# Malmesbury Park Primary School

# Multiplication

Welcome!

This booklet is designed to show the progression of key written calculation methods taught across the school from Year R to Year 6. These methods build on the children's developing understanding of number, with the aim of becoming more efficient and succinct.

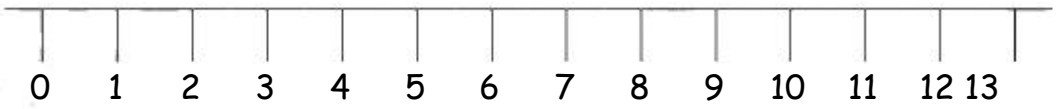
We hope that this booklet will help to explain some of the newer calculation methods we use in school as well as enabling you to work with your child at home with their maths. As the methods are taught in progression through the school, when helping your child, we recommend you start by looking at the method they have most recently been taught at school.

## Glossary

**Array** – An array is a systematic arrangement of objects, usually in columns and rows and is used as an image to represent multiplication.

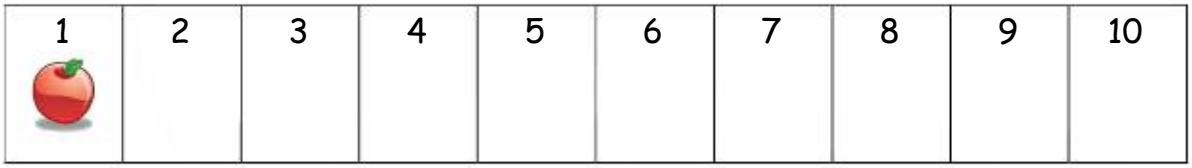

3x2=6

**Number line** – A line marked with numbers used by children to help them with their calculations. Number lines can be 'structured' with numbers already marked on, or 'unstructured' without numbers marked on.




**Number sentence** – the calculation written out with the answer.
e.g. 3 x 5 = 15

**Number track** – A track marked with numbers. Children can place objects on the track to help them count.




**Partitioning** – Splitting a number into each digit's place value. For example, if we partitioned the number 382 we would recognise it is made up of 300 + 80 + 2 or 3 hundreds 8 tens 2 units.

**Place Value** – The value of a digit within a number. For example, the place value of the digit 8 in the number 382 is 80 or 8 tens.

## Key for Arrows


A 'jump' forward (counting on) or backwards (counting back). The size of the jump is written above the arrow.

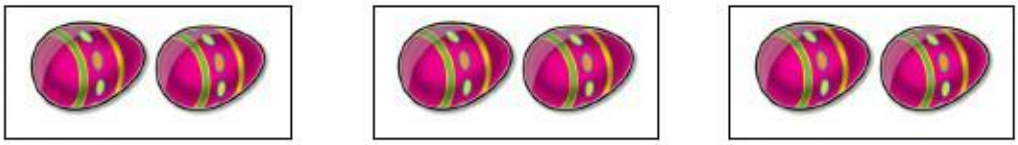
# 1. Using repeated addition for multiplication

In order to do this, children must:

- ✓ Be able to rote count in ones to 20 and beyond
- ✓ Begin to count in 2's, 5's and 10's
- ✓ Accurately count objects
- ✓ Begin to link multiplication to repeated addition

Children begin by understanding multiplication as repeated addition. They arrange concrete objects into groups of the same size, before adding the groups together using repeated addition.

Example problem: I have 3 boxes with 2 eggs in each box. How many eggs do I have altogether?



2 + 2 + 2 = 6

so 3 boxes of 2 is 6

3x2=6

Using concrete objects is a good way to help children count and enable them to visualise and understand what multiplication means. This is then extended from using concrete objects to pictorial representation with the total number written next to their drawing. In terms of language we talk about 'groups of' or 'lots of' the object (so 3 groups of 2 is…)

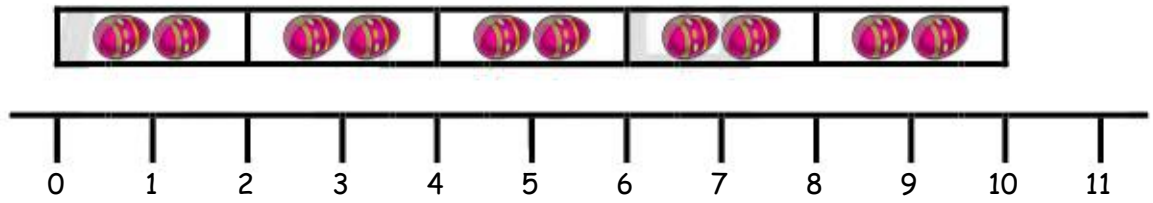
## 2. Repeated addition on a structured number line

In order to do this, children must:

- ✓ Be able to rote count in ones to 20 and beyond
- ✓ Begin to count in 2's, 5's and 10's
- ✓ Accurately count objects
- ✓ Begin to link multiplication to repeated addition

Once children are confident adding groups of objects, a structured number line or track can be introduced to begin a more formal arrangement. Children place the groups of objects and then pictorial representations onto the number line and use repeated addition to solve the calculation.

Example problem: Easter eggs are put into boxes of 2. I have 5 boxes, how many eggs do I have altogether?




Initially, children will count the total objects in ones (1, 2, 3, 4, 5, 6…), before beginning to count in multiples of the number of objects in each group (so in this case with a group size of 2, they count 2, 4, 6, 8, 10).

Problems are still set here in context and written as a number sentence (2 x 5 = 10) so children begin to recognise the symbol for multiplication. Even at this early stage, children can begin to build up some knowledge of times tables, beginning with 2x's 5x's and 10x's.

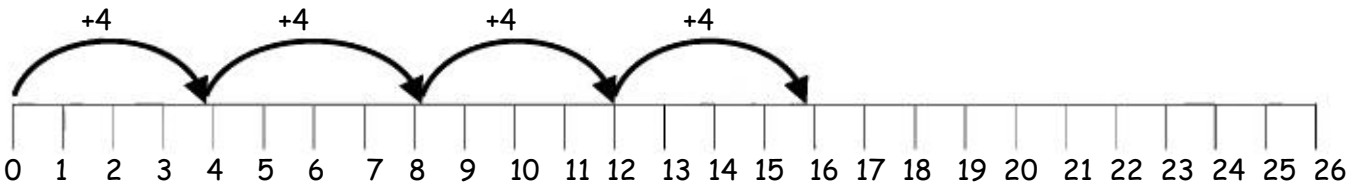
## 3. Repeated addition on an unstructured number line

In order to do this, children must:

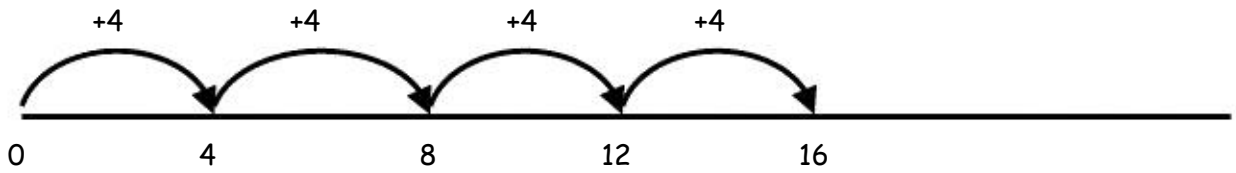
- ✓ Be able to count or add up in 2's, 3's, 4's, 5's, 6's, 7's, 8's and 10's
- ✓ Be developing an understanding of multiplying by 10
- ✓ Understand the concept of multiplication

At this stage, the pictures are removed from the number line, and the calculation is set out using jumps to represent the groups. Children now progress beyond counting in ones to count in multiples of the group number (2's, 4's, 5's, 10's etc)

Example problem: A teacher gives 4 pupils, 4 pencils each. How many pencils are given out in total?
4x4=




They then begin to draw their own blank number lines in order to record the jumps.




Children here record their answers as a number sentence.
4 x 4 = 16

## 4. Using known multiplication facts to aid repeated addition

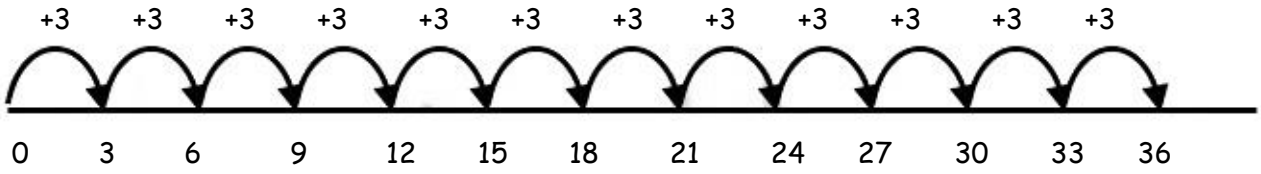
In order to do this, children must:

- ✓ Be able to count or add up in 2's, 3's, 4's, 5's, 6's, 7's, 8's and 10's
- ✓ Be developing an understanding of multiplying by 10
- ✓ Understand the concept of multiplication
- ✓ Be able to recall the 2x's, 5x's and 10x's tables up to 10x10

As the children begin to multiply larger numbers, they should begin to consider multiplication facts already known to them to help them solve problems.

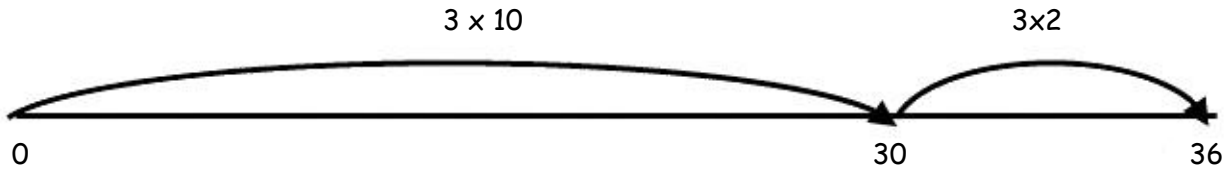
Example problem: 3 x 12 =

Where pupils are yet to secure their tables knowledge, they can work out the answer by adding 12 lots of 3 together.




However, by partitioning the 12 into a 10 and a 2, if they already know that 10 lots of 3 is 30 and that 3 groups of 2 is 6, they can calculate the answer much quicker by adding these two known facts together.

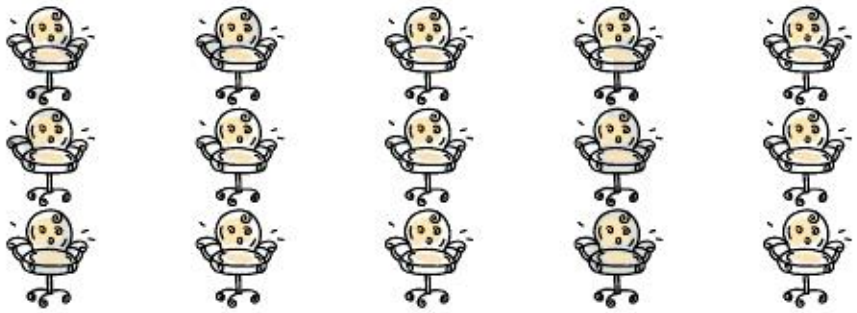
This can be recorded on a number line like this:



## 5. Using arrays to solve multiplication

Arrays can be used to support children's developing understanding of multiplication by arranging items in an ordered manner to aid addition. Children use objects and then pictorial representations and arrange them into rows as an array, then use repeated addition to solve the problem.

Example problem: There are 3 rows of chairs with 5 chairs in each row. How many chairs are there?

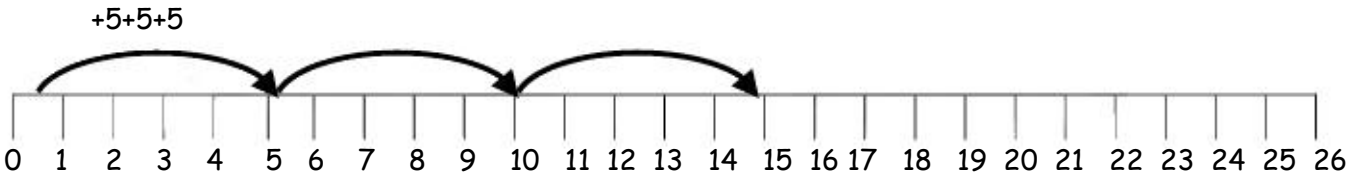


3 rows of chairs

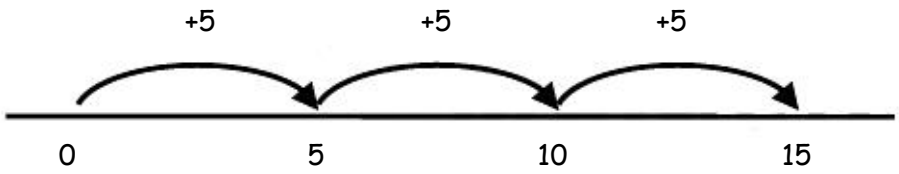
Children solve this problem by carrying out 5 + 5 + 5 = 15 or 3 x 5 = 15.

It is important to note that this problem could also be solved as 3 + 3 + 3 + 3 + 3 = 15 or 5 x 3 = 15.
3 x 5 = 15 gives the same result as 5 x 3 = 15.

Alongside the array, this problem can be demonstrated on a structured number line:




Or a blank number line:

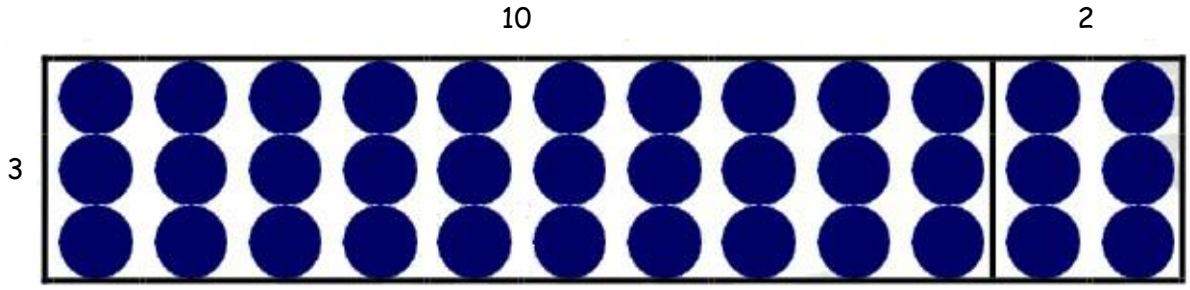


## 6. The Grid Method

In order to do this, children must:
- ✓ Understand the concept of multiplication
- ✓ Recall times tables up to 10x10
- ✓ Be able to partition numbers into hundreds, tens and units.

The grid method begins to organise the partitioning of numbers to aid multiplication.
Example problem: There are 12 players in a football team. How many players are there in 3 teams?

To begin, 12 lots of 3 are arranged in an array, pictorially broken down into 10 x 3 and 2 x 3.




The children then calculate 10x3, and 2x3 and add the results to give the final answer.
30 + 6 = 36

At this stage, the learning is reinforced by the use of pictures or counters, so pupils have a clear visual representation of the problem.

Once pupils have grasped how the numbers are partitioned and then multiplied, the grid can be drawn without the pictorial representation.

Example problem: There are 17 bunches of flowers in the shop. Each bunch has 8 flowers in it. How many flowers are there altogether?
8 x 17 =

| X | 10 | 7 |
|---|---|---|
| 8 | 80 | 56 |

= 136

First calculate 10 x 8 = 80

Then 7 x 8 = 56

Finally add 80 and 56 together to give the answer of 136.

This grid method can then be extended to multiplying larger numbers by adding in extra columns or rows onto the grid as needed.

Example problem: There are 12 children in a team. How many in 14 teams?

12 x 14 = 168

| X | 10 | 2 |
|---|---|---|
| 10 | 100 | 20 |
| 4 | 40 | 8 |

= 120

= 48

Here the total for each row is found first, before the two row totals are added together to give the answer.

120 + 48 = 168

Example problem: There are 11 cartons of juice in a box. 144 boxed are delivered. How many in cartons of juice?

11 x 133 = 1584

| X | 100 | 40 | 4 |
|---|---|---|---|
| 10 | 1000 | 400 | 40 |
| 1 | 100 | 40 | 4 |

= 1440

= 144

1440 + 144 = 1584

The method also works when multiplying decimals, although by the time children come to multiply decimals, they will most likely have progressed to the next stage.

Example problem: 2.5 x 13 =

| X | 10 | 3 |
|---|---|---|
| 2 | 20 | 6 |
| 0.5 | 5 | 1.5 |

= 26

= 6.5

26 + 6.5 = 32.5

## 7. Long multiplication (expanded column method)

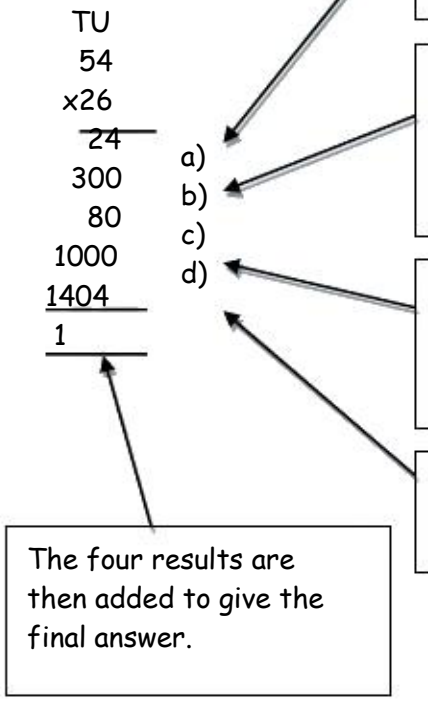
In order to do this, children must:

- ✓ Recall times tables up to 12x12
- ✓ Have secure place value knowledge
- ✓ Be able to use knowledge of multiplying by 10 or 100 to help with their calculations (e.g. knowing that 3x5 = 15, so 30x5 = 150)
- ✓ Be able to add using formal column method

This expanded form of multiplication bridges the gap between the grid method and the short-hand formal multiplication method. Whilst it is set out differently from the grid method, the process is actually the same. The expanded form helps to illustrate these similarities.

Example problem: 54 x 26

Children begin by setting out the multiplication much the same way as other formal methods, with the two numbers over each other, tens and units lined up.




First, 4 x 6 is calculated (the units from each number), and the answer (24) written underneath the line, keeping the columns lined up.

Next, 6 x 50 is calculated (the units of the bottom number x the tens of the upper number). The answer (300) is written underneath.

Next, 20 x 4 is calculated (the tens of the bottom number x the units of the upper number). The answer (80) is written underneath.

Finally, 20 x 50 is calculated (the tens of each number), and the answer (1000) written underneath.

In terms of the grid method, children are essentially calculating each answer from the grid, in this order:

| X | 50 | 4 |
|---|---|---|
| 20 | d) | c) |
| 6 | b) | a) |

## 8. Short multiplication

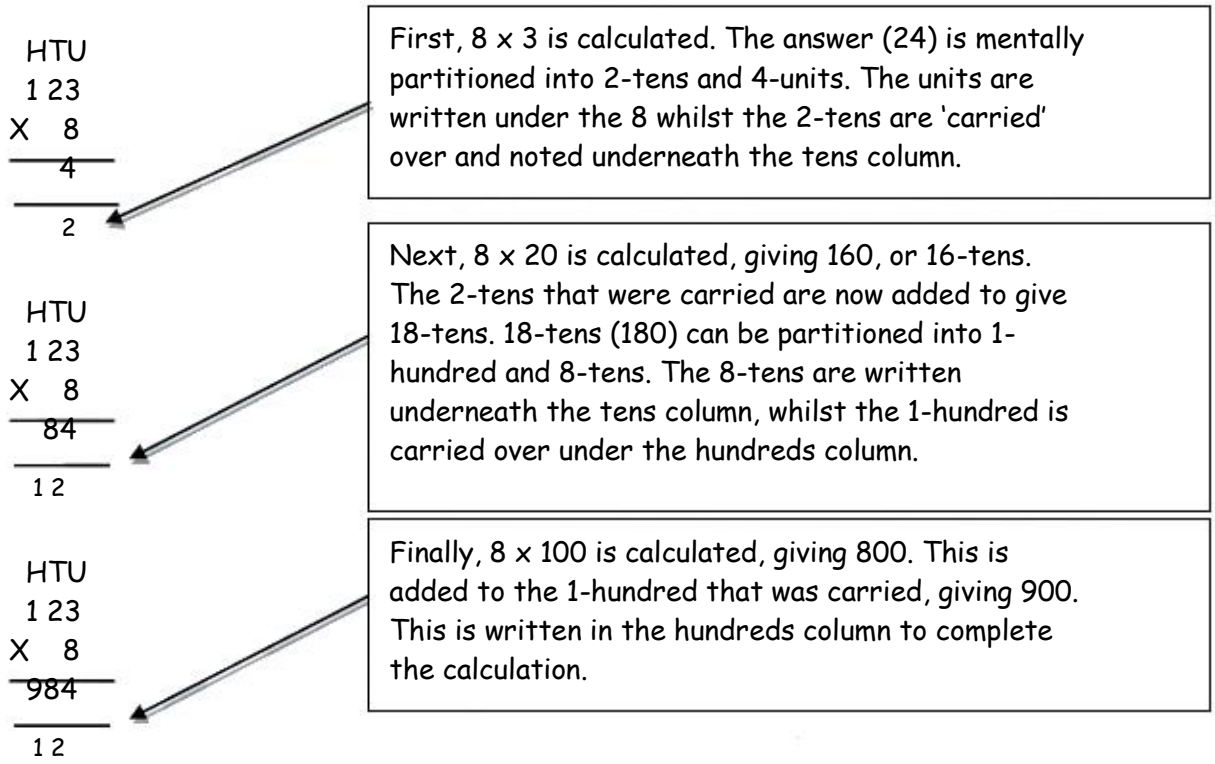
In order to do this, children must:

- ✓ Recall times tables up to 12x12
- ✓ Have secure place value knowledge
- ✓ Be able to use knowledge of multiplying by 10 or 100 to help with their calculations (e.g. knowing that 3x5 = 15, so 30x5 = 150)
- ✓ Be able to add using formal column method, carrying numbers mentally

Short multiplication removes the middle stages from the formal method, and so children must ensure they are still multiplying all possible combinations (i.e. all the individual cells in the grid method) to ensure they get the right answer.

Example problem: 123 x 8

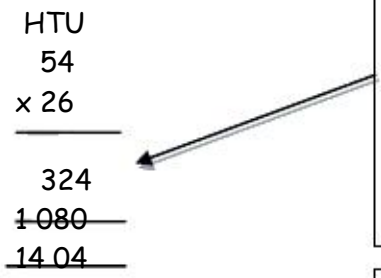
Children start by setting out the calculation as before:



When multiplying two 2-digit numbers together, or a 2- and a 3-digit number, the method is again expanded slightly.

Example problem: 54 x 26


Here, the 6 from the lower number is first multiplied by both the 4 and the 50 from the top number, and the answer noted down.
6 x 4 = 24… note the 4, carry the 2-tens, as before.
6 x 50 = 300… add the 2-tens to give 320, note this down next to the 4.



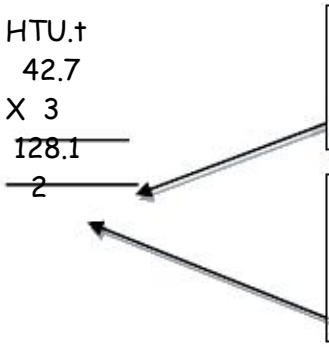

Next, the 20 from the lower number is multiplied by both the 4 and the 50 from the top number, and the answer noted down.
20 x 4 = 80… note the 80 (remembering the 0 in the units column)
20 x 50 = 1000… note this down next to the 80.

Finally, add these two partial answers to give the final answer.

Some pupils may progress further with this method, to multiplying numbers with 1- or 2- decimal places by a single digit number.

Example problem: 42.7 × 3

Children are encouraged to make an estimate first, by rounding the numbers to whole 10's or 100's. In this case, 42.7 x 3 is approximately 40 x 3 = 120.




As 3 x 7 = 21, 3 x 0.7 = 2.1 or 2-units and 1-tenth
The 1-tenth is noted down and a decimal point added.
The 2-units are carried.

The calculation is then completed as before:
3 x 2 = 6, plus the carried 2, gives 8 units.
3 x 40 = 120, giving a answer of 128.1

Pupils who are very confident multiplying and dividing by 10 may prefer to solving this problem by multiplying 42.7 by 10 first to give 427. 427 is then multiplied by 3, giving 1281. 1281 can then be divided by 10 again to give 128.1