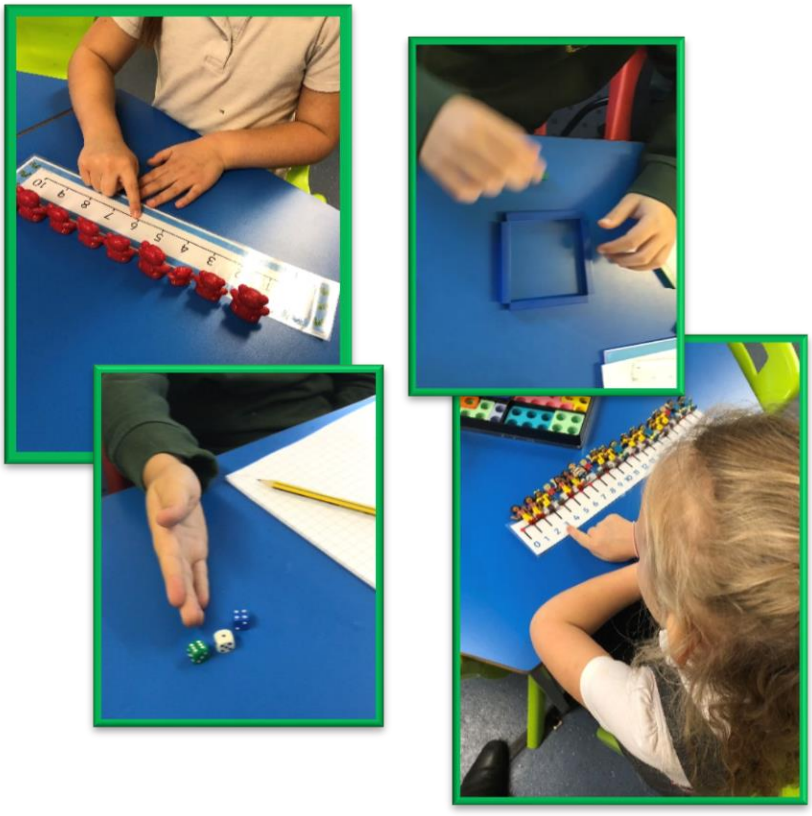
# St. Luke's C of E (Aided) Primary School

# Calculation Policy



Created November 2018

## Introduction

This calculation policy has been written with the input of all teachers at St. Luke's and aims to provide guidance for teaching the four main operations used in primary schools (addition, subtraction, multiplication and division). It is written in line with the programmes of study taken from the revised National Curriculum for Mathematics (2014). Statements taken directly from the programme of study are listed in bold at the beginning of each section.

## Aims of the policy

- To ensure consistency and progression in our approach to calculation
- To ensure that children develop an efficient, reliable, formal written method of calculation for all operations
- To ensure that children can use these methods accurately with confidence and understanding

## How to use this policy

- Use the policy as the basis of your planning but ensure you use previous or following years' guidance to allow for personalised learning
- Always use Assessment for Learning to identify suitable next steps in calculation for groups of children
- If, at any time, children are making significant errors, return to the previous stage in calculation
- Always use suitable resources, models and images to support children's understanding of calculation and place value, as appropriate
- Encourage children to make sensible choices about the methods they use when solving problems
- Ensure that children are confident at each stage before moving them onto the next stage.

## Stages in Addition

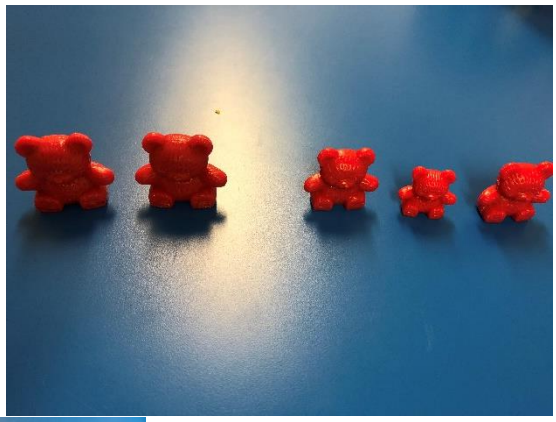
Stage 1

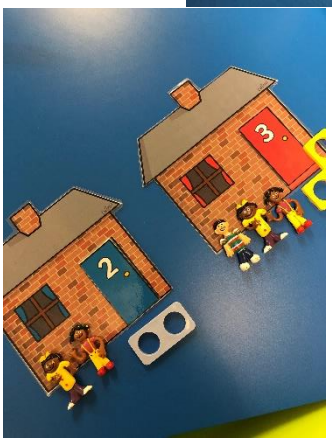
Children will engage in a wide variety of songs and rhymes, games and activities.
They will begin to relate addition to combining two groups of objects, first by counting all and then by counting on from the largest number.

They will find one more than a given number.

In practical activities (particularly using concrete materials such as compare bears, multilink cubes and dinosaurs) 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?'






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 up to 20, including zero**
- **Solve missing number problems eg 10 + ? = 16**

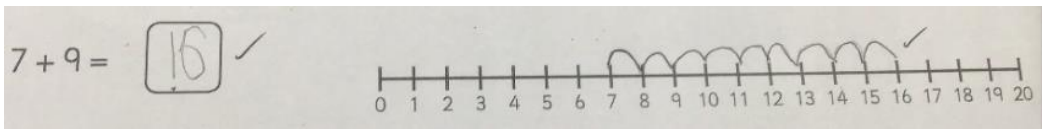
Children will continue to practise counting on from any number e.g. 'Put five in your head and count on four.'

We use a range of strategies to enable children to begin to use written methods for addition sums. These include: numicon, hundred squares, number lines, ten frames and twenty frames.

Initially children will use a number track/caterpillar/snake for addition, counting on from the largest number. E.g.

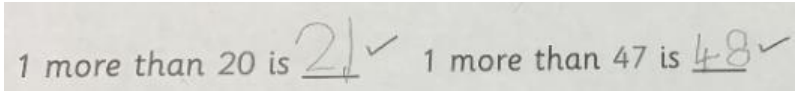
5 + 4 = 9 'Put your finger on number five. Count on (count forwards) four.'

They will then progress to a marked line:

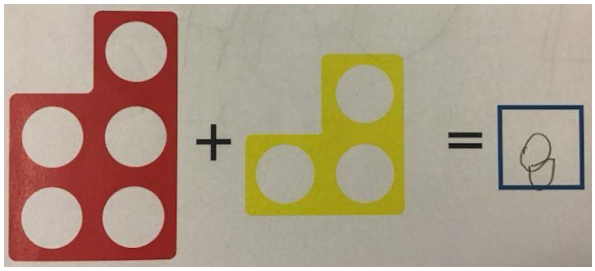



'Put your pencil on 7 and count on 9.'

Various exercises will be used to develop the children's abilities with finding one more (such as the one below).




Children will also use numicon to develop their addition skills.

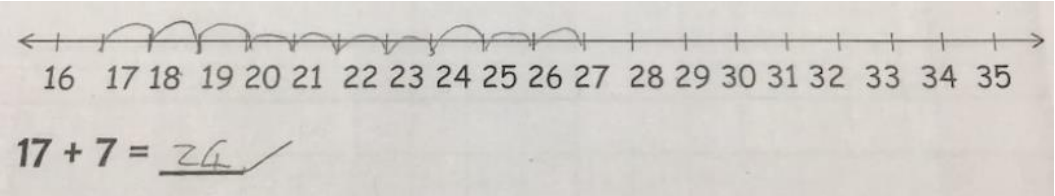


Stage 3

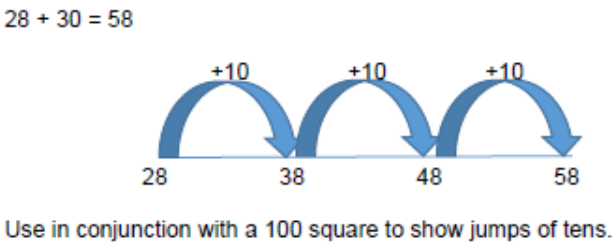
**Add numbers using concrete objects, pictorial representations and mentally, including:**

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

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

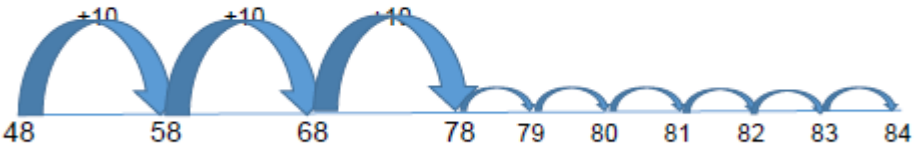



… and in tens.



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

Some children may be taught the partitioning method to add two 2 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'.

Children that are confident with the above methods may also be taught how to do the following:

48 + 36 = 40 + 8 + 30 + 6

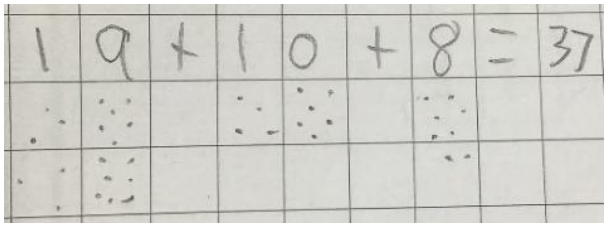
40 + 30 = 70
8 + 6 = 14
70 + 14 = 84

48 + 36 = 84

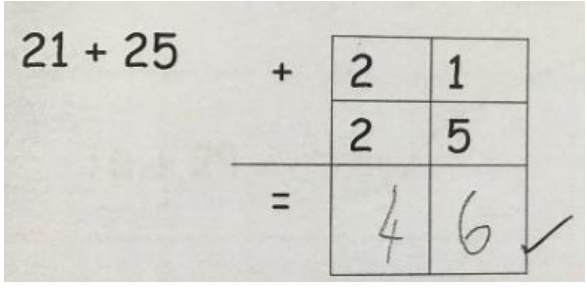
Stage 4

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

Children will be taught to add 3 numbers using a method of drawing dots to represent each number and then counting the dots.




At this stage children will be taught how to use the formal written method, firstly using numbers where there is no need to carry to the next column.




They will be taught to start on the right hand side, and work their way across, adding each column and writing the answer underneath.

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

```
     68
   + 24
     92
     □□
```

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.'

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.

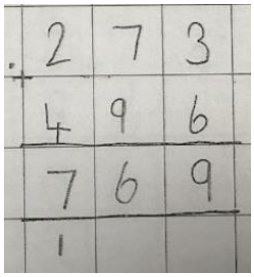
If **children are confident**, further develop with the addition of a three-digit number and a two-digit number:
178 + 43 = 221

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

Stage 5

- **Add numbers with up to 4 digits using the formal written method of columnar addition where appropriate**

At this stage children will move to adding three digit numbers to three digit numbers.




Use the language of place value to ensure understanding:
'Three add six equals 9. Write 9 in the ones column. 70 add 90 equals 160. Write 6 in the tens column (60) and 'carry' 1 (100) across into the hundreds column. 200 add 400 and the 100 that has been carried equals 700. Write 7 in the hundreds column (700).

If children are confident, introduce the addition of a four-digit number and a three digit number:

1845 + 526 = 2371

```
  1 8 4 5
+   5 2 6
-------
  2 3 7 1
  1 1
```

Continue to develop with addition of two four-digit numbers and with decimals (in the context of money or measures).

Stage 6

- **Add whole numbers with more than 4 digits, including using formal written method (columnar addition)**

Continue to develop the formal written method for addition with larger numbers (and decimal numbers) and with the addition of three or more numbers:

21848 + 1523 = 23371

```
  21848
+ 1523
-------
  23371
  1   1
```

Continue to use the language of place value to ensure understanding. Ensure that the digits that have been 'carried' are recorded under the line in the correct column.

Use the **formal written method** for the addition of decimal numbers:

£154.75 + £233.82 = £388.57

```
  154·75
+ 233·82
--------
  388·57
    1
```

Continue to use the language of place value to ensure understanding.

Stage 7

Children will continue to practise and use the formal written method for larger numbers and decimals and use these methods when solving problems, when appropriate (see previous stage's guidance for methods).

Our aim is that by the end of Y6, children use mental methods (with jottings) when appropriate, but for calculations that they cannot do in their heads, they use an efficient formal written method accurately and with confidence.

## Stages in 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 use numicon and other concrete objects to develop their understanding of subtraction.

Children will begin to count back from a given number.

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**

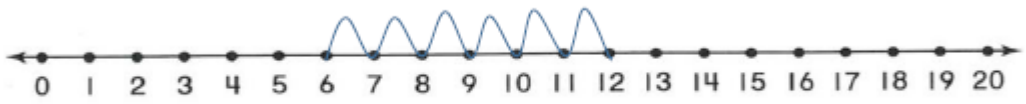
Children will continue to practise counting back from a given number.

Initially use a number track to count back for subtraction:


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

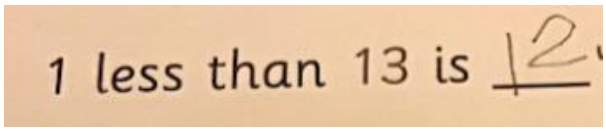
They will then progress to a marked line:

$12 - 6 = 6$




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

Various exercises will be used to develop the children's abilities with finding one less (such as the one below).




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**

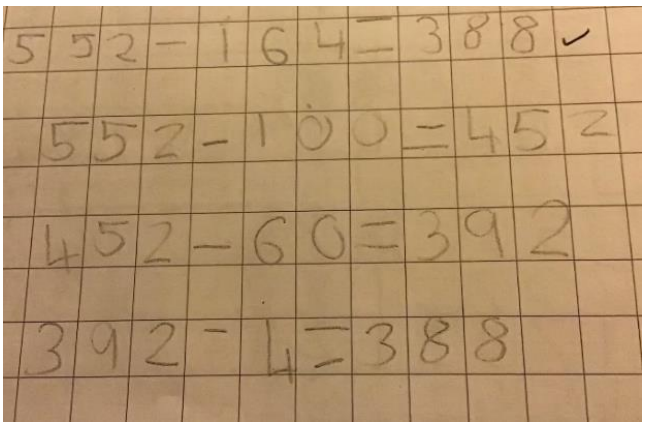
At this stage children will use a variety of concrete materials (bears, cubes, etc.), and will be introduced to pictorial ways to subtract (e.g. drawing and then crossing out).

**14 – 5 = 9**

Stage 4

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

Children will be taught how to subtract three digit numbers by using partitioning:




Partition 164 (100, 60 and 4)

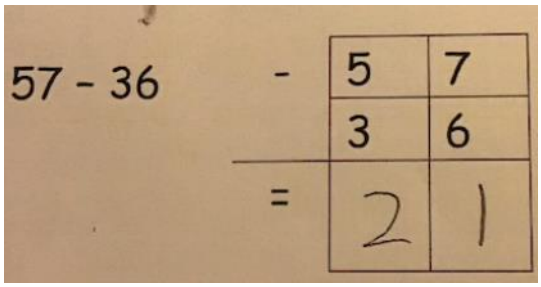
Take 100 away from 552 (452)

Take 60 away from 452 (392)

Take 4 away from 392 (388)

At this stage children will be taught how to use the formal written method, firstly using numbers where there is no need to carry to

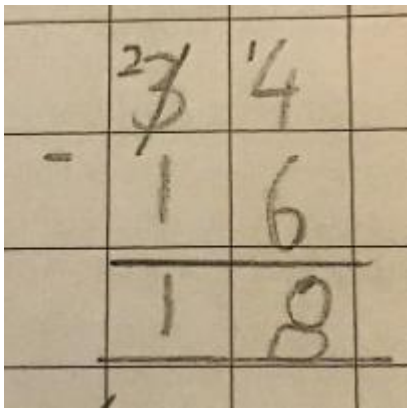
borrow from the next column. It is important that children understand that they need to start on the right and move across.




When children are confident with this we will move them onto problems where they will need to exchange. When teaching this we will use a variety of language to ensure that children have a good understanding of what they actually have to do. Examples of this language are:

- Exchanging
- Borrowing
- Going next door

It is important that children apply their understanding of place value to this (teachers may use concrete objects such as base 10, or iPad apps such as Number Pieces to aid children's understanding).




If the number on the top is smaller than the number on the bottom, then you must borrow from the column to the left.

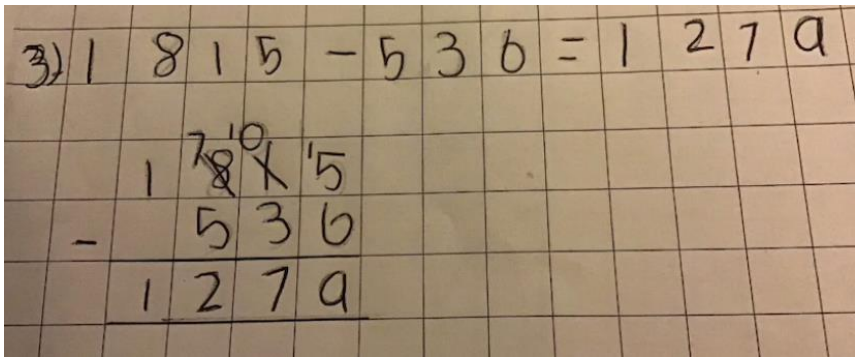
To do this you take one away from that column, and place it in front of the number in the column you are currently working on.

Stage 5

- **Subtract numbers with up to 4 digits using the formal written method of columnar subtraction where appropriate.**

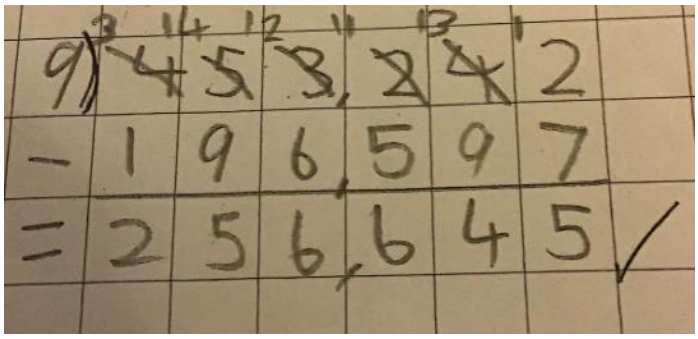
Continue to develop the **formal written method of subtraction** by revisiting the expanded method first, if necessary. Continue to use concrete objects such as base 10, or iPad apps such as Number Pieces to support understanding.

When **children are confident,** develop with four-digit numbers and decimal numbers (in context of money and measures).




Stage 6

Continue to develop the formal written method for subtraction with three and four digit numbers (see stage 5 guidance), returning to an expanded method and using base Ten / Dienes materials, if necessary.




Introduce subtraction of decimals, initially in the context of money and measures (e.g.):

**£166.25 – £83.72 = £82.53**

Children will need to be specifically instructed to make sure that the decimal points line up.

Stage 7

Children will continue to practise and use the formal written method for larger numbers and decimals and use these methods when solving problems, when appropriate (see previous stage's guidance for methods).

Our aim is that by the end of Y6, children use mental methods (with jottings) when appropriate, but for calculations that they cannot do in their heads, they use an efficient formal written method accurately and with confidence.

## Stages in 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. We will also use concrete materials such as numicon to aid early development.

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

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.

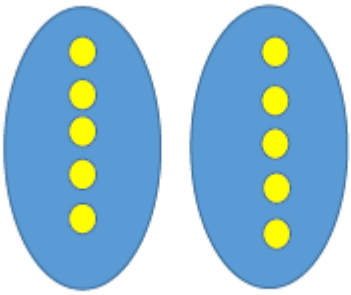
They will solve **practical problems** that involve combining groups of 2, 5 or 10. E.g. socks, fingers and cubes.

'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

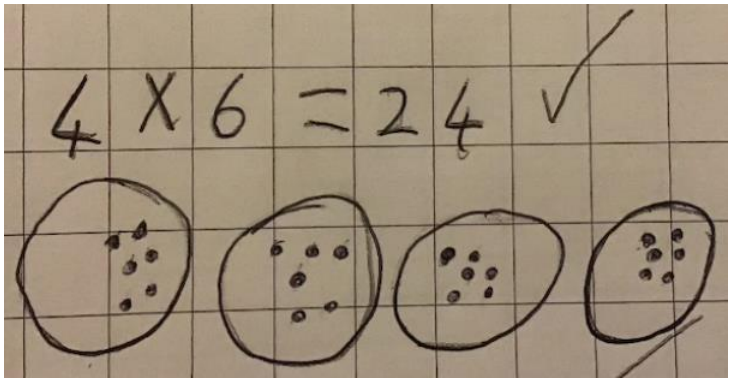
Continue to solve problems in practical contexts and develop the language of early multiplication, with appropriate resources, throughout stage 2.

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)**

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

Children will first be taught how to use repeated addition (as below).




Following this we will introduce the concept of arrays:

**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'

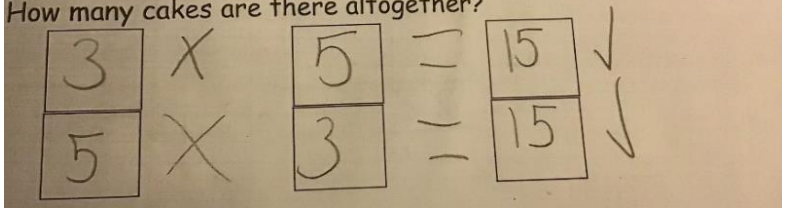
'6 x 5 = 30'

The next step is skip counting, either mentally or by using an empty number line:

**6 x 5 = 30**


We will use activities such as the one below to aid children in their understanding of commutativity:

2. There are 3 shelves in a cake shop. Each shelf holds 5 cakes.
How many cakes are there altogether?



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**

At this point we will introduce the children to the grid method for multiplication. This is to develop their understanding of using partitioning to multiply larger numbers:

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.'

We will also being to introduce the formal short multiplication method for times tables that they are confident with:

**13 X 8 = 104**

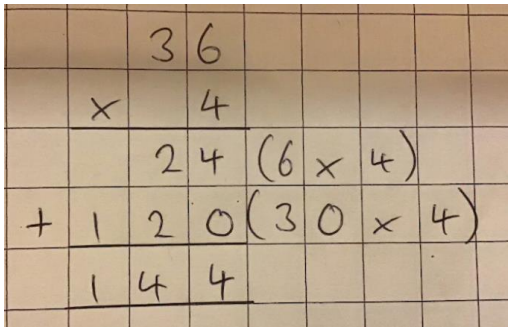
```
    1 3        Use the language of place value to ensure
understanding
    X 8
    2 4 (3 x 8)      Include an addition symbol when adding partial
      +8 0 (10 x 8)  products
    1 0 4
```

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

Stage 5

- **Recall multiplication facts for multiplication tables up to 12 × 12**
- **Multiply two-digit and three-digit numbers by a one-digit number using formal written layout**

Further develop the grid method for two-digit numbers multiplied by a one-digit number.


36
x 4
24 (6 x 4)
+ 120 (30 x 4)
144

This leads to **short multiplication (formal method)** of a two-digit number multiplied by a one-digit number:

36 x 4 = 144

```
   3 6        Use the language of place value to ensure
understanding
   X 4
  144         Ensure that the digit 'carried over' is
written under the line
   2          in the correct column.
```

If necessary, return to the **grid method and/or expanded method** first:

**127 x 6 = 762**

| X | 100 | 20 | 7 |
|---|---|---|---|
| 6 | 600 | 120 | 42 |

600 + 120 + 42 = 762 (add the partial products)

Stage 6

- **Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers**

When children are confident introduce multiplication by a two-digit number.

If necessary, return to the grid method and/or expanded method first.

Grid method (two-digit number multiplied by a teen-number):

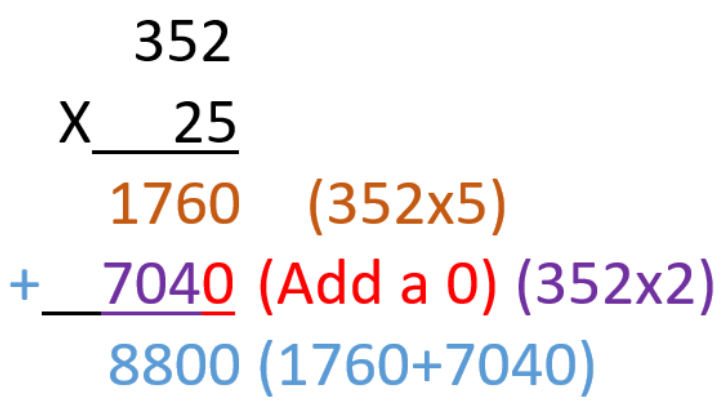
23 x 13 = (20 + 3) x (10 + 3) = 299

| X | 20 | 3 |
|---|---|---|
| 10 | 200 | 30 |
| 3 | 60 | 9 |

```
 2 3 0
+  6 9
 2 9 9
```

Add the partial products (200+30) + (60+9) = 299

The development of this will be the introduction of the method for long multiplication.




Stage 7

- **Multiply multi-digit numbers (including decimals) up to 4 digits by a two-digit whole numbers using the formal written method of multiplication**

Continue to practise and develop the **formal short multiplication** method and **formal long multiplication** method with larger numbers and decimals throughout Stage 6. Return to an expanded form of calculation initially, if necessary (see stage 6 guidance).

**53.2 x 24 = 1276.8**

| X | 50 | 3 | 0.2 | |
|---|---|---|---|---|
| 20 | 1000 | 60 | 4 | 1064.0 |
| 4 | 200 | 12 | 0.8 | 212.8 |
| | | | | 1276.8 |

**The formal written method of long multiplication:**

```
    5 3 . 2
X   2 4 . 0
      1
    2 1 2 . 8  (53.2x4)
1 0 6 4 . 0  (53.2x20)
1 2 7 6 . 8
```

It is an option to include .0 in this example, but not essential.

The prompts (in brackets) can be omitted if children no longer need them.

Our aim is that by the end of stage 7 children use mental methods (with jottings) when appropriate, but for calculations that they cannot do in their heads, they use an efficient formal written method accurately and with confidence.

## Stages in 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. We will use concrete materials such as aliens and spaceships to develop children's understandings.

Share the apples between two people.

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

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?'

We will also use concrete materials, and make cross curricular links using things like pizza toppings and baking gingerbread.

Children will then 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?'

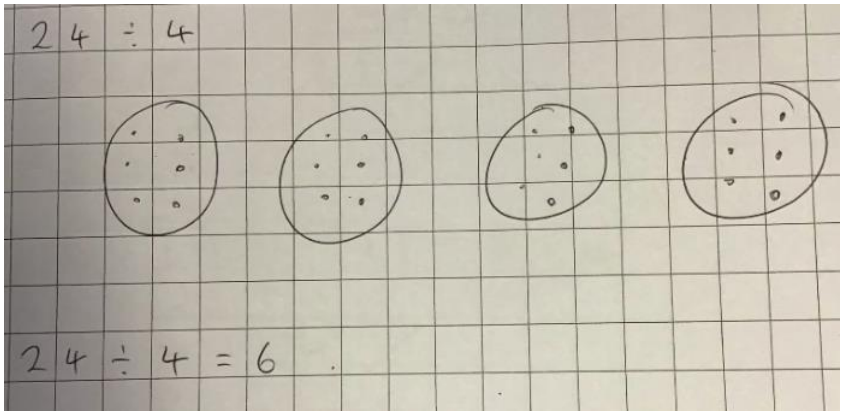
'Five groups of two.'

Stage 3

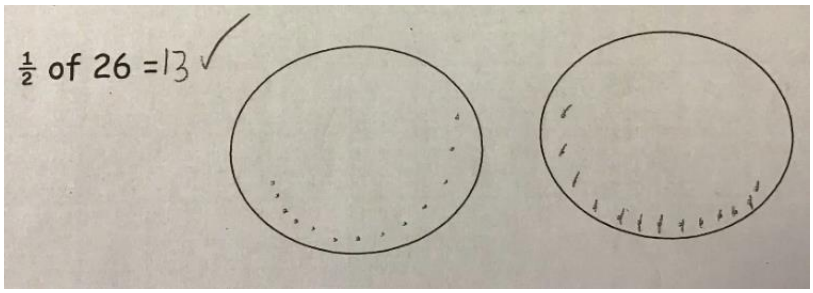
- **Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables**
- **Calculate mathematical statements for division within the multiplication tables they know and write them using the division (÷) and equals (=) signs**
- **Solve problems involving division, using materials,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

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.

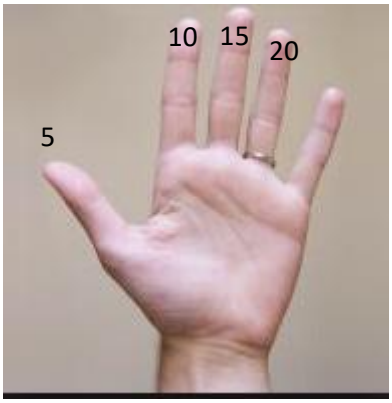
At this stage we will primarily use the sharing method (as shown below):




However, we will also use this method to introduce fractions:




Children will also be taught to skip count on their fingers as a method for dividing.

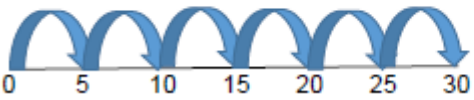



20 ÷ 5 = 4 (because we used 4 fingers)

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

**30 ÷ 5 = 6**

'How many jumps of 5 make 30?'




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**

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…

$$3\overline{)24}\quad 8$$

'Twenty four divided by three equals eight.'

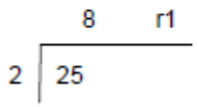
'How many threes are there in twenty four?'

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)**

Continue using the formal written layout, introducing remainders:

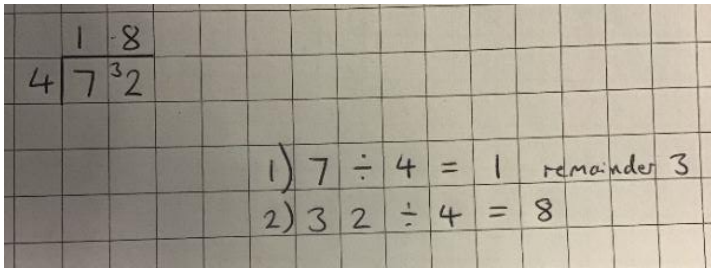
**25 ÷ 3 = 8 r1**




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 will then lead to the introduction of the formal written method of short division:

**72 ÷ 4 = 18**




Children may need to be specifically instructed, that unlike in addition, subtraction and multiplication, with division we go from left to right.

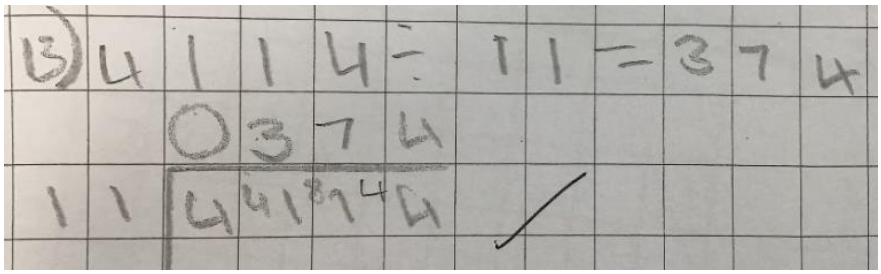
Within this stage children may be developed further by using the same method to divide a 3 digit number by a 1 digit number.

Stage 6

- **Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context**

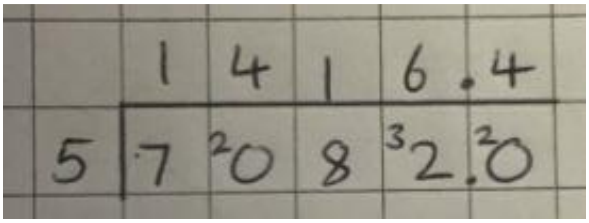
At this stage children will continue to practise the formal written method of short division with whole number answers and with remainders.

They will also develop their understanding by extending to 4 digit numbers divided by 1 digit numbers.



At this stage children will also be taught what they can do with remainders:

1) Leave it as a remainder
   7082 ÷ 5 = 1416 r 2
2) Convert it to a fraction (where the remainder becomes the numerator and the number you are dividing by becomes the denominator)
   7082 ÷ 5 = 1416 2/5
3) Add zeroes to find a decimal answer


1 4 1 6 . 4
5 7 2 0 8 3 2 . 3 0

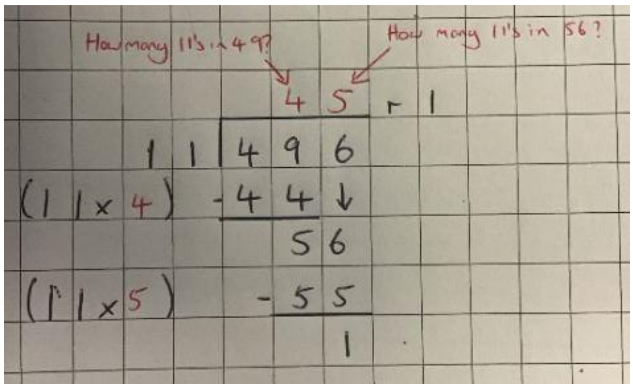
Stage 7

- **Divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context**
- **Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context**

Continue to practise the formal method of short division, with and without remainders, using the language of place value to ensure understanding (see stage 6 guidance).

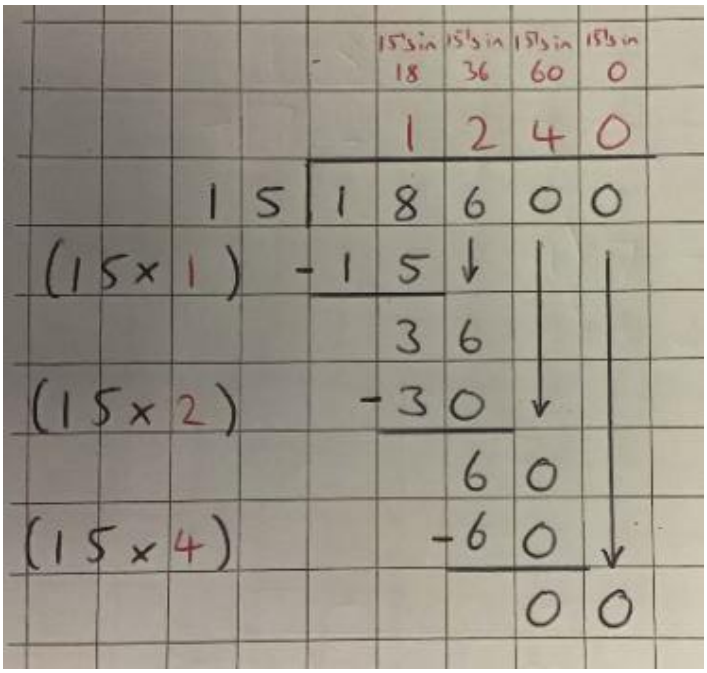
At this stage children will be introduced to the formal method for long division in order to divide by a 2 digit number.

**496 ÷ 11 = 45 r1** (see guidance in Stage 6 for what to do with remainders)




This can then be extended to larger numbers:

**18600 ÷ 15 = 1240**



With confidence this method can then be extended to decimal numbers.