St George's Catholic Primary

School – Maths Policy Appendix B

Progression in Calculations

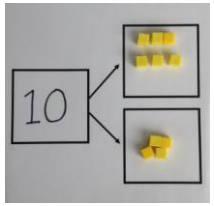
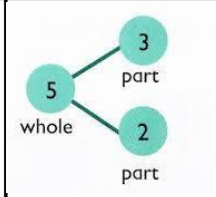
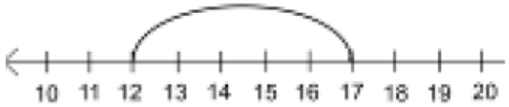
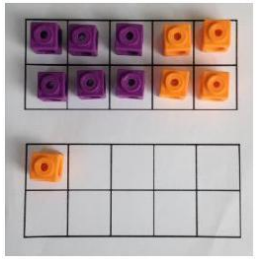
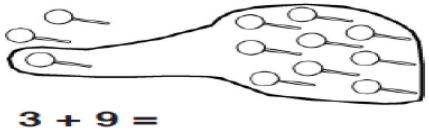
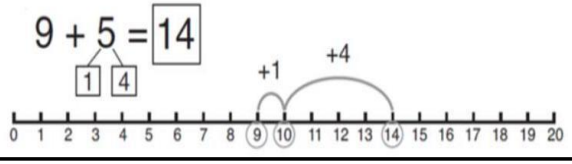
Addition

Before addition can be introduced, children need to have a secure knowledge of number. In Nursery, children are introduced to the concept of counting, number order and number recognition through practical activities and games. This is taught through child initiated games such as hide and seek and I spy. Children also learn how to count 1-1 (pointing to each object as they count) and that anything can be counted, for example, claps, steps and jumps. This is reinforced by opportunities provided in the outdoor area for the children to count e.g. counting building blocks, twigs etc.

Children in Reception build on concepts taught in Nursery by working through the number objectives in the 40 – 60 month band of Development Matters. Children need to have a secure knowledge of number in order to begin addition. They are then introduced to the concept of addition through practical games and activities. Children act out addition sums to physically add two groups of objects together and use arm gestures to represent the signs + and =. This is reinforced by opportunities provided in the outdoor area for the children to use addition e.g. adding together groups of building blocks, twigs etc. Children build on their previous knowledge of 'more' by learning that adding two groups of objects together gives them a larger number (more objects). Adults model addition vocabulary supported by age appropriate definition. An example of this is "addition means we add two groups together / we put 2 lots of objects together. Equals means we find out how many we have got altogether. 3 add 2 equals 5! We have got 5 altogether". Adults support children in recording their addition sums in the written form on whiteboards and in their maths books.

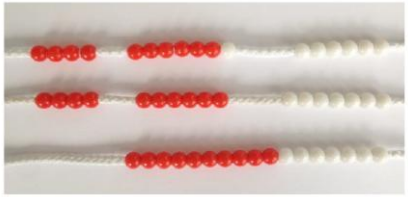
Progression in Calculations

Addition

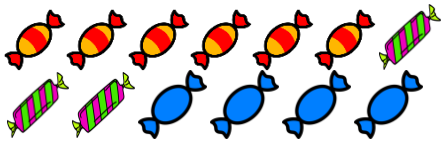
Strategies	Concrete →	Pictorial →	Abstract
Combining 2 groups to make a whole Counting sets of objects, combining then recounting using a 1:1 correspondence.	  	  	4 + 3 = 7 I have 4 apples and I pick 3 more, how many have I got altogether?
Counting on Pupils should be taught to start at the biggest number and count on, using this as an opportunity to Introduce the commutativity of addition.	 		5 + 12 = 17 Reinforce starting from the largest number. 7 + 3 = 10 Encourage recall of known number facts to develop fluency in mental calculations. .
Regrouping to make 10 To move on from the previous strategy, rather than counting on, children use their number bond knowledge and bridge to 10 e.g. if 4 + 6 = 10, so 4 + 7 must equal 11.	 6+5=11 Start with the bigger number and use the smaller number to make 10.	 	7p+4p=11p I have 7p, how much more do I need to make 10p. How much more do I add on now? If you know 10=7+3, what else do you know?

Adding 3 single digits

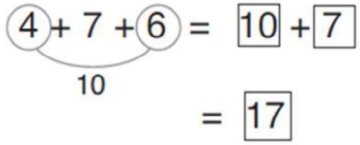
Use this method as an opportunity to develop fluent recall and application of known number facts including bonds and doubles.



Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.



6 + 3 + 4 = 13

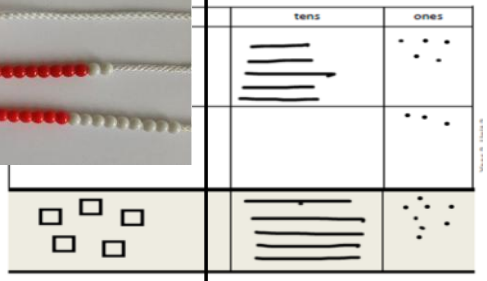


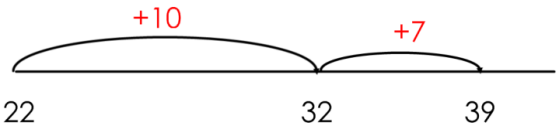
Partitioning to add

The emphasis for this strategy in KS1 is to develop a deep understanding of place value.

In year 2, recording addition and subtraction informally in columns supports place value and prepares for formal written methods with larger numbers later on in KS2. Ensure that when moving into any form of column the ones are calculated first.

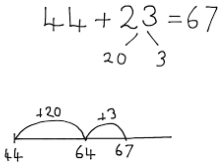
22+17=39

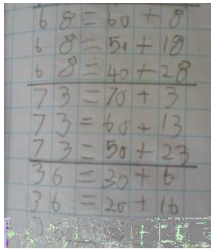


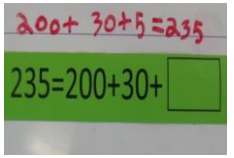


22+17=39

Begin with jumps of tens and ones then progress to jumps of all the tens and all the ones as children become more fluent.



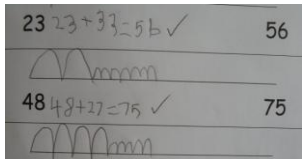




25+48=73

Informal recording in columns

$$\begin{array}{rrrr} 20 & + & 5 & \\ \underline{40} & + & \underline{8} & \\ 60 & + & 13 & = 73 \end{array}$$



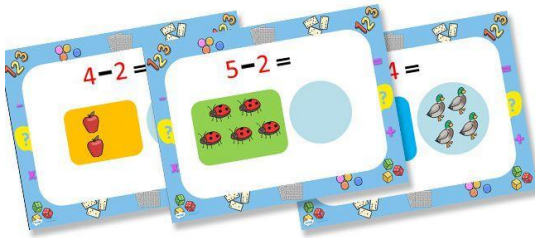
Counting on in tens and ones to solve missing number problems

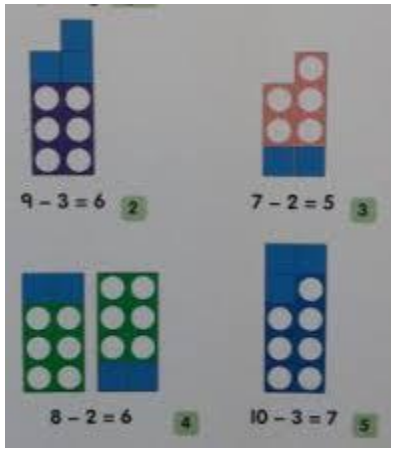
Progression in Calculations

Subtraction

Before subtraction can be introduced, children need to have a secure knowledge of number. In Nursery, children are introduced to the concept of counting backwards. This is taught through child initiated games indoors and outdoors such as acting out counting songs and running races (children shouting “5,4,3,2,1,0 - GO!”).

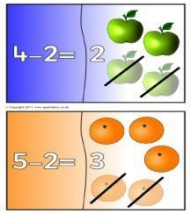
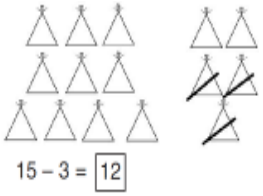
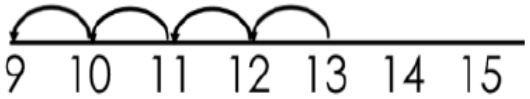
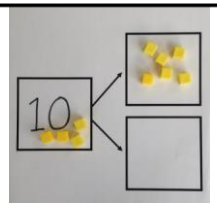
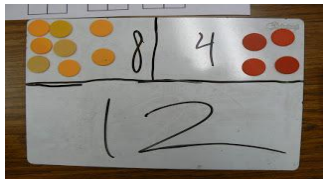
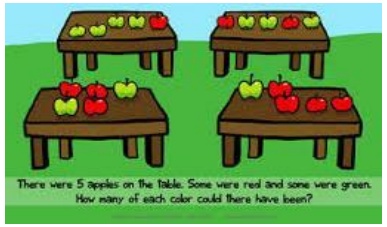
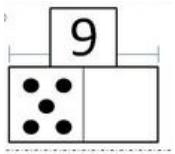
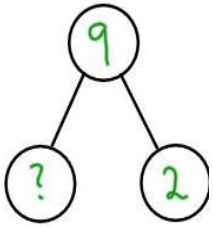
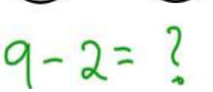
Children in Reception build on concepts taught in Nursery by working through the number objectives in the 40 – 60 month band of Development Matters. Children need to have a secure knowledge of number in order to begin subtraction. Children are then introduced to the concept of subtraction through practical games and activities. Children act out subtractions to physically subtract a number of objects from a group. Children use arm gestures to represent the signs - and =. This is reinforced by opportunities provided in the outdoor area for the children to count e.g. counting building blocks, twigs etc. Children build on their previous knowledge of ‘less’ by learning that subtracting means taking away a certain number of objects from a group (leaving them with less objects). Adults model subtraction vocabulary supported by age appropriate definition. An example of this is “subtraction means we take away objects from a group / we have 11 got less objects now. Equals means we find out how many we have got left. Wow! We have only got 3 left!” Adults support children in recording their subtractions in the written form on whiteboards and in their maths books.





Progression in Calculations

Subtraction

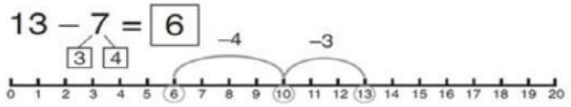
Strategies	Concrete	Pictorial	Abstract
Taking away ones Use physical objects to demonstrate how something can be taken away. Move on to crossing out drawn representations. This can be developed by representing a group of ten with a line and ones with dots.	  	   23 - 1 = 12	18 -3= 15 8 – 2 = 6 There are 15 cakes in the shop. One cake is eaten, how many are left.
Counting back As with the previous, this strategy is used for subtracting small numbers from larger numbers and provides a good foundation for the concept of subtraction	 Use counters or objects and move away from the group as they are counted.	 13-4=9	Put 17 in your head, count back 5. What number are you at? Use your fingers to help.
Part, part, whole model This model develops knowledge of the inverse relationship between addition and subtraction and is used to find the answer to missing number problems.	 If 10 is the whole and 6 is one of the parts. What is the other part? 	  Children should be taught the skills to approach problems in a systematic way.	 I made 9 buns for the cake sale and I only had 2 left at the end. How many did I sell?  

Make 10

Use this strategy to subtract a single digit number from a 2-digit number. Pupils identify how many need to be taken away to make ten first. Then they take away the rest to reach the answer.

14-5=9

Make 14 on the ten frame or with different coloured cubes to represent the ten and the ones. Take away the four first to make 10 and then takeaway one more so you have taken away 5. You are left with the answer of 9.



15 – 7=

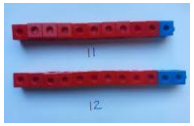
How many do we subtract to reach the next 10?

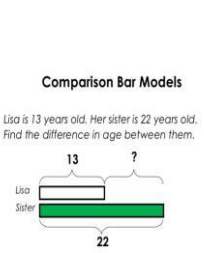
How many do we have left to subtract?

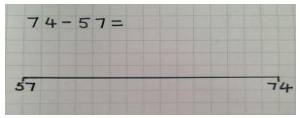
Find the difference

Pupils should develop a good understanding of the meaning of 'difference', exploring the inverse relationship with addition by counting back and counting up.

Practical resources to visualise 'difference' and recognise inverse relationships e.g. 12-1=11 and 11+1=12







Use a blank number line to count back and count up between 2 numbers.

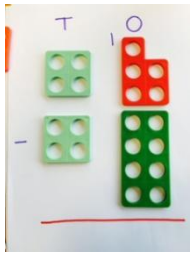
Lexie has 5 more strawberries than Jake. Jake has 11 cherries. How many does Lexie have?

Look at the graph. Fewer children have green eyes than blue. What is the difference?

Partitioning to subtract

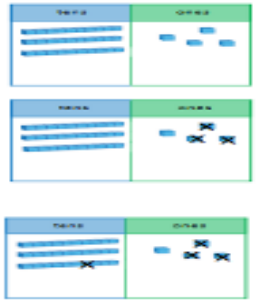
The emphasis for this strategy in KS1 is to develop a deep understanding of place value.

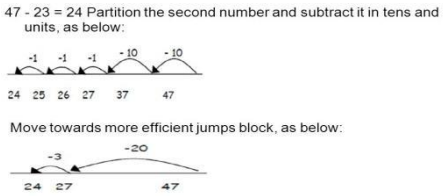
When not regrouping, partitioning should be developed as a mental strategy rather than formal recording in columns.



34-13=21

Subtract the ones first and then the tens to prepare for formal methods later





There are 35 children in the class and 12 are boys. How many are girls?

35-12=

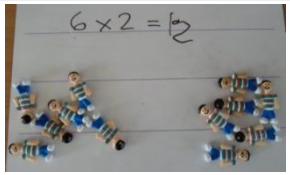
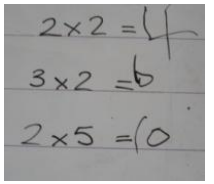
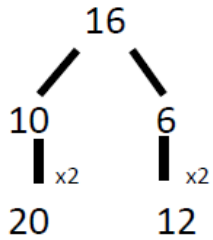
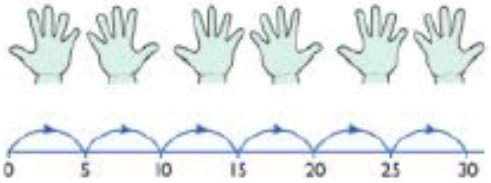
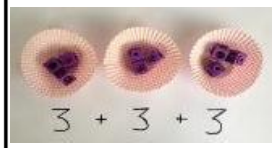
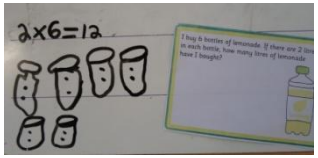
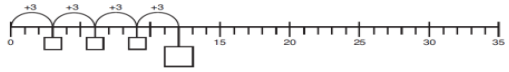
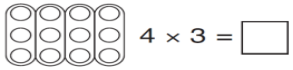
Progression in Calculations

Multiplication

By the end of Reception, children are expected to understand the concept of doubling and to be able to double a number up to 10. Before doubling can be introduced, children need to have a secure knowledge of counting, number facts and addition in order to double. Children are then introduced to the concept of doubling through practical games and activities, including the use of the outdoor areas. Children act out 'doubling' by physically add two equal groups together to find out the 'doubles' answer.

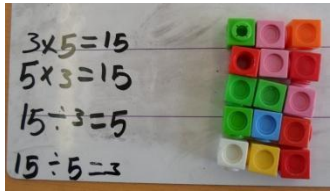
Progression in Calculations

Multiplication

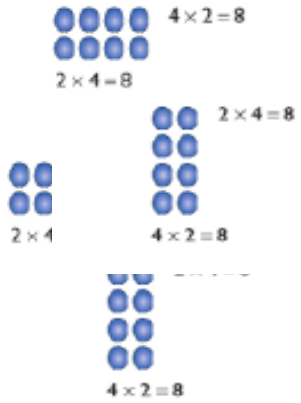
Strategies	Concrete	Pictorial	Abstract
Doubling Pupils should be encouraged to develop fluent mental recall of doubles and relate to the 2 x table.	  	Double 4 is 8 	  If I can see 10 wheels, how many bikes are there?
Counting in multiples Pupils can use their fingers as they are skip counting, to develop an understanding of 'groups of'. Children should become increasingly fluent as they practise.	  	Use a number line or pictures to continue support in counting in multiples. 	Count in multiples of a number aloud. Write sequences with multiples of numbers and work out missing numbers in sequences both forward and backward. If I count in 2's will I get to the number 58?
Repeated addition Pupils should apply skip counting to help find the totals of repeated additions.	 5+5+5=15  3+3+3=9	 Pupils begin to recognise the relationship between repeated addition and multiplication.  	Write addition or multiplication sentences to describe objects and pictures.  2+2+2+2+2=10 2x5=10

Arrays showing commutative multiplication

Pupils should understand that an can represent different equations and that, as multiplication is commutative, the order of the multiplication does not affect the answer.



Draw arrays in different rotations to find **commutative** multiplication sentences.



3 children go to the park to hunt for plne cones. They find 5 each, how many do they find altogether?

5 children eat the same number of cakes at a party. 15 cakes are eaten in total, how many did they each eat?

5+5+5=15
3x5=15

3+3+3+3+3=15
5x3=15

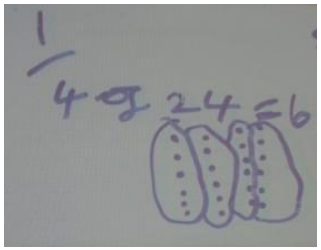
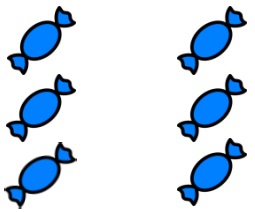
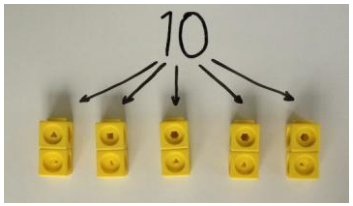
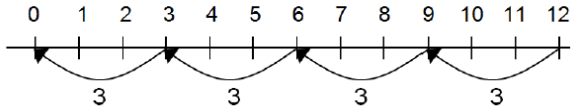
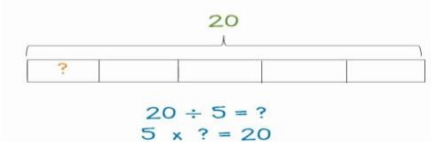
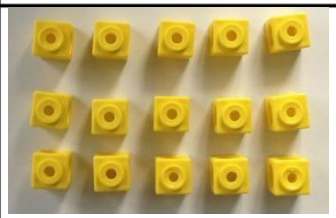
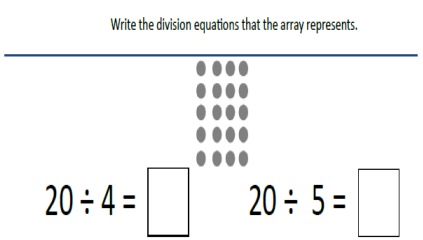
Progression in Calculations

Division

By the end of Reception, children are expected to understand the concept of halving and sharing. Before this can be introduced, children need to have a secure knowledge of counting backwards, number facts and subtraction in order to halve and share. Children are then introduced to the concept of halving and sharing through practical games and activities. They act out 'halving and sharing' through activities such as
sharing food for their Teddy Bear's Picnic, sharing resources equally to play a game. This is reinforced by opportunities provided in the outdoor area for the children to halve and share out objects such as building blocks, twigs etc.

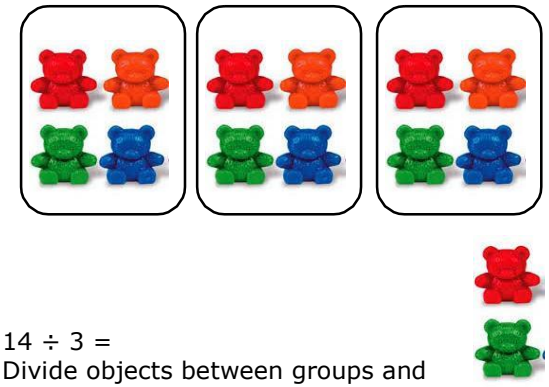
Progression in Calculations

Division

Strategies	Concrete →	Pictorial →	Abstract
Sharing Here, division is shown as sharing. E.g. If we have 24 squares of chocolate and we share them between 3 people, each person will have 8 squares each.	 	  6÷2=3	Share 9 buns between three people. 9 ÷ 3 = 3 Can you make up your own 'sharing' story and record a matching equation?
Division as grouping Here, division is shown as grouping. If we have ten cubes and put them into groups of two, there are 5 groups. This is a good opportunity to demonstrate and reinforce the inverse relationship with multiplication.	 Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.	Show jumps in groups. The number of jumps equals the number of groups.   Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group.	28 ÷ 7 = 4 Divide 28 into 7 groups. How many are in each group? Max is filling party bags with sweets. He has 20 sweets altogether and decides to put 5 in every bag. How many bags can he fill?
Division within arrays Use arrays of concrete manipulatives and images of familiar objects to find division equations. Begin to use dot arrays to develop a more abstract concept of division.		 Children can draw lines to divide their array	Find the inverse of multiplication and division sentences by creating four linking number sentences. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7

Division with a remainder

This strategy provides an opportunity to reinforce prior learning of odd and even and 'multiples' when exploring how numbers can and cannot be divided into different whole numbers.



14 ÷ 3 =
Divide objects between groups and see how many are left over.

7 ÷ 2 = 3 R 1 ← Remainder

Complete written divisions and show the remainder using r.

29 ÷ 8 = 3 REMAINDER 5

dividend divisor quotient remainder