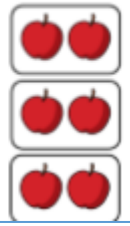
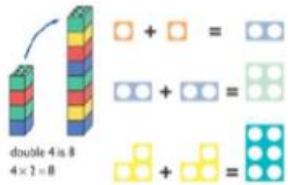
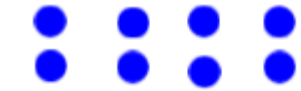
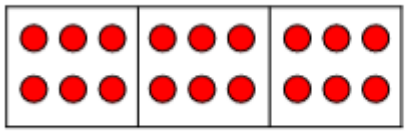
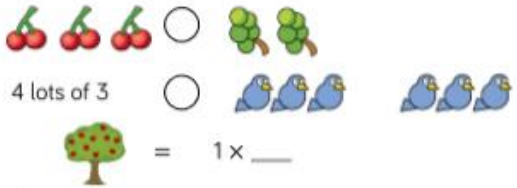
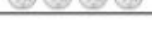
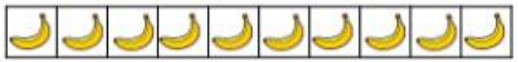
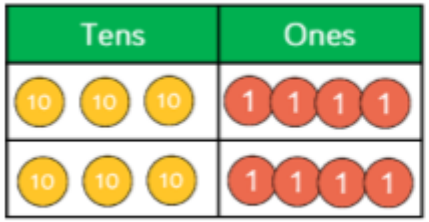
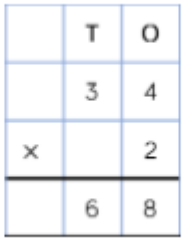
West Jesmond Calculation Policy Yr 1-Yr 6: Multiplication

Progression In Written Multiplication Methods

Year 1	
Count in 10s Children count in groups of tens for the first time. They use pictures, bead strings and number lines to support their counting.	How many birds are there altogether?  There are ____ birds in each tree. There are ____ trees. There are ____ birds altogether.
Make Arrays Children begin to make arrays by making equal groups and building them up in column or rows. They use a range of concrete and pictorial representations alongside sentence stems to support their understanding.	Build an array with counters to represent the apples. Complete the sentences.  There are ____ apples in each row. There are ____ rows. ____ + ____ + ____ = ____ There are ____ apples altogether.
Making Doubles Children explore doubling with numbers up to 20. Reinforce understanding that 'double' is two groups of a number or amount.	Circle the representations which have been doubled:  Use practical activities using manip-ultives including cubes and Numicon to demonstrate doubling 

Counting in Multiples Count the groups as children are skip counting.	 Children make representations to show counting in multiples. 
Year 2	
The Multiplication Symbol Children are introduced to the multiplication symbol for the first time. They should link repeated addition and multiplication together, using stem sentences to support their understanding. They should also be able to interpret mathematical stories and create their own involving multiplication.	Complete the sentences to describe the equal groups.  ___ + ___ + ___ = 18 ___ × ___ = 18 There are ___ equal groups with ___ in each group. There are three ___.
Multiplication from Pictures Children will use the multiplication symbol and work out the total from pictures.	Complete:  ___ × ___ = ___ ___ lots of 3 = ___ ___ multiplied by ___ = 12 Complete:  4 lots of 3 ○ = 1 × ___ Complete the table.

Picture	Multiplication	Sentence
	4 × 10 = 40	4 lots of 10 is equal to 40
	35 = 7 × 5	
		6 lots of 3 is equal to 18

Use Arrays Children explore arrays to see the commutativity of multiplication facts e.g. 5x2=2x5	Complete the number sentences to describe the arrays.  2 x 3 and ___ x ___  ___ x ___ and ___ x ___
Year 3	
Multiplying 2-digits by 1-digit (1) Children use their understanding of repeated addition to represent a two-digit number multiplied by a one-digit number with concrete manipulatives. They use the formal method of column multiplication alongside the concrete representation. They also apply their understanding of partitioning to represent and solve calculations. In this step, children explore multiplication with no exchange.	Annie uses place value counters to work out 34 × 2   Use Annie's method to solve: 23 × 3 32 × 3 42 × 2

Multiplying 2-digits by 1-digit (1)

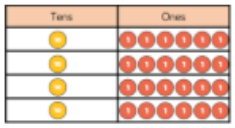
Children continue to use their understanding of repeated addition to represent a two-digit number multiplied by a one-digit number with concrete manipulatives.
They move on to explore multiplication with exchange. Each question in this step builds in difficulty.

Jack uses Base 10 to calculate 24 × 4

	T	O
	2	4
×		4
	9	6
	1	

Use Jack's method to solve:
13 × 4
23 × 4
26 × 3

Amir uses place value counters to calculate 16 × 4



	T	O
	1	6
×		4
	6	4
	2	

Use Amir's method to solve:
16 × 6
17 × 5
28 × 3

Amir then calculates 5 × 34

	T	O
	3	4
×		5
1	7	0
1	2	

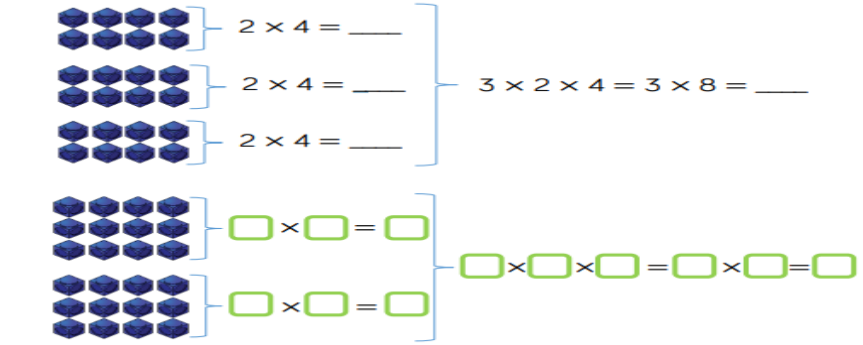
Use Amir's method to solve:
36 × 6
48 × 4

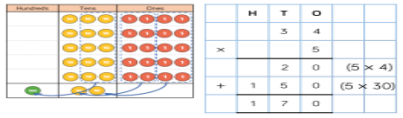
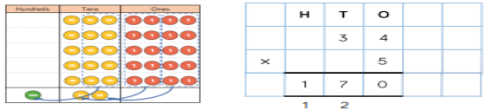
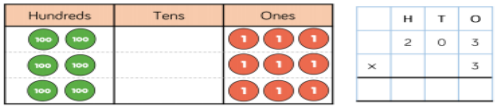
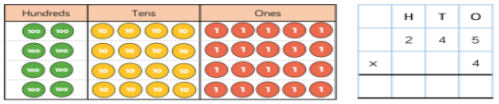
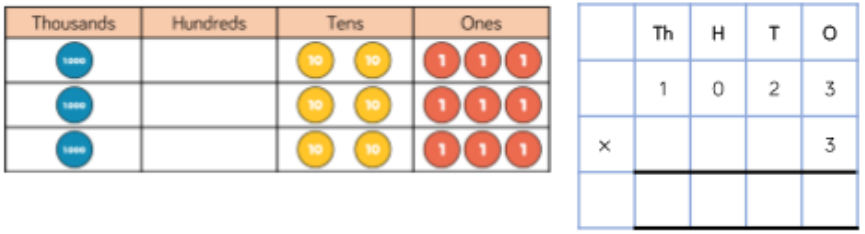
Year 4

Multiply 3 Numbers

Children are introduced to the 'Associative Law' to multiply 3 numbers. This law focuses on the idea that it doesn't matter how we group numbers when we multiply.
e.g. 4x5x2=(4x5)=20x2=40 or
4x5x2=4x(5x2)=4x10=40
They link this idea to commutativity and see that we can change the order of the numbers to group them more efficiently. e.g. 4x2x5=(4x2)x5=8x5=40

Complete the calculations.



Multiply 2-digits by 1-digit Children build on their understanding of formal multiplication from Year 3 to move to the formal short multiplication method. Children use their knowledge of exchanging ten ones for one ten in addition and apply this to multiplication, including exchanging multiple groups of tens. They use place value counters to support understanding.	Whitney uses place value counters to calculate 5 × 34  Use Whitney's method to solve 5 × 42 23 × 6 48 × 3 Ron also uses place value counters to calculate 5 × 34  Use Ron's method to complete:
Multiply 3-digits by 1-digit Children build on previous steps to represent a three-digit number multiplied by a one-digit number with concrete manipulatives. Children continue to exchange groups of ten ones for tens and record this in a written method.	Complete the calculation.  A school has 4 house teams. There are 245 children in each house team. How many children are there altogether? 
Year 5	
Multiply 4-digits by 1-digit Children build on previous steps to represent a 4-digit number multiplied by a 1-digit number using concrete manipulatives. Children then move on to explore multiplication with exchange in one, and then more than one column.	Complete the calculation. 

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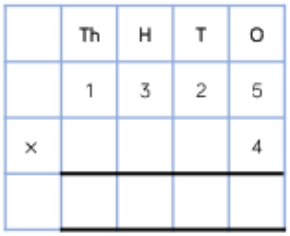
<td>
Annie earns £1,325 per week.
How much would he earn in 4 weeks?

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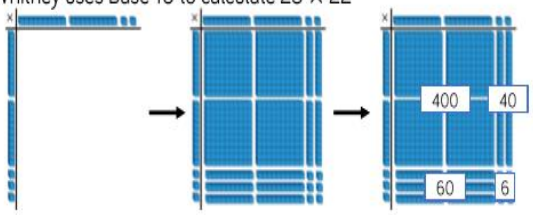
<tr>
<td rowspan="2">Multiply 2 – digits (Area Model)
Children use Base 10 to represent the area model of multiplication, which will enable them to see the size and scale linked to multiplying.

Children will then move on to representing multiplication more abstractly with place value counters and then numbers.</td>
<td>
Whitney uses Base 10 to calculate 23 x 22


How could you adapt your Base 10 model to calculate these:
32 x 24 25 x 32 35 x 32
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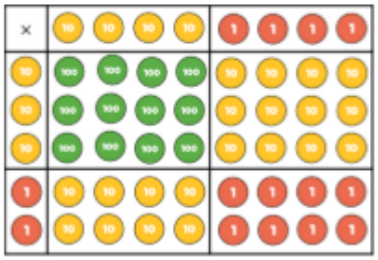
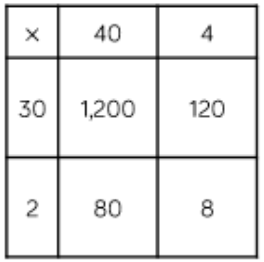
<td>
Rosie adapts the Base 10 method to calculate 44 × 32



</td>
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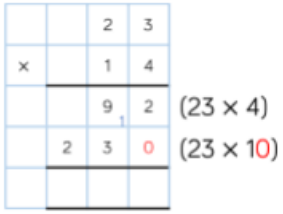
<tr>
<td>Multiply 2-digits by 2-digits
Children will move on from the area model and work towards more formal multiplication methods.
They will start by exploring the role of the zero in the column method and understand it’s importance.</td>
<td>


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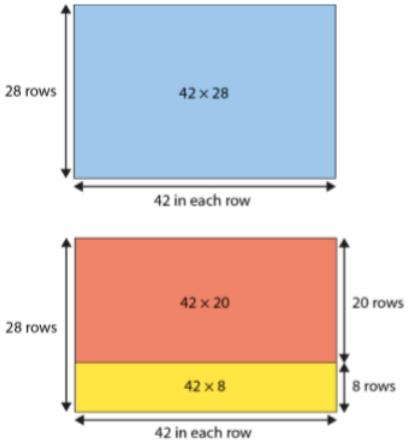
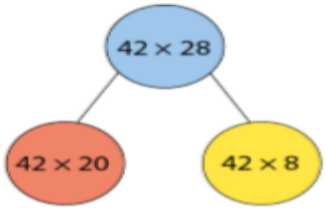
Multiply 3-digits by 2-digits Children will extend their multiplication skills to multiply 3-digit numbers by 2-digit numbers. They will use multiplication to find area and solve multi-step problems.	Complete: 1 3 2 × 1 4 5 2 8 (132 × 4) 1 3 2 0 (132 × 10)
Multiply 4-digits by 2-digits Children will build on their understanding of multiplying a 3-digit number by a 2-digit number and apply this to multiplying 4-digit numbers by 2-digit numbers.	Use the method shown to calculate 2,456 × 34 3 2 5 0 × 2 6 1 9 5 0 0 (3,250 × 6) 6 5 0 0 0 (3,250 × 20) 8 4 5 0 0
Year 6	
Varying representations	*'Seats in one section of a stadium are in rows of forty-two. If there are twenty-eight rows, how many seats are there in this section?'* Area model/grid:  Part–part–whole model: 

Multiply 4-digits by 2-digits

Children consolidate their knowledge of column multiplication, multiplying numbers with up to 4 digits by a 2-digit number.

Calculate.

	4	2	6	7
×			3	4

	3	0	4	6
×			7	3

Relate to real life

'A lorry driver takes deliveries from Swindon to York once a week. The journey there and back is 472 miles. How far does she travel in three weeks?'

$$\begin{array}{r} 4\ 7\ 2 \\ \times \quad\quad 3 \\ \hline 1\ 4\ 1\ 6 \\ \hline 2 \end{array}$$

- *'The lorry driver drives 1,416 miles in three weeks.'*

'The driver does this journey for thirty weeks each year. How far will she have travelled in one year?'

$472 \times 3 = 1{,}416$
$472 \times 30 = 14{,}160$

- *'The lorry driver will have travelled 14,160 miles in one year.'*

Comparing efficiency of methods

Introduce children to the two methods shown opposite and ask them to discuss what's the same and what's different.

- Ezra has chosen to remove the zero, use short multiplication and then scale the product by a factor of ten by replacing the zero.
- Ling has chosen to use short multiplication to multiply by 30 by placing a zero in the ones column to show that she is multiplying by a multiple of ten before she starts.

Children should notice that the product is the same in each case. Ask *'Whose method do you think is the most efficient?'*

- *'What's the same?'*
- *'What's different?'*

Ezra's method:

472×30

$$\begin{array}{r} 4\ 7\ 2 \\ \times \quad\quad 3 \\ \hline 1\ 4\ 1\ 6 \\ \hline 2 \end{array}$$

$1{,}416 \times 10 = 14{,}160$

Ling's method:

472×30

$$\begin{array}{r} 4\ 7\ 2 \\ \times \quad 3\ 0 \\ \hline 1\ 4\ 1\ 6\ 0 \\ \hline 2 \end{array}$$

Strategies and Long Multiplication

Multiplication algorithm – expanded layout:

	100s	10s	1s	
		3	1	
×		2	4	
	1	2	4	31 × 4
	6	2	0	31 × 20
	7	4	4	

Multiplication algorithm – compact layout:

		3	1
×		2	4
	1	2	4
	6	2	0
	7	4	4

Multiplication algorithm – expanded layout:

Step 1 – write the factors

	1,000s	100s	10s	1s
		3	1	2
×			2	8

Step 2 – multiply the ones digit by the ones digit and regroup

	1,000s	100s	10s	1s	
		3	1	2	
×			2	8	
				6	8 × 2 ones = 16 ones = 1 ten + 6 ones

Step 3 – multiply the tens digit by the ones digit and add the regrouped tens

	1,000s	100s	10s	1s	
		3	1	2	
×			2	8	
			9	6	8 × 1 ten = 8 tens; 8 tens + 1 ten = 9 tens

Step 4 – multiply the hundreds digit by the ones digit and regroup

	1,000s	100s	10s	1s	
		3	1	2	
×			2	8	
	2	4	9	6	8 × 3 hundreds = 24 hundreds = 2 thousands + 4 hundreds

Step 5 – place a zero to show that it's ten times the size

	1,000s	100s	10s	1s
		3	1	2
×			2	8
	2	4	9	6
				0

Step 6 – multiply the ones digit by the tens digit

	1,000s	100s	10s	1s	
		3	1	2	
×			2	8	
	2	4	9	6	
			4	0	2 tens × 2 ones = 4 tens

Step 7 – multiply the tens digit by the tens digit

	1,000s	100s	10s	1s	
		3	1	2	
×			2	8	
	2	4	9	6	
		2	4	0	2 tens × 1 ten = 2 hundreds

Step 8 – multiply the hundreds digit by the tens digit

	1,000s	100s	10s	1s	
		3	1	2	
×			2	8	
	2	4	9	6	
	6	2	4	0	2 tens × 3 hundreds = 6 thousands

Step 9 – add the partial products

	1,000s	100s	10s	1s	
		3	1	2	
×			2	8	
	2	4	9	6	312 × 8
	6	2	4	0	312 × 20
	8	7	3	6	
		1			

Multiplication algorithm – compact layout:

$$\begin{array}{r} {\scriptstyle 1} \\ 3\,1\,2 \\ \times\quad 2\,8 \\ \hline 2\,4\,9\,6 \\ 6\,2\,4\,0 \\ \hline 8\,7\,3\,6 \\ \hline 1 \end{array}$$

Step 1 – write the factors

	10,000s	1,000s	100s	10s	1s
		3	1	2	6
×				2	8

Step 2 – multiply the four-digit number by the ones digit, regrouping where necessary

	10,000s	1,000s	100s	10s	1s	
		3	1	2	6	
×				2	8	
	2	5	0	0	8	3,126 × 8

Step 3 – place a zero to show that it's ten times the size

	10,000s	1,000s	100s	10s	1s	
		3	1	2	6	
×				2	8	
	2	5	0	0	8	3,126 × 8
					0	

Step 4 – multiply the four-digit number by the tens digit, regrouping where necessary

	10,000s	1,000s	100s	10s	1s	
		3	1	2	6	
×				2	8	
	2	5	0	0	8	3,126 × 8
	6	2	5	2	0	3,126 × 20

Step 5 – add the partial products

	10,000s	1,000s	100s	10s	1s	
		3	1	2	6	
×				2	8	
	2	5	0	0	8	3,126 × 8
	6	2	5	2	0	3,126 × 20
	8	7	5	2	8	

Multiplication algorithm – compact layout:

$$\begin{array}{r} {\scriptstyle 1} \\ {\scriptstyle 1\,2\,1} \\ 3\,1\,2\,6 \\ \times\quad 2\,8 \\ \hline 2\,5\,0\,0\,8 \\ 6\,2\,5\,2\,0 \\ \hline 8\,7\,5\,2\,8 \end{array}$$