Robert Le Kyng

Calculation Policy for Parents

Multiplication

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 multiplication, 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.

Multiplication

In the **Early Years**, multiplication is introduced in a practical context using toys and equipment to solve mathematical problems. For example, 3 plates with 2 cakes on each plate: 3 lots of 2.

Once the children are confident counting, we introduce the idea of counting in 2s and 10s.

Some children may be ready to start using jottings to represent each of the items. For example, 3 plates with 2 cakes on each plate: 3 lots of 2.

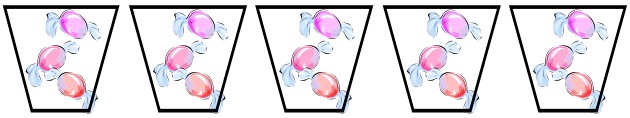
In this case, each cake is represented by a straight line.

Year 1

In year 1 the emphasis is on solving practical problems that involve combining groups of 2, 5 or 10. The numbers begin to become bigger, with some children working with numbers up to and beyond 100.

An example of this might be: There are three sweets in one bag.

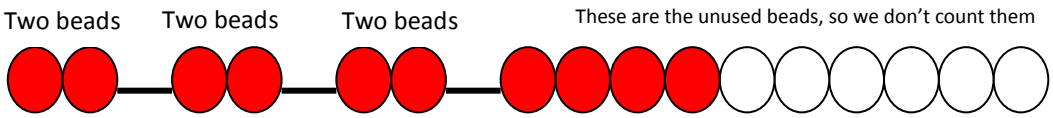
How many sweets are there in five bags?



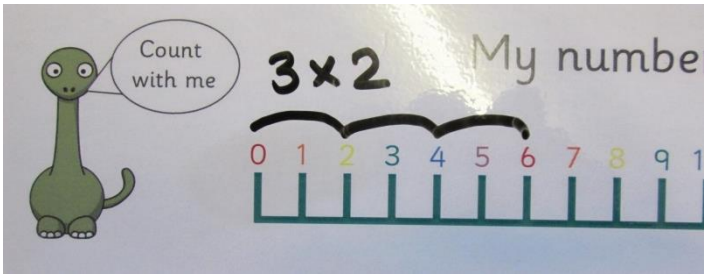
Initially, the children will still use practical equipment to help them model this, eg.

In this case, each of the sweets is represented by a cube.

Bead strings and number lines can also be used to show the calculation. In this case, the calculation is 3 x 2 **or** 2 x 3, (three groups of two **or** two, three times. The child moves three lots of 2 beads along the bead string and counts how many they have altogether.

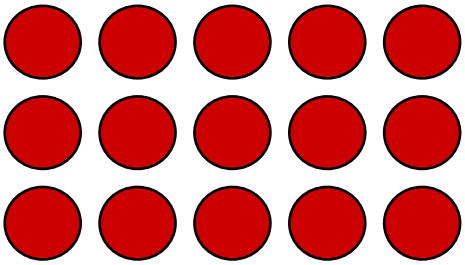


As the year moves on the children will learn to use a number line to represent this. For example the calculation above would look like this.



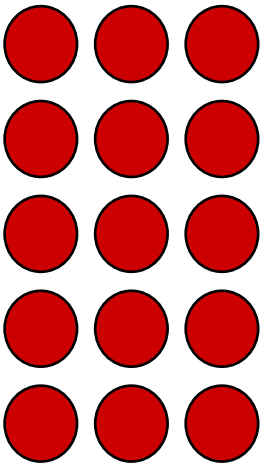
Some children may be ready at this point to work with larger numbers and to represent these using arrays. Eg.

5 x 3 or 3 x 5



In this case the "array" has 3 columns and five rows, so could represent five lots of three or three lots of five.

It is important that children begin to learn that multiplication can be done either way round in order to achieve the same answer, so an array that has five rows and three columns (as below) would be an equally good model for this calculation.



To support your child at home with multiplication, lots of counting in 2s, 5s and 10s will certainly help (both forwards and backwards)!

Year 2

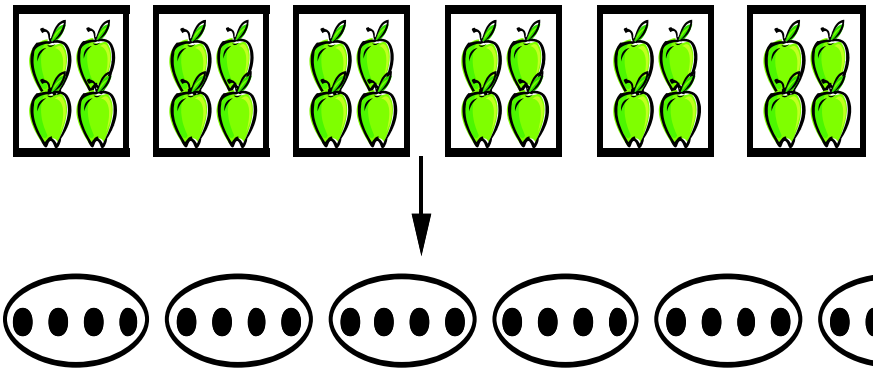
In year 2, the focus is on helping the children to see that multiplication is the same thing as "repeated addition". For example, '3 x 5 =' is the same thing as '5 + 5 + 5' (three groups of 5) or '3 + 3 + 3 + 3 + 3' (three, five times). This is again supported by the use of practical equipment, number lines and arrays.

Children should now begin to know their 2, 5 and 10 times tables (rather than just counting on in 2s, 5s and 10s) and by the end of the year be able to recall these facts quickly and efficiently eg, find 6 x 5 = 30 without having to count up through the times table.

They will still use pictures or jottings to support their calculation where appropriate.

Eg. There are four apples in each box.

How many apples in six boxes

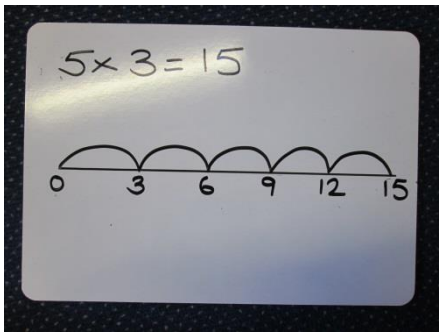


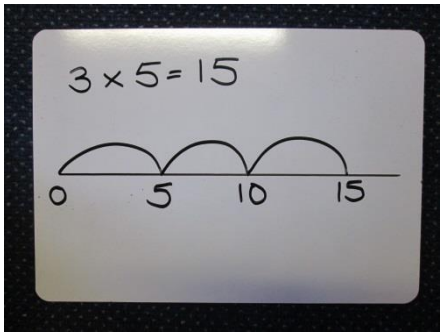
Some children will still need to "see" the apples in order to understand what the problem is asking them.

Many will be able to use 'jottings' to represent the apples.

By year 2, the number line begins to be the standard method for children to calculate multiplication problems. They will be taught to start with a blank number line and ten jump on from zero.

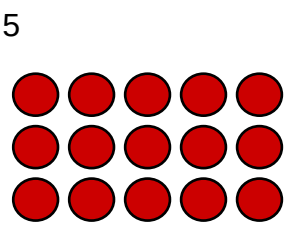
eg.

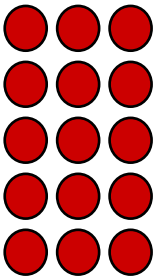




Arrays continue to be used to support children's understanding of what is happening in multiplication.

5 x 3 or 3 x 5





To help your child at home, support them with know their 2, 5 and 10 times tables. They also need to know all the doubles of the numbers up to 20, eg, double 12 is 24.

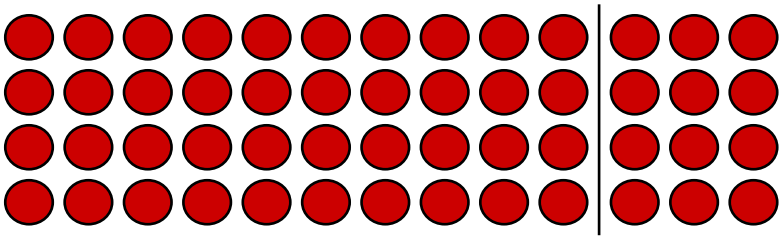
Year 3

In year 3, we move onto multiplying a two digit number by a single digit number using the times tables that they know. The children will first see this as an array.

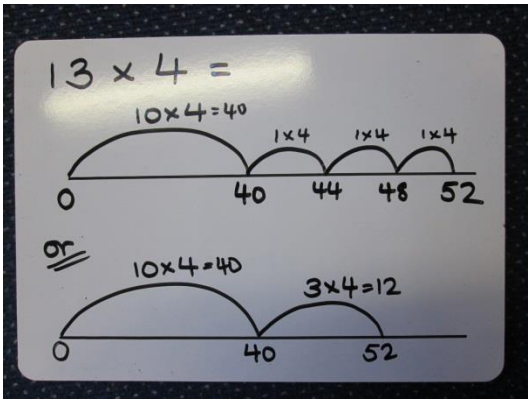
eg.

13 x 4

In this case, 13 is "partitioned" into a 10 and a 3. Each part of this is multiplied by 4 and the two answers are added together. (By the time children reach year 3, they should be very familiar with "partitioning" a number into its tens and units as part of their place value work in Key Stage 1.)



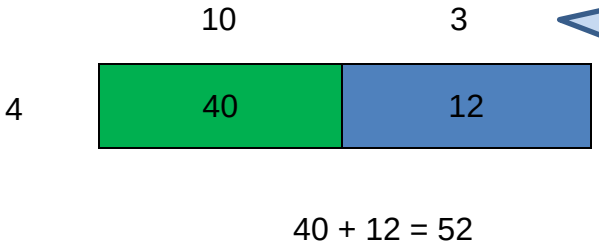
10 x 4 = 40 3 x 4 = 12 40 + 12 = 52



As the children are now becoming very familiar with some of their times tables, we can now skip a few steps when recording on a number line and take one larger jump of 10 x 4 to start with. Some children may then count on 3 more jumps of 4 and others might be ready to take 3 x 4 as one jump.

Once they are secure with this, they can use the "grid method", which is essentially a more efficient written way of recording the same calculations. We still need to partition the two digit number into its tens and units and calculate each part separately.

eg. 13 x 4 = 52



40 + 12 = 52

Once you have partitioned 13 into 10 and 3, you then multiply the 10 by 4 and place the answer in the first box and then multiply 3 by 4 and place that in the corresponding box. Most children will be able to add these together mentally to derive the final answer.

The children then use exactly the same calculations to move onto the "expanded vertical" method. This again, is a more efficient way of recording the same calculations.

```
  13
x  4
  12   (3 x 4)
  40   (10 x 4)
  52
```

You will notice that we now start from the units column in order to prepare for the short written method.

By the end of year 3 some children will be ready for the compact (or short) vertical method. This is the method that many of you may already be familiar with.

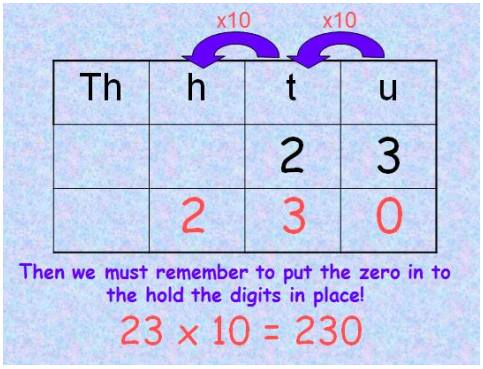
```
  13
x  4
 52
 1
```

First find 3 x 4, as previously. This gives us 12. Record the ten under the line in the tens column and put the units into the units column. Then find 10 x 4. You will need to add on the ten that you recorded under the line to give you the total of 5 tens.

As well as these written methods, the children will be expected to be able to recall their 2, 3, 4, 5, 8 and 10 times tables and to use them fluently.

Another skill that they will need is to be able to understand what happens to a whole number when we multiply by 10 or 100. We do not tell children that they add a zero to multiply by ten, as this does not work when they come to work with decimals (we still have many children telling us that 2.1 x 10 = 2.10 !).

We teach the children that to multiply by ten, all the digits move one place to the left on a place value chart and that if a gap is left in the units column we insert a zero as a “place holder”. Similarly, multiplying by 100 is taught as moving all the digits two places to the left.



This is because x 100 = x 10, then x 10 again.

Year 4

In year 4 we continue to develop these strategies, with increasingly more complex numbers. Initially, this is simply that the “tens column” now has more than one ten (eg. 43 is 4 tens and 3 units). The children will also work with a three digit number multiplied by a one digit number. For example:

Partitioning method:

43 x 6	**243 x 6 =**
40 x 6 = 240	200 x 6 = 1200
3 x 6 = 18	40 x 6 = 240
	3 x 6 = 18
240 + 18 = 258	1200 + 240 + 18 = 1458

Grid method:

eg. 43 x 6 =

	40	3
6	240	18

240 + 18 = 258

eg. 243 x 6 =

	200	40	3
6	1200	240	18

1200 + 240 + 18 = 1458

Expanded vertical method:

43		243	
x 6		x 6	
18	(3 x 6)	18	(3 x 6)
240	(40 x 6)	240	(40 x 6)
258		1200	(200 x 6)
		1458	

Compact vertical method

43		243	
x 6		x 6	
258		1458	
1		2 1	

By the end of year 4 children should know their times tables up to 12 x 12, so that they can quickly derive any of the times table facts. This is vital so that the children can use these fluently in year 5 and 6 to work with fractions and percentages.

Year 5

During year 5, the children will refine their written methods and then extend them to:

four digits multiplied by one digit (Th H T U x U);
two digits multiplied by two digits (T U x T U);
three digits multiplied by two digits (H T U x T U);
introducing tenths (U.t x U)

Some children will go back to the grid method when new concepts are introduced to give them a structure for finding all of the necessary steps in a more complex multiplication

eg. 47 x 36

x	40	7	
30	1200	210	
6	240	42	
	1440	252	1692

Start by multiplying 30 by 40, then do 30 by 7, 6 by 30 and finally 6 by 7. Add the answer of each column together and then find the final answer by adding these two.

To multiply multiples of 10 and 100, we encourage children to use their "known facts" and work step by step to get to the final answer Eg. 30 x 40 =

I know 3 x 4 is 12,
so I know 30 x 4 is 120,
so I know that 30 x 40 is 1200

or 4.7 x 8

x	4	0.7	
8	32	5.6	37.6

The same principle works when dividing by a decimal number Eg. 0.7 x 8 =

I know 7 x 8 is 56,
so I know 0.7 x 8 is 5.6

The expanded vertical method is another way of recording this:

237 x 24

237
x 24
28 (4 x 7)
120 (4 x 30)
800 (4 x 200)
140 (20 x 7)
600 (20 x 30)
4000 (20 x 200)
4688
1

When ready, the children then apply their new learning to the compact vertical method:

eg. 4.7 x 8

4.7
x 8
37.6
5

Although they should know their times tables by the end of year 4, it is crucial that they keep practising them. In order to work efficiently, children should be able to find any times table up to 12 x 12 quickly. They should also be able to use these to derive other number facts.

eg. If I know the 8 x 7 = 56, then I also know that 8 x 70 = 560 and 8 x 0.7 = 5.6

Year 6

In year 6, these methods are extended to numbers up to two decimal places and to traditional “long multiplication”.

The grid method may be used to consolidate understanding before moving to more formal written strategies:

5.65×9

(estimate: $6 \times 9 = 54$)

×	5	0.6	0.05	
9	45	5.4	0.45	50.85

Answer: $5.65 \times 9 = 50.85$

By the end of year 6 many children will use the traditional compact method of recording. This is what you may know as “long multiplication”.

eg. 2327 x 18
(estimate: 2000 x 20 = 40 000)

```
  2327
x   18
18616
 2 2 5

23270
41886
```

Start by multiplying the units of each number, then move onto multiplying the tens, hundreds and thousands of the first number by the units of the second number.

Put in a 0 as a place holder and then carry out the same process with the tens of the second number.

Add the two answers together to get final answer.