East Bierley CE (VC) Primary School

Calculation Policy

2016

Calculation Policy

At East Bierley CE (VC) Primary School, our main aim is to provide a high quality education for all of our pupils, balanced with a friendly atmosphere and a Christian perspective within a village community school.

Mission Statement

Within the community, our church school is a special place filled with inclusive learning, laughter and friendship, fostering care and respect where all feel safe and valued.

Our vision is to hold true these beliefs, enabling our children to achieve their fullest potential.

Friendship, Trust, Courage, Respect, Forgiveness

Our aim is to making learning irresistible. We want the children of our school to be respectful and honest with a sound knowledge of right and wrong and the role they have in our school, local and wider community, both now and in the future. We aim to nurture tolerance of others, self reflection and independent learning skills, children who have the resilience to solve problems and persevere with new skills using a 'have a go' attitude towards their learning. We aim to ensure our curriculum is meaningful and enables children to develop the skills they need for the future. The curriculum content is progressive and increasingly adapts to reflect what is relevant now, special anniversaries, the local area and children's interests whilst ensuring coverage of the statutory curriculum is thorough.

Maths at our school is taught through a practical approach using concrete apparatus, games and investigative problem solving. Children are encouraged to access the resources they require and to develop the resilience required to solve problems and search all possible answers. The national curriculum for maths is followed throughout school with lessons targeted for individuals and groups as appropriate to meet their needs and narrow the gap to age related expectations.

Purpose of study

Mathematics is a creative and highly inter-connected 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.

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.

Calculation Policy

Mathematics is an interconnected subject in which pupils need to be able to move fluently between representations of mathematical ideas. The programmes of study are, by necessity, organised into apparently distinct domains, but pupils should make rich connections across mathematical ideas to develop fluency, mathematical reasoning and competence in solving increasingly sophisticated problems. They should also apply their mathematical knowledge to science and other subjects.

The expectation is that the majority of pupils will move through the programmes of study at broadly the same pace. However, decisions about when to progress should always be based on the security of pupils' understanding and their readiness to progress to the next stage. Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice, before moving on.

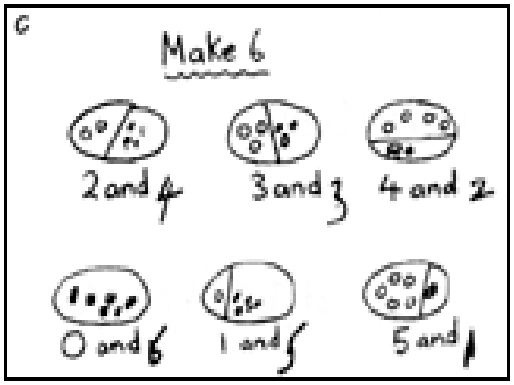
The Calculation approaches may be adapted without the policy being returned immediately to Governors if current research and training indicate an immediate change is required. Any adaptations would then be shared with Governors as soon as appropriate.
Throughout all calculations the importance of place value must not be underestimated. If there are gaps in place value understanding, further learning is being built on shaky foundations and should be addressed immediately.

Calculation Policy
Addition

EYFS
Children will engage in a wide variety of songs and rhymes, games and activities.
They will begin to relate addition to combining two groups of objects, first by counting all and then by counting on from the largest number.
They will find one more than a given number.
In practical activities and through discussion they will begin to use the vocabulary involved in addition.

'You have 5 apples and I have 3 apples. How many apples altogether?'

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures, etc.



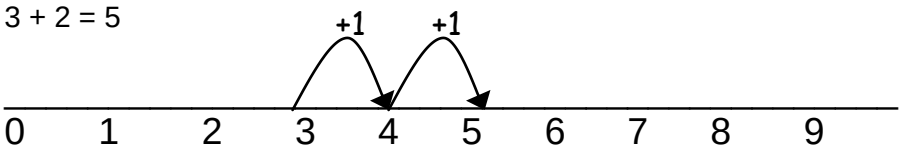
Year 1

They will use Numicon to gain a concrete understanding of number.

They will practise counting on from any number 'Put five in your head and count on 4'.

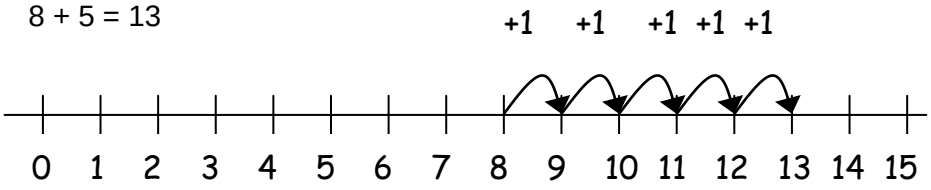
They use numberlines and practical resources to support calculation and teachers *demonstrate* the use of the numberline.

3 + 2 = 5

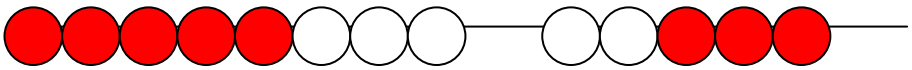


Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones.

8 + 5 = 13



Calculation Policy
Bead strings or bead bars can be used to illustrate addition including bridging through ten by counting on 2 then counting on 3.



Continue to practise counting on from the largest number for addition with totals within 20.
Encourage mental calculations of number bonds and doubles.

Year 2

A number of strategies should be taught always starting with concrete apparatus leading to pictorial representation. When using practical resources such as numicon or base ten it can be laid out vertically in preparation for key stage two methods. The number line is within the national curriculum expectations for year 2 so must be covered but should not be the only taught method for addition there should be a greater emphasis given to partitioning and using numicon or base ten and laying it out whilst simpley recording a number sentence.

Partitioning numbers using Numicon, place value counters, base ten and arrow cards. Children must be confident partitioning before they can move on to the next method.

Also use partitioning method to add two digit numbers – use base ten or place value counters to support this. **This does not need to be formally laid out as it is the partitioning process and use of resources that are the key skills.** Much of this addition once partitioned may be added mentally with parts jotted down. Formal recording will come in KS2.

43 + 25 =
40 +20 = 60
3 + 5 =8
60 + 8= 68

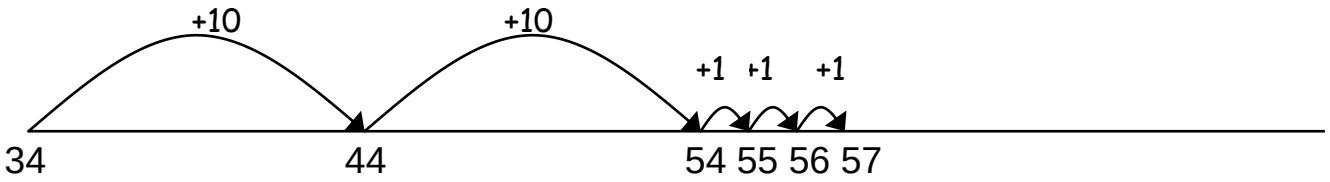
Then move on to calculations that bridge tens:

48 + 36 = 40+ 8 + 30 + 6
40 + 30 = 70
8 + 6 = 14
70 + 14 = 84

Children will begin to use 'empty number lines' themselves starting with the larger number and counting on.

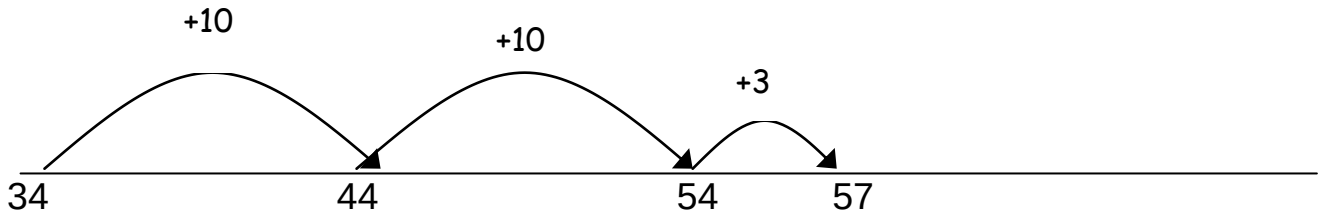
- ✓ First counting on in tens and ones. This directly contrasts how we add in column method where we start with the smallest unit so requires place value understanding.

34 + 23 = 57



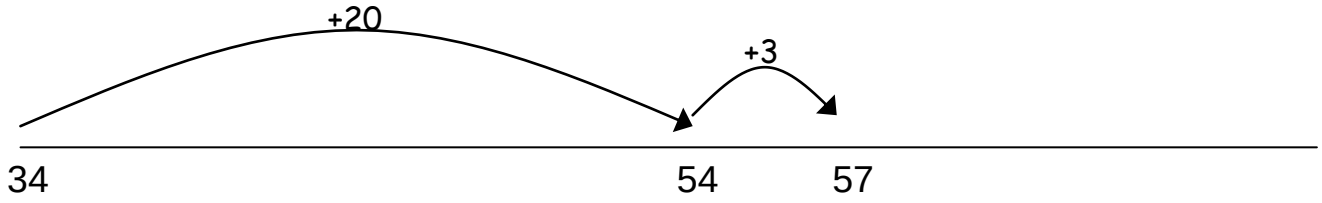
- ✓ Then helping children to become more efficient by adding the units in one jump (by using the known fact 4 + 3 = 7).

✓ 34 + 23 = 57



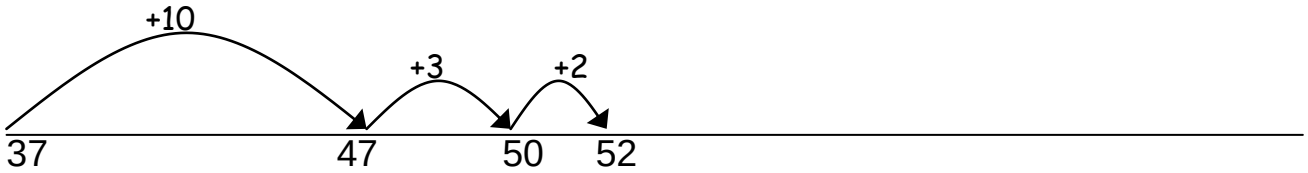
✓ Followed by adding the tens in one jump and the units in one jump.

34 + 23 = 57



✓ Bridging through ten can help children become more efficient.

37 + 15 = 52



Year 3

We will introduce a written vertical column method once children are ready for the Year 3 curriculum. This knowledge of partitioning can then be used in a vertical column calculation where the smallest part of the number is added first in preparation for moving to vertical addition.

	TO	
	67	
+	24	
	1 1	(7 + 4)
	80	(60 + 20)
	91	

	HTO	
	267	
+	85	
	12	(7 + 5)
	140	(60 + 80)
	200	
	352	

Always use column headers and one digit per square. Until they are confident, practical resources should be used to reinforce the method. Use place value language throughout the process so that you begin with the ones and when adding the tens would say that you are adding 60 and 20 so answers are recorded in the tens column.
Always start with the least significant digit (ones) in preparation for the formal written method.

Calculation Policy
Before bridging ten/hundred it may be necessary to return to partition method for first examples. Again use the language of place value so 80 plus 30 is 110 so needs recording as 1 hundred, 1 ten and zero ones.

This method will be used for all addition including money, weights and measures, all the time reinforcing place value. Where children require practical resources these can be used alongside this method and column headers should be used.

Year 4

Formal written method will be introduced

```
  TO
   63
+  32
   95
```

Use the language of place value to ensure understanding: 'Three add two equals five. Write five the ones column. 60 add 30 equals 90 write 9 (90) in the tens column.

Introduce how to 'carry' ten from the ones to the tens column with two digit numbers. Children can add larger numbers using the column method that do not require a 'carry' over.

```
  TO
   68
 +24
  1
   92
```

use the language of place value to ensure understanding: 'eight add four equals 12. write two in the ones column and carry 1 (10) across into the tens column. 60 add 20 and the ten we carried equals 90. Write 9 (90) in the tens column. 92 is the answer.

```
  HTO
  789
+642
  1 1
1431
```

Extend through 3 digit numbers to four digit numbers and numbers with decimals (in the context of money and measure). All the time reinforce place value language.

Year 5

Continue with the formal written column method including for addition of decimal numbers. Ensure the language of place value is still modelled at all times.

```
 TO.t
  12.3
+23.5
  35.8
```

use language of place value zero point 3 plus zero point 5 is 0.8 so we put the 8 in the tenths column. Then 2 plus 3 equal 5 so the 5 is put in the ones column. 10 plus 20 are 30 and that is recorded in the tens column.

Where bridging occurs it may be necessary to return to partitioning the number briefly but still ensure the place value language is used. (Zero point 8 plus zero point 4 is 1.2 so we write the zero point 2 in the tenths column and we carry the 1 to the ones column.

Ensure children have the opportunity to find errors in examples to consolidate understanding.
GfGing teachers work and later their own provides the key to checking steps carefully. Examples where the ten was carried but not added in etc.

Year 6

Consolidate written method. Our aim is that by the end of Year 6, children use mental methods (with jottings) when appropriate, but for calculations that they cannot do in their heads,they use as efficient formal written method accurately and with confidence.

Using this method, children will:

- *add several numbers with different numbers of digits;*
- *begin to add two or more three-digit sums of money, with or without adjustment from the pence to the pounds;*
- *know that the decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. £3.59 + 78p*.

Children should not be made to go onto the next stage if:

1) **they are not ready.**
2) **they are not confident.**

Children should be encouraged to approximate their answers before calculating. They can record this with an E= in their books alongside the calculation. This ensures they check their answer makes sense.

Children should be encouraged to check their answers after calculation using an appropriate strategy.

The Learning objective should be explicit for children to show if using a mental calculation is an option or whether showing working is considered essential.

If not explicitly required to show working, children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

Calculation Policy
Subtraction

EYFS

Children will engage in a variety of counting songs, rhymes and practical activities. IN practical activities and through discussion they will begin to use the vocabulary associated with subtraction.

They will find one less than a given number.
They will begin to relate subtraction to taking away using objects to count 'how many are left' after some have been taken away.

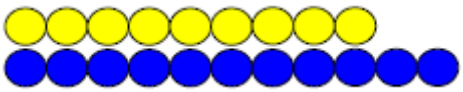
6-2=4

'Take two apples away. How many are left?'

Children will begin to find the difference between two amounts counting on from the smaller number using objects.

Year 1

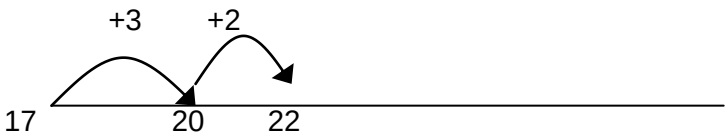
Count on to find the difference. Use of models here is extremely important.
11-9=2



Numicon is effective for this. Lay the smaller number over the larger number to 'see' the difference.

We always begin with the smaller number and count on to the bigger number. Encourage to work round multiples of 10 and 100.
Start with the smallest number on the numberline and count on in steps to the larger number. Then add the total of the jumps to find the difference. Jumps of one are to be used within questions to 20 but when working on larger numbers aim to incorporate larger jumps.

22-17 = 5

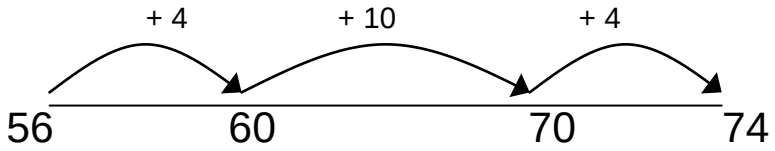


3+2 = 5

Year 2

Leading to a more refined method of counting on (counting to the nearest 10 first). Children need to be confident with number bonds for this method to be efficient.

74 – 56 = 18



Calculation Policy
10 + 4 + 4 =18

This strategy can be used to subtract bigger numbers.

Children need to work on subtracting tens quickly and number bond work throughout year 2.
Use of numicon and base ten should be encouraged so children can visually see the concept.
Children can still partition to help develop an understanding of subtraction but should always be taught to subtract units first. For children working at greater depth, it is appropriate for children to taught to lay out base ten vertically.

Children can be introduced to the concept of exchanging where needed using practical resources.

Year 3

When children can partition quickly and following plenty of mental practise taking away tens (counting backwards) and with number bonds so single digits can be subtracted quickly, move on to partitioned method as a prelude to the formal column method. This method of counting up can also be recorded vertically – but only when a child has a sound understanding of the maths involved in counting on using a number line. This is more efficient when using larger numbers as errors in addition of jumps are less likely to occur.

Column headers should always be used.

When partitioning the number 54 it should be

50 and 4 or

Tens	ones	
50	4	rather than 50+4 so children are not confused about the calculation

89-35=54 introduce using numbers where no exchanging is necessary

80 and 9 use base ten or place value counters to aid understanding
-30 and 5
50 and 4

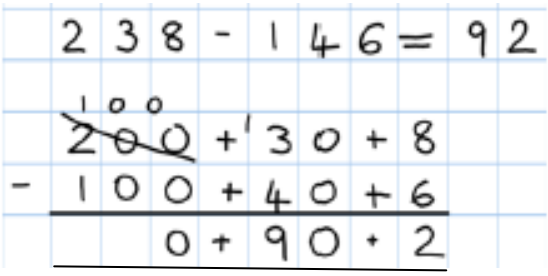
Once ready to 'exchange' move onto

72-47=

Before subtracting the 7 blocks a ten will need to be exchanged for ten ones.

Once children are secure with the understanding of 'exchanging', they can use the partitioned column method to subtract any two or 3 digit numbers.

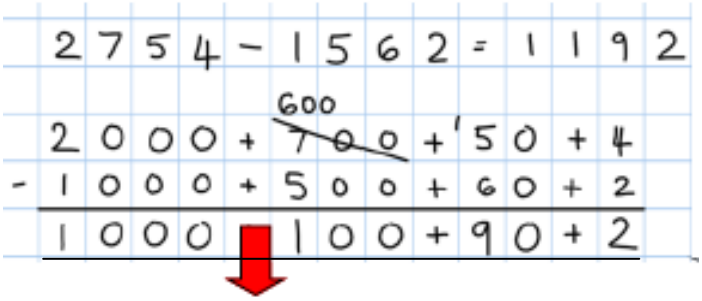
Calculation Policy

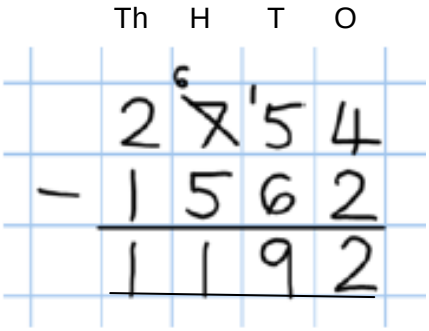


Continue to use counting on as a mental strategy for close together numbers (eg 121-118 and also for numbers that are 'nearly' multiples of 10, 100, 1000 or £s, which make it easier to count on (eg 131-79. start at the smaller number and count on the tens first then the ones). **Strategies for mental calculations should be taught alongside written methods so children can choose the most appropriate method.**

Year 4

Continue to use the partitioned method to work with larger numbers





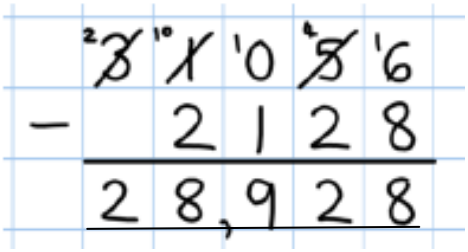
To introduce the compact method, ask children to perform a subtraction calculation with the familiar partitioned column subtraction then display the compact version for the calculation they have done. Ask children to consider how it relates to the method they know, what is similar and what is different, to develop an understanding of it. It is a good idea to return to subtraction of 2 and 3 digit numbers here to introduce the concept of short subtraction. If necessary also use practical resources – base ten or place value counters. Column headers should be used.

Children who are not secure with number facts will need to remain on the partitioned method. Children who enter school within the key stage need to be encouraged to use practical resources to subtract using school methods.

Year 5

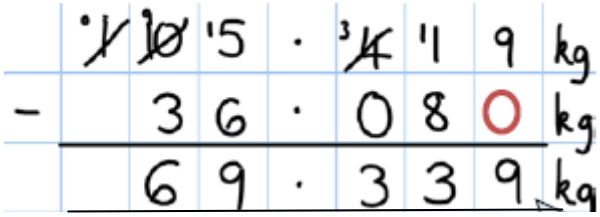
Calculation Policy

Subtraction using larger numbers and decimals. Ensure the decimal point remains lined up (it does not need a square just the lines between them squares) and support using column headers.



Year 6

Larger numbers. Zero can fill empty decimal places to show the place value **but don't leave a square for the decimal as below, put it on the line in the corner between squares.**



There should be regular opportunities for children to check calculations using the inverse. Subtraction can be the lead calculation so children check the answer using the addition.

Calculation Policy
Multiplication

EYFS

Children will engage in a wide variety of songs, rhymes, games and activities. In practical activities and through discussion they will being to solve problems including doubling.

'Three apples for you and three apples for me. How many apples altogether?'

Year 1

Early multiplication begins with counting in different steps. Learning tables should begin in Year 1 as multiplication and division facts as per medium term planning

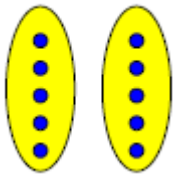
Children will count repeated groups of the same size in practical contexts. They will solve practical problems that involve combining groups of 2,5 or 10. eg socks, fingers, cubes.

'six pairs of socks. How many socks altogether? 2,4,6,8,10,12'

'Three pots of ten crayons. How many crayons altogether? 10, 20, 30'

Use arrays to support early multiplication

'Five groups of two faces. How many faces altogether? 2,4,6,8,10'
'two groups of five faces. How many faces altogether? 5,10'



'2 groups of 5 How many altogether? 5+5=10 Double 5 is ten.

Calculation Policy

Continue to solve problems in practical contexts and develop the language of early multiplication, with appropriate resources.

Year 2

Children will be taught that when multiplying by 10 the digits move one column to the left and a place holder is put in the place (if required). Column headers and children's understanding of them are very important. **Only children who require additional support because they have additional needs should be taught to add a zero.** Introducing the concept to a whole class it should be about moving column. Demonstrating with 1.5 to become 15 proves we are not adding a zero but requires a deeper understanding of the concept.

Combining groups (repeated addition)

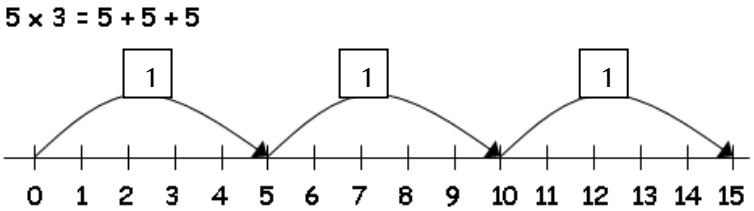
3 groups of 10 crayons / 10 + 10 + 10= 30 / 3 groups of ten / 3 times ten / 3 x 10=30 10 x 3 =30

Children will develop their understanding of multiplication and use jottings to support calculation:

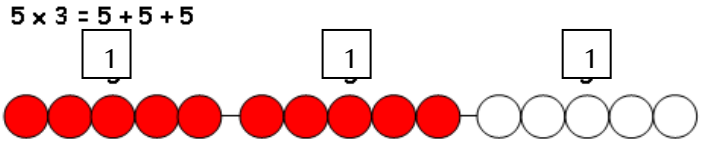
Repeated addition

3 times 5 is 5 + 5 + 5 = 15 or 3 lots of 5 or 5 x3

Repeated addition can be shown easily on a number line:

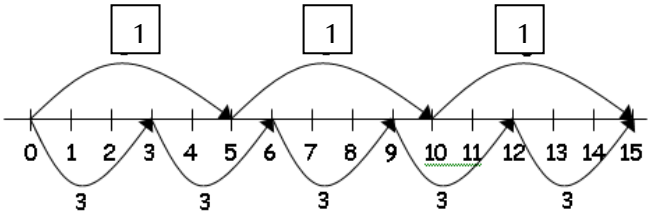


and on a bead bar:



Calculation Policy
Commutativity

Children should know that 3 x 5 has the same answer as 5 x 3. This can also be shown on the number line.



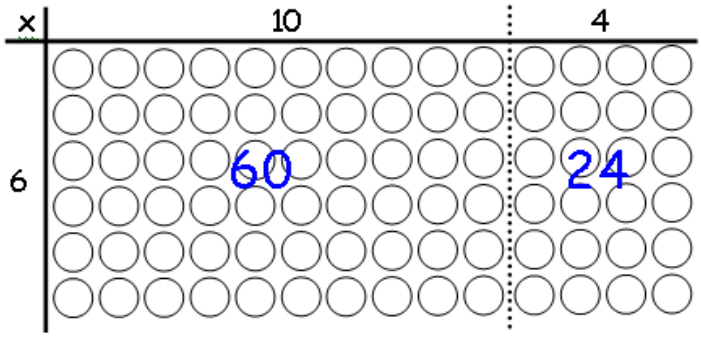
Arrays
Children should be able to model a multiplication calculation using an array. **This knowledge will support with the development of the grid method.**

5 x 3 = 15

3 x 5 = 15

3 rows of 5 / 3 groups of 5 / 5 groups of 3 / 3x5=15 5x3=15

Children will use partitioning when multiplying larger numbers. Where necessary they should be encouraged to still picture the groups in arrays if it helps their understanding.



(6 x 10) + (6 x 4)

60 + 24

84

23 x 8

x	20	3
8	160	24

160	
+ 24	
4	(4+0)
80	(60 +20)
100	(100 +0)
184	

Year 3 and 4

Calculation Policy

The move should be made to long multiplication (using the grid method as a tool in the transition)

36 x 4 = 144

X	30	6
4	120	24

from this

To this

36 x 4 = 144

```
   3 6
 x   4
 ------
 + 2 4   (4 x 6)
 1 2 0   (4 x 30)
 ------
 1 4 4
```

2 digit by 2 digit multiplication

23 x 13 = 299

```
   2 3
 X 1 3
 ------
     9   (3 x 3)
   6 0   (3 x 20)
 + 3 0   (10 x 3)
 2 0 0   (10 x 20)
 ------
 2 9 9
```

in this way it links back to the grid method.

Only use this method without the brackets when children are confident with it. Begin the method using place value counters and using language referring back to place value. Use column headers and check place value understanding. Once confident, children will not need practical resources or brackets – they should be able to use them for calculations they feel it will be beneficial for them to do so.

Year 6

Children should be confident using long multiplication. If they are fluent with the method they may begin to use short multiplication where appropriate.

```
     5 3·2
 x   2 4·0
 ---------
   2 1 1²2·8   (53·2 x 4)
 1 0 6 4 ·0    (53·2 x 20)
 ---------
 1 2 7 6 ·8
```

brackets can be omitted when no longer required

Calculation Policy

Division

EYFS

Children will engage in a wide variety of songs and rhymes, games and activities. In practical activities and through discussion they will begin to solve problems involving halving and sharing.

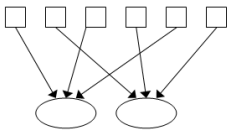
Half of the apples for you and half of the apples for me.

Year 1
Children will understand equal groups and share items out in play and problem solving. They will count in 2s and 10s and later in 5s.

Children will develop their understanding of division and use jottings to support calculation

✓ **Sharing equally**

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



Share these eight apples between two children. How many apples will each child get?

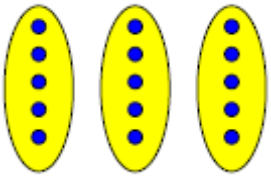
Share 20 crayons between 2 pots.

Year 2

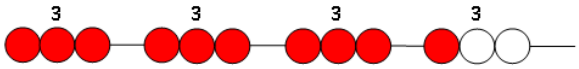
Grouping or repeated subtraction
There are 6 sweets, how many people can have 2 sweets each?

Calculation Policy

How many groups of 5? 15 shared equally between 3 people is…? 15 divided by 5 is 3 15 divided by 3 if 5

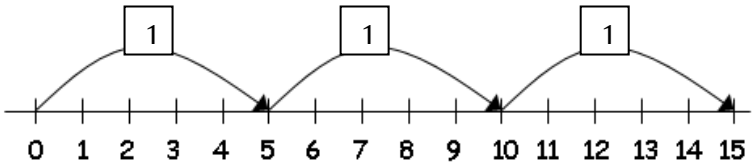


Repeated subtraction using a number line or bead bar
12 ÷ 3 = 4



The bead bar will help children with interpreting division calculations such as 10 ÷ 5 as 'how many 5s make 10?'

15 ÷ 5 = 3



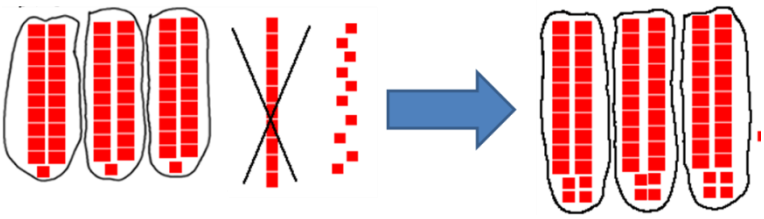
Children will develop their use of repeated subtraction to be able to subtract multiples of the divisor. Initially, these should be multiples of 10s, 5s, 2s and 1s – numbers with which the children are more familiar.

Arrays should also be modelled for division.

Provide a lot of practical opportunities for regrouping using practical resources.

Year 3 and 4
Children need to be confident with appropriate year group table facts.

Move children onto a formal written method using base ten / place value counters.



Calculation Policy

Use the formal (bus stop) method using place value counters. Reinforce language of place value throughout.

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65÷5 =     TO
           13
        5) 65
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Put the 6 tens under the tens column and 5 ones in the ones column. circle 5 tens and the carry the last ten forwards (initially exchange into ten ones).This method can be used with remainders which will not be circled but will be left over. Begin with numbers requiring no exchanging, then with a remainder then with an exchange.

Moving onto larger jumps as a prelude for the vertical chunking method. Use place value counters / base ten to support this process.

If looking at numbers like 210 divided by 7 look for patterns within the table (eg 3 x 7 = 21 30 x 7 = 210).

Year 5 and 6

Children should be able to divide decimal numbers confidently using this method.

Calculation Policy
General

- Maths to be recorded one digit per square once squared books are used.
- Weekly mental maths session using mental test. **Teacher to complete the test as well**. Teach strategies for how to approach question types. Encourage use of jottings – does yours look like the teachers?
- Build in opportunities to develop pace of calculation through mixed question type.
- Problem solving to be built into lessons and recorded in a specific independent learning book so children can revisit strategies. This will provide useful evidence of application of skills taught for curriculum coverage.
- Column headers to be encouraged where required to consolidate place value in all year groups.
- Games to be built into planning in all year groups.
- Calculators to be used where appropriate for children to check work, particularly where they have generated their own questions using dice / dominoes or cards. Also to be used to improve place value skills through games such as Zap the digit.
- All maths to begin with concrete resources, move onto pictorial representation before children are expected to work in the abstract. Resources should be freely available if children wish to use them to consolidate learning or check work.