

# FEATHERSTONE ACADEMY

## Progression through calculations for MULTIPLICATION

## Reception

Methods:

Key Vocabulary:

**Early Learning Goal:**  
**Children solve problems, including doubling.**

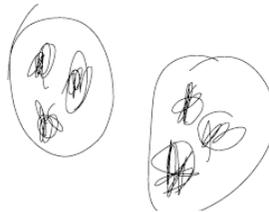
Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They should experience practical calculation opportunities using a wide variety of equipment, including small world play, role play, counters, cubes etc.

Children may also investigate putting items into resources such as egg boxes, ice cube trays and baking tins which are arrays

They may develop ways of recording calculations using pictures, etc.



A child's jotting showing the fingers on each hand as a double.



A child's jotting showing double three as three cookies on each plate.

zero, ten, twenty... one hundred, count, count (up) to count on (from, to) count back (from, to) count in ones, twos... tens..., how many times? pattern, estimate, double, sort, equal, sets of

### Ideas for assessment questions:

I will clap where a number is missing.

1 2 3 [one clap] 5

Tell me the missing number.

I will clap where a number is missing.

2 4 6 [one clap] 10

Tell me the missing number.

I will clap where a number is missing.

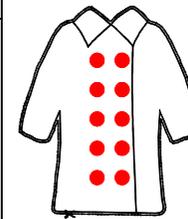
20 40 60 [one clap] 100

Tell me the missing number.

How many buttons are there on this coat?

Count them in twos.

Count them in fives.



Count the pairs of animals on the Ark.



How are the eggs arranged in the egg box?



How many eggs are there altogether in the box?

Count these pairs of socks.

How many pairs are there?

How many socks are there altogether?



There are five paintbrushes in each jar.

Count the paintbrushes.



Useful Links:

<http://www.tentown.co.uk/>

Common Misconceptions:

- Confuses numbers when counting in twos; has difficulty understanding a pair consists of two objects.
- Has difficulty with identifying doubles and adding a small number to itself, for example  $2 + 2$ , to make twice as many.
- Has difficulty with counting reliably in tens from a multiple of ten.

Problem Solving Links/Ideas:

<http://www.mathswarriors.co.uk/inv.html>

# FEATHERSTONE ACADEMY

## Progression through calculations for MULTIPLICATION

## Year 1

Methods:

Key Vocabulary:

### End of Year Objective:

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

problem, solution, calculate, calculation, number sentence, answer, method, explain, money, coin, pence, penny, pound, pay, change, buy, sell, price, spend  
 number sequences, zero, ten, twenty... one hundred count (up) to ,count on (from, to), count in ones, twos... tens...  
 more, many, odd, even, how many times?  
 pattern, pair, multiple

In year one, children will continue to solve multiplication problems using practical equipment and jottings. They may use the equipment to make groups of objects. Children should see everyday versions of arrays, e.g. egg boxes, baking trays, ice cube trays, wrapping paper etc and use this in their learning, answering questions such as 'How many eggs would we need to fill the egg box? How do you know?'

### Ideas for assessment questions:

Useful Links:

Common Misconceptions:

Count five hops of two along this number line.

What number will you reach?

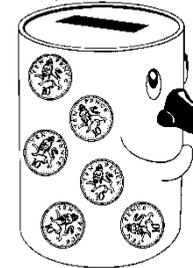
[oral question]

The numbers in the shaded squares make a sequence. Continue the sequence by shading more squares.

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	35

For common misconceptions in Year 1 please see Reception or Year 2.

How much money is in the money box?



Level 2c

### KS1 2001 level 2c

There are 10 crayons in each box.



How many crayons are there altogether?

Level 2c

How many pairs of socks are there?



Level 2b

Problem Solving Links/Ideas:

Write the next number in this sequence:

Five, ten, fifteen, twenty ...

Level 2c [oral]

How many  coins make 20p?

Level 2b

# FEATHERSTONE ACADEMY

## Progression through calculations for MULTIPLICATION

## Year 2

Methods:

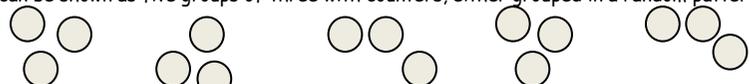
Key Vocabulary:

**End of Year Objective:**  
Calculate mathematical statements for multiplication (*using repeated addition*) and write them using the multiplication (x) and equals (=) signs.

calculate, calculation, inverse, answer, explain, method, sign, operation, symbol, number sentence, number line, mental calculation, written calculation, informal method, jottings, diagrams, pictures, images  
lots of, groups of, x sign, times, multiply, multiplied by, multiple of, once, twice, three times, four times, five times... ten times... times as (big, long, wide and so on), repeated addition, array, row, column  
double,

Children should understand and be able to calculate multiplication as repeated addition, supported by the use of practical apparatus such as counters or cubes. e.g.

5 x 3 can be shown as five groups of three with counters, either grouped in a random pattern, as below:

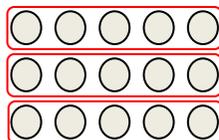
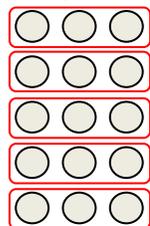


or in a more ordered pattern, with the groups of three indicated by the border outline:



Children should then develop this knowledge to show how multiplication calculations can be represented by an array, (this knowledge will support with the development of the grid method in the future). Again, children should be encouraged to use practical apparatus and jottings to support their understanding, e.g.

5 x 3\* can be represented as an array in two forms (as it has commutativity):



$$5 + 5 + 5 = 15$$

\*For mathematical accuracy 5 x 3 is represented by the second example above, rather than the first as it is five, three times. However, because we use terms such as 'groups of' or 'lots of', children are more familiar with the initial notation. Once children understand the commutative order of multiplication the order is irrelevant).

$$3 + 3 + 3 + 3 + 3 = 15$$

### Ideas for assessment questions:

There are 4 apples in each pack. Mrs Pullen buys 3 packs of apples. How many apples does she buy?

Level 2b

Ella's dad washes some cars. He uses 12 buckets of water. Each bucket has 5 litres of water.



How many litres of water does he use altogether?

Level 2a

$$4 + 4 + 4 + 4 + 4 = 20$$

Write this addition fact as a multiplication fact.

$$\underline{\quad} \times \underline{\quad} = \underline{\quad}$$

Write the missing number in the box.

$$5 \times 4 = 10 \times \square \quad \text{Level 3}$$

Draw rings around all the multiples of 5.  
45    20    54    17    40

Level 2c

Write the missing number in the box.

$$\square \times 5 = 50$$

Level 2b

Circle two numbers that add to make a multiple of 10.

11   12   13   14   15   16   17   18  
19

Level 3

Match each addition to a multiplication.

One is done for you

$4 + 4 + 4 + 4 + 4$	$3 \times 4$
$3 + 3 + 3$	$6 \times 5$
$6 + 6 + 6 + 6 + 6$	$6 \times 4$
$6 + 6 + 6$	$4 \times 5$
	$6 \times 3$

Level 3

Useful Links:

Common Misconceptions:

- Still counts in ones to find how many there are in a collection of equal groups; does not understand vocabulary, for example, 'groups of', 'multiplied by'.
- Does not link counting up in equal steps to the operation of multiplication; does not use the vocabulary associated with multiplication.
- Does not focus on 'rows of' or 'columns of', but only sees an array as a collection of ones.
- Has difficulty relating multiplying by 2 to known facts about doubles; records double 4 as 4 + 4. Does not use partitioning to find double 12 or double 35.

Problem Solving Links/Ideas:

# FEATHERSTONE ACADEMY

## Progression through calculations for MULTIPLICATION

## Year 3

Methods:

Key Vocabulary:

### End of Year Objective:

Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, progressing to formal written methods.\*

*\*Although the objective suggests that children should be using formal written methods, the National Curriculum document states "The programmes of study for mathematics are set out year-by-year for key stages 1 and 2. Schools are, however, only required to teach the relevant programme of study by the end of the key stage. Within each key stage, schools therefore have the flexibility to introduce content earlier or later than set out in the programme of study." p4*

*It is more beneficial for children's understanding to go through the expanded methods of calculation as steps of development towards a formal written method.*

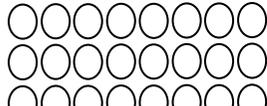
Initially, children will continue to use arrays where appropriate linked to the multiplication tables that they know (2, 3, 4, 5, 8 and 10), e.g.

$$3 \times 8$$

or by jottings using squared paper: They may show this using practical equipment:

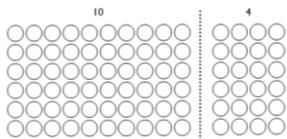
x	x	x	x	x	x	x	x		
x	x	x	x	x	x	x	x		
x	x	x	x	x	x	x	x		

$$3 \times 8 = 8 + 8 + 8 = 24$$



$$3 \times 8 = 8 + 8 + 8 = 24$$

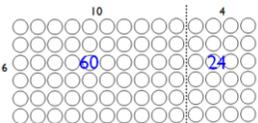
As they progress to multiplying a two-digit number by a single digit number, children should use their knowledge of partitioning two digit numbers into tens and units/ones to help them. For example, when calculating  $14 \times 6$ , children should set out the array, then partition the array so that one array has ten columns and the other four.



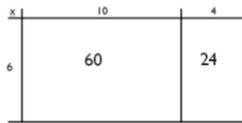
Partitioning in this way, allows children to identify that the first array shows  $10 \times 6$  and the second array shows  $4 \times 6$ . These can then be added to calculate the answer:

$$\begin{aligned} &(6 \times 10) + (6 \times 4) \\ &= 60 + 24 \\ &= 84 \end{aligned}$$

This method is the precursor step to the grid method. Using a two-digit by single digit array, they can partition as above, identifying the number of rows and the number of columns each side of the partition line.

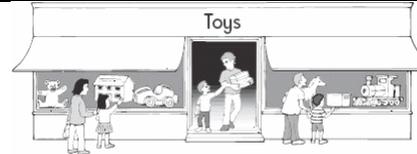


By placing a box around the array, as in the example below, and by removing the array, the grid method can be seen.



problem, solution, calculate, calculation, inverse, answer, method, explain, predict, estimate, reason, operation, symbol, number sentence, equation, mental calculation, written calculation, informal method, jottings, number line, pound (£), penny/pence (p), note, coin, units of measurement and their abbreviations  
lots of, groups of, x sign, times, multiplication multiply, multiplied by, multiple of, product, once, twice, three times, four times, five times... ten times...  
times as (big, long, wide and so on), repeated addition  
array, row, column, double

### Ideas for assessment questions:



The shop is open for 6 days each week. It is open for 8 hours each day. How many hours is the shop open each week?

Show how you work it out.  
Level 3

Circle three numbers that add to make a multiple of 10.

11 12 13 14 15 16 17 18 19  
Level 3

Calculate  $13 \times 3$ .  
Level 3

Write a number in each box to make this correct.



Level 3

Write the answer.

$$24 \times 4 =$$

Level 3

A bus ticket costs 25p. How much will 5 of these tickets cost?  
Level 3

What is four multiplied by nine?  
Mental test level 4

Multiply seven by six.  
KS2 2003 Mental test level 4

Write what the missing numbers could be.

$$\square \times \square = 150$$

Level 3

Useful Links:	Common Misconceptions:	
	For common misconceptions in Year 3 please see Year 2 or Year 4.	
Problem Solving Links/Ideas:		

# FEATHERSTONE ACADEMY

## Progression through calculations for MULTIPLICATION

## Year 4

Methods:

Key Vocabulary:

**End of Year Objective:**

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

Children will move to Y4 using whichever method they were using as they transitioned from Y3. They will further develop their knowledge of the grid method to multiply any two-digit by any single-digit number, e.g.

$$37 \times 6$$

x	30	7
6	180	42

$$79 \times 8$$

x	70	9
8	560	72

$$180$$

$$+ \frac{42}{222}$$

$$560$$

$$+ \frac{72}{632}$$

To support the grid method, children should develop their understanding of place value and facts that are linked to their knowledge of tables. For example, in the calculation above, children should use their knowledge that  $7 \times 8 = 56$  to know that  $70 \times 8 = 560$ .

By the end of the year, they will extend their use of the grid method to be able to multiply three-digit numbers by a single digit number, e.g.

$$346 \times 8$$

x	300	40	6
8	2400	320	48

$$2400$$

$$+ \frac{320}{2768}$$

$$+ \frac{48}{2768}$$

When children are working with numbers where they can confidently and correctly calculate the addition (or parts of the addition) mentally, they may do so.

Children should also be using this method to solve problems and multiply numbers in the context of money or measures.

calculate, calculation, equation, operation, symbol, inverse, answer, method, explain, predict, reason, reasoning, pattern, relationship, decimal, decimal point, decimal place, pound (£), penny/pence (p), units of measurement and abbreviations, degrees Celsius  
lots of, groups of, times, multiplication, multiply multiplied by, multiple of, product, once, twice, three times, four times, five times... ten times  
times as (big, long, wide, and so on)  
repeated addition, array row, column double, factor  
inverse

### Ideas for assessment questions:

Sita worked out the correct answer to  $16 \times 5$ .

Her answer was 80.

Show how she could have worked out her answer.

Level 3

What is fifty-six multiplied by ten?

Mental test level 3

What is four multiplied by nine?

Mental test level 4

Multiply seven by six.

Mental test level 4

Circle all the multiples of 8 in this list of numbers.

18 32 56 68 72

Level 4

Calculate  $58 \times 6$ .

Level 4

Write in the missing numbers.

$$4 \times \square = 200$$

Level 3

Here is a number sentence.

$$4 \times \square < 17$$

Which number could go in the box to make the sentence true?

A 4

B 5

C 12

D 13

Write a calculation that you could do to check that the answer to  $53 \times 4$  is 212.

Write in the missing digit.

$$\square \times 9 = 333$$

Level 4

Useful Links:

Common Misconceptions:

- Is not confident in recalling multiplication facts.
- Is muddled about the correspondence between multiplication and division facts, recording, for example,  $3 \times 5 = 15$  so  $5 \div 15 = 3$ .
- Describes the operation of multiplying by ten as 'adding a nought'.
- Does not apply partitioning and recombining when multiplying, for example,  $14 \times 3$  is calculated as  $(10 \times 3) + 4 = 34$  or  $14 \times 3 = 312$ , confusing the value of two-digit numbers.

Problem Solving Links/Ideas:

# FEATHERSTONE ACADEMY

## Progression through calculations for MULTIPLICATION

## Year 5

Methods:

Key Vocabulary:

**End of Year Objective:**

**Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers.**

Children should continue to use the grid method and extend it to multiplying numbers with up to four digits by a single digit number, e.g.

$$4346 \times 8$$

x	4 000	300	40	6	+	32000
8	32 000	2400	320	48	+	2400
					+	320
					+	48
					+	34768

and numbers with up to four digits by a two-digit number, e.g.

$$2693 \times 24$$

x	2000	600	90	3	+	40000
20	40000	12000	1800	60	+	8000
4	8000	2400	360	12	+	12000
					+	2400
					+	1800
					+	360
					+	60
					+	12
					+	64632

When children are working with numbers where they can confidently and correctly calculate the addition (or parts of the addition) mentally, they may do so.

Children should also be using this method to solve problems and multiply numbers in the context of money or measures.

Useful Links:

Common Misconceptions:

For common misconceptions in Year 5 please see Year 4 or Year 6.

Problem Solving Links/Ideas:

calculate, calculation, equation, operation, symbol, inverse, answer, method, strategy, explain, predict, reason, reasoning, pattern, relationship, decimal, decimal point, decimal place, estimate, approximate, pound (£), penny/pence (p), units of measurement and abbreviations, degrees Celsius

lots of, groups of, times, multiply, multiplication, multiplied by, multiple of, product, once, twice, three times, four times, five times... ten times times as (big, long, wide, and so on), repeated addition, array, row, column, factor, inverse

### Ideas for assessment questions:

Here are five digit cards.



Use all five digit cards to make this correct.

$$\square\square \times 2 = \square\square\square$$

Level 3

-----This relationship connects the number of pencils and the number of boxes.

$$\text{number of pencils} = \text{number of boxes} \times 12$$

How many pencils are in 18 boxes?

Level 4

John says: 'Multiples of 4 always end in 2, 4, 6 or 8.'

Is he correct? Write YES or NO. Explain how you know.

-----  
Use the digits 2, 3 and 4 once to make the multiplication which has the greatest product.

$$\square\square \times \square$$

Level 4

-----  
An apple costs seventeen pence. How much will three cost?

Mental test L4

# FEATHERSTONE ACADEMY

## Progression through calculations for MULTIPLICATION

**Year 6**

Methods:

Key Vocabulary:

**End of Year Objective:**

Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication.

Multiply one-digit numbers with up to two decimal places by whole numbers.

By the end of Y6, children should be able to use the grid method to multiply any number by a two-digit number. They should also develop the method to be able to multiply decimal numbers with up to two decimal places, e.g.

4.92 x 3

x	4	0.9	0.02
3	12	2.7	0.06

$$\begin{array}{r}
 12 \\
 + 2.7 \\
 + 0.06 \\
 \hline
 14.76
 \end{array}$$

When children are working with numbers where they can confidently and correctly calculate the addition (or parts of the addition) mentally, they may do so.

Children should also be using this method to solve problems and multiply numbers, including those with decimals, in the context of money or measures, e.g. to calculate the cost of 7 items at £8.63 each, or the total length of six pieces of ribbon of 2.28m each.

calculate, calculation, equation, operation, symbol, inverse, answer, method, strategy, explain, predict, reason, reasoning, pattern, relationship, decimal, decimal point, decimal place, estimate, approximate, pound (£), penny/pence (p), units of measurement and abbreviations, degrees Celsius

lots of, groups of, times, multiplication, multiply multiplied by, multiple of, product, once, twice, three times, four times, five times... ten times times as (big, long, wide, and so on), repeated addition, array, row, column, double, factor, inverse, integer

**Ideas for assessment questions:**

Some children do a sponsored walk. Jason is sponsored for £3.45 for each lap. He does 23 laps. How much money does he raise? Lynne wants to raise £100. She is sponsored for £6.50 for each lap. What is the least number of whole laps she must do? Level 4

Explain why 16 is a square number. Y5 optional test 1998 L3  
-----  
Multiply seven by nought point six. Mental test L4  
-----  
What is the next square number after thirty-six? Level 4  
-----  
What is nought point four multiplied by nine? Mental test level 4

Useful Links:

Common Misconceptions:

- Is not confident in recalling multiplication facts.
- Misuses half understood rules about multiplying and dividing by powers of ten and the associative law, for example:  $145 \times 30 = 145\ 000$
- Is not confident in making reasonable estimates for multiplication or division calculations.

Problem Solving Links/Ideas:

Four biscuits cost twenty pence altogether. How much do twelve biscuits cost? Mental test level 4

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The test questions above refer to general MULTIPLICATION, however pupils will also be required to solve both mental and written MULTIPLICATION calculations in a range of contexts and using negative numbers. E.g.

## PROGRESSION THROUGH CALCULATIONS FOR MULTIPLICATION