KINGS ASH ACADEMY

Calculation strategies for multiplication

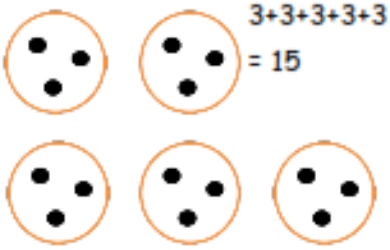
<u>Year 1</u> Multiply with concrete objects, arrays and pictorial representations.

Present practical problem solving activities involving counting equal sets or groups using concrete objects, pictorial representations and arrays to support.

How many legs will 3 teddies have?

2 + 2 + 2 = 6

There are 3 sweets in one bag.
How many sweets are in 5 bags altogether?



3+3+3+3+3
= 15

Mental Calculations:

- Count in multiples of 2s, 5s and 10s.
- Begin to double numbers using concrete objects and pictorial representations to support.

Points to consider:

Key Vocabulary: groups of, lots of, times, array, altogether, multiply, count

Children should:

- Be given experience of counting equal groups of objects in 2s, 5s and 10s.
- Be given practical problem solving activities involving counting equal sets or groups.

Key skills for multiplication at Y1:

- Count in multiples of 2, 5 and 10.
- Solve one step problems involving multiplication, by calculating the answer using concrete objects, pictorial representations and arrays with support.
- Make connections between arrays, number patterns and counting in 2s, 5s and 10s.
- Begin to understand doubling using concrete objects and pictorial representations.

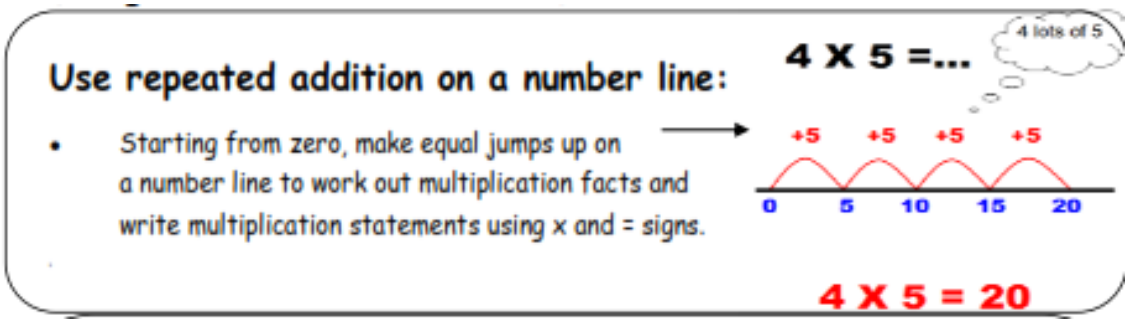
The Big Ideas for Y1:

- The Counting in steps of equal sizes is based on the big idea of 'unitising' ; treating a group of, say, five objects as one unit of five.
- Working with arrays helps pupils to become aware of the commutative property of multiplication, that 2 × 5 is equivalent to 5 × 2.

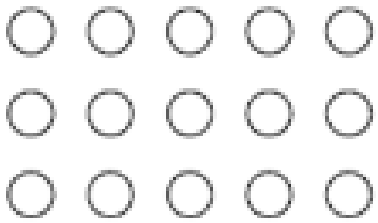
Year 2 Multiply using arrays and repeated addition (using at least 2s, 5s and 10s).

Use repeated addition on a number line:

Starting from zero, make equal jumps on a number line to work out multiplication statements using x and = signs. Children should be aware that 4 x 5 is the same as 5 x 4.



Use **arrays** to help teach children to understand the commutative law of multiplication and give examples such as 3 x ? = 6.



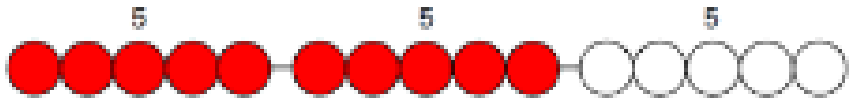
3 x 5 = 15

5 x 3 = 15

5 x 3 = 3 + 3 + 3 + 3 = 15

3 x 5 = 5 + 5 + 5 = 15

Use **practical apparatus:**



Mental Calculations:

- Recall and use multiplication facts from the 2, 5 and 10 multiplication tables, including recognising odds and evens.
- Show that multiplication can be done in any order (commutative).
- Count in steps of 2, 3 and 5 from zero and in 10s from any number, forwards and backwards.

Points to consider:

Key Vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times

Children should:

- Be given practical problem solving activities using concrete objects and pictorial representations wherever possible.

Key skills for multiplication at Y2:

- Count in steps of 2, 3 and 5 from zero and in 10s from any number, forwards and backwards.
- Write and calculate number statements using x and = signs.
- Show that multiplication can be done in any order (commutative).
- Solve a range of problems involving multiplication, using concrete objects, arrays, repeated addition, mental methods and multiplication facts, including problems in context.
- Pupils use a variety of language to discuss and describe multiplication.

The Big Ideas for Y2:

- It is important that pupils both commit multiplication facts to memory and also develop an understanding of conceptual relationships. This will aid them in using known facts to work out unknown facts and in solving problems.
- Pupils should look for and recognise patterns within tables and connections between them (e.g. 5× is half of 10×).
- Pupils should recognise multiplication and division as inverse operations and use this knowledge to solve problems. They should also recognise division as both grouping and sharing.
- The recognition of pattern in multiplication helps pupils commit facts to memory, for example doubling twice is the same as multiplying by four, or halving a multiple of ten gives you the related multiple of five.

Year 3 Multiply 2 digits by a single digit

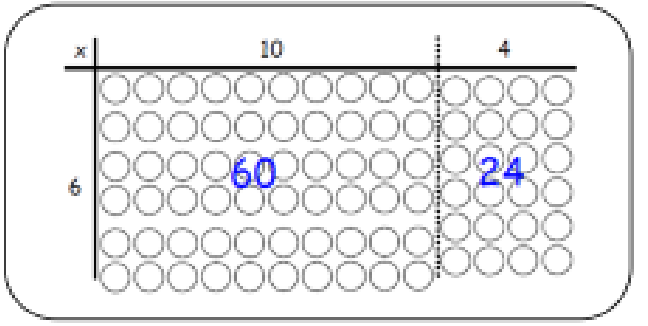
Introduce the grid method with children physically making an array to represent the calculation (eg make 8 lots of 23 with 10s and 1s place value counters), then translate this to grid method format:

Eg. 23 x 8 = 184

X	20	3
8	160	24

160 + 24 = 184

Link the layout of the grid to an array initially



Mental Calculations:

- Recall and use multiplication facts for the 2, 3, 4, 5, 8 and 10 times tables and multiply multiples of 10.
- Develop efficient mental methods to solve a range of problems eg using commutativity (4 x 12 x 5 = 4 x 5 x 12 = 20 x 12= 240) and for missing number problems eg ? x 5 = 20, 3 x ? = 18, ? x ? = 32
- Count from 0 in multiples of 4, 8, 50 and 100.
- Estimate the answer to a calculation and use inverse to check answers.

Points to consider:

Key Vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times, partition, grid method, multiple, product, tens, units, value

Children should be able to:

- Partition numbers into 10s and units.
- Multiply multiples of 10 by a single digit (eg 20 x 4) using their knowledge of multiplication facts and place value.
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Key skills for multiplication at Y3:

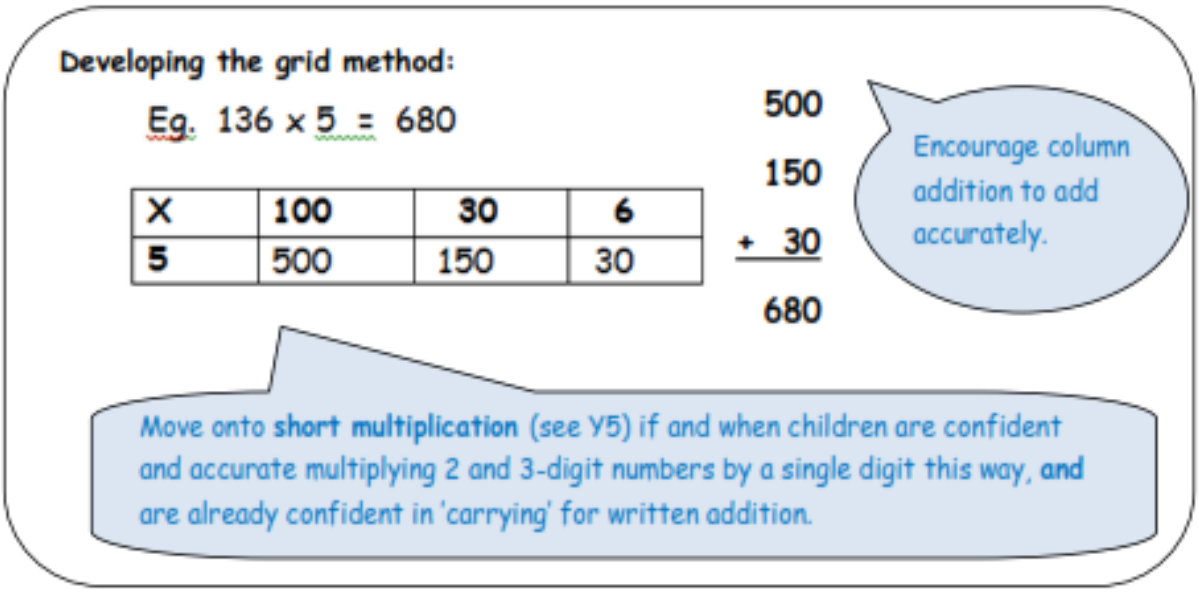
- Write and calculate number statements using the multiplication tables they know, including 2 digit x single digit, drawing upon mental methods and progressing to reliable written methods.
- Solve multiplication problems including missing number problems.
- Develop mental strategies using commutativity (eg 4 x 12 x 5 = 4 x 5 x 12 = 20 x 12 = 240)
- Solve simple problems in contexts deciding which operations and methods to use.

The Big Ideas for Y3:

- It is important for children not just to be able to chant their multiplication tables but also to understand what the facts in them mean, to be able to use these facts to figure out others and to use in problems. It is also important for children to be able to link facts within the tables (e.g. 5× is half of 10×).
- They understand what multiplication means, see division as both grouping and sharing, and see division as the inverse of multiplication.

Year 4 Multiply 2 and 3 digits by a single digit using all multiplication tables up to 12 x 12.

Children should approximate answers first. The grid method is used without the support of arrays:



Mental Calculations:

- Recall multiplication facts for all multiplication times tables up to 12 x 12.
- Count in multiples of 6, 7, 9, 25 and 1000.
- Use place value, known facts and derived facts to multiply mentally eg multiply by 0 and 1, 10, 100 or to multiply 3 numbers.
- Use commutativity and other strategies mentally 3 x6 = 6 x3, 2 x 6 x 5 = 10 x 6, 39 x 7 = 30 x7 + 9 x 7.
- Estimate and use inverse operations to check answers to a calculation.
- Recognise and use factor pairs and commutativity in mental calculations.

Points to consider:

Key Vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times, partition, grid method, multiple, product, tens, units, value, total, sets of, inverse

Children should be able to:

- Approximate before they calculate and make this a regular part of their calculating, going back to the approximation to check their answer eg 346 x 9 is approximately 350 x 10 = 3500.
- Multiply multiples of 10 and 100 by a single digit using their multiplication table knowledge.

Key skills for multiplication at Y4:

- Solve problems involving multiplying and adding, including distributive law to multiply 2 digit by single digit numbers
- Recognise place value of digits in up to 4 digit numbers (thousands, hundreds, tens and units).
- Solve problems with increasingly complex multiplication in a range of contexts.
- Multiply 2 and 3 digit numbers by a single digit using formal written methods.

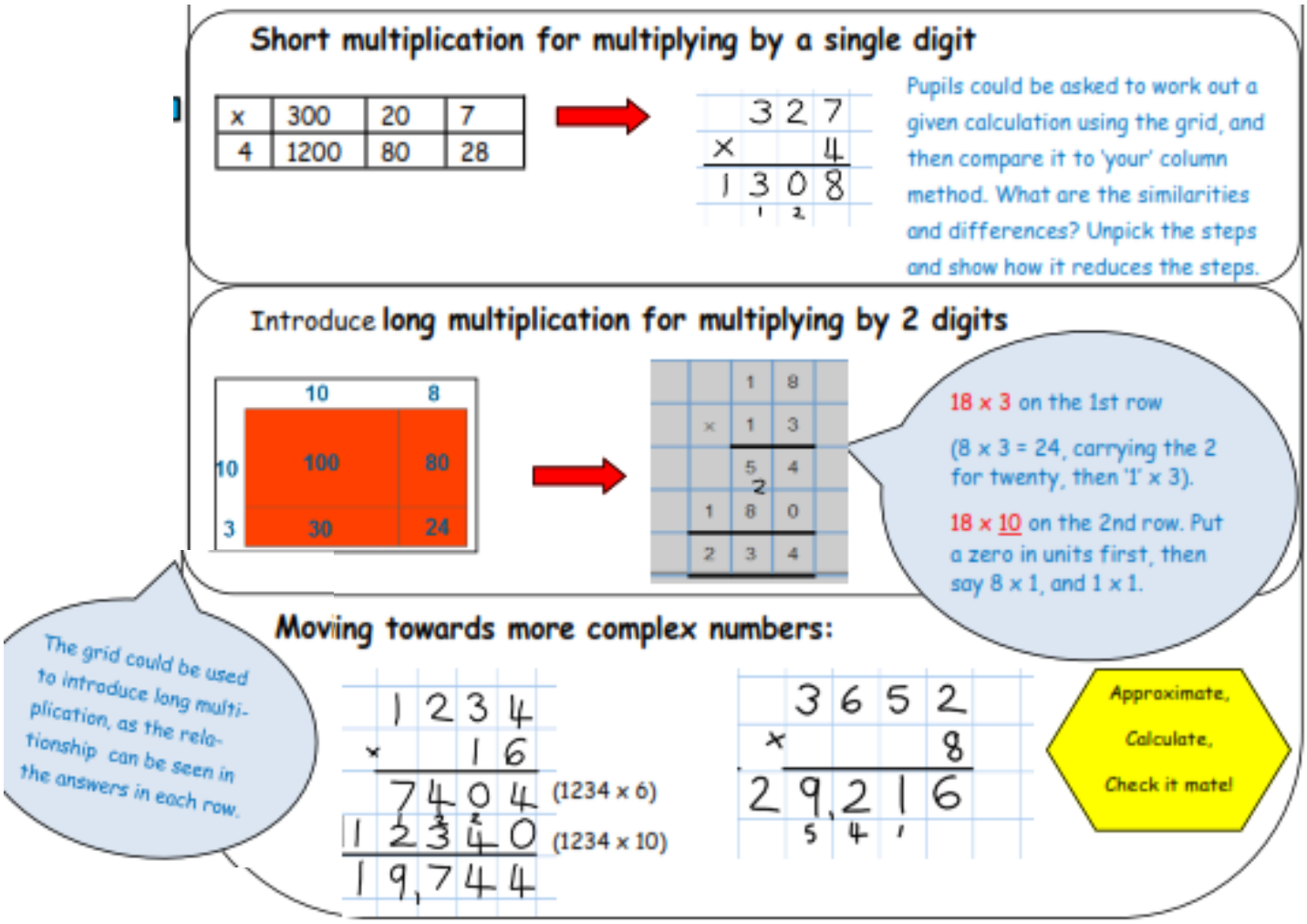
The Big Ideas for Y4:

- It is important for children not just to be able to chant their multiplication tables but to understand what the facts in them mean, to be able to use these facts to figure out others and to use them in problems.
- It is also important for children to be able to link facts within the tables (e.g. 5× is half of 10×).
- They understand what multiplication means and see division as both grouping and sharing, and to see division as the inverse of multiplication.
- The distributive law can be used to partition numbers in different ways to create equivalent calculations. For example, 4 × 27 = 4 × (25 + 2) = (4 × 25) + (4 × 2) = 108.
- Looking for equivalent calculations can make calculating easier. For example, 98 × 5 is equivalent to 98 × 10 ÷ 2 or to (100 × 5) – (2 × 5). The array model can help show equivalences.

Year 5 Multiply up to 4 digits by 1 or 2 digits.

Introducing column multiplication:

- Introduce by comparing a grid method calculation to a short multiplication method to see how the steps are related but notice how there are less steps involved in the column method.



Mental Calculations:

- Count forwards and backwards in steps of powers of 10 for any given number up to 1,000,000.
- Recall prime numbers to 19.
- Estimate and use inverse operations to check answers to a calculation.

Points to consider:

Key Vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times, partition, grid method, multiple, product, tens, units, value, total, sets of, inverse, square, factor, integer, decimal, short/long multiplication, 'carry'

Children should:

- Approximate before they calculate and make this a regular part of their calculating, going back to the approximation to check their answer eg 346 x 9 is approximately 350 x 10 = 3500.

Key skills for multiplication at Y5:

- Identify multiples and factors, including finding all factor pairs of a number and common factors of 2 numbers, using knowledge of multiplication tables to 12 x 12.
- Solve problems where larger numbers are decomposed into their factors.
- Multiply integers and decimals by 10, 100 and 1000.
- Recognise and use square and cube numbers and their notation.
- Solve problems involving combinations of operations, choosing and using calculations and methods appropriately.
- Know and use the vocabulary of prime numbers, prime factors and composite numbers.
- Establish whether a number up to 100 is a prime number.
- Multiply numbers up to 4 digits by a single or 2 digit number using a formal written method including long multiplication for 2 digit numbers.

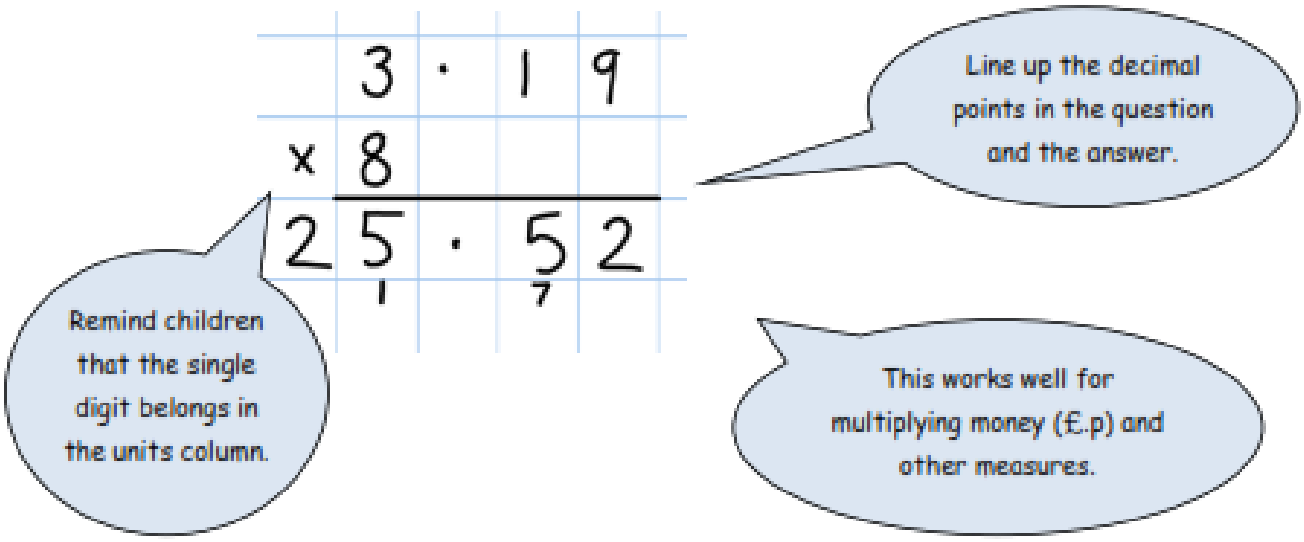
The Big Ideas for Y5:

- Pupils have a firm understanding of what multiplication and division mean and have a range of strategies for dealing with large numbers, including both mental and standard written methods. They see the idea of factors, multiples and prime numbers as connected and not separate ideas to learn.
- They recognise how to use their skills of multiplying and dividing in new problem solving situations.
- Factors and multiples are connected ideas: 48 is a multiple of 6 and 6 is a factor of 48.

Year 6 Short and long multiplication as in Y5 and multiply decimals with up to 2 dp by a single digit.

By Y6 some children will be ready to use similar methods to multiply decimals with up to 2 dp by a single digit, approximating first. They should know that the decimal points line up under each other.

Eg 3.19 x 8 = 25.52



Mental Calculations:

- Recall multiplication facts for all times tables up to 12 x 12.
- Perform mental calculations with mixed operations and large numbers.
- Estimate answers using rounding and approximation and determine levels of accuracy.

Points to consider:

Key Vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times, partition, grid method, multiple, product, tens, units, value, total, sets of, inverse, square, factor, integer, decimal, short/long multiplication, 'carry', tenth, hundredth, decimal

Children should be able to:

- Use rounding and place value to make approximations before calculating and use these to check answers against.
- Use short multiplication (see Y5) to multiply numbers with more than 4 digits by a single digit to multiply money and measures and to multiply decimals with up to 2 dp by a single digit.
- Use long multiplication (see Y5) to multiply numbers with at least 4 digits by a 2 digit number.

Key skills for multiplication at Y6:

- Multiply multi-digit numbers up to 4 digit x 2 digit using long multiplication.
- Solve multi step problems in a range of contexts choosing appropriate combinations of operations and methods.
- Round any integer to a required degree of accuracy.
- Use knowledge of the order of operations to carry out calculations involving the four operations.
- Identify common factors, common multiples and prime numbers.

The Big Ideas for Y6:

- Standard written algorithms use the conceptual structures of the mathematics to produce efficient methods of calculation.
- Standard written multiplication method involves a number of partial products. For example, 36 × 24 is made up of four partial products 30 × 20, 30 × 4, 6 × 20, 6 × 4.
- There are connections between factors, multiples and prime numbers and between fractions, division and ratios.