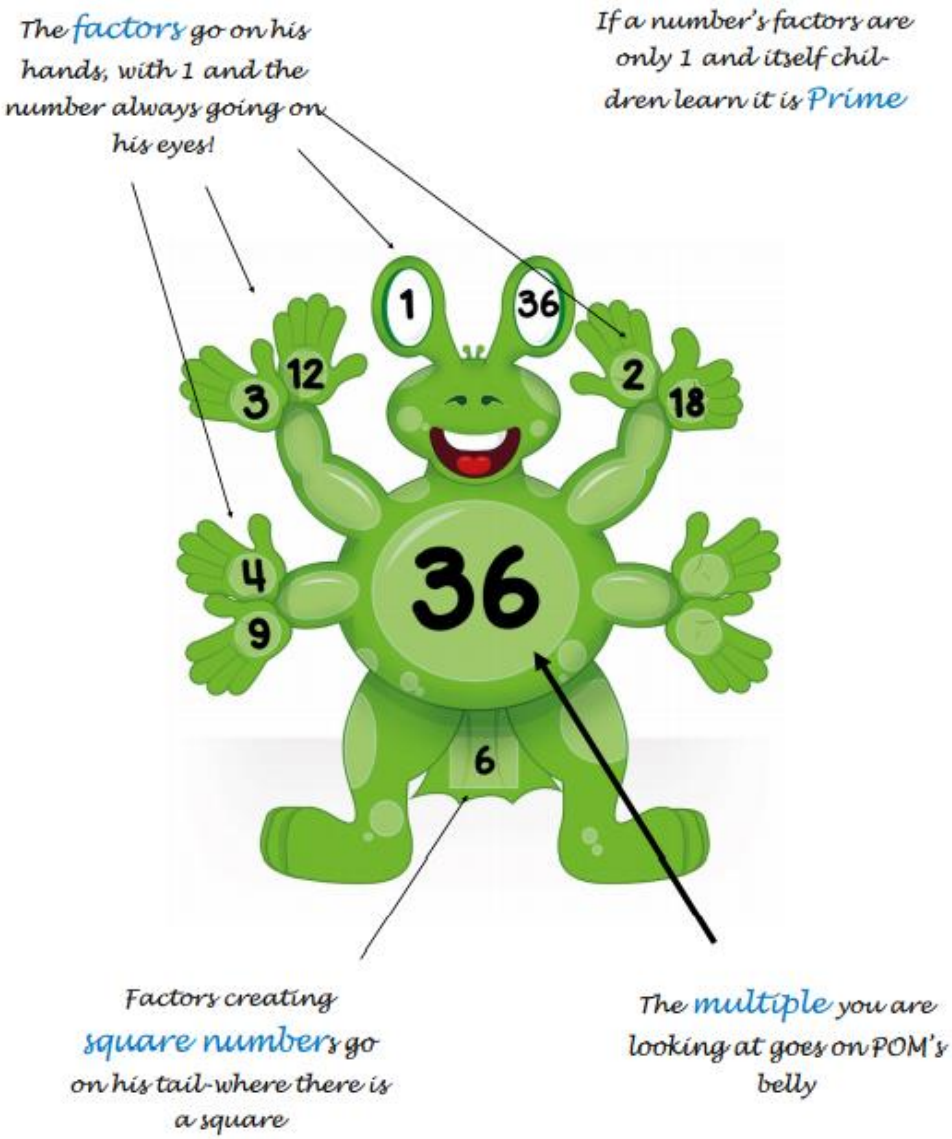
What the pupils don't realise while they are playing 'Where's Mully?' is that they are actually learning to become proficient at division! Using the example given in the introduction here, the challenge of finding Mully when he is hiding behind the biggest multiple of 3 without going past 40 is actually the division question, '40 divided by 3'. If we get pupils good at multiplication, then it is a win-win! They are actually getting good at division too, so long as we show them how to use their multiplication skills to solve division.

Where's Mully for Calculation

In order to complete formal division methods, Mully is key, as he allows the pupils to quickly identify the multiples and know how much is left to carry over.

Pom

Pom is an alien. He lives with Pom on the planet CLIC. Pom has several features that help pupils learn 4 key mathematical words: multiple, factor, square and prime. With Pom's help, these words can be learnt easily and early.



Squiggleworth

Squiggleworth helps us to understand what each Squiggle is worth. He is an alien pet with a body, where each section represents a different place value column.

Using Squiggleworth for partitioning is a key learning step to pupils identifying the value of individual digits. This leads pupils well into understanding the importance of place value when using column methods for calculation.

What's that Squiggleworth?

50

How do you know?

Because it's a 5 in the tens column.

Count Fourways

For each way of counting, and for each step of progression the pupils learn to count in that way, and then count in that way anywhere in the number system (in line with their ability to read, partition and order numbers), and then count backwards in that way anywhere in the number system.

Later on the pupils will use these different ways of counting to read along unmarked values on a number line in the context of measures and graphs. However, it is worth noting at this point that this is exactly where these four different ways of counting arise from. This is summarised in the bottom row of the table below.

Why Count Fourways?

Using the Count Fourways method allows pupils to develop a strong understanding of the number system as well as their understanding of fractions and decimals. Count Fourways also helps pupils to understand how scales work and the divisions between them.

Step				
7	-1s	-2s	-5s	-25s
6	0.1s	0.2s	0.5s	0.25s
5	Tenths	Fifths	Halves	Quarters
4	1000s	2000s	5000s	2.5s
3	100s	200s	500s	2500s
2	10s	20s	50s	250s
1	1s	2s	5s	25s
Amount of divisions between marked numbers	**10**	**5**	**2**	**4**

Year 1

Cubes: Initial teaching is physical with gathering groups of cubes and counting your total.

Fingers: Addition then moves to counting on using fingers.

Numberline: Abstract concept of numbers is introduced with pupils jumping along a numberline– Big Maths step 9.

2d + 2d At the end of Year 1 addition of a 2 digit and 2 digit number is taught by holding one number in the head and counting along the second number on a numberline.

Cubes: Initial teaching is physical with gathering groups of cubes and taking away from this group then counting those remaining.

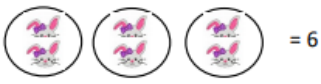
Images: To support the move to the abstract pupils are then given sets of images to then cross off those that they are taking away.

Numberline: Pupils are taught to find the larger number on a numberline and count backwards to find the answer - Big Maths step 9.

GD: FAB methods for mental subtraction are taught with pupils counting back in their heads.

Physical: Multiplication begins with the physical concept of 'lots of' an object– often using cubes.

Images: Continuing with the concept of lots of, pupils are shown to create lots of an object as images or dots and count them up.

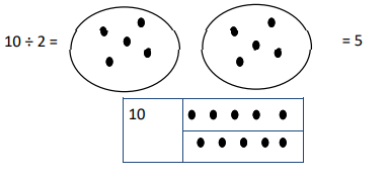


GD: Pupils are extended to begin learning their multiplication facts for rapid recall through a range of active methods and regular practise.

PIM: During Year 1 the concept of PIM is introduced where the 'thing' you are multiplying can change but your answer is the same eg KG or M.

Physical: Pupils begin by sharing physical objects into halves, quarters or thirds.

Grouping: The physical sharing is quickly moved to using dots to split a number into groups, using either circles or grids.



GD: Move on from using written grouping methods to learning core facts of division.

Year 2

Cubes: Knowledge is secured using physical objects.

Numberline/ number square: Pupils use numberlines and number squares to solve addition by counting on.

Column methods: Speedy Col forms the core of addition methods in year 2.

$$\begin{array}{r} 2 \\ +\ 3 \\ \hline 5 \end{array}$$ ← Initially the 1d+1d number sentences are used to secure the layout.

Children very quickly move on to 2d + 2d using the column layout without carrying.

$$\begin{array}{r} 12 \\ +\ 23 \\ \hline 35 \end{array}$$

$$\begin{array}{r} 1 \\ 12 \\ +\ 9 \\ \hline 21 \end{array}$$

GD:

Some pupils are then extended through to solving a 2d+1d with carrying.

Cubes: Physical methods are used to secure subtraction knowledge.

Column methods: Speedy Col forms the core of subtraction methods in Year 2.

$$\begin{array}{r} 9 \\ -\ 2 \\ \hline 7 \end{array}$$ ← Initially the 1d-1d number sentences are used to secure the layout.

Children very quickly move on to 2d - 2d using the column layout without borrowing.

$$\begin{array}{r} 24 \\ -\ 13 \\ \hline 11 \end{array}$$

$$\begin{array}{r} {}^{1}\cancel{2}{}^{1}2 \\ -\ 9 \\ \hline 13 \end{array}$$

GD:

Some pupils are then extended through to solving a 2d-1d with borrowing.

Physical: Multiplication begins with the physical concept of 'lots of' an object– often using cubes.

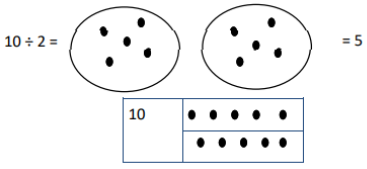
Images: Continuing with the concept of lots of, pupils are shown to create lots of an object as images or dots and count them up

TT facts: Pupils learn their core TT facts following the Big Maths Learn-Its schedule with their knowledge being secured through practise on Times Table Rock Stars.

PIM: During Year 2 the concept of PIM is continued where the 'thing' you are multiplying can change but your answer is the same eg KG or M.

Physical: Pupils begin by sharing physical objects into groups.

Grouping: The physical sharing is quickly moved to using dots to split a number into groups, using either circles or grids.



Division Facts

Move on from using written grouping methods to learning core facts of division, these are

Year 3

Column methods: Pupils begin by securing the use of 2d + 2d without carrying first, then carrying.

$$\begin{array}{r} 36 \\ +\ 42 \\ \hline 78 \end{array} \qquad \begin{array}{r} 76 \\ +\ 48 \\ \hline 124 \\ {\scriptstyle 1} \end{array}$$

Pupils are then extended through to solving a 3d+2d without carrying first, then carrying.

$$\begin{array}{r} 442 \\ +\ 36 \\ \hline 478 \end{array} \qquad \begin{array}{r} 547 \\ +\ 94 \\ \hline 641 \\ {\scriptstyle 1\ 1} \end{array}$$

Pupils then move on to completing 3d + 3d without carrying first, then carrying. carrying– remaining within equal number of digits.

$$\begin{array}{r} 636 \\ +\ 242 \\ \hline 878 \end{array} \qquad \begin{array}{r} 686 \\ +\ 549 \\ \hline 1235 \\ {\scriptstyle 1\ 1} \end{array}$$

Column methods: Pupils begin by focusing on a 2d number subtract another 2d number, where borrowing is needed.

$$\begin{array}{r} {\scriptstyle 6\ 1} \\ 7\not{6} \\ -\ 48 \\ \hline 28 \end{array}$$

Pupils are then introduced to 3d numbers, so no borrowing initially, before moving onto borrowing later on.

$$\begin{array}{r} 986 \\ -\ 42 \\ \hline 944 \end{array} \qquad \begin{array}{r} {\scriptstyle 8\ 12} \\ \not{9}\not{3}1 \\ -\ 82 \\ \hline 849 \end{array}$$

Finally, pupils move onto subtracting a 3d number from another 3d number, with borrowing.

$$\begin{array}{r} {\scriptstyle 8\ 17\ 1} \\ \not{9}\not{3}\not{5} \\ -\ 596 \\ \hline 389 \end{array}$$

TT Facts: Children continue to learn their core TT facts following the Big Maths Learn-Its schedule with their knowledge being secured through practise on Times Tables Rock Stars.

SMILE: The concept of smile multiplication is used alongside the PIM principle when multiplying 10s, 100s or 1000s

$$20 \times 3 = 60$$
$$\smile_{6}$$

Column multiplication: Pupils begin by laying out 1dx1d as column to bridge their knowledge before moving to 2d x 1d within Times Tables they are secure with (2, 3, 4 or 5).

$$\begin{array}{r} {\scriptstyle 2} \\ 35 \\ \times\ 5 \\ \hline 175 \end{array}$$

Division Facts: Learning of division facts (switchers) from tables facts continues throughout the year.

SMILE: The concept of SMILE division is used to support It's Nothing New where pupils are able to identify division facts.

$$60 \div 3 = 20$$
$$\smile_{2}$$

Bus Stop division: The bus stop method is used within times tables that pupils are aware of (2, 3, 4 or 5), initially with no remainders inside the question.

$$3 \overline{)\ 69}\ 23$$

Year 4

Column Methods: Pupils begin by securing 3d+ 3d with carrying.

Pupils also complete column addition with mixed numbers of digits such as 4d + 2d, focusing on Squiggleworth for place value.

$$\begin{array}{r} 6549 \\ +\ 686 \\ \hline 7235 \\ {\scriptstyle 1\,1\,1} \end{array}$$

Throughout the year pupils move to 4d + 4d with carrying.

$$\begin{array}{r} 8686 \\ +\ 6549 \\ \hline 15235 \\ {\scriptstyle 1\,1\,1} \end{array}$$

Column Methods: Pupils are introduced to 4d numbers. They start by subtracting 2d numbers, before progressing to 3d numbers.

$$\begin{array}{r} {\scriptstyle 4\,1\,7\,1} \\ \not{5}\not{6}86 \\ -\ 749 \\ \hline 4937 \end{array}$$

Pupils then subtract 4d numbers from other 4d numbers.

$$\begin{array}{r} {\scriptstyle 4\,1\,7\,1} \\ \not{5}\not{6}86 \\ -\ 4749 \\ \hline 937 \end{array}$$

TT facts: Pupils continue to learn their core TT facts following the Big Maths Learn-Its schedule with their knowledge being secured through practise on TT rockstars.

SMILE: The concept of smile multiplication is secured alongside the PIM principle when multiplying 10s, 100s or 1000s

$$20 \times 8 = 160$$
(16)

Column multiplication: Pupils move onto solving any 2d number multiplied by a 1d number, before multiplying 3d numbers.

$$\begin{array}{r} {\scriptstyle 3} \\ 85 \\ \times\ 6 \\ \hline 510 \end{array} \qquad \begin{array}{r} {\scriptstyle 5\,3} \\ 385 \\ \times\ 6 \\ \hline 2310 \end{array}$$

Division Facts: Learning of division facts (switchers) from tables facts continues throughout the year.

SMILE: The concept of SMILE division is used to support It's Nothing New where pupils are able to identify division facts.

$$160 \div 8 = 20$$
(2)

Bus Stop division: The bus stop method is used within times tables that pupils are aware of (2, 3, 4 or 5), then to any tables.

$$3\overline{)\,8^{2}1} \quad 27$$

Then, pupils use the bus stop method to divide 3d and 4d numbers, with no remainders in the answer.

$$7\overline{)\,29^{1}4} \quad 42 \qquad 9\overline{)\,{}^{3}3^{5}54} \quad 406$$

Year 5

Column Methods: Pupils move on to adding several numbers together using column addition.

```
  868
  582
+ 654
 2104
  21
```

Later on in the year pupils move onto adding 2 5d numbers.

```
 81686
+66549
148235
 111
```

Column Methods: Pupils are introduced to 5d numbers for the first time with column subtraction.

```
  41 71
  95686
- 54749
 40937
```

SMILE: The concept of smile multiplication is secured alongside the PIM principle when multiplying 10s, 100s or 1000s

Column multiplication: Pupils move onto multiplying two 2d numbers, then 3d x 2d.

```
  3
 85
x 16
510
850
1360
```

```
  53
 485
x 16
2910
4850
7760
 1
```

Pupils then move to a 4d x 1d number. The focus here is on doing it carefully.

```
  31
 8152
x    6
48912
```

SMILE: The concept of SMILE division is used to support It's Nothing New where pupils are able to identify division facts.

Bus Stop division: Pupils now move to using the bus stop method to find answers with remainders.

```
    83 r5
  2
6 503
```

Pupils then progress to dividing 4d numbers, and interpreting the context of the remainder.

```
     666 r4
   44
6 4000
```

Year 6

Column Methods: Pupils should already be able to add two 1dp numbers mentally.

Pupils then move onto adding numbers with 1dp formally.

$$\begin{array}{r} 18.7 \\ +\ 56.4 \\ \hline 75.1 \\ \hline {\scriptstyle 1\ 1} \end{array}$$

Pupils then progress onto adding numbers with 2dp.

$$\begin{array}{r} 8.68 \\ +\ 6.54 \\ \hline 15.22 \\ \hline {\scriptstyle 1\ 1} \end{array}$$

These skills can be linked to money, so 8.68 becomes £8.68 and so on. The size of the whole number before the decimal point can also be

Column Methods: Pupils should have a good understanding of place value in decimal numbers.

Pupils start be subtracting a 1dp number from another, before subtracting 2dp numbers, then 3dp numbers.

$$\begin{array}{r} {\scriptstyle 7\ 1} \\ 8.6 \\ -\ 4.9 \\ \hline 3.7 \end{array} \qquad \begin{array}{r} {\scriptstyle 7\ 1} \\ 8.67 \\ -\ 4.91 \\ \hline 3.76 \end{array} \qquad \begin{array}{r} {\scriptstyle 7\ 1\ 1\ 1} \\ 8.625 \\ -\ 4.908 \\ \hline 3.717 \end{array}$$

Finally, pupils move onto subtracting numbers with mixed amounts of decimal places.

$$\begin{array}{r} {\scriptstyle 7\ 1} \\ 8.625 \\ -\ 4.8 \\ \hline 3.825 \end{array}$$

SMILE: The concept of smile multiplication is secured alongside the PIM principle when multiplying 10s, 100s or 1000s

Column multiplication: Pupils move to 4d x 2d numbers.

$$\begin{array}{r} 3123 \\ \times\ 22 \\ \hline 6246 \\ 62460 \\ \hline 68706 \\ \hline {\scriptstyle 1} \end{array}$$

Pupils then move to multiply decimal numbers by 1d and 2d numbers.

$$\begin{array}{r} {\scriptstyle 2} \\ 5.6 \\ \times\ 4 \\ \hline 22.4 \end{array} \qquad \begin{array}{r} {\scriptstyle 1\ 2} \\ 5.24 \\ \times\ 6 \\ \hline 31.44 \end{array} \qquad \begin{array}{r} {\scriptstyle 1} \\ 5.2 \\ \times\ 36 \\ \hline 31.2 \\ 156.0 \\ \hline 187.2 \end{array} \qquad \begin{array}{r} {\scriptstyle 1\ 2} \\ 5.24 \\ \times\ 26 \\ \hline 31.44 \\ 104.80 \\ \hline 136.24 \\ \hline {\scriptstyle 1} \end{array}$$

Bus Stop division: Pupils now move to dividing 2d and 3dnumbers by 2d numbers.

$$\begin{array}{r|l} & 28\ r1 \\ \hline 23 & {\scriptstyle 1}\not{6}45 \\ -\ 46 & \\ \hline 185 & \\ -\ 184 & \\ \hline 1 & \end{array}$$

Then, pupils divide 4d numbers by a 2d number, and show the remainder as fraction.

Finally, pupils solve division with decimal places in the answer.

$$\begin{array}{r|l} & 305.5 \\ \hline 22 & 6721.0 \\ -\ 66 & \\ \hline 121 & \\ -\ 110 & \\ \hline 110 & \end{array}$$