Year 1

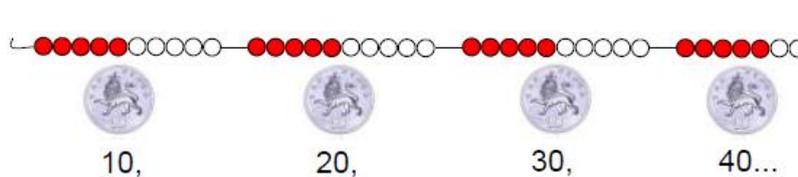### Expectations in number and multiplication.

KPI: Solve one step problems involving multiplication by calculating the answer using concrete objects, pictorial representations and arrays, with the support of the teacher.

Count in 2s, 5s and 10s and begin counting in 3s.

Representations of number:

Introduce the x symbol once repeated addition is understood.

Show multiplication using pictures as repeated addition.

1 group of 3 = 3   and   2 groups of 3 = 6

3 x 2 =6 three lots/groups of 2

By grouping small quantities, children should begin to gain some understanding of multiplication.

At this stage, they will solve simple problems using repeated addition, although the language of multiplication will also be introduced.
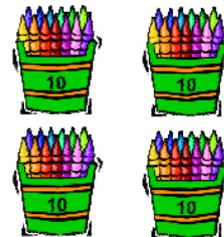
There are 10 crayons in each box. How many are there altogether?

10 + 10 + 10 + 10 = 40 crayons

There 4 groups of 10

10 x 4 = 40

10 multiplied by 4 is 40

How much money do I have?

5 + 5 + 5 + 5 + 5 = 25p

The are 5 lots of 5p

5 x 5 = 25

Providing opportunity for multiplying in different c contexts.

Understand patterns when dealing with multiples – describe the pattern, what number will come next? Will 47 be in the pattern? Why? How do you know?
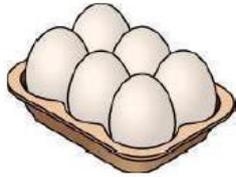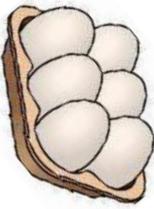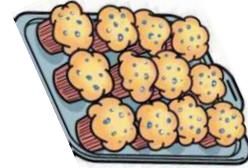
Arrays will also be used to help children visualise and understand multiplication. Represent the number in real life contexts to start:
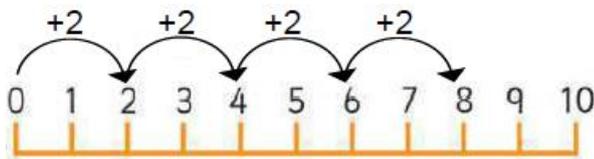
3 x 2 is the same as 2 x 3
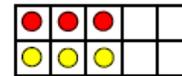
4 x 3 is the same as 4 x 3

These everyday items, arranged in rows and columns, highlight an important multiplication fact to the children: that multiplication can be done in any order (commutative)
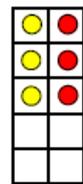
<u>Written strategies for multiplying:</u>

Using repeated addition on the number line

Use of the tens frame to develop arrays; moving from real life contexts as above

3 x 2 =

2 x 3 =

Year 2

Expectations in number and subtraction

Key Skills: Recall and use multiplication facts for the 2, 5 and 10 times tables, including recognising odd and even numbers.

Know tables facts 2s, 10s and 5s and begin counting in 3s and 4s

Calculate mathematical statements for multiplication within the multiplication tables and write them using x and =

Know that multiplication of two numbers can be done in any order (commutative).

Solve problems involving multiplication using materials, arrays, repeated addition, mental methods and multiplication facts, including problems in context.

Representations of number:
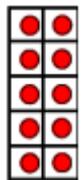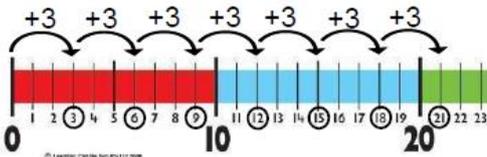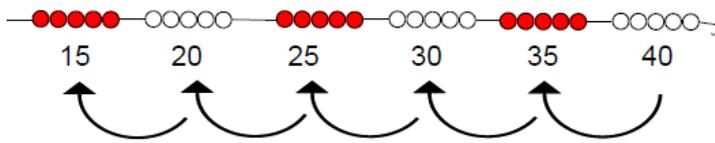
Use accurate vocabulary including double, multiply, groups of, sets of, lots of.

Understand what happens to a number when you multiply it by 10; be able to explain the movement of the digits.

Calculate multiplication and division statements within the multiplication tables and write them using multiplication (x), division (÷) and equals (=) signs.

Multiplication:

Children should continue to use **grouping** or **number lines** to calculate other unknown multiplications, developing their understanding of multiplication as **repeated addition**.
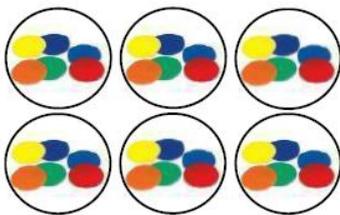
$6 \times 6 = ?$
6 groups of 6
$6 + 6 + 6 + 6 + 6 + 6 = 36$
$6 \times 6 = 36$

Developing into a representation on a marked number line then to a blank one:

$6 \times 4 = ?$
6 lots of 4
$4 + 4 + 4 + 4 + 4 + 4 = 24$
$6 \times 4 = 24$

$3 \times 6 = ?$
3 lots of 6
$6 + 6 + 6 = 18$
$3 \times 6 = 18$

Using known facts to solve missing number problems:

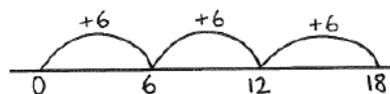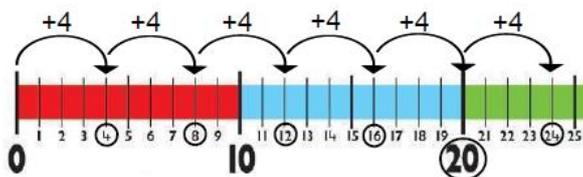Which of these numbers are in the 5 times table? How do you know?

72	45	53
80	69	95

$7 \times 2 = \square$

$\square \times 2 = 14$

$7 \times \square = 14$

$\square \times \bigcirc = 14$

5 times table
1 × 5 = 5
2 × 5 = 10
3 × 5 = 15
4 × 5 = 20
5 × 5 = 25
6 × 5 = 30
7 × 5 = 35
8 × 5 = 40
9 × 5 = 45
10 × 5 = 50
11 × 5 = 55
12 × 5 = 60

10 times table
1 × 10 = 10
2 × 10 = 20
3 × 10 = 30
4 × 10 = 40
5 × 10 = 50
6 × 10 = 60
7 × 10 = 70
8 × 10 = 80
9 × 10 = 90
10 × 10 = 100
11 × 10 = 110
12 × 10 = 120

The 5 times table is half the 10 times table. So to find 6 x 5, I could work out 6 x 10 and then halve it!

As well as knowing doubles up to 10 + 10, children should use these known facts to double bigger, 2-digit numbers.

Double 22 =   Double 20   + double 2 =

Double 35 = 30 x 2 + 5 x 2

```
        35
      /    \
   x2        x2
   60        10
      \    /
        70
```
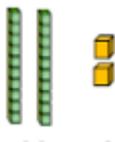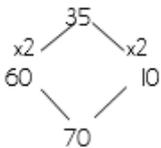
Leading into jottings of partitioning to double.

Year 3

Expectations in number and multiplication.

Key Skills: Count from 0 in multiples of 4, 8, 50 and 100.

Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including 2-digit and 3 digit numbers x 1 digit numbers, using mental and progressing to written methods.

Solve problems, including missing number problems, involving multiplication with corresponding problems in which *n* objects are connected to *m* objects.
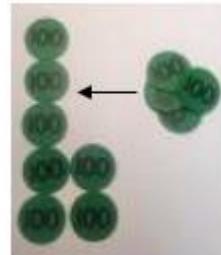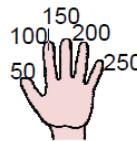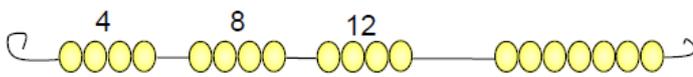
Recall and use multiplication facts for the 3,4 and 8 times tables, in addition to 2,3, 5 and 10

Be able to recall facts in any order.

Multiply one and two digit numbers by 100, be able to explain the movement of the digits.

Understand that multiplication can be done in any order/commutative law and it is the inverse of division.

Representations of number:

Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables.
As children become more familiar with their multiplication and division facts, they should start to see the links between the different tables.

Look! The 4 times table is just double the 2 times table!

And the 8 times table is double the 4 times table!

This will strengthen the children's awareness of the **commutativity of multiplication** (that is, when we swap the number over, we still get the same answer: 7 x 3 = 3 x 7). It will also help them grasp that multiplication and division are **inverse operations**.

21
3 × 7 = 21
7 × 3 = 21
21 ÷ 3 = 7
21 ÷ 7 = 3
7   3

x4   x4
12   120
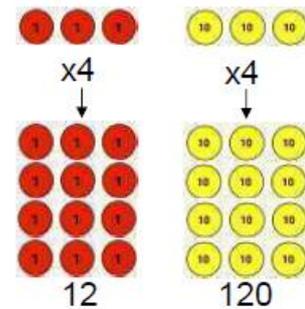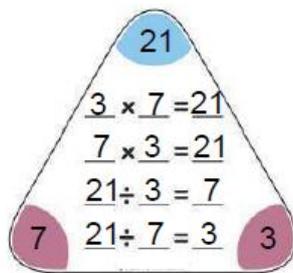
Place value counters can be used to demonstrate this idea.

Children should also start to use facts that they know to make links with other facts, for instance with numbers that are 10 times bigger (multiples of 10).

Write and calculate multiplication statements using the multiplication tables that they know, including two-digit numbers multiplied by one-digit numbers, using mental methods before progressing to formal written methods.

Multiplication:

36 x 5 = ?
30   6

30 x 5   +   6 x 5

150   +   30   =   180

Once the children are ready to multiply bigger numbers, they are taught to partition them first. By breaking the number up into smaller parts, the calculation becomes much easier to deal with.

Informal written methods

15 x 5 = 75

10 x 5 = 50
5 x 5 = 25
50 + 25 = 75

24 x 3 =
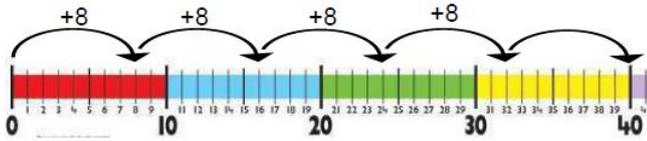
20 x 3 = 60
4 x 3 = 12
60 + 12 = 72

Use place value counters to begin to develop grid method of multiplication: 42 x 3 = 126
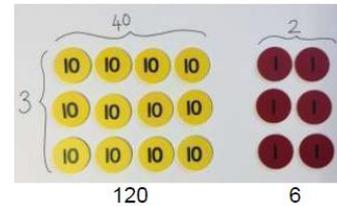
Once confidence is gained in using counters, move into grid method

53 x 3 = 159
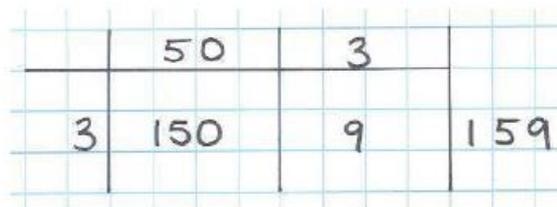
	50	3	
3	150	9	159

Year 4

Expectations in number and multiplication.

Key Skills: Know table facts up to 12 x 12

Count in multiples of 6,7,9, 25 and 100.

Use place value, known derived facts to multiply mentally

- Including multiplying by 0 and 1
- Including multiplying together three numbers.

Recognise and use factor pairs and commutativity in mental calculations.

Solve problems, including missing number problems, involving multiplication with harder corresponding problems in which n objects are connected to m objects and including using the distributive law to multiply two-digit numbers by 1 digit and integer scaling problems.

Explain the effect of multiplying by 10 and 100

Partition TU x U, HTU x TU, HTU x HTU

Multiply 2 digit and 3 digit numbers by a 1 digit number using a formal written layout

Know table facts up to 12 x 12

Representations of number:
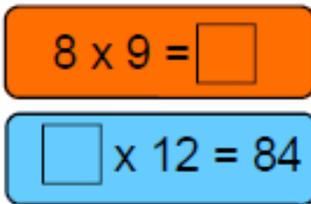

Knowing their factor pairs (which two numbers multiply together to make a particular value) is another skill the pupils need to acquire.

$70 \times 7 = 490$

$70 \times 70 = 4,900$

$7 \times 700 = 4,900$

$70 \times 700 = 49,000$

$7 \times 7 = 49$
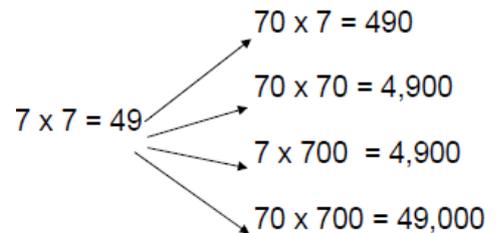
Using known multiplication and division facts, children should be able to derive other associated facts for multiples of 10 and 100. Place value counters can help pupils to visualise this

For some calculations, children may be able to mentally partition the numbers and work the answer out by jotting bits down.

$7 \times 700 = 4,900$

$$6 \times 17$$
$$= 6 \times 10 + 6 \times 7$$
$$= 60 + 42$$
$$= 102$$
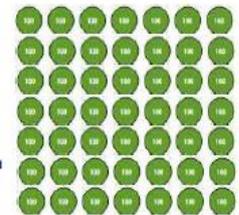
Pupils must also be able to tell you what happens when you multiply a number by 0, or when you multiply a number by 1. They should master how to multiply three numbers together too. Through practise, they will notice that, no matter how they group the numbers, they will always get the same answer.

Multiply two-digit and three-digit numbers by a one-digit number using a formal, written layout.

Pupils should focus on deepening their understanding of the grid method to multiply a two-digit number by a one-digit number. Place value apparatus can be used to embed this.
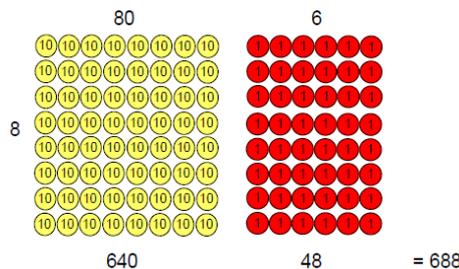
80   6

8

640   48   = 688

86×8

When pupils are ready, they can move away from using place value counters and record this method on paper using a grid instead.

69 x 7 = ?

	60	9	
7	420	63	483

69 x 7 = 483

453 x 6 = 2718

	400	50	3	
6	2400	300	18	2718

The pupils should then progress to using the **expanded column method**, whereby the same process is used, only now the information is recorded in columns.

```
  6 9
x   7
  6 3   (7 x 9)
4 2 0   (7 x 6 0)
4 8 3
```

Recording this will help pupils to keep track of their calculation.

```
  4 5 3
x     6
    1 8   (6 x 3)
  3 0 0   (6 x 5 0)
2 4 0 0   (6 x 4 0 0)
2 7 1 8
```

Move to 3 digits by 1 digit when secure

When they are ready, pupils reduce their recordings even further and start using **short multiplication (by a unit)**.

In this calculation, first we multiply the 3 by the 6.

3 x 6 = 18, which has 1 ten and 8 units.

We write down the 8 in the units column and then carry over the ten into the tens column. The 'carry digits' are recorded below the line.

Next, we multiply the 5 (which is really 50) by 6.

5 x 6 lots of 10 = 30 lots of 10. With the 10, which was carried over, added on, we now have 31 lots of 10.

The 1 is written in the tens column and the 3 is carried over into the hundreds column. Finally, we can calculate 4 x 6 = 24.

Add on the 3 carried over to get 27. This is written down to the left of the 1.

```
  4 5 3
x     6
2 7 1 8
  3 1
```

Year 5

Expectations in number and multiplication.

Identify factors and multiples, including finding all factor pairs of a number and common factors of two numbers.

Solve problems involving multiplication where larger numbers are used by decomposing them into their factors.

Multiply numbers up to 4 digits by a 1 or 2 digit number, using a formal written method, including long multiplication for 2 digit numbers (Th HTU, HTU, TU x TU and U)

Multiply numbers mentally by drawing on known facts.

Multiply whole numbers and those involving decimals by 10, 100 and 1000.

Recognise and use square numbers and cube numbers. Solve problems involving multiplication, including their knowledge of factors, multiples, squares and cubes.

Representations of number:

Children should be able to use the vocabulary multiple and factor correctly and consistently. Factors are numbers you can multiply together to make another number.

A number can have several factors:

$$24$$
1 x 24
2x 12
3 x 8
4 x 6

A number can have some of the same factors as another number.

1 and 7 are common factors of 21 and 14.

Know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers; establish whether a number up to 100 is a prime number and recall prime numbers up to 19.

Pupils must be able to explain, and find examples of, prime numbers. These are whole numbers that can only be divided evenly by 1 or itself. In other words, they only have two factors.

Any number that is NOT a prime number, is a composite number, which is a number that can be divided evenly by numbers other than 1 or itself. The number 1 is the only exception; it is considered neither a prime number, nor a composite one.

Prime factors are factors of a number that are prime numbers.
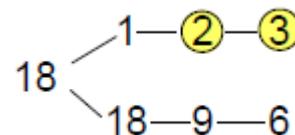
Prime numbers are often considered the 'basic building blocks' of all other numbers, since all composite numbers can be made up of prime numbers multiplied together.

$$12 = 2 \times 2 \times 3$$

This can form the basis of a great investigation for pupils.

Multiply and divide numbers mentally, and recognise and use square and cube numbers (and their notations).

A number of efficient mental calculation strategies should be made available to the pupils; they should not be expected to rely solely on written strategies. Using their times table knowledge, they may want to partition the numbers in their head first and then multiply each part mentally. They may find it helpful to make jottings as they go.

$$35 \times 6 = 30 \times 6 \quad + \quad 5 \times 6$$
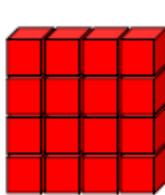$$= 180 \quad + \quad 30$$
$$= 210$$

Other strategies may include:

To multiply by 4:
Double and then *double* again.
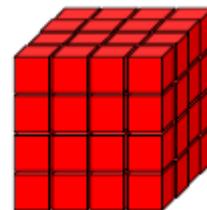
To multiply by 20:
Multiply by 10 and then *double.*

To multiply by 5:
Multiply by 10 and then *halve.*

They should also recognise square and cube numbers, and use the appropriate notation.

4^2
$= 4 \times 4$
$= 16$

4^3
$= 4 \times 4 \times 4$
$= 64$

Multiply and divide whole numbers, and those involving decimals, by 10, 100 or 1000.

It is essential that children are able to identify and apply rules for multiplying and dividing by 10, 100 and 1000.

Place value charts, like this one, are used to demonstrate how far the digits move, and in what direction, when multiplying or dividing by 10, 100 or 1000. Pupils are encouraged to use these charts until they are confident enough to do it without.

$432 \times 10 = 4320$
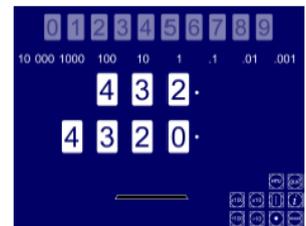
It can be tempting to teach the children to simply 'add a 0 on the end' when multiplying by 10, or add two 0s when multiplying by 100, and so on. However, this approach falls apart when multiplying a decimal number.

Multiply numbers up to four digits by a one or a two-digit number using a formal written method, including long multiplication for two-digit numbers.

When pupils first start multiplying four-digit numbers, they may prefer to revert to the expanded column method until they feel more confident.

$3628 \times 4 = ?$

```
    3 6 2 8
  x       4
  _____
        1 6    (4 x 4)
        8 0    (4 x 2 0)
    2 4 0 0    (4 x 6 0 0)
  1 2 0 0 0    (4 x 3 0 0 0)
  _____
  1 4 4 9 6
```

They should move on to using short multiplication when they are ready.

Use **short multiplication** using least significant digit first.

24 × 6 becomes

```
      2  4
×        6
_____
   1  4  4
      2
```

Answer: 144

342 × 7 becomes

```
      3  4  2
×           7
_____
   2  3  9  4
      2  1
```

Answer: 2394

2741 × 6 becomes

```
   2  7  4  1
×           6
_____
1  6  4  4  6
   4  2
```

Answer: 16 446

Long Multiplication

24 × 16 becomes

```
         2
      2  4
×     1  6
_____
   2  4  0
   1  4  4
_____
   3  8  4
```

Answer: 384

The first step is to solve 76×8 using the **short multiplication** method (see Year 4). The 5 in 58 is 50, or 5 lots of 10. So, instead of multiplying by 50, we can multiply by 10 first and then 5.

To multiply by 10, we move our digits one place to the left; this can be done by putting a 0 in the units column. **Short multiplication** can then be used to multiply the 76 by 5.

Here is an example of a three-digit number being multiplied by a two-digit one:

Year 6

Expectations in number and multiplication.
Know all times tables to 12.
Children to choose suitable method for number size.
Children need to recognise and use cubed numbers up to 12 x 12

Representations of number:
Perform mental calculations, including those with mixed operations and large numbers.
Children should be able to draw upon a number of different mental strategies to help them solve some calculations in their head.

To multiply by 4: *Double* and then *double* again.

To multiply by 5: *Multiply by 10* and then *halve.*

To multiply by 20: *Multiply by 10* and then *double.*

To multiply by 9: *Multiply by 10* and then *adjust.*

To multiply by 6: *Multiply by 3* and then *double.*

As well as knowing the square numbers up to 12 x 12, pupils are also expected to derive the corresponding squares of multiples of 10:

e.g. 8 x 8 = 64 so... 80 x 80 = 6400

The strategy of rounding should also be used to help make sensible approximations when multiplying or dividing decimal numbers:

3.6 x 18.2
becomes+. 4 x 18 = 72

Use their knowledge of the order of operations to carry out calculations involving the four operations.
The term 'operation' refers to the function being carried out in a calculation, such as adding, subtracting, squaring, multiplying and so on. When children are presented with a calculation that includes more than one operation, they need to know which is the correct order to complete it, as doing so in the wrong order will result in an incorrect answer.

For instance, the following calculation will generate two different answers, depending on how it is completed:

$$6 \times 9 + 4 = ?$$

Either... $54 + 4 = 58$

or... $6 \times 13 = 78$

Therefore there needs to be a set of rules for children to follow. We use the acronym BODMAS to help them remember.

B   brackets
O   orders - squared, cubed, square root
DM   division and multiplication
AS   addition and subtraction

In this regard, the correct order to have completed the example calculation above is:

$$6 \times 9 + 4 = ?$$
$$54 + 4 = 58$$

Multiply multi-digit numbers up to four digits by a two digit whole number using the formal written method of long multiplication.

```
        6 7 4 9
    ×     2 6
    4 0 4 9 4
  1 3 4 9 8 0
  1 7 5,4 7 4
```

Multiply one-digit numbers with up to two decimal places by whole numbers.
When multiplying a decimal number, it is important to place the decimal point on the answer line before doing anything else. Short multiplication should then be used to complete the rest.

```
      4 . 8 3
    ×       7
  3 3 . 8 1
      5   2
```

```
      9 . 2 2
    ×     3 7
    6 4 . 5 4
  2 7 6 . 6 0
  3 4 1 . 1 4
```

Long multiplication can used to multiply a decimal number by a two-digit whole number **Least significant digit first**. Again, the decimal point should be placed on the answer line first.

Decimals – Teach pupils to use known facts to build new facts, eg.
0.75 x 6
0.7 x 6 = 4.2
0.05 x 6 = 0.3
0.75 x 6 = 4.5