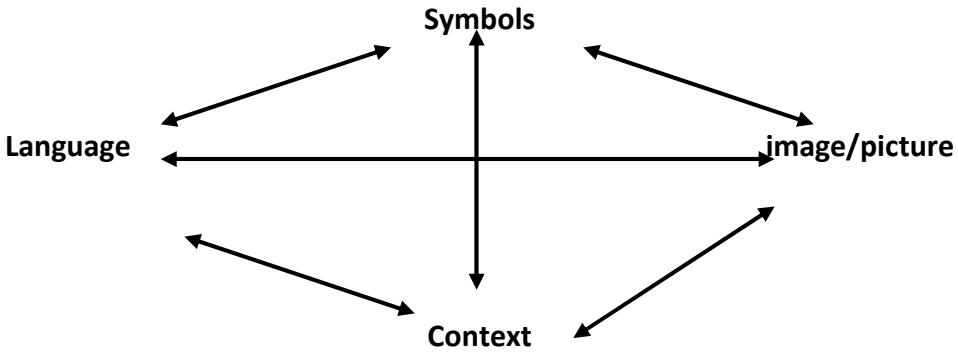
This calculation policy has been developed to support all staff in the effective implementation of the new Primary National Curriculum. The policy focuses on the four operations of addition, subtraction, multiplication and division and includes a list of the key mental maths skills that support written methods. For each operation, there are three stages, starting with the practical methods that support conceptual understanding moving through to methods that allow children to demonstrate efficiency in procedural approaches.

It is important to emphasise that when teaching each stage of calculation, all staff should ensure that the pupils are consistently exposed to the following model;



The calculation sequence

Skill – Teach the calculation skill and then practice with the inverse.

Consolidate – Include units of measurement and missing box questions.

Apply – Problem solving questions or open ended investigations.

When pupils are recording calculations in their books and when this work is marked, teachers must ensure that the calculation policy and sequence is always adhered to, as well as our school's marking policy.

Addition

Written methods for addition

It is important that children's mental methods of calculation are practised on a regular basis and secured alongside their learning and use of written methods of addition.

The aim is that children use mental methods when appropriate, but for calculations that they cannot do in their heads they use a written method accurately and with confidence.

Children are taught and acquire secure mental methods of calculation and one written method of calculation for addition which they know they can rely on when mental methods are not appropriate.

This policy shows the possible stages of each written method for addition, each stage building towards a more refined method.

There are some key basic skills that children need to help with addition, which include:

- counting
- estimating
- recalling all addition **pairs** to 10, 20 and 100 (7 + 3 = 10, 17 + 3 = 20, 70 + 30 = 100)
- knowing number **facts** to 10 (6 + 2 = 8)
- adding mentally a series of one-digit numbers (5 + 8 + 4)
- adding multiples of 10 (60 + 70) or of 100 (600 + 700) using the related addition fact, 6 + 7, and their knowledge of place value
- partitioning two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways

(432 into 400 + 30 + 2 and also into 300 + 120 + 12)

- Understanding and using addition and subtraction as inverse operations

Using and applying is a key theme and one of the aims of National Curriculum and before children move onto the next stage in written calculation it is important that their skills are broadened through their use and application in a range of contexts, these include:

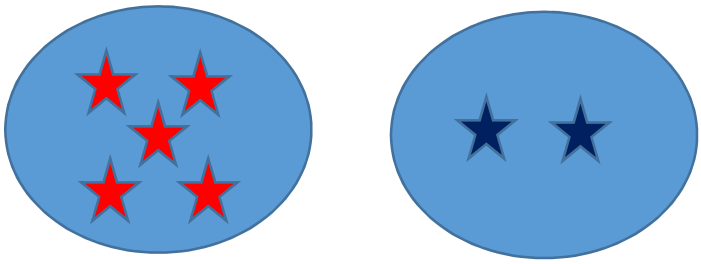
- using inverse
- missing box questions
- using units of measure including money and time
- word problems and open ended investigations.

Stage 1: Practical (combining) and counting on

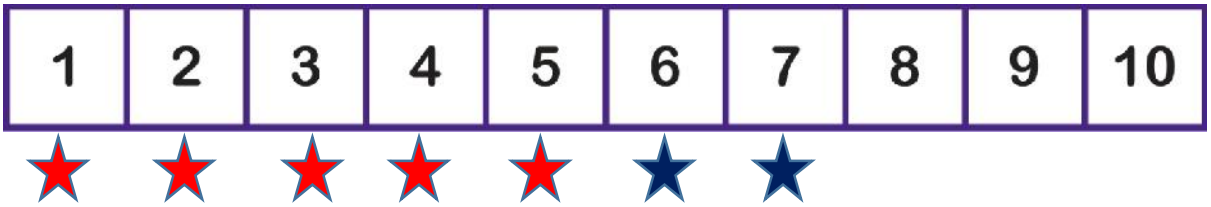
When using objects to add, the addition must be always mirrored on a number line to prepare them for the abstract concept of adding numbers rather than objects.

Step 1

Children will add two sets of objects by combining them and counting all by counting from 1.

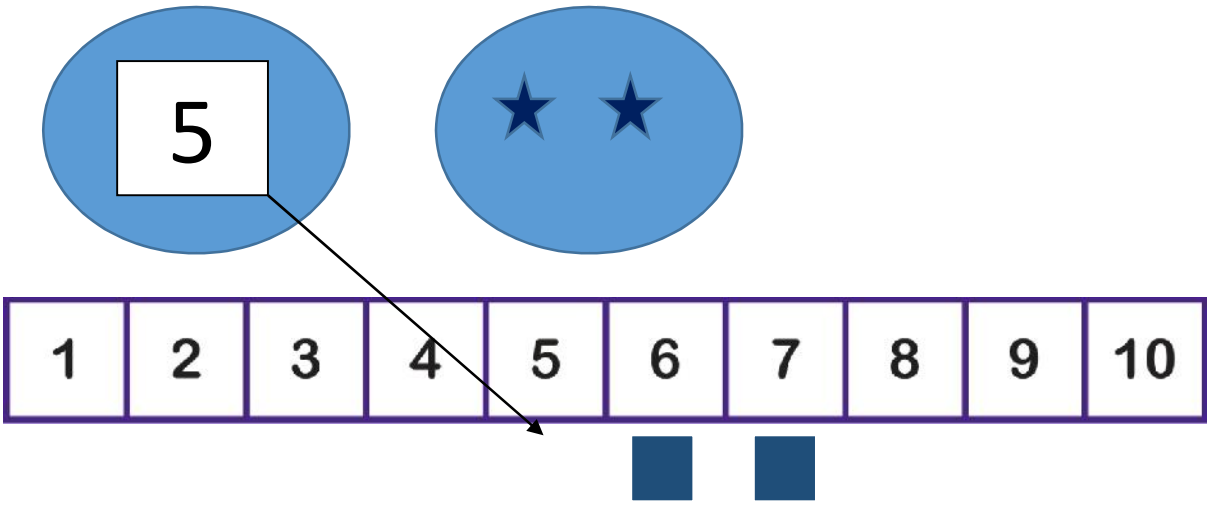


When combining both sets of objects, encourage children to arrange the objects in a line along a number line.



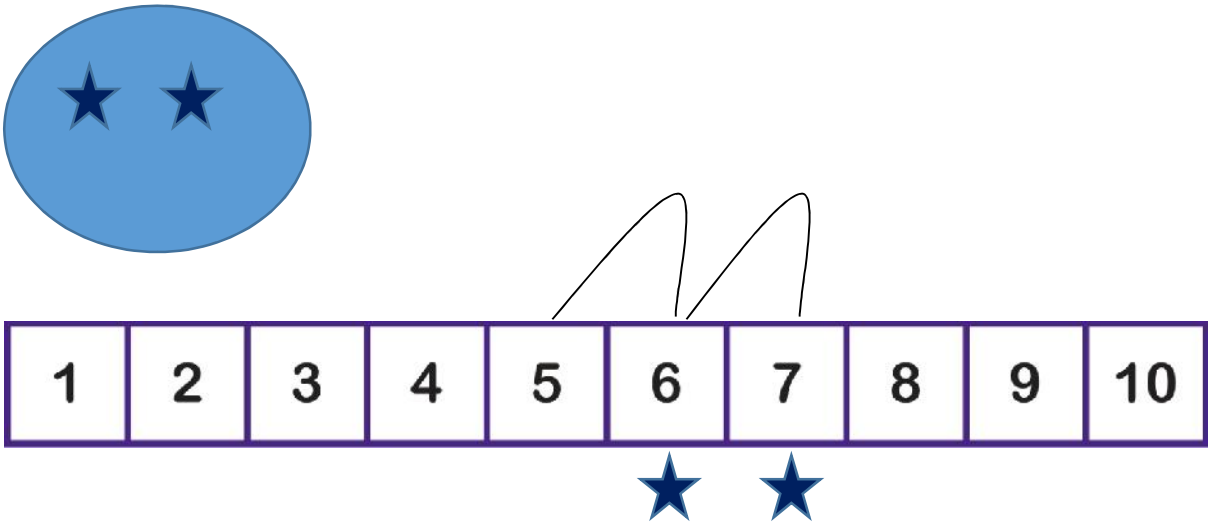
Step 2

A number will be used to represent the first set of objects and children will count on using the visible objects in the second set. They will count on from 5 on a number line, placing the visible objects along the number line as shown.



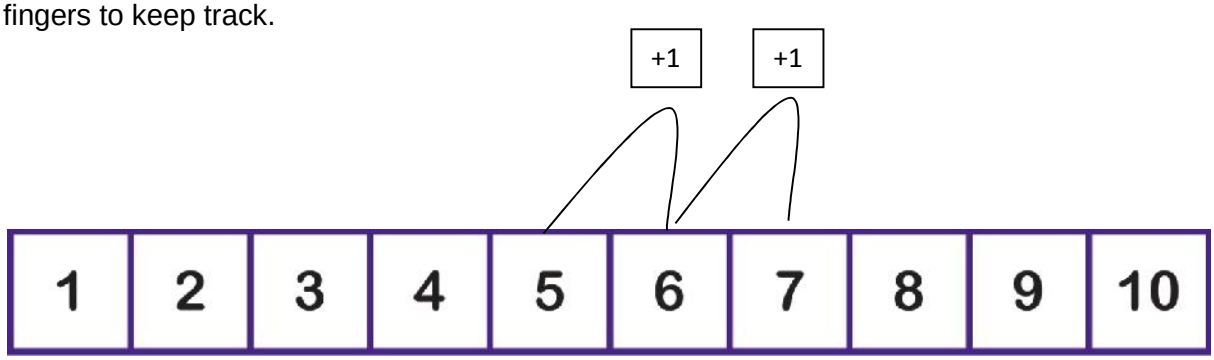
Step 3

Children will visualise the first number in their head and count on using the visible objects e.g. I have 5 sweets in my bag and I am going to add 2 more. How many sweets will there be altogether?

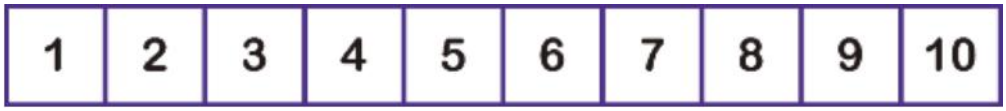


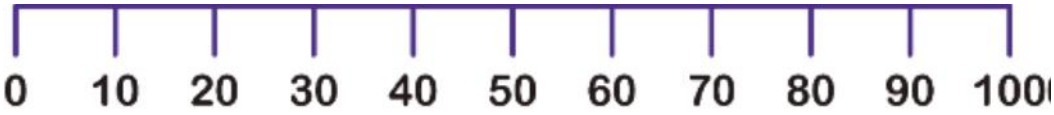
Step 4

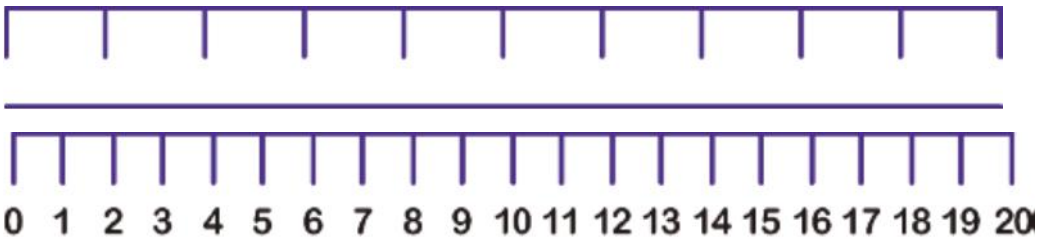
Children will calculate 5 + 2 mentally by counting on from the first number, often using their fingers to keep track.



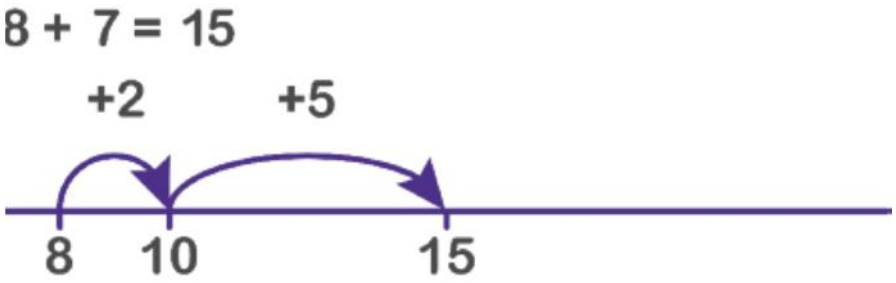
Stage 2: Number Tracks & Number Lines



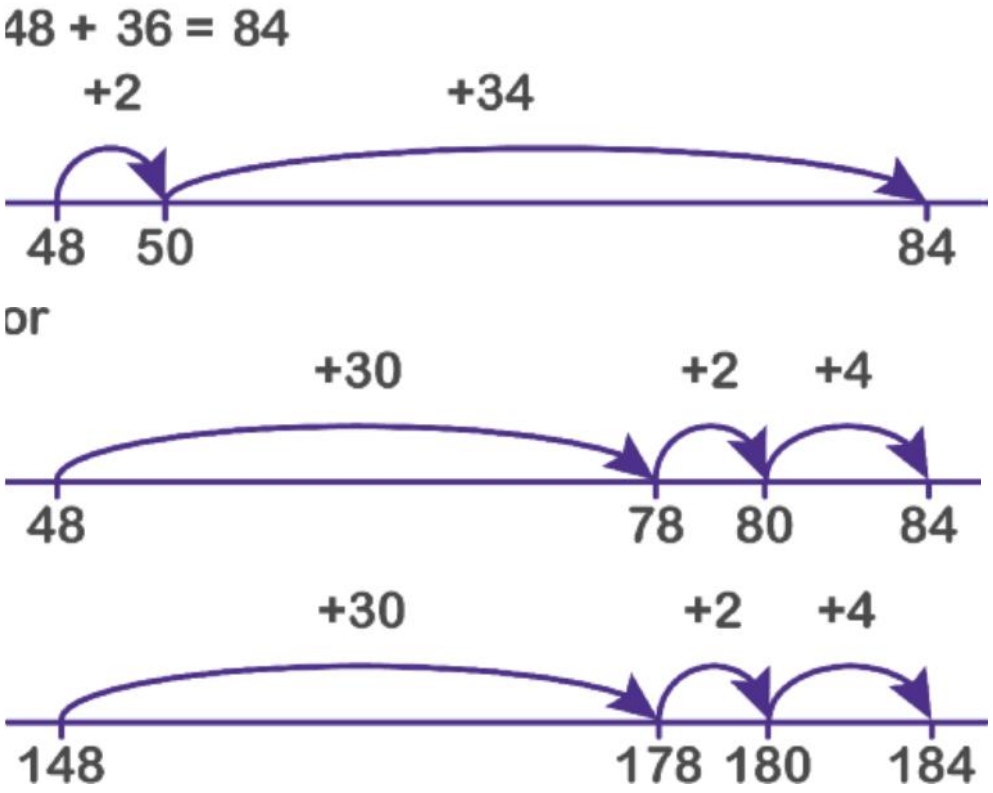




Steps in addition can be recorded on a blank number line or a number line drawn by the children. The steps often bridge through a multiple of 10 which is more efficient if children know how to partition 1-digit numbers. This is an important skill which will be practiced and consolidated during basic skills lessons in both Foundation Stage and Key Stage One.



In this example, 7 has been partitioned into 2 and 5 which makes bridging through 10 more efficient.



In these examples, the 6 in 36 has been partitioned into 2 and 4 which makes bridging through 10 more efficient. With practice, children will need to record fewer jumps.

Stage 3: Partitioning (expanded columnar method)

Partition both numbers into tens and units or hundreds, tens and units (using a grid makes this easier). **Give children plenty of opportunities to add two two-digit numbers which do not involve crossing tens boundaries for example, 42 + 33 = 75**

48 + 36 = 84

	40	8	
+	30	6	
	70	$^{1}4$	84

148 + 36 = 184

	100	40	8	
+		30	6	
	100	70	$^{1}4$	184

Subtraction

Written methods for Subtraction

It is important that children's mental methods of calculation are practised on a regular basis and secured alongside their learning and use of written methods of subtraction.
The aim is that children use mental methods when appropriate, but for calculations that they cannot do in their heads they use a written method accurately and with confidence.
Children are taught and acquire secure mental methods of calculation and one written method of calculation for subtraction which they know they can rely on when mental methods are not appropriate.
This policy shows the possible stages of each written method for subtraction, each stage building towards a more refined method.

There are some key basic skills that children need to help with subtraction, which include:

• counting
• estimating
• recalling all addition **pairs** to 10, 20 and 100 along with their inverses (7 + 3 = 10, 10 – 3 = 7,
17 + 3 = 20, 20 – 3 = 17, 70 + 30 = 100, 100 – 30 = 70)
• knowing number **facts** to 10 and their inverses (6 + 2 = 8, 8 - 2 = 6)
• subtracting multiples of 10 (160 - 70) using the related subtraction fact, 16 - 7, and their knowledge of place value
• partitioning two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways
(432 into 400 + 30 + 2 and also into 300 + 120 + 12)
• understanding and using subtraction and addition as inverse operations

Using and applying is a key theme and one of the aims of National Curriculum and before children move onto the next stage in written calculation it is important that their skills are broadened through their use and application in a range of contexts, these include:

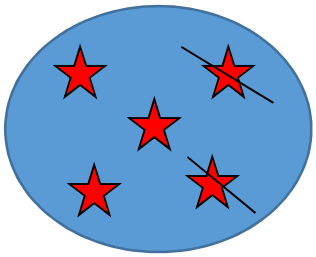
• using inverse
• missing box questions
• using units of measure including money and time
• word problems
• open ended investigations

Stage 1: Practical (taking away)

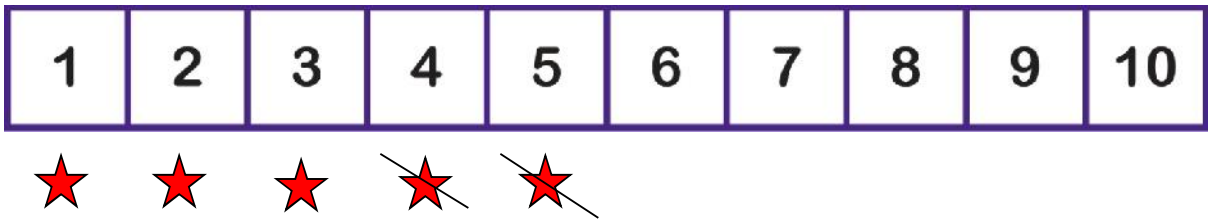
When using objects to take-away, the subtraction must be always mirrored on a number line to prepare them for the abstract concept of taking away numbers rather than objects.

Step 1

Children will remove items from a set of objects and count what is left by counting from 1.

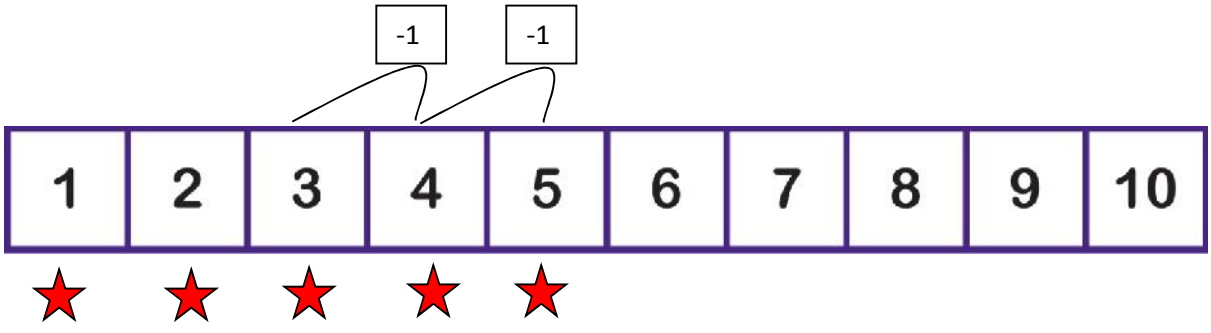


When removing items from a set of objects, encourage children to arrange all of the objects along a number line and then remove the number of objects to be taken away. Children will count the objects left from 1.



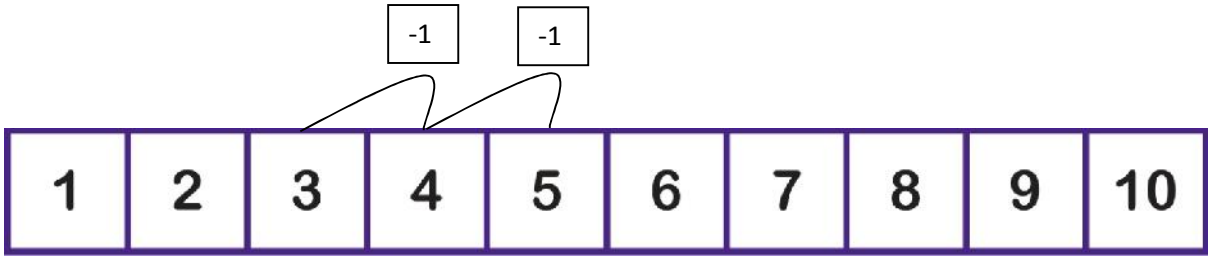
Step 2

Children will use objects like above but not count the remaining items by counting from 1



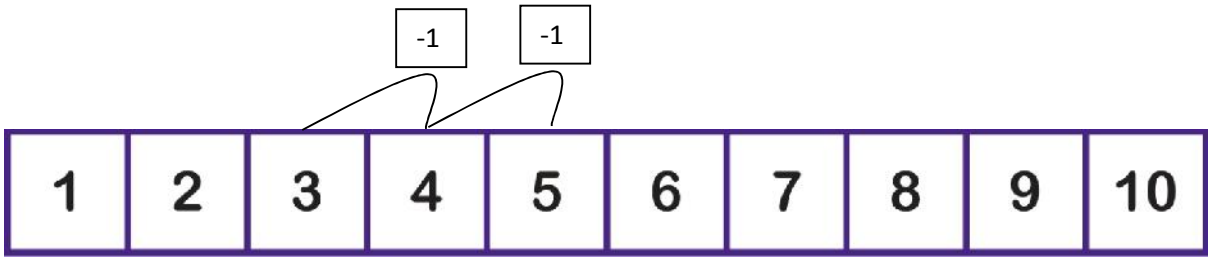
Step 3

Children will use objects but these will be hidden in a bag. Objects from the bag will be removed and a number line will be used to work out how many objects are left in the bag. Children will count back from the original number of objects in the bag. When counting back using the number line, always ask children to say each number they land on as they count back. Always ask children to check their answer by counting the remaining objects in the bag.



Step 4

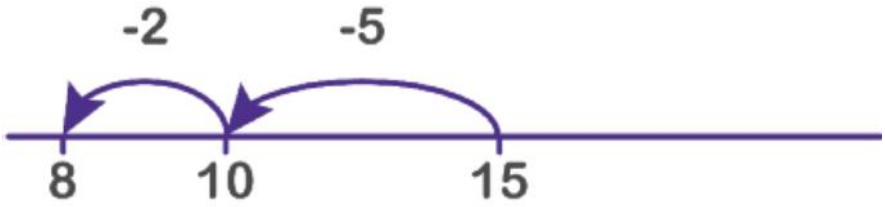
Children will calculate 5 - 2 mentally by counting back from the largest number, often using their fingers to keep track.



Stage 2: Number Lines

As children become more confident in using counting back as a strategy to subtract, steps in subtraction can be recorded from right to left on a number line. The steps often bridge through a multiple of 10, which is more efficient if children know how to partition 1-digit numbers. Counting back **must** be taught before counting up.

15 - 7 = 8

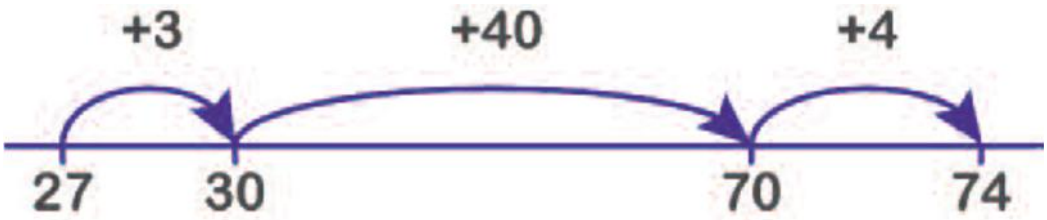


or

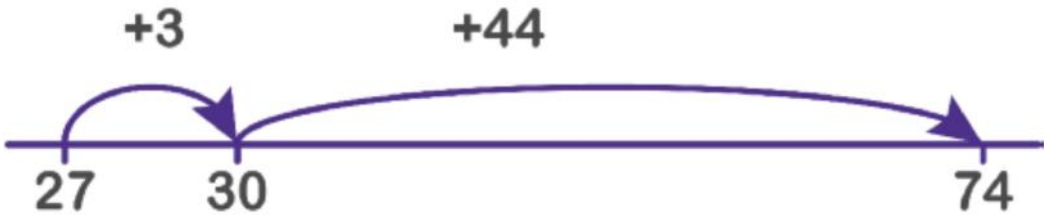
174 - 27 = 147

Counting up (to be introduced after counting back)

Steps in subtraction can be recorded from left to right on a number line. The steps often bridge through a multiple of 10.



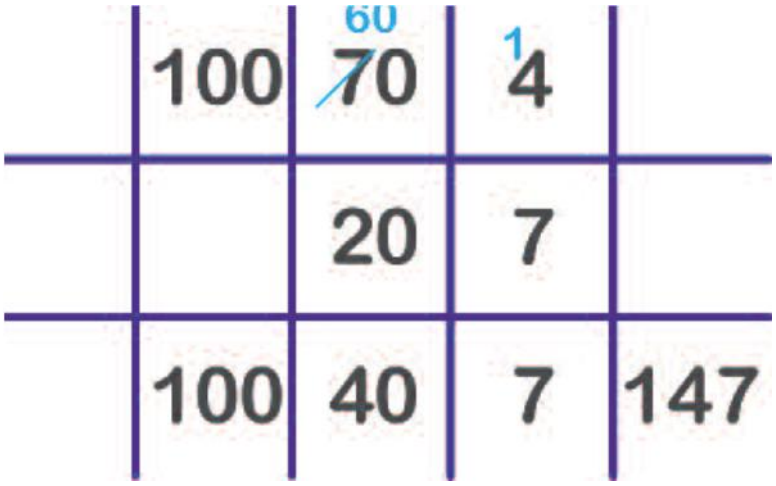
or



Stage 3: Partitioning (expanded columnar method)

Partition both numbers into tens and units or hundreds, tens and units (using a grid makes this easier). **Ensure that children have plenty of opportunities to solve calculations such as 78-42=, which will not involve the concept of 'borrowing.'** Once children are confident in solving such calculations, move on to the following examples.

	60 70	1 4	
-	20	7	
	40	7	47


60
70
1
4
100
20
7
100
40
7
147

Multiplication

Written methods for Multiplication

It is important that children's mental methods of calculation are practised on a regular basis and secured alongside their learning and use of written methods of multiplication.
The aim is that children use mental methods when appropriate, but for calculations that they cannot do in their heads they use a written method accurately and with confidence. Children are taught and acquire secure mental methods of calculation and one written method of calculation for multiplication which they know they can rely on when mental methods are not appropriate.
This policy shows the possible stages of each written method for multiplication, each stage building towards a more refined method.

There are some key basic skills that children need to help with multiplication, which include:

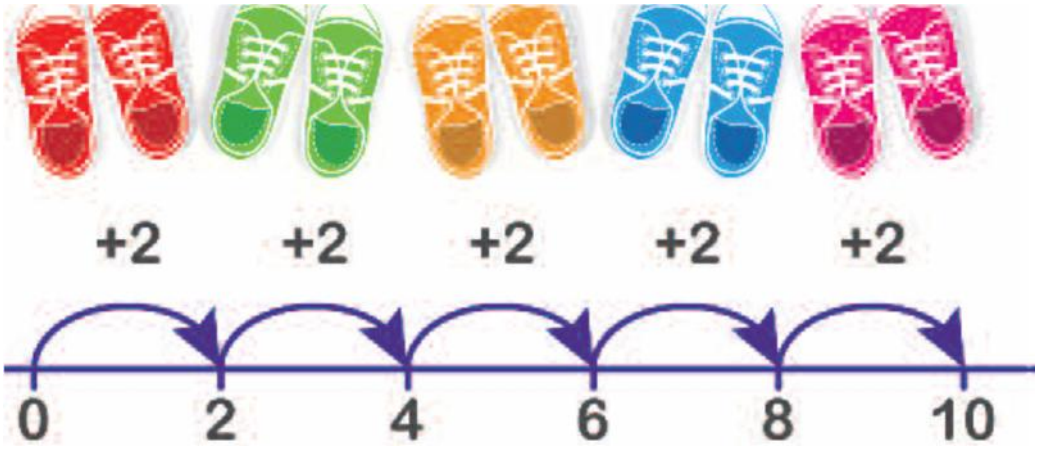
- counting
- estimating
- understanding multiplication as repeated addition
- recalling all multiplication facts to 12 × 12
- partitioning numbers into multiples of one hundred, ten and one
- working out products (70 × 5, 70 × 50, 700 × 5, 700 × 50) using the related fact 7 × 5 and their knowledge of place value
- adding two or more single-digit numbers mentally
- adding multiples of 10 (60 + 70) or of 100 (600 + 700) using the related addition fact, 6 + 7, and their knowledge of place value
- adding combinations of whole numbers
- understanding and using division and multiplication as inverse operations

Using and applying is a key theme and one of the aims of National Curriculum and before children move onto the next stage in written calculation it is important that their skills are broadened through their use and application in a range of contexts, these include:

- using inverse
- missing box questions
- using units of measure including money and time
- word problems
- open ended investigations

Stage 1: Practical (repeated addition)

Children will work practically with equipment grouping objects to see multiplication as repeated addition. As they become more confident, this practical grouping of objects will be mirrored on a number line using the vocabulary 'lots of', 'groups of', 'how many lots', 'how many times' so that the two are being done together. This will prepare them for the abstract concept of multiplying numbers rather than objects.

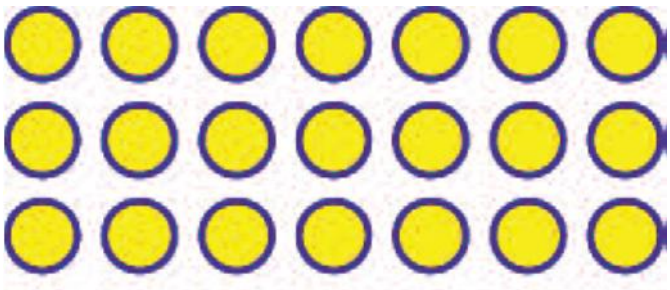


This image can be expressed as:

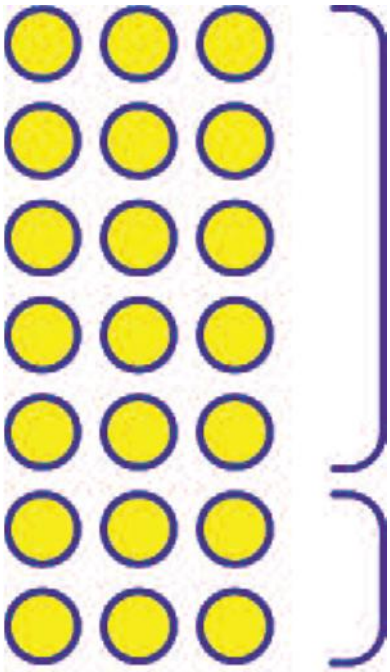
- 2 multiplied by 5
- two, five times
- 5 groups of 2
- 5 lots of 2
- 5 jumps of 2 on a number line

Stage 1: Practical and pictorial arrays

Children use arrays to demonstrate their understanding of commutativity for multiplication facts.



7 x 3 = 21



3 x 7 = 21

Stage 3: Partitioning (grid method)

24 x 3 = 72

x	20	4	
3	60	12	72

24 x 32 = 768

x	20	4	
30	600	120	720
2	40	8	48
			768

Division

Written methods for Division

It is important that children's mental methods of calculation are practised on a regular basis and secured alongside their learning and use of written methods of division.

The aim is that children use mental methods when appropriate, but for calculations that they cannot do in their heads they use a written method accurately and with confidence. Children are taught and acquire secure mental methods of calculation and one written method of calculation for division which they know they can rely on when mental methods are not appropriate.

This policy shows the possible stages of each written method for division, each stage building towards a more refined method.

There are some key basic skills that children need to help with subtraction, which include:

• counting
• estimating
• understanding division as repeated subtraction
• partitioning two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways
(432 into 400 + 30 + 2 and also into 300 + 120 + 12)
• recalling multiplication and division facts to 12 × 12
• recognising multiples of one-digit numbers and dividing multiples of 10 or 100 by a single-digit
number using their knowledge of division facts and place value
• knowing how to find a remainder working mentally, for example, find the remainder when 48 is
divided by 5
• understanding and using division and multiplication as inverse operations

Using and applying is a key theme and one of the aims of National Curriculum and before children move onto the next stage in written calculation it is important that their skills are broadened through their use and application in a range of contexts, these include:

- using inverse
- missing box questions
- using units of measure including money and time
- word problems
- open ended investigations

Stage 1: Practical (sharing)

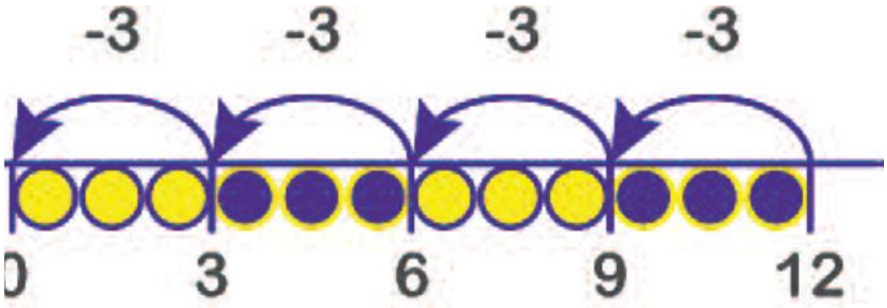
Children will work practically with equipment sharing objects one to one.

12 cakes are shared equally between 3 people.

Stage 2: Number Lines (grouping)

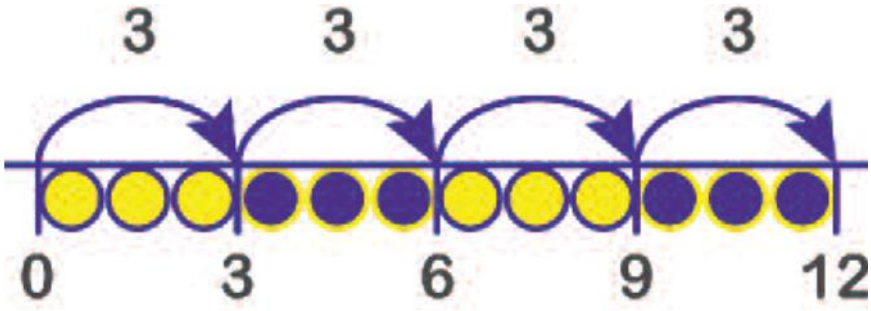
Children will move from sharing objects practically to grouping them, this will be mirrored on a number line, working from right to left so that they see division as repeated subtraction. This will prepare them for the abstract concept of dividing numbers rather than objects.

Each cake box holds 3 cakes, if I have 12 cakes, how many cake boxes will I need?



How many times can I subtract 3 from 12?

Using their knowledge of the inverse relationship between multiplication and division, children can use their multiplication tables when grouping on a number line, working from left to right.



How many groups of 3 are there in 12?

First without and then with remainders and ensuring that divisors offer an appropriate level of challenge.

Stage 3: Short division

$372 \div 3 = 124$

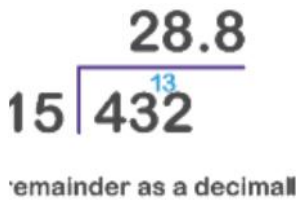
$$\begin{array}{r} 124 \\ 3\overline{)\,3^{1}72} \end{array}$$

$432 \div 15 = 28\ r12$

$$\begin{array}{r} 28_{r12} \\ 15\overline{)\,43^{13}2} \end{array}$$

$$\begin{array}{r} 28\frac{12}{15} \\ 15\overline{)\,43^{13}2} \end{array}$$

remainder as a fraction



Progression across the Year Groups: Addition

Year Group	Typical Calculations	Suitable Methods
R	U+U	Practical/number line
Y1	U+U TU + U (to 20 including 0)	Practical/number line
Y2	TU+U TU+ multiples of 10 TU+TU U+U+U	Practical/number line Expanded columnar
Y3	HTU+U HTU+TU HTU+HTU	Number Line Expanded columnar Column

Progression across the Year Groups: Subtraction

Year Group	Typical Calculations	Suitable Methods
R	U-U	Practical/number line
Y1	U-U TU - U (to 20 including 0)	Practical/number line
Y2	TU-U TU- multiples of 10 TU-TU U-U-U	Practical/number line Expanded columnar
Y3	HTU-U HTU-TU HTU-HTU	Number Line Expanded columnar Column

Progression across the Year Groups: Multiplication

Year Group	Typical Calculations	Suitable Methods
R		Practical (repeated addition)
Y1	UXU	Practical (repeated addition) Practical and pictorial arrays
Y2	UXU	Practical (repeated addition) Practical and pictorial arrays
Y3	TUXU	Grouping on a number line progressing into expanded (grid) and into short

Progression across the Year Groups: Division

Year Group	Typical Calculations	Suitable Methods
R		Practical sharing
Y1	U÷U	Practical sharing Number-line grouping
Y2	U÷U TU÷U	Practical sharing Number-line grouping
Y3	TU÷U	Grouping on a number line progressing into short