Robert Le Kyng

Calculation Policy for Parents

Division

Mathematics is a creative and highly inter-connected discipline that has been developed over centuries, providing the solution to some of history's most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity about the subject. (*National Curriculum, 2014*)

At Robert Le Kyng Primary School, every class has a daily maths lesson of 45 minutes to one hour. Teachers often teach the whole class together for a proportion of the time, and oral and mental work feature strongly in each lesson. Many parents find that their children are using methods or strategies which are different from those used in the past. This can often cause confusion when trying to support your child at home. It is important that methods used in school are reinforced at home so as not to cause unnecessary confusion for the child.

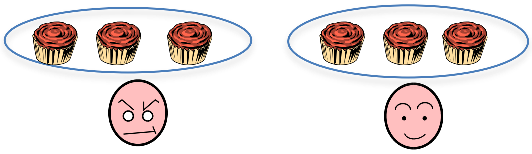
The purpose of this booklet is to show the progression from mental to written strategies in division, as taught at Robert Le Kyng Primary School. This will enable you to support your child with strategies which you may previously have been unfamiliar with.

This booklet gives an indication of when each strategy is likely to be used. This will be the case for the majority of children but it is important to be aware that some children will still need to consolidate earlier methods whilst some will be working on more complex strategies. Your child's teacher will be able to tell you which methods your child should be using.

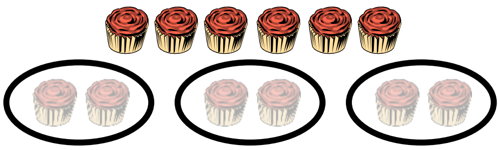
Division

To support children's understanding of when to use division in problem solving contexts, it is important for them to understand that there are **two key concepts** in division.

Firstly there is the concept of **sharing.** This is useful for problems such as, "There are six cakes that are shared out equally among 2 people. How many cakes do they get each?" These types of problems can be worked out by physically sharing the cakes out – or through use of our known number bonds.



Secondly, there is the concept of **grouping.** In this case the problem might be, "There are 6 cakes. 2 cakes are placed on each plate. How many plates are needed?"

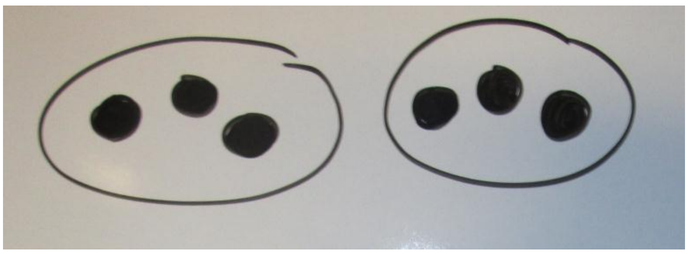


In this case, we would expect the child to place two cakes on the first plate and then move onto the second plate until they had used up all the cakes. This concept becomes more useful as numbers get bigger and more complicated as it can be represented on a number line and supports the calculations in the short written methods (eg. How many 8s go into 54?).

In the **Early Years**, division is introduced in a practical context using toys and equipment to solve mathematical problems. They solve problems, including doubling, halving and sharing.

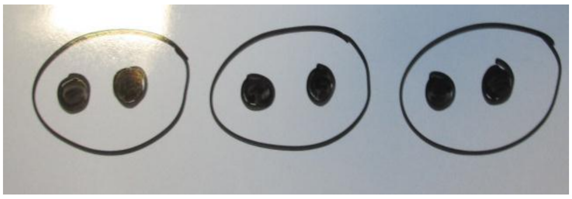
When the children are ready, they move onto representing the objects with simple symbols:

For example, **"6 cakes are shared between two children."** could be recorded like this and the child would be able to tell you that each child would get three cakes each. At this point, there is no formal recording of the calculation.



The **grouping** problem above would be recorded as,

"There are 6 cakes. 2 cakes are placed on each plate. How many plates are needed?"

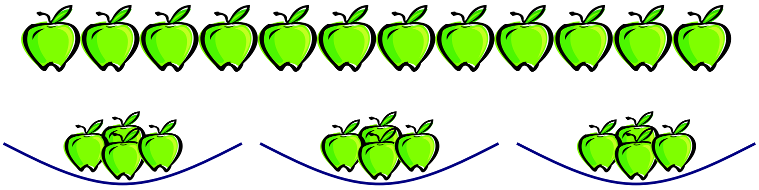


In this case, the child would work in exactly the same way as placing the cakes on the plates previously, but might record on a whiteboard using simple symbols.

Year 1

Initially, children will continue to use pictorial representations and symbols to solve many problems, possibly with slightly larger numbers.

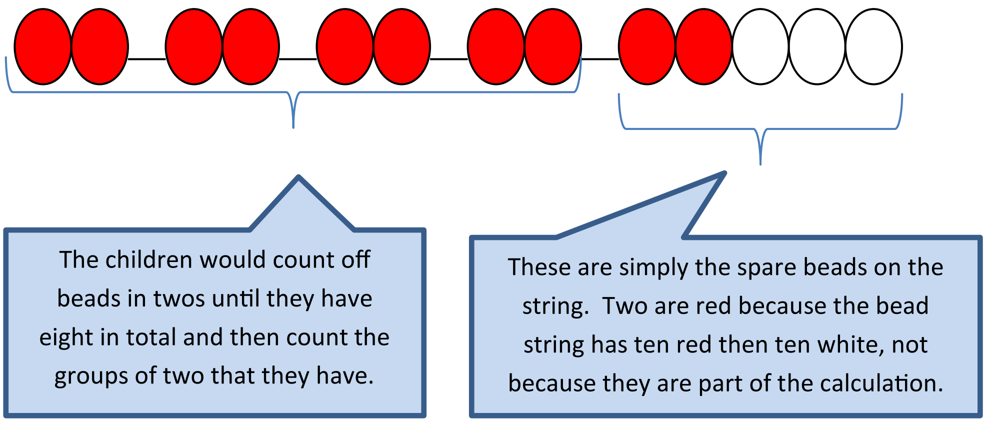
Eg. How many apples in each bowl if I share 12 apples between 3 bowls?



As the children become more confident, they will begin to use other tools to support their calculation and will begin to record in a more formal way. Many children will need a significant level of support to do this.

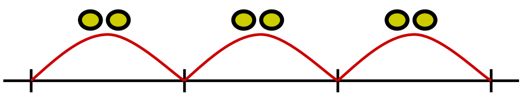
For example they might use a "bead string".

8 ÷ 2 = 4



Recording on a number line is the next step

Eg. 6 ÷ 2 = 3



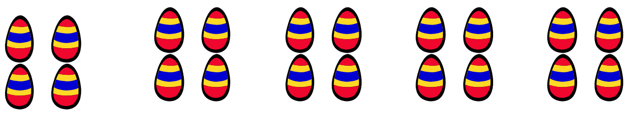
In this case, we use a blank number line to count up in groups of two until we get to the number we are dividing into. The answer is found by counting the number of jumps that we made.

Year 2

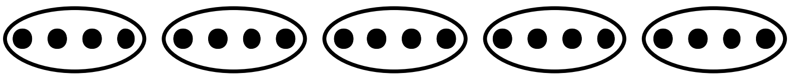
As the children move into year 2, they are becoming more familiar with their times tables, especially the 2, 5 and 10s. This will support their calculations for division and so it is important that they are fluent with these by the end of the year. Some children will be introduced to division calculations with remainders when they are ready.

Some children will continue to record their calculation pictorially or with simple symbols, again with slightly larger numbers.

eg. Four eggs fit in a box. How many boxes would you need to pack 20 eggs?

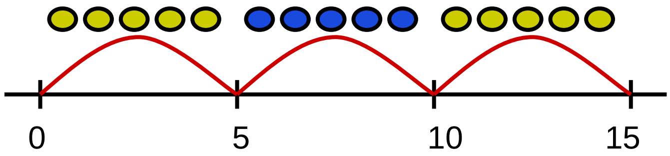


or

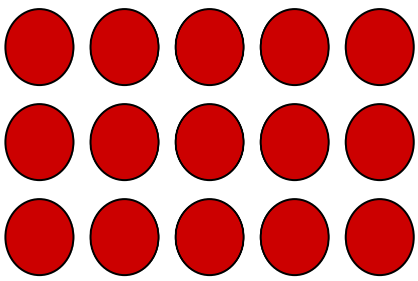


Number lines continue to be used and developed.

15 ÷ 5 = 3



As a link to the work the children are doing with multiplication, they will also learn to use **arrays** to support their division calculations. This works best when there is a division calculation without a remainder.



From this array we can derive several multiplication and division facts:

3 x 5 = 15	15 ÷ 3 = 5
5 x 3 = 15	15 ÷ 5 = 3
15 = 3 x 5	5 = 15 ÷ 3
15 = 5 x 3	3 = 15 ÷ 5

To support children’s mental strategies for division, they may also be taught to **“partition”** the number that we are dividing by to give them numbers that are easier to handle, and then to recombine. Often we partition into tens and ones, (eg 28 = 20 + 8), but breaking it up into any more convenient chunks is also a helpful strategy, (eg 28 = 14 + 14).

So, to calculate 28 ÷ 2, we might partition 28 into 20 and 8,

20 ÷ 2 = 10

8 ÷ 2 = 4

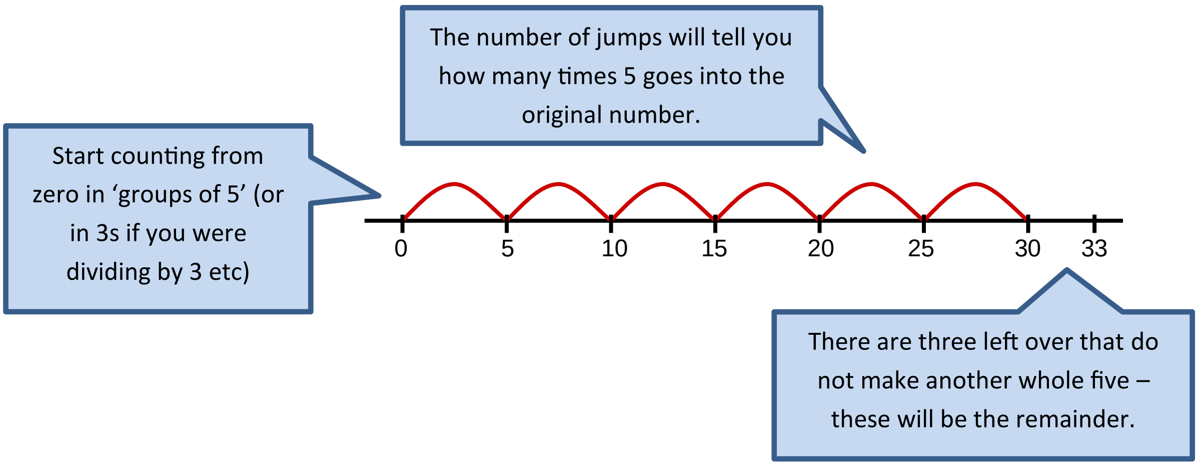
Finally, we would recombine (add) the 10 and 4 to reach the answer of 14.

Year 3

By year 3, most children are moving away from the direct representation of objects and will consistently be using number lines and partitioning as their main tools for division. Almost all children will now meet division problems with remainders as well as those that they can use their times tables to calculate.

To use a number line to calculate, we are looking to see how many times the divisor (ie. the number we are dividing by) goes into the original number:

33 ÷ 5 = 6 r3



When we are using the mental strategy of "partitioning", we are following a similar principle, in that we are trying to calculate how many times the divisor goes into the original number. However, we are now moving onto calculating this in "chunks" of the divisor rather than counting up in ones. We start with "known facts" and build from them.

eg. 50 ÷ 4 = 12 r2

10 x 4 = 40

2 x 4 = 8

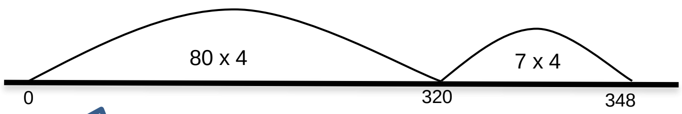
Because I know my 10 times table, I know that 10 times 4 is 40. I can get another 2 lots of 4 from 50, which is another 8, so I have 2 left over.

It is useful to always place the number being multiplied by in the same position in the calculation so that you can easily see how many groups have been made.

Year 4

By the end of year 4, children should be able to divide a two or three digit number by a one digit number. Most of them will still be using a number line or partitioning method, as their main "mental" strategy, but will be becoming more strategic in choosing the "chunks" that they use to calculate with.

Eg. 348 ÷ 4 = 87



If I know that 8 x 4 = 32, then I know that 80 x 4 =320. This is a good first jump as it gets me quite close to the target number of 348.

This method can also be recorded without the need for a number line by jotting the numbers that we partition the target number into.

Eg. 177 ÷ 4 = 44 r 1

40 x 4 = 160

4 x 4 = 16 (176)

This could also be used in contexts where there is a remainder.

During year 4, children will also be introduced to the traditional short written method for division. Sometimes this is known as the "bus-stop" method as the numbers appear to be written inside a bus shelter! This will start with calculations where the divisor is a single digit.

98 ÷ 7 becomes

$$\begin{array}{r|l} & 1\;\;4 \\ \hline 7 & 9\;\;{}^{2}8 \end{array}$$

Answer: 14

In this case, we would first ask ourselves how many sevens go into the 9 (tens) and record the answer above the 9. There will still be 2 tens left over and this is carried across to the 8. The next step is to find how many 7s there are in 28 and this is recorded above the 8. The answer is then 14.

Years 5 and 6

As the children move into year 5 and 6, we continue to develop the use of the number line and partitioning methods to support their mental calculations. In real life situations, for example when out shopping, it is much easier to work out how many of an item you can afford from a certain amount of money by counting up in sensible chunks, so this is a skill we do not want to lose. However, as calculations get more complex, the children become more reliant on the formal short written methods of short and then long division.

432 ÷ 5 becomes

$$\begin{array}{r|l} & \;\;\;\;8\;\;6\;\;r\,2 \\ \hline 5 & 4\;\;3\;\;{}^{3}2 \end{array}$$

Answer: 86 remainder 2

496 ÷ 11 becomes

$$\begin{array}{r|l} & \;\;\;\;4\;\;5\;\;r\,1 \\ \hline 1\;\;1 & 4\;\;9\;\;{}^{5}6 \end{array}$$

Answer: $45\frac{1}{11}$

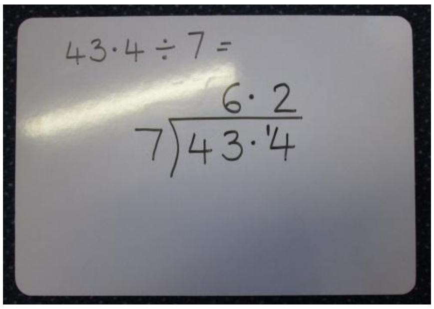
Some calculations will have remainders and the children are expected to interpret the remainder appropriately according to the context of the problem.

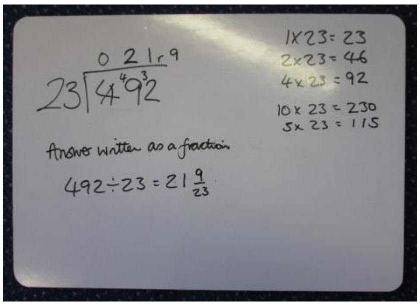
Sometimes the number remains as a remainder and we use this in the context where something can be “left over”. For example, when sharing out sweets there might be two left over at the end.

Alternatively, if the calculation were 27÷5, the remainder of 2 might also be shared out. Eg. if there were two cupcakes left over after sharing 27 cupcakes between 5 friends, I could cut these two up and each friend would have another 2 fifths of a cupcake each – one fifth of each left over cake. In total, each friend would have five and two fifths cakes!

A third alternative would be that we need to round the number up. For example I have 2 eggs left after placing all the other eggs in boxes, but I also need to keep these two eggs safe. In this case I would need another whole box.

Short division can also be extended to use with decimals.





With many calculations, the method for short division can be used for larger divisors, with the support of additional jottings. For example a child might “jot” some of their 23 times table down the side of the page to support their calculation. We encourage the children to use key multiples (see over) and use these to find others if they are needed.

Finally, some children may decide to use a more formal **long division** strategy.

eg.