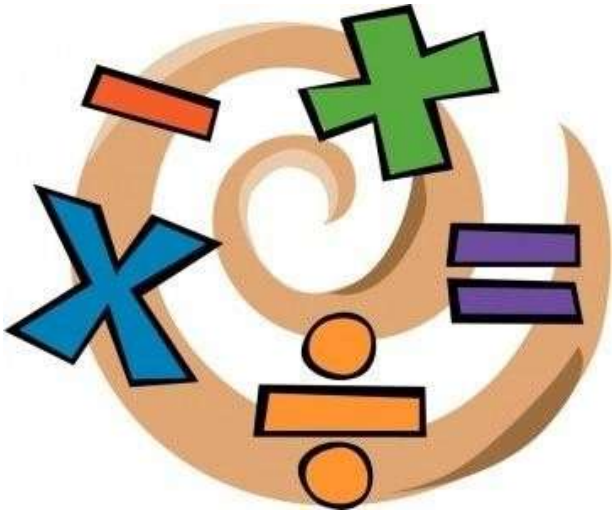
HILLSIDE INFANT SCHOOL

CALCULATION POLICY



(Aligned with the 2014 National Curriculum)

Hillside Infant School

Calculation Policy - Written and Mental methods.

AIMS OF POLICY

The policy aims to set out the strategies taught at Hillside Infant School to ensure that children develop confidence and understanding of efficient, reliable, formal written and mental methods of calculation for all operations.

This calculation policy has been written in line with curriculum guidance and provides information on appropriate calculation methods and progression in addition, subtraction, multiplication and division. Statements taken directly from the programmes of study are shown in bold at the beginning of each section. Children will use mental methods as their first port of call when appropriate, but for calculations that they cannot do in their heads, they will need to use an efficient written method accurately and with confidence.

HOW TO USE THIS POLICY

The policy aims to ensure consistency in approach by all teachers, support staff and parents and carers through home learning.

Our maths planning mainly follows the White Rose Hub maths scheme. There is an emphasis on children using the following strategies in the order below:

- **Concrete** – using real objects that can be manipulated and counted
- **Pictorial** – using images that can be counted, graphs and any other visual representation
- **Abstract** – no visual clues

Children will be given opportunities to select the most appropriate method and explain their thinking in line with the maths mastery approach.

Written: February 2024
Agreed: February 2024
Review Date: February 2029

Stages in Addition

Addition – Stage 1

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 five apples and I have three apples. How many apples altogether?'

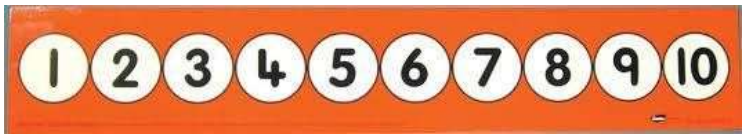
Addition – Stage 2

Given a number, identify one more
Read, write and interpret mathematical statements involving addition (+) and the equals (=) sign
Add one- digit and two-digit numbers within 20, including zero
Solve missing number problems eg 10 + = 16

NB Ensure that children are confident with the methods outlined in the previous stage's guidance before moving on.

Children will continue to practise counting on from any number e.g.'Put five in your head and count on four.'

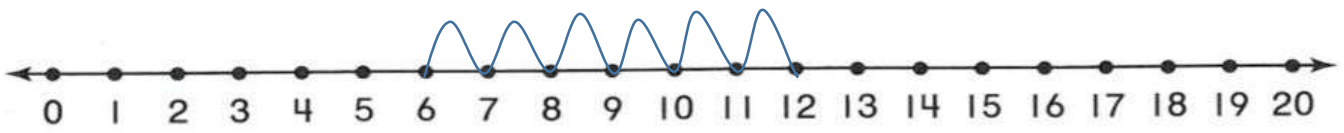
Initially use a number track to count on for addition, counting on from the largest number:



5 + 4 = 9 'Put your finger on number five. Count on (count forwards) four.'

Then progress to a marked number line:

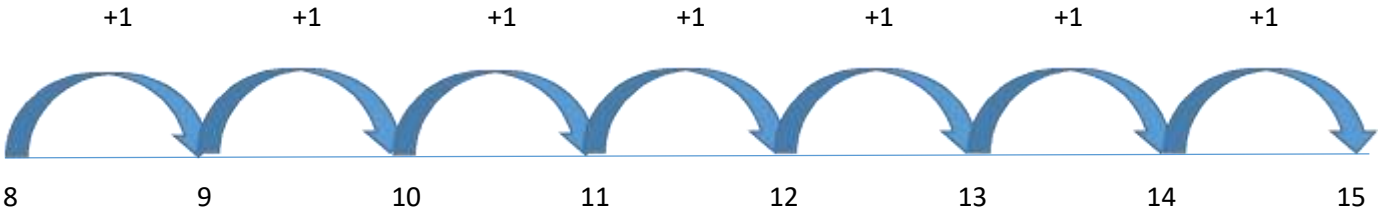
6 + 6 = 12



'Put your finger on number six and count on six.'

8 + 7 = 15

‘Put your finger on number eight and count on seven.’



Ensure children are confident with using a marked number line before moving on to an empty number line (see stage 3 guidance).

Continue to practise counting on from the largest number for addition with totals within 20.

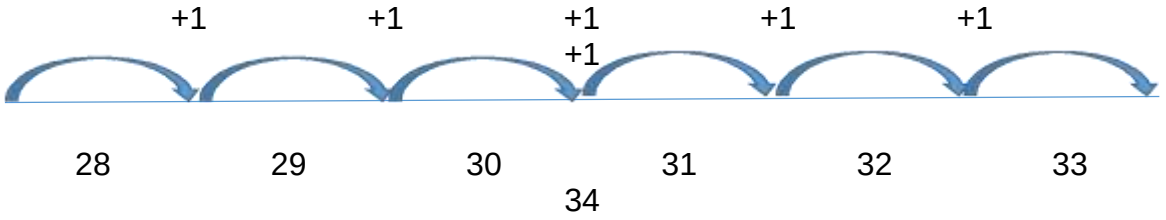
Addition – Stage 3

- **Add numbers using concrete objects, pictorial representations, and mentally, including:**
  - **A two digit number and ones**
  - **A two digit number and tens**
  - **Two two-digit numbers**
  - **Three one-digit numbers**

NB Ensure that children are confident with the methods outlined in the previous stage’s guidance before moving on.

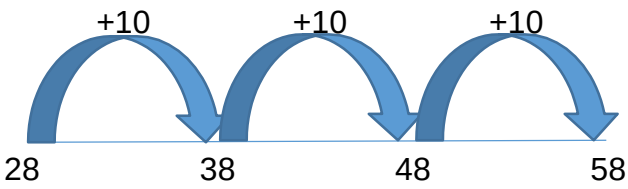
Counting on in ones using an empty number line, within 100…

28 + 6 = 34



…and in tens

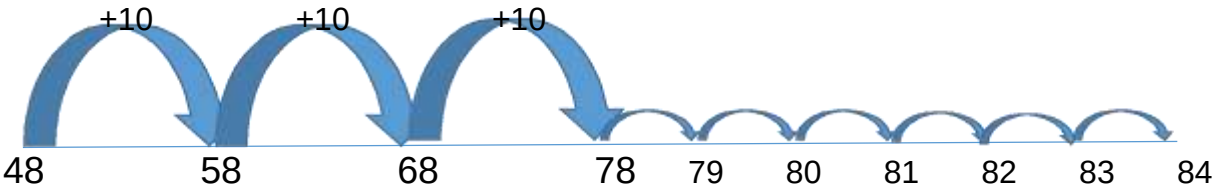
28 + 30 = 58



Use in conjunction with a 100 square to show jumps of tens.

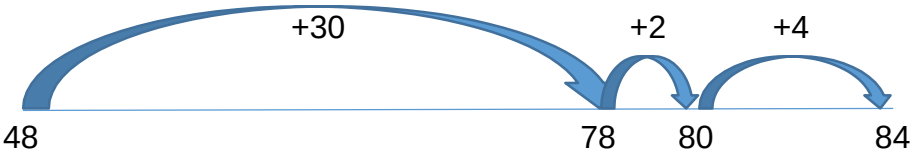
48 + 36 = 84

'Put the biggest number first (48), and then partition the smaller number (36 = 30 + 6) and count on: 48 + 30 + 6.'



Use in conjunction with a 100 square to show jumps of tens and ones.

If children are confident, use more efficient jumps…



Use in conjunction with a 100 square to show jumps of tens and ones/units.

Also use the partitioning method to add two two-digit numbers:

43 + 25 = 68

40 3 20 5

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

'Partition the numbers into tens and ones.
Add the tens together and then add the ones together.
Recombine to give the answer'.

Then move on to calculations that **bridge** the tens:

48 + 36 = 40 + 8 + 30 + 6

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

48 + 36 = 84

This is an alternative way of recording the partitioning method.

Further develop addition with numbers that bridge 100, using a **200 grid** to support.

NB If, at any time, children are making significant errors, return to the previous stage in calculation.

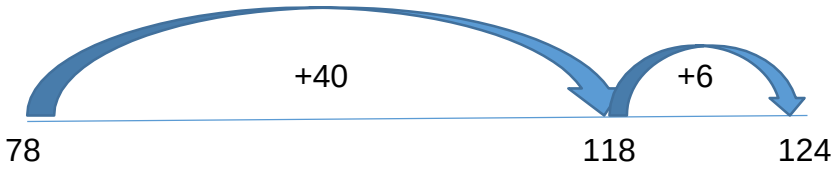
Addition – Stage 4

Add numbers with up to three digits, using formal written method of columnar addition

NB Ensure that children are confident with the methods outlined in the previous stage's guidance before moving on.

Further develop the use of the **empty number line** with calculations that **bridge 100**:

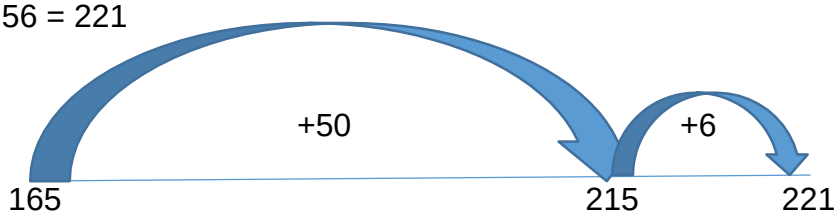
78 + 46 = 124



Use a 200 grid to support counting on in tens and bridging 100…

… and with addition of a three-digit and a two -digit number:

165 + 56 = 221



165
+50
+ 6
221

The partitioning method can also be used with three-digit numbers.

Introduce the **expanded written method** with the calculation presented both horizontally and vertically (in columns).

Initially use calculations where it has not been necessary to bridge across the tens or hundreds:

63 + 32 = 95

60 and 3
+ 30 and 2
90 and 5 = 95

'Partition the numbers into tens and ones. Add the tens together and then add the ones together. Recombine to give the answer.'

Then…

6 3
+ 3 2
5 (ones)
9 0 (tens)
9 5

Add the least significant digits (ones) together first and then the tens in preparation for the formal written method. Writing the units and tens is not necessary as long as the children understand the method.

This will lead into the **formal written method**…

```
  6 3
+ 3 2
  9 5
```

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

NB Informal/mental methods would be more appropriate for numbers of this size, but use two-digit numbers when introducing the columnar method.

Then introduce calculations where it is necessary to bridge:

```
  68
+ 24
  12  (ones)
  80  (tens)
  92
```

Add the least significant digits (ones) together first and then the tens in preparation for the formal written method. Writing the units and tens is not necessary as long as the children understand the method.

If children are ready, introduce the formal written method, where it is necessary to 'carry' ten from the ones to the tens column:

```
  68
+ 24
  92
  1
```

Use the language of place value to ensure understanding: 'Eight add four equals 12. Write two in the ones column and 'carry' one (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.'

The digit that has been 'carried' should be recorded under the line in the correct column.

When **children are confident**, extend with examples where it is necessary to bridge across the tens and the hundreds:

76 + 47 = 123

```
  76
+ 47
  13 (ones)
 110 (tens)
 123
```

Add the least significant digits (ones) together first and then the tens in preparation for the formal written method. Writing the ones and tens is not necessary as long as the children understand the method.

If children are ready introduce the formal written method, where it is necessary to 'carry' across the columns and bridge 100:

76 + 47 = 123

```
  47
+ 76
 123
 1 1
```

Use the language of place value to ensure understanding: 'Seven add six equals 13. Write 3 in the ones column and 'carry' one (10) across to the tens column. 40 + 70 and the ten that we 'carried' equals 120. Write 2 (20) in the tens column and 'carry' one (100) across into the hundreds column (100).

The digits that have been ‘carried’ should be recorded under the line in the correct column.

If **children are confident**, further develop with the addition of a three- digit number and a two - digit number:

178 + 43 = 221

```
  178
+
 43
 221
1 1
```

Stages in Subtraction

Subtraction – Stage 1

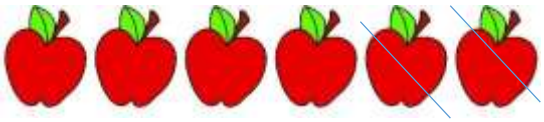
Children will engage in a variety of counting songs and rhymes and practical activities.

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 count back from a given number.

Subtraction – Stage 2

Given a number, identify one less

Read, write and interpret mathematical statements involving subtraction (-) and the equals (=) sign

Subtract one- digit and two-digit numbers within 20, including zero

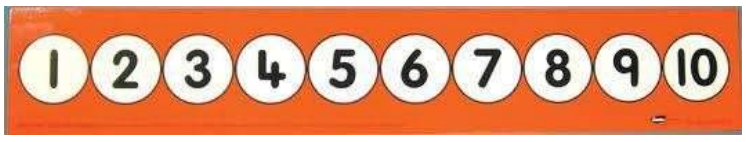
Solve missing number problems eg 20 - = 15

NB Ensure that children are confident with the methods outlined in the previous stage's guidance before moving on.

Children will continue to practise counting back from a given number.

Initially use a number track to count back for subtraction:

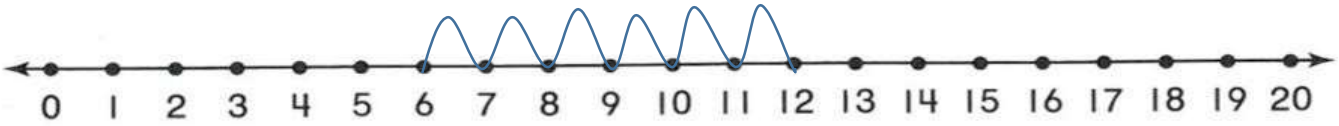
Initially use a number track to count on for addition, counting on from the largest number:



9 – 5 = 4 'Put your finger on number nine. Count back 5.'

Then progress to a marked number line:

12 – 6 = 6



'Put your finger on number twelve and count back 6'

14 – 5 = 9

'Put your finger on number 14 and count back five.'

NB Ensure children are confident with using a marked number line before moving on to an empty number line (see stage 3 guidance).

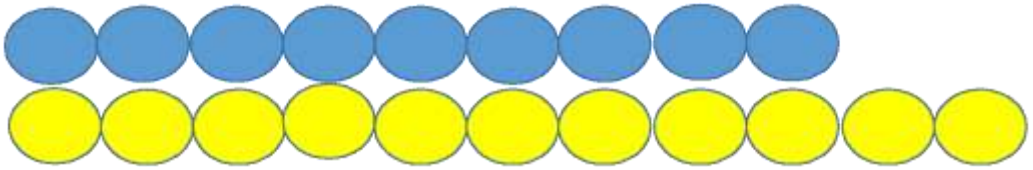
Continue to practise counting back for subtraction with numbers within 20.

Counting on to find a small difference:

Introduce complementary addition to find differences (only use for small differences).
The use of models is extremely important here to understand the idea of "difference".

Count up from the smallest number to the largest to find the difference using resources, e.g. cubes, beads, number tracks/lines:

11 – 9 = 2



The **difference between** nine and eleven is two.

NB If, at any time, children are making significant errors, return to the previous stage in calculation.

Subtraction – Stage 3

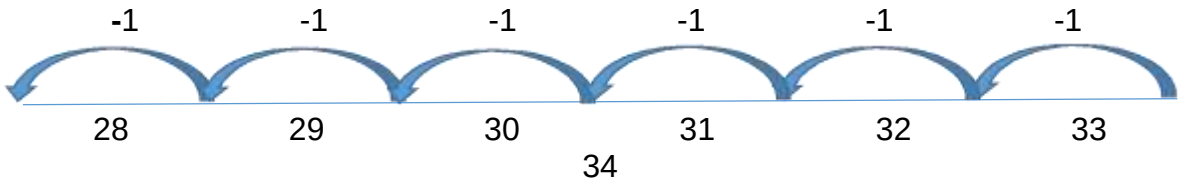
Subtract numbers using concrete objects, pictorial representations, and mentally, including:

- **A two digit number and ones**
- **A two digit number and tens**
- **Two two-digit numbers**

NB Ensure that children are confident with the methods outlined in the previous stage's guidance before moving on.

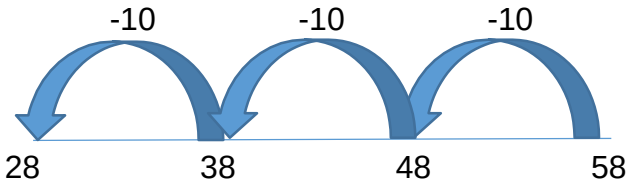
Counting back using an empty number line within 100, in ones…

34 - 6 = 28



…and in tens

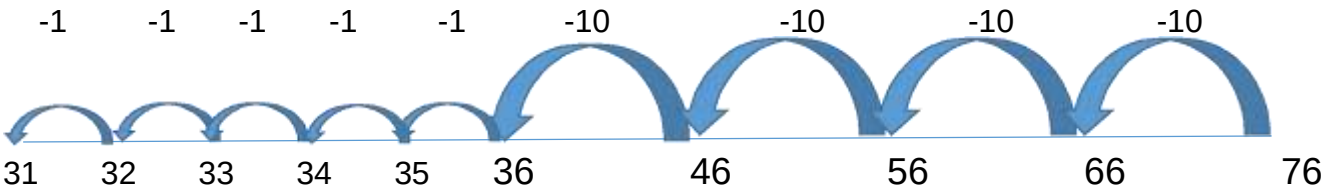
58 – 30 = 28



Use in conjunction with a 100 square to show jumps of tens.

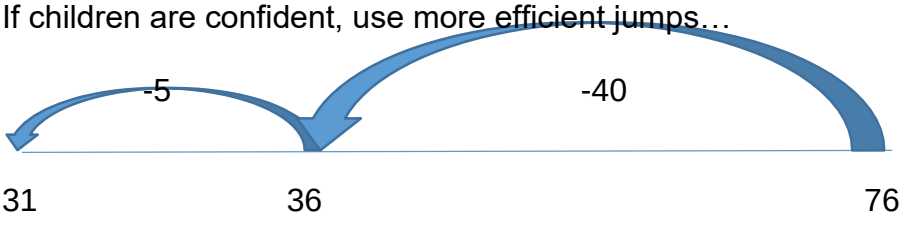
Subtraction, using partitioning, on an empty number line:

76 – 45 = 31



Use in conjunction with a 100 square to show jumps of tens and ones.

If children are confident, use more efficient jumps…



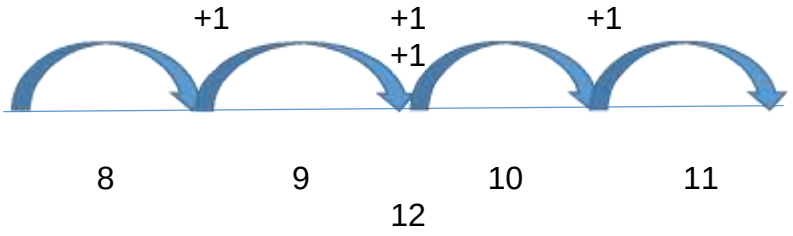
Use in conjunction with a 100 square to show jumps of tens and ones/units.

Counting on to find a small difference

Introduce complementary addition to find differences (only use for small differences). The use of models is extremely important here to understand the idea of “difference” (see stage 2 guidance).

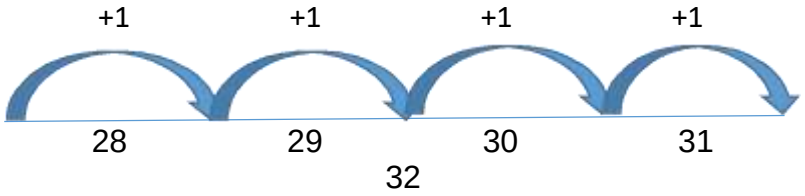
Count up from the smallest number to the largest to **find the difference**.

12 - 8 = 4



‘The difference between 8 and 12 is 4.’

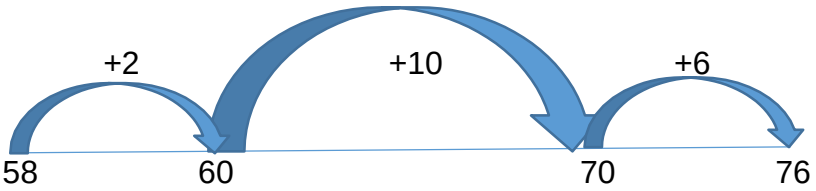
32 – 28 = 4



‘The difference between 28 and 32 is 4.’

If **children are confident**, further develop this method:

76 – 58 = 18



‘The difference between 58 and 76 is 18.’

Further develop subtraction with numbers that bridge 100, using a 200 grid to support.

NB If, at any time, children are making significant errors, return to the previous stage in calculation.

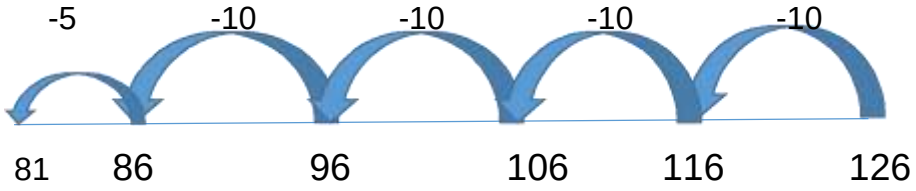
Subtraction – Stage 4

Subtract numbers with up to three digits, using formal written method of columnar subtraction

NB Ensure that children are confident with the methods outlined in the previous stage's guidance before moving on.

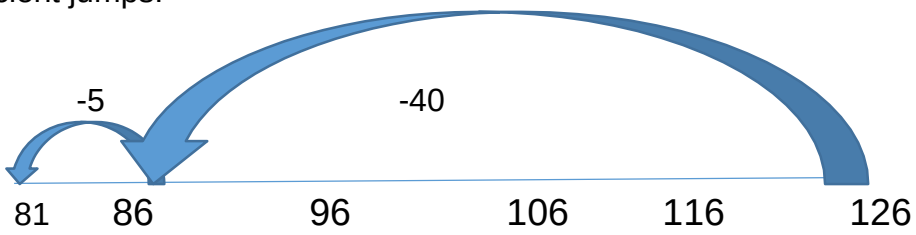
Further develop the use of the empty number line with calculations that bridge 100:

126 – 45 = 81



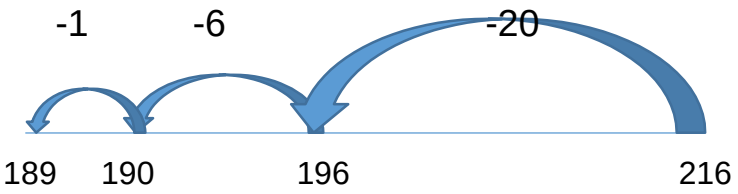
Use practical equipment to support counting back in tens and bridging 100 such as 200 grid, Numicon, Cuisinaire rods etc.

Then use more efficient jumps:



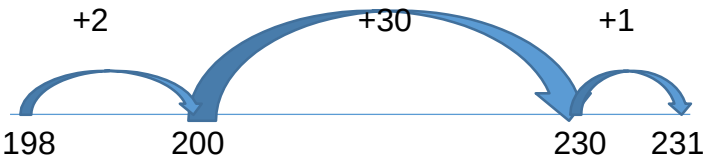
Extend with larger numbers by counting back…

216 – 27 = 189



…and by counting on to find the difference (small difference):

231 – 198 = 33



'The difference between 198 and 231 is 33.'

Introduce the **expanded written method** with the calculation presented both horizontally and vertically (in columns) and **supported with practical activities**. Use two-digit numbers when introducing this method, initially:

78 – 23 = 55

70 and 8	'Partition numbers into tens and ones. Subtract
−20 and 3	the ones, and then subtract the tens. Recombine to
50 and 5 = 55	give answer.'
	Use practical activities (such as Dienes) to support the teaching of this method.

NB In this example decomposition (exchange) is not required.

You may replace the 'and' with a + symbol or give the place value column headings to avoid confusion.

This will lead into the **formal written method**:

7 8	Use the language of place value to ensure understanding.
-2 3	'Eight subtract three, seventy subtract twenty.'
5 5	

NB A number line would be an appropriate method for this calculation but use two digit numbers to illustrate the formal written method initially.

Introduce the **expanded written method** where **exchange/decomposition** is required:

73 − 27 = 46

70 + 3	becomes	60 and13	73 is partitioned into 60 and 13
- 20 + 7		- 20 and 7	in order to calculate 73 - 27
		40 + 6 = 46	

This can be demonstrated practically and does not have to be recorded

NB children will need to practise partitioning numbers in this way. **Base- ten materials** could be used to support this (such as Dienes).

When **children are confident** with the expanded method introduce the **formal written method**, involving **decomposition/exchange**:

73 − 27 = 46

6 13	Use the language of place value to ensure understanding.
~~7~~ ~~3~~	'We can't subtract seven from 3, so we need to exchange a ten
2 7	for ten ones to give us 60 and 13.
4 6	
	Use **base ten / Dienes** materials to support understanding

If children are confident, extend the use of the formal written method with **numbers over 100**, returning to the expanded method first, if necessary.

235 – 127 = 108

```
  2 15
  2 3 5
- 1 2 7
  1 0 8
```

Use the language of place value to ensure understanding.
In this example, it has only been necessary to exchange from the tens column.

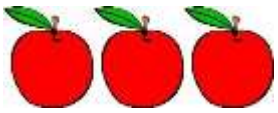
Use **base ten / Dienes** materials to support understanding

NB If, at any time, children are making significant errors, return to the previous stage in calculation.

Stages in Multiplication

Multiplication – Stage 1

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 doubling.



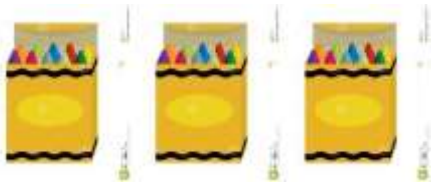
'Three apples for you and three apples for me. How many apples altogether?'

Multiplication – Stage 2

Solve one-step problems involving multiplication by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher
Count in multiples of twos, fives and tens (to the 10th multiple)

Children will count repeated groups of the same size in practical contexts.
They will use the vocabulary associated with multiplication in practical contexts.
They will solve **practical problems** that involve combining groups of 2, 5 or 10. E.g. socks, fingers and cubes

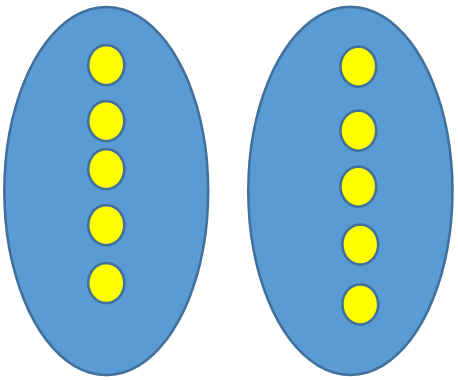
'Six pairs of socks. How many socks altogether? 2, 4, 6, 8, 10, 12'



'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 five is ten

Continue to solve problems in practical contexts and develop the language of early multiplication, with appropriate resources, throughout stage 2.

Multiplication – Stage 3

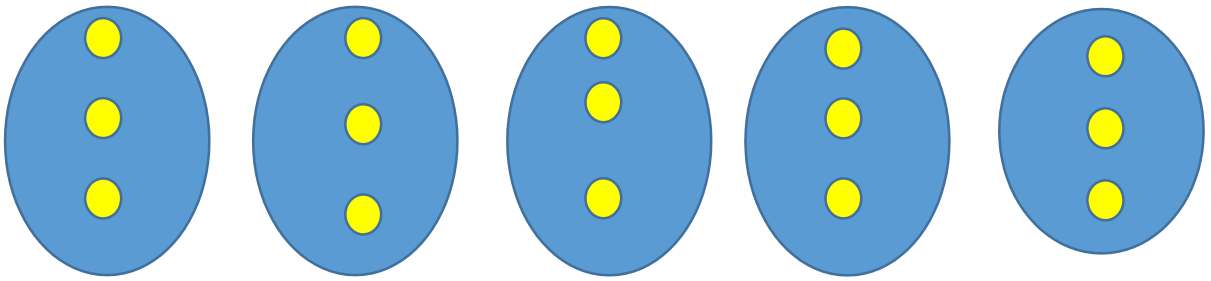
Recall and use multiplication facts for the 2, 5 and 10 multiplication tables
Calculate mathematical statements for multiplication within the multiplication tables and write them using the multiplication (×) and equals (=) signs
solve problems involving multiplication, using materials, arrays, repeated addition, mental methods, and multiplication facts, including problems in contexts
show that multiplication of two numbers can be done in any order (commutative)

NB Ensure that children are confident with the methods outlined in the previous stage’s guidance before moving on.

Children will use a range of vocabulary to describe multiplication and use practical resources, pictures, diagrams and the x sign to record.

Combining Groups (repeated addition):

‘3 groups of 10 crayons’
‘How many crayons altogether?’
’10 + 10 + 10 = 30’
‘3 groups pf 10’ ‘ 3 times 10’
‘3 x 10 = 30’ ’10 x 3 = 30’



‘5 groups of 3’ ‘5 lots of 3’ ‘3 + 3 + 3 + 3 +3 = 15’

‘5 times 3’ ‘3 multiplied by 5’ ‘5 x 3 = 15’ ‘3 x 5 = 15’

Use arrays to support multiplication

6 x 5 = 30

‘5 + 5 + 5 + 5 + 5 + 5 = 30’

‘6 rows of 5’

‘6 groups of 5’

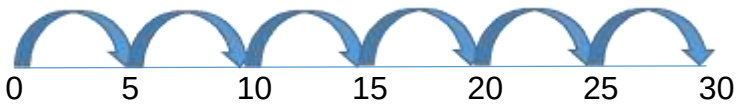
‘5 groups of 6’

‘5 x 6 = 30’

‘6 x 5 = 30’

Use an empty number line:

6 x 5 = 30



Make the link to repeated addition.

NB If, at any time, children are making significant errors, return to the previous stage in calculation.

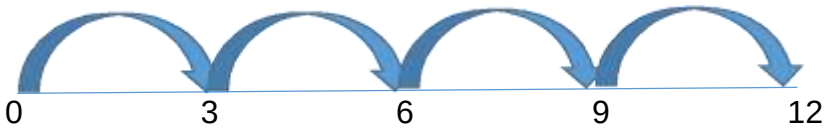
Multiplication – Stage 4

Recall and use multiplication facts for the 3, 4 and 8 multiplication tables (continue to practise the 2, 5 and 10 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 a formal written method

NB Ensure that children are confident with the methods outlined in the previous stage's guidance before moving on.

Continue to use number lines and arrays to support multiplication, as appropriate (see stage 3 guidance).

4 x 3 = 12



Partitioning method for multiplication of a teen number by a one-digit number:

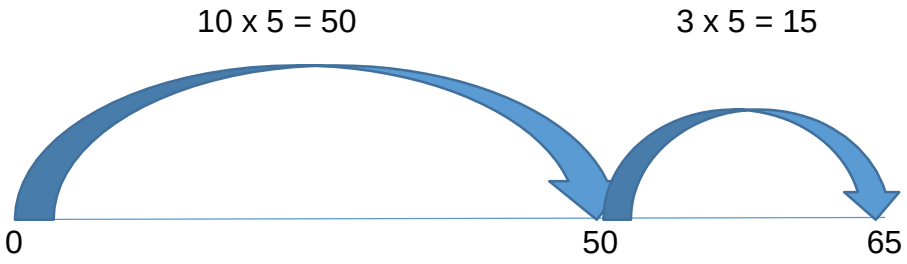
13 x 5 = 65 (Partition 13 into 10 + 3)

10 x 5 = 50
3 x 5 = 15

50 + 15 = 65

Demonstrate the partitioning method using **a number line**:

13 x 5 = 65



Grid Method (teen number multiplied by a one- digit number):

13 x 8 = 104

X	10	3
8	80	24

'Partition 13 into 10 + 3 then multiply each number by 8. Add the partial products (80 and 24) together.'

This will lead into **expanded short multiplication**:

13 x 8 = 104

10 3
x 8
2 4 (3 x 8)
+ 8 0 (10 x 8)
1 0 4

Include an addition symbol when adding partial products.

Refine the recording in preparation for **formal short multiplication**:

13 X 8 = 104

1 3 X 8 2 4 (3 x 8) +8 0 (10 x 8) 1 0 4	Use the language of place value to ensure understanding Include an addition symbol when adding partial products

Model the same calculation using a number line, if necessary, to ensure understanding.

Formal short multiplication:

1 3 X 8 10 4	Ensure that the digit 'carried over' is written under the line in the correct column. Use the language of place value to ensure understanding

Continue to develop the formal written method of multiplication throughout year three using teen-numbers multiplied by a one-digit number.

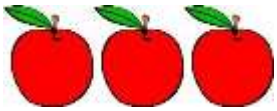
If children are confident progress to multiplying other two-digit numbers by a one-digit number (see stage 5 guidance).

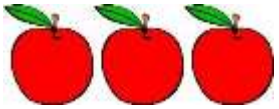
NB If, at any time, children are making significant errors, return to the previous stage in calculation.

Stages in Division

Division – Stage 1

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.





Share the apples between two people.

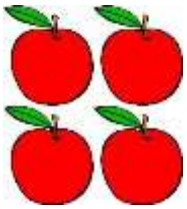
'Half of the apples for you and half of the apples for me.'

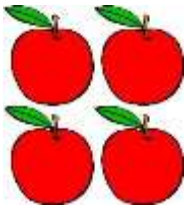
Division – Stage 2

Solve one-step problems involving division by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher
Count in multiples of twos, fives and tens (to the 10th multiple)

Children will start with practical sharing using a variety of resources.
They will share objects into equal groups in a variety of situations.
They will begin to use the vocabulary associated with division in practical contexts.

'Share these eight apples equally between two children. How many apples will each child have?'





'Share 20 crayons between 2 pots.'

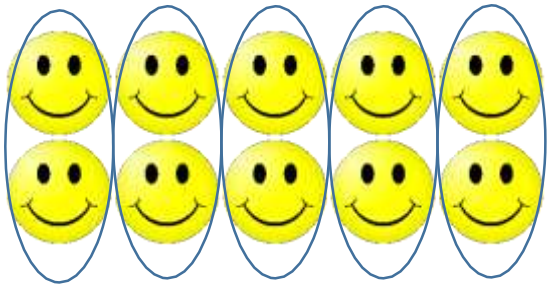
'How many crayons are in each pot?'

Children will move from **sharing** to **grouping** in a practical way

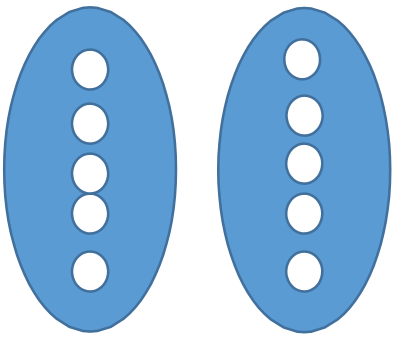
‘Put 20 crayons into groups of 10. How many pots do we need?’

Use arrays to support early division

‘How many faces altogether? How many groups of two?’



‘Five groups of two.’



‘How many groups of 5?’

’10 shared equally between 2 people.’

‘Half of ten is five.’

Continue to solve problems in practical contexts throughout stage 2, and develop the language of early division, with appropriate resources.

Division – Stage 3

Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables
Calculate mathematical statements for division within the multiplication tables they know and write them using the division (÷) and equals (=) signs
Solve problems involving division, using materials, arrays, repeated subtraction, mental methods, and multiplication and division facts, including problems in contexts

NB Ensure that children are confident with the methods outlined in the previous stage's guidance before moving on.

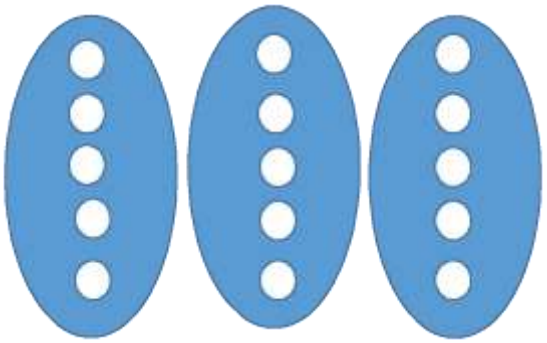
Children will use a range of vocabulary to describe division and use practical resources, pictures, diagrams and the ÷sign to record, using multiples that they know.

Sharing and grouping:

'30 crayons shared equally between 3 pots.' (Sharing)
'We have 30 crayons and put ten in each pot. How many pots do we need?' (Grouping).

30 ÷10 = 3
30 ÷ 3 = 10

'30 divided by 10 = 3'
'30 divided by 3 = 10'



'How many groups if 5?'

'15 shared equally between 3 people is…?'

'15 divided by 3 equals 5'

'15 divided by 5 equals 3'

15 ÷ 5 = 3
15 ÷ 3 = 5

Using arrays to support division

15 ÷ 5 = 3
15 ÷ 3 = 5

How many groups of 3?

How many groups of 5?

15 shared between 3 people is…?

15 shared between 5 people is…?

15 divided by 5 = 3
15 divided by 3 = 5

When children are ready, use an empty number line to count forwards:

30 ÷ 5 = 6

'How many jumps of 5 make 30?'

0 5 10 15 20 25 30

0 5 10 15 20 25 30

NB If, at any time, children are making significant errors, return to the previous stage in calculation.

Division – Stage 4

Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables (continue to practise the 2, 5 and 10 multiplication tables)
Write and calculate mathematical statements for division using the multiplication tables that they know, including for two-digit numbers divided by one-digit numbers, using mental and progressing to a formal written method

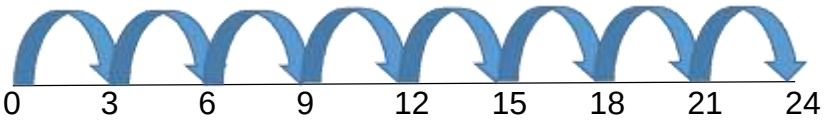
NB Ensure that children are confident with the methods outlined in the previous stage's guidance before moving on.

Continue to use practical resources, pictures, diagrams, number lines, arrays and the ÷ sign to record, using multiples that they know, as appropriate (see stage 3 guidance).

Using an empty number line to count forwards…

24 ÷ 3 = 8

'How many threes are in 24?'



'How many groups of three in 24?'

Introduce the formal layout using multiplication/division facts that the children know:

24 ÷ 3 = 8

This can also be recorded as…

$$\begin{array}{r|l} & 8 \\ \hline 3 & 24 \end{array}$$

'Twenty four divided by three equals eight.'

'How many threes are there in twenty four?'

NB If, at any time, children are making significant errors, return to the previous stage in calculation

Division – Stage 5

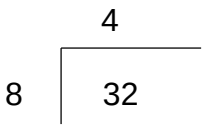
Recall multiplication and division facts for multiplication tables up to 12 × 12
Use place value, known and derived facts to divide mentally
Divide two-digit and three-digit numbers by a one-digit number using formal written layout (not explicitly stated in the programmes of study but implied in the non-statutory guidance)

NB Ensure that children are confident with the methods outlined in the previous stage's guidance before moving on.

Continue to write and calculate mathematical statements for division using the multiplication tables that the children know e.g.

32 ÷ 8 = 4

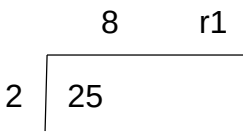
Continue using the **formal written layout** for division using multiplication tables that they know:



'How many eights are there in 32?'

Continue using the formal written layout, introducing remainders:

25 ÷ 3 = 8 r1



NB Remainders are not specifically referred to until year 5 in the National Curriculum. However, this may be an appropriate point to introduce them using familiar multiplication facts.

This could be modelled using an empty number line, <u>if necessary</u>:

Division using partitioning (two digits divided by one digit):

65 ÷ 5 = 13

65 = 50 + 15 Partition 65 into 50 and 15
50 ÷ 5 = 10
15 ÷ 5 = 3
10 + 3 = 13

NB Children will need to practise partitioning in a variety of ways.

98 ÷ 7 = 14

98 = 70 + 28 Partition 98 into 70 and 28

70 ÷ 7 = 10
28 ÷ 7 = 4
10 + 4 = 14

This could be modelled on an empty number line to further develop understanding.

NB Children will need to practise partitioning in a variety of ways.

This will lead into the formal written method of short division:

98 ÷ 7 = 14

$$\begin{array}{r|l} & 14 \\ \hline 7 & 9^{2}8 \end{array}$$

Continue to practise the formal method of short division throughout stage 5.

If children are confident develop further, by dividing three-digit numbers by a one-digit number using the formal method of short division with whole number answers (no remainders).

NB If, at any time, children are making significant errors, return to the previous stage in calculatio