FULWELL INFANT SCHOOL ACADEMY

How we teach calculations:

Calculation Policy for Mathematics

About our Calculation Policy

The following calculation policy has been devised to meet requirements of the current National Curriculum for the teaching and learning of mathematics, and is also designed to give pupils a consistent and smooth progression of learning in calculations across the school. Early learning in number and calculation in Reception follows the 'Development Matters' EYFS document, and this calculation policy is designed to build on progressively from the content and methods established in the Early Years Foundation Stage.

Primary Stars Maths

As a school we implemented Primary Stars Maths in 2022. It is a mastery curriculum that follows a spiral learning approach which systematically develops skills and concepts. It is the idea that a concept is introduced at an early age and then built upon. The programme is built around the CPA approach, allowing all learning styles to access and understand a concept. There is an emphasis on the development of intellectual competence, such as the ability to visualise different concepts. This decision was made due to the ever evolving mastery approach that was introduced to the maths curriculum in 2016. Our children were exceeding within maths and Primary Stars was the program to add challenge and depth for the children's learning. It is accessed by Year 1 and Year 2 children and brings depth and understanding to their learning. We pride using the scheme to ensure children get varied access and exposure to achieve fluency, reasoning and problem solving within their mathematical journey with us.

Mastering Number is also a daily practise within our lessons as well as providing children with Financial Education learning to help them further understand the role of math in the wider word.

Providing a context for calculation:

It is important that any type of calculation is given a real life context or problem solving approach to help build children's understanding of the purpose of calculation, and to help them recognise when to use certain operations and methods when faced with problems. This must be a priority within calculation lessons, although skills will still need careful teaching and practice.

Primary Stars Maths lessons and EYFS learning may include the following stages:

- Work from their previous lesson
- Explore by using practical materials solving a given problem
- Adult/child modelling
- Jottings
- Intelligent practice of a skill
- Application through word problems, explanations or 'What if' questions
- Reflection on work and self-assessment

Choosing a calculation method:

The CPA approach
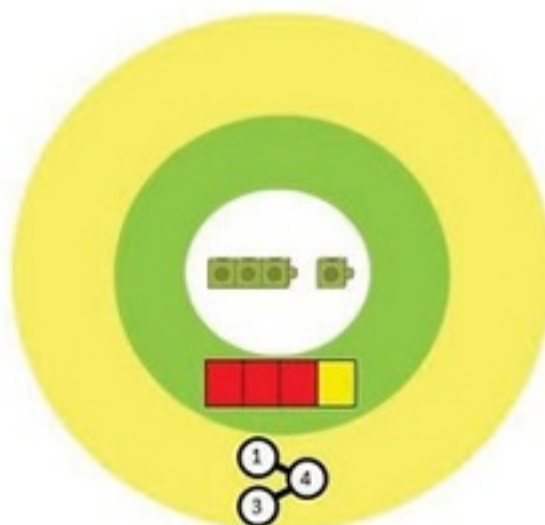
Concrete:

resources such as cubes, counters and shapes

Pictorial:
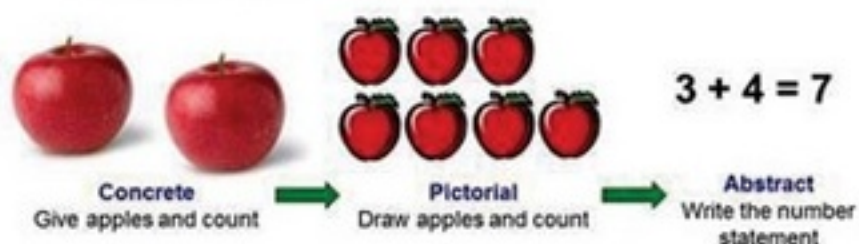
pictures, drawings

Abstract:

numbers and symbols

Children have the opportunity to explore with different manipulatives in order to arrive to their answer. This allows all learning styles to feel confident and be able to achieve the same learning objectives as peers, without being capped.

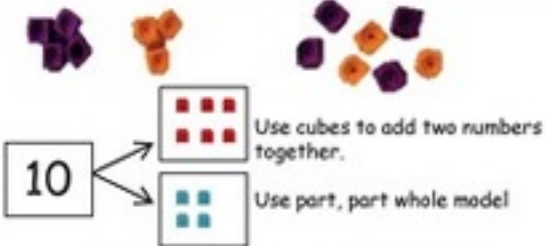| CPA Approach	
Stage	**Characteristics**
Concrete	Refers to the use of manipulatives, measuring tools or objects that the student handles.
Pictorial	Refers to the use of drawings, diagrams, charts or graphs that the student draws
Abstract	Refers to abstract representations such as numbers and letters that the student writes

Example:
Tom had 3 apples. His mother gave him 4 more apples. How many apples did he have altogether?
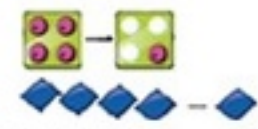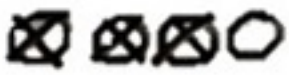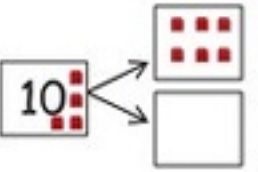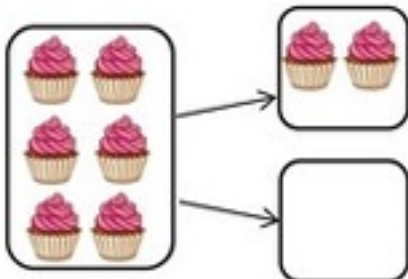
$3 + 4 = 7$

Concrete
Give apples and count

Pictorial
Draw apples and count

Abstract
Write the number statement
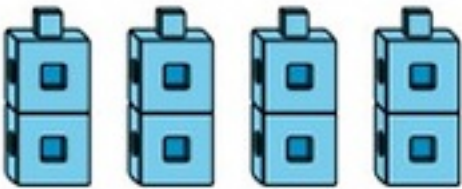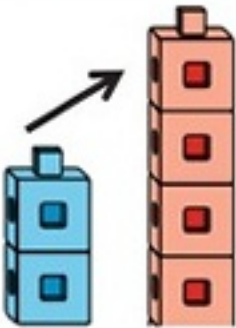
EYFS

Here are some examples of how children across Nursery and Reception will be taught to reach answers and understand concepts.

EYFS will use concrete resources and pictorial representations to teach the following objectives. If, or when ready, staff will move children on to the use of simple abstract concepts which suit EYFS learners.

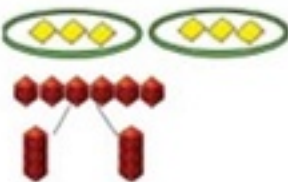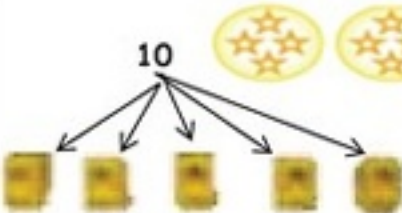| Addition -EYFS		
Objective and strategy	Concrete	Pictorial
Combining 2 parts to make a whole Use a variety of resources e.g. shells, teddy bears, cars. Part-whole models.	Use cubes to add two numbers together. Use part, part whole model	Use pictures to add two numbers together.
Counting on	Start with the larger number and count on 1 by 1 to find the answer.	Start with the larger number and count on in ones to find the answer.

EYFS will use concrete resources and pictorial representations to teach the following objectives. If, or when ready, staff will move children on to the use of simple abstract concepts which suit EYFS learners.

Subtraction -EYFS		
Objective and strategy	Concrete	Pictorial
Taking away ones	Physically taking away and away and removing objects from a whole.	Children will use drawings to visualise the equation then cross out to represent the subtraction.
Part whole model	Link to addition-use the part whole model to help explain the inverse between addition and subtraction. If 10 is the whole and 6 is one of the parts, what is the other part? 10 - 6 =	Use a pictorial representation of objects to show the part whole model.

Multiplication EYFS

Objective and strategy	Concrete	Pictorial
Recognising and making equal groups Only in 2s, 5s and 10s.	There are 4 equal groups with 2 in each group. 2, 4, 6, 8. There are 8 altogether.	Children to represent the practical resources in a picture. Counting in 2s, 5s and 10s.
Doubling	Use practical activities to show how to double.	Draw pictures to show how to double.

Multiplication EYFS

Objective and strategy	Concrete	Pictorial
Sharing objects into groups.	Sharing using a range of objects.	Represent the sharing pictorially.
Division as grouping	10 Divide quantities into equal groups. Use cubes, counters and other objects.	This objective is only taught using concrete objects unless a child is ready.

EYFS Vocabulary

Number:
- Zero, one, two, three... to twenty and beyond
- Zero, ten, twenty... to one hundred
- How many?
- Count, count (up) to, count on (from, to)
- Count in ones, twos, tens...
- More, less, many, few
- Add, plus, sum, make, total, altogether
- How many more to make...?
- Subtract, take away difference between
- How many are left/left over?, how many are gone?, how many fewer is ... then ...? What is the difference between? Is ... the same as...? What is one less than?
- Answer, right, wrong, group, same, different, pattern, puzzle

Mathematics in the Foundation Stage is planned for in all areas of the curriculum. Children will access Maths within play, practical situation, child initiated and adult supported activities.

National Curriculum for Year 1 and Year 2

Addition

Year 1

Add with numbers up to 30 (experience to 100)
Children to use concrete equipment such as Dienes, everyday objects, bead strings, drawings and recording their work using symbols.

Concrete ▸ **Pictorial** ▸ **Abstract**

$$2 + 1 = 3$$

Resources
Counters
Multilink
Numicon
Straws
Tens and ones
Dienes

Children should:

- Have access to a wide range of counting equipment, everyday objects, number tracks and number lines and be shown numbers in different contexts.
- Read and write the addition (+) and equals (=) signs within number sentences.
- Interpret addition number sentences and solve missing box problems, word problems using concrete objects, drawing or mental strategies:
-

$8 + 3 = \square$ $15 + 4 = \square$ $5 + 3 + 1 = \square$ $\square + \square = 6$

This builds on from prior learning of adding by combining two sets of objects into one group (5 cubes and 3 cubes) in Early Years.

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

$$8 + 5 =$$

Addition

Skill: Add 1-digit and 2-digit numbers to 100	Year: 2/3

$$38 + 5 = 43$$

When adding single digits to a two-digit number, children should be encouraged to count on from the larger number.

They should also apply their knowledge of number bonds to add more efficiently e.g. 8 + 5 = 13 so 38 + 5 = 43.

Hundred squares and straws can support children to find the number bond to 10.

Skill: Add two 2-digit numbers to 100	Year: 2/3

$$3 + 23 = 61$$

$$\begin{array}{r} 38 \\ + 23 \\ \hline 61 \\ \hline \scriptstyle 1 \end{array}$$

At this stage, encourage children to use the formal column method when calculating alongside straws, base 10 or place value counters. As numbers become larger, straws become less efficient.

Children can also use a blank number line to count on to find the total. Encourage them to jump to multiples of 10 to become more efficient.

Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, sum, tens, units, partition, addition, column, tens boundary

Key skills for addition at Y2:
- Add a 2-digit number and ones (e.g. 27 + 6)
- Add a 2-digit number and tens (e.g. 23 + 40)
- Add pairs of 2-digit numbers (e.g. 35 + 47)
- Add three single-digit numbers (e.g. 5 + 9 + 7)
- Show that adding can be done in any order (the commutative law).
- Recall bonds to 20 and bonds of tens to 100 (30 + 70 etc.)
- Count in steps of 2, 3 and 5 and count in tens from any number.
- Understand the place value of 2-digit numbers (tens and ones)
- Compare and order numbers to 100 using < > and = signs.
- Read and write numbers to at least 100 in numerals and words.
- Solve problems with addition, using concrete objects, pictorial representations, involving numbers, quantities and measures, and applying mental and written methods.

Resources
Counters
Multilink
Numicon
Straws
Tens and ones
Dienes

Subtraction

Year 1 Subtract from numbers up to 30

Children consolidate understanding of subtraction practically, showing subtraction on bead strings, using cubes etc. and in familiar contexts, and are introduced to more formal recording using column and mental strategies.

Subtracting by taking away

Read, write and interpret number sentences with + and = signs

Count back in ones
Using a bead string
And number track

$6 - 2 = 4$

Model subtraction using practical equipment, everyday objects, pictures and examples of real life situations.

Find the difference between

This will be introduced practically with the language **'find the difference between'** and **'how many more?'** In a range of familiar contexts.
Seven is 3 more than 4.
I am 2 years older than my sister.

Crossing out method

$7 - 2 = 5$

Key vocabulary:
equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back , how many left, how much less is_?

Key skills for subtraction at Y1:
- Given a number, say **one more or one less**.
- Count to and over 100, **forward and back**, from any number.
- Represent and use **subtraction facts to 20 and within 20**.
- Subtract with **one-digit and two-digit** numbers to 20, including zero.
- Solve one-step problems that involve addition and subtraction, using concrete objects (i.e. bead string, objects, cubes) and pictures, and missing number problems.
- Read and write numbers from 0 to 20 in numerals and words.
- Mental subtraction - Children should start recalling subtraction facts up to **and within 10** and 20, and should be able to subtract zero.

Subtraction

Year 2 Subtract with 2-digit numbers

Subtract on a number line by **counting back**, aiming to develop mental subtraction skills.

This strategy will be used for:
- 2-digit numbers subtract units (by taking away / counting back) e.g. 36-7
- 2-digit numbers subtract tens (by taking away / counting back) e.g. 48-30
- Subtracting pairs of 2-digit numbers (see below)

Skill: Subtract 1 and 2-digit numbers to 100	Year: 2
$65 - 28 = 37$	At this stage, encourage children to use the formal column method when calculating alongside straws, base 10 or place value counters. As numbers become larger, straws become less efficient. Children can also use a blank number line to count on to find the difference. Encourage them to jump to multiples of 10 to become more efficient.

Key vocabulary:
equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back, how many left, how much less is_? difference, count on, strategy, partition, tens, units

Key skills for subtraction at Y2:
- Recognise the place value of each digit in a two-digit number.
- Recall and use subtraction facts to 20 fluently, and derive and use related facts up to 100.
- Subtract using concrete objects, pictorial representations, 100 squares and mentally, including: a two-digit number and ones, a two-digit number and tens, and two two-digit numbers.
- Show that subtraction of one number from another cannot be done in any order.
- Recognise and use inverse relationship between addition and subtraction, using this to check calculations and missing number problems.
- Solve simple addition and subtraction problems including measures, using concrete objects, pictorial representation, and also applying their increasing knowledge of mental and written methods.
- Read and write numbers to at least 100 in numerals and in words.

Multiplication

Year 1

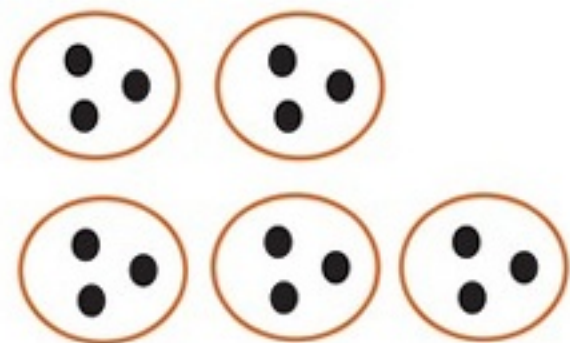Multiply with concrete objects, arrays and pictorial representations.

How many legs will 3 teddies have?

There are 3 sweets in one bag. How many sweets altogether in 5 bags?

$$3 + 3 + 3 + 3 + 3 = 15$$

$$2 + 2 + 2 = 6$$

- Give children experience of counting equal group of objects in 2s, 5s and 10s.
- Present practical problem solving activities involving counting equal sets or groups, as above.

Key vocabulary:
groups of, lots of, sets of, times, array, altogether, multiply, count, repeated addition

Key skills for multiplication at Y1:
Count in multiples of 2, 5 and 10.
Solve one-step problems involving multiplication, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.
Make connections between arrays, number patterns, and counting in twos, fives and tens. Begin to understand doubling using concrete objects and pictorial representations.
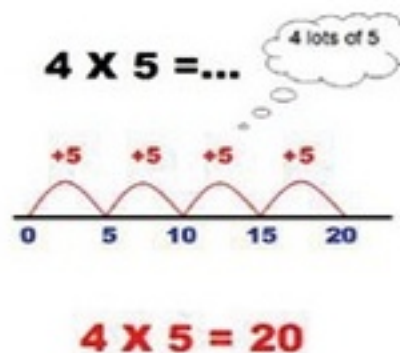
Multiplication

Year 2
Multiply using arrays and repeated addition
(using at least 2s, 5s and 10s)

Use repeated addition on a number line:

- Starting from zero, make equal jumps up on a number line to work out multiplication facts and write multiplication statements using x and = signs.

4 X 5 =...

4 lots of 5

+5 +5 +5 +5

0   5   10   15   20

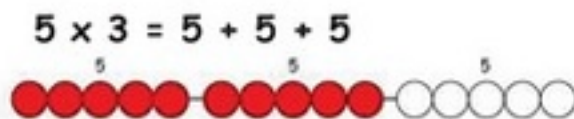**4 X 5 = 20**

Use arrays:

$5 \times 3 = 15$

$3 \times 5 = 15$

5 x 3 =
3 + 3 + 3 + 3 + 3 = 15

3 x 5 =
5 + 5 + 5 = 15

Use arrays to help teach children to understand the commutative law of multiplication and give examples such as 3 x .... = 6

5 x 3 = 5 + 5 + 5

5   5   5

Use practical apparatus:

Use mental recall:
Children should begin to recall multiplication facts for 2, 5 and 10 times tables through practice in counting and understanding of the operation.

Key vocabulary:
groups of, lots of, sets of, times, array, altogether, multiply, count, repeated addition
Key skills for multiplication at Y1:
Count in multiples of 2, 5 and 10.
Solve one-step problems involving multiplication, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.
Make connections between arrays, number patterns, and counting in twos, fives and tens. Begin to understand doubling using concrete objects and pictorial representations.

Division

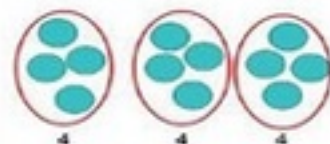**Year 1   Group and share small quantities**
Using objects, diagrams and pictorial representations to solve problems involving **both** grouping **and** sharing.

How many groups of 4 can be made with 12 stars? = 3

Grouping:

Sharing:

4   4   4

12 shared between 3 is 4

Example division problem in a familiar context:
There are 6 pupils on this table and there are 18 pieces of fruit to share between us. If we share them equally, how many will we each get?
Can they work it out and give a division statement...?
"18 shared between 6 people gives you 3 each."

Children should:
- Use lots of practical apparatus, arrays and picture representations
- Be taught to understand the difference between 'grouping' objects (How many groups of 2 can you make?) and 'sharing' (Share these sweets between 2 people)
- Be able to count in multiples of 2s, 5s and 10s.
- Find half of a group of objects by sharing into 2 equal groups.

Key Vocabulary: share, share e q u al l y , one each, two each..., group, groups of, lots of, sets of, array
Key number skills needed for division at Y1:
- Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations arrays with the support of the teacher
- Through grouping and sharing small quantities, pupils begin to understand, division, and finding simple fractions of objects, numbers and quantities.
- They make connections between arrays, number patterns, and counting in twos, fives and tens.

Division

Year 2   Group <u>and</u> share using the ➗ and = sign.

Using objects, arrays, diagrams and pictorial representations to solve grouping on a number line.

Arrays:
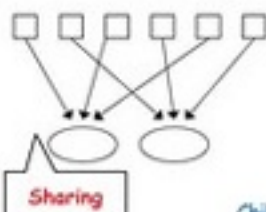
$12 ÷ 3 = 4$
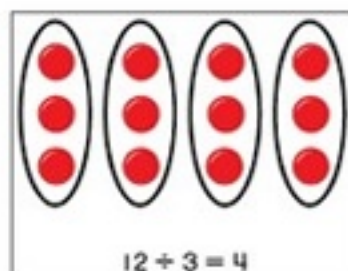
This represents $12 ÷ 3$, posed as how many groups of 3 are in 12?

Pupils should also show that the same array can represent $12 ÷ 4 = 3$ if grouped horizontally.

Know and understand sharing <u>and</u> grouping:

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

This is an important stage in teaching the difference between grouping and sharing.

Sharing

Grouping

There are 6 sweets, how many people can have 2 sweets each?

OO / OO / OO

Children should be taught to recognise whether problems require sharing or grouping.

Grouping using a number line:

Group from zero in equal jumps of the divisor to find out "how many groups of _ in _ ?".
Pupils could and using a bead string or practical apparatus to work out problems like "A CD costs £3. How many CDs can I buy with £12?" This is an important method to develop understanding of division as grouping.

0 1 2 3 4 5 6 7 8 9 10 11 12
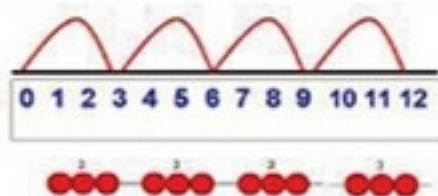
$12 ÷ 3 = 4$

Pose 12 ÷ 3 as 'How many groups of 3 are in 12?'

Key Vocabulary: share, share equally, one each, two each..., group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over

Key number skills needed for division at Y2:

- Count in steps of 2, 3, and 5 from 0
- Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers.
- Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the x, ÷ and = signs.
- Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot.
- Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.