John Fletcher of Madeley Primary School

Calculation Policy- MULTIPLICATION

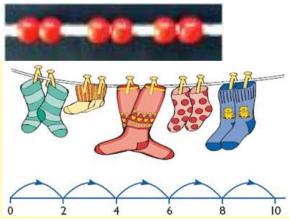
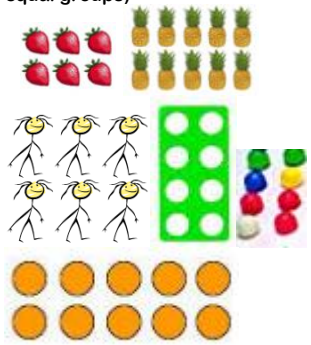
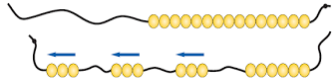
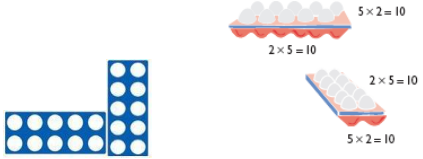
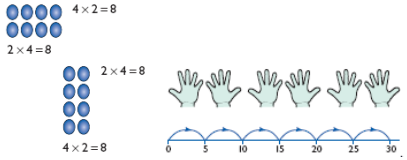
Policy reflects: concrete (do it!) abstract (see it!) visual (remember it!) communication (record it!)

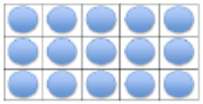
<table>
<tr><th>Year</th><th colspan="3">1</th><th colspan="3">2</th></tr>
<tr><td>Overview and key vocabulary</td><td colspan="2">Doubles and grouping (grouping is a random arrangement of a quantity into equal groups)
Pictorial recording of practical experiences.
Use number tracks to develop counting skills, forwards and backwards.
Jumping along number lines in jumps of 1,2,5 and 10</td><td>array, double, groups of, lots of</td><td colspan="2">Introduce the multiplication tables. Practise to become fluent in the 2x, 5x and 10x tables and connect them to each other. Connect the 10x table to place value and the 5x table to the divisions on a clock face.
Begin to use other multiplication tables and recall multiplication facts.
Use commutativity and inverse relations to develop multiplicative reasoning (for example, 4 x 5 = 20 and 20 ÷ 5 =4).
To know that '=' means 'the same as' and can appear in a different place within a calculation.</td><td>commutative $a \times b = b \times a$, repeated addition, odd, even, sets of</td></tr>
<tr><td>Written Methods</td><td colspan="3"></td><td colspan="3">Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (x), division (÷) and equals (=) signs.</td></tr>
<tr><td>Developing Conceptual/ Procedural Understanding

Structures:
Repeated aggregation- combining quantities

Scaling- increasing quantities by a scale factor</td><td colspan="2">Grouping
 
2 frogs on each lily pad

Pictures to show 2 lots of 3 or 3 lots of 2 etc.

Doubles
  </td><td>Arrays
(rectangular arrangements to show equal groups)
  </td><td colspan="2">Repeated addition
 
Introduce the x symbol once repeated addition is understood.
Grouping
 
5 frogs on each lily pad 5 x 3 = 15
 
Arrays
 
Building tables
 
Build tables using counting stick- forwards and backwards and with missing jumps</td><td>Commutativity
 
5 x2 = 2 x 5
 
5 + 5 + 5 + 5 + 5 + 5 = 30
5 × 6 = 30
5 multiplied by 6
6 groups of 5
6 hops of 5

Decision making
How many number sentences can you write to describe this array? Can you use addition, multiplication and division?
 
Explain your answers.</td></tr>
<tr><td>With jottings… or in your head</td><td colspan="3">Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.</td><td colspan="3">Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot. Solve problems involving multiplication and division using materials, arrays, repeated addition, mental methods and x and ÷ facts, including problems in contexts.</td></tr>
<tr><td>Just know it!</td><td colspan="3">Count in multiples of twos, fives and tens.</td><td colspan="3">Recall and use x and ÷ facts for the 2, 5 and 10 x tables, including recognising odd and even numbers.</td></tr>
<tr><td rowspan="3">Foundations</td><td>Count in 2s</td><td>Doubles up to 10</td><td></td><td>2 x table</td><td>Doubles up to 20</td><td></td></tr>
<tr><td>Count in 10s</td><td>Double multiples of 10</td><td></td><td>10 x table</td><td>Doubles of multiples of 5</td><td></td></tr>
<tr><td>Count in 5s</td><td>Count in 2s, 5s and 10s</td><td></td><td>5 x table</td><td>Count in 3s</td><td></td></tr>
</table>

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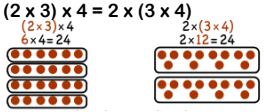
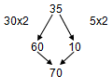
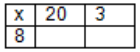
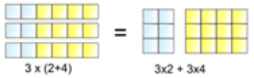
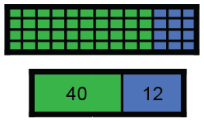
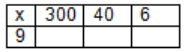
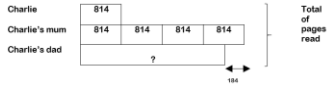
<table>
<tr><th>Year</th><th colspan="4">3</th><th colspan="4">4</th></tr>
<tr><td>Overview and key vocabulary</td><td colspan="3">Continue to practise mental recall of multiplication tables when calculating mathematical statements in order to improve fluency.
Through doubling, connect the 2x, 4x and 8x multiplication tables.
Estimate the answer to a calculation and use inverse operations to check answers.
Develop efficient mental methods, for example, using commutativity and associativity (4 x 12 x 5= 4 x 5 x 12= 20 x 12 = 240 or 4 x 5 x 12 = 4 x 60 = 240) and multiplication and division facts to derive related facts.</td><td>associative
(a x b) x c = a x (b x c)</td><td colspan="3">Continue to practise recalling and using multiplication tables and related division facts to aid fluency.
Practise mental methods and extend this to 3 digit numbers to derive facts.
Solve two-step problems in contexts, choosing the most appropriate operation, working with increasingly harder numbers.
Estimate and use inverse operations to check answers to a calculation.
Approximate using the most significant digit, rounding skills.
Refer to the carried digit as a ten or a hundred.</td><td>distributive
(a + b) x c= (a x c) + (b x c),
factor pairs</td></tr>
<tr><td>Written Methods</td><td colspan="4">Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including 2 digit numbers times 1 digit numbers progressing to formal written methods.</td><td colspan="4">Multiply 2 digit and 3 digit numbers by a 1 digit number using formal written layout. Solve problems involving multiplying and adding.</td></tr>
<tr><td>Developing Conceptual/ Procedural Understanding

Structures: Repeated aggregation- combining quantities

Scaling- increasing quantities by a scale factor</td><td>Building tables
 
Build tables using counting stick- forwards and backwards and with missing jumps
Using known facts
If 3 x 2 = 6, then 30 x 2 = 60, 60 ÷3 = 20 and 30 = 60 ÷ 2.
Associativity
(2 x 3) x 4 = 2 x (3 x 4)
  </td><td>Partitioning strategy to double
Double 35
 
Place value materials to represent calculations
Diennes and then place value counters.
Partitioning
Informal recording of partitioned numbers
15 x 5 = 75
10 x 5 = 50
5 x 5 = 25
27 x 3 = 81
20x3 = 60
7x3 = 21
“20 multiplied by 3 equals 60 and 7 multiplied by 3 equals 21. 60 add 21 equals 81.”</td><td>Grid method
23 x 8 =
20 x 8 =160
3 x 8 = 24
23 x 8= 184
 
Short multiplication
Expanded
23
x 8
24 (8 x3)
160 (8 x20)
184
leading to compact
23
x 8
184
2
Decision making
What pair of numbers could be written in the boxes?
☐ x ☐ = 24</td><td>Building tables
 
Build tables using counting stick- forwards and backwards and with missing jumps
Using known facts
If 2 x 3 = 6 then 200 x 3 = 600 and 600 ÷3 = 200
Distributivity
3 x (2 +4) = 3 x 2 + 3 x 4
So the ‘3’ can be ‘distributed’ across the ‘2 + 4’ into 3 times 2 and 3 times 4
 
leading to
13 x 4 = 10 x 4 + 3 x 4 = 52
  </td><td>Place value materials to represent calculations
Place value counters.
Grid method
(if needed for conceptual understanding)
346 x 9
 
Short multiplication
Expanded
346
x 9
54 (9 x 6)
360 (9 x 40)
2700 (9 x 300)
3114
leading to compact
346
x 9
3114
4 5</td><td>Representing problems
In one month, Charlie read 814 pages in his books. His mum read 4 times as much as Charlie which was 184 pages more than Charlie’s dad. How many pages did they read altogether?
  </td></tr>
<tr><td>With jottings… or in your head</td><td colspan="4">Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for 2 digit numbers times 1 digit numbers using mental methods.
Solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems (four times as high, eight times as long etc.) and correspondence problems in which n objects are connected to m objects (3 hats and 4 coats, how many different outfits?).</td><td colspan="4">Use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers.
Recognise and use factor pairs and commutativity in mental calculations.
Solve problems involving multiplying and adding, including using the distributive law to multiply 2 digit numbers by 1 digit (39 x7 =30 x 7 + 9 x7), integer scaling problems and harder correspondence problems such as n objects are connected to m objects.</td></tr>
<tr><td>Just know it!</td><td colspan="4">Recall and use x and ÷ facts for the 3, 4 and 8 x tables</td><td colspan="4">Recall x and ÷ facts for x tables up to 12 x 12.</td></tr>
<tr><td rowspan="3">Foundations</td><td colspan="2">Review 2 x, 5 x and 10 x</td><td colspan="2">Double 2 digit numbers</td><td colspan="2">4 x and 8 x tables</td><td colspan="2">10 x bigger</td></tr>
<tr><td colspan="2">4 x table</td><td colspan="2">3 x table</td><td colspan="2">3 x, 6 x and 12 x tables</td><td colspan="2">Double larger numbers and decimals</td></tr>
<tr><td colspan="2">8 x table</td><td colspan="2">6 x table</td><td colspan="2">3 x and 9 x tables</td><td colspan="2">11 x and 7 x tables</td></tr>
</table>

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<table>
<tr><th>Year</th><th colspan="3">5</th><th colspan="2">6</th></tr>
<tr><td>Overview and key vocabulary</td><td colspan="2">Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy.
Promote decision making so that pupils choose an appropriate method/strategy.</td><td>prime, composite, square, cube, multiple</td><td>Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.</td><td></td></tr>
<tr><td>Written Methods</td><td colspan="3">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.
Solve problems involving multiplication and division including using knowledge of factors and multiples, squares and cubes.
Solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign.
Solve problems involving multiplication and division including scaling by simple fractions and problems involving simple rates.</td><td colspan="2">Multiply multi-digit numbers up to 4 digits by a 2 digit whole number using the formal written method of long multiplication.
Solve problems involving addition, subtraction, multiplication and division.</td></tr>
<tr><td>Developing Conceptual/ Procedural Understanding

Structures: Repeated aggregation- combining quantities

Scaling- increasing quantities by a scale factor</td><td>Building tables

Apply tables knowledge to multiples of 10, 100 and 1000 using counting stick- forwards and backwards and with missing jumps
Using known facts
If 2 x 3 = 6 then 2000 x 3 = 6000 and
200 x 30 = 6000
Place value materials to represent calculations
Place value counters.
Short multiplication
Use expanded method first if needed to build conceptual understanding
4346
x 8
34768
2 3 4</td><td>Grid method
(if needed for conceptual understanding)
28 x 27
<table><tr><td>x</td><td>20</td><td>8</td></tr><tr><td>20</td><td></td><td></td></tr><tr><td>7</td><td></td><td></td></tr></table>Addition to be done mentally or across followed by column addition

Long multiplication
Expanded
28
x 27
56 (7x8)
140 (7 x20)
160 (20x8)
400 (20x20)
756</td><td>leading to compact

28
x 27
196
5
560
1
756
1
Extend to HTU x TU or ThHTU x TU as appropriate
Decision making
Children investigate alternative methods such as compensation strategies and doubling and halving and discuss when these might be most appropriate and efficient.
Examples:

24x99 could be calculated by x100 and subtracting 24x1.

24 x25 could be calculated by 24x100, halving to find x50 and halving again to find x 25.
or using doubling and halving,
24 x25=12x50
=6 x100</td><td>Building tables

Apply tables knowledge to decimals using counting stick- forwards and backwards and with missing jumps

Using known facts
If 2 x 3 = 6 then 0.2 x 3 =0.6 and 0.02 x 3 = 0.06

Long multiplication
Use expanded method first if needed to build conceptual understanding
5172
x 27
36204
1 5 1
103440
1
139644</td><td>If place value is secure, use grid method for decimal multiplication
0.75 x 6

0.7 x 6 = 4.2
0.05 x 6 = 0.3
0.75 x 6 = 4.5

<table><tr><td>x</td><td>0.7</td><td>0.05</td></tr><tr><td>6</td><td></td><td></td></tr></table>Decision making
Kim knows that 137 x 28= 3836. Explain how she can use this information to work out this multiplication: 138 x 28

Mike works out that 14 × 12 = 168. What is 14 × 1.2? How do you know?

‘When you multiply two numbers together, the answer is always greater than either of the numbers you started with.’
Is Alfie correct? Explain how you know.</td></tr>
<tr><td>With jottings… or in your head</td><td colspan="3">Multiply and divide numbers mentally drawing upon known facts
Partition to multiply mentally
Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000
Identify multiples and factors, including finding all factor pairs of a number and common factors of two numbers
Establish whether a number up to 100 is prime</td><td colspan="2">Perform mental calculations, including with mixed operations and large numbers
Use knowledge of the order of operations to carry out calculations involving the four operations (2 +1 x 3= 5 and (2+1) x 3 = 9)</td></tr>
<tr><td>Just know it!</td><td colspan="3">Know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers
Recall prime numbers up to 19
Recognise and use square and cube numbers and the notation for squared (2) and cubed (3)</td><td colspan="2">Identify common factors, common multiples and prime numbers</td></tr>
<tr><td rowspan="3">Foundations</td><td colspan="2">4 x and 8 x tables</td><td>100, 1000 times bigger</td><td>Multiplication facts up to 12 x 12</td><td>Partition to multiply mentally</td></tr>
<tr><td colspan="2">3 x, 6 x and 12 x tables; 3 x and 9 x tables</td><td>10, 100, 1000 times smaller</td><td rowspan="2">Apply place value to derive multiplication facts, e.g. 3 x 4 = 12 so 3 x 0.4 = 1.2</td><td>Double larger numbers and decimals</td></tr>
<tr><td colspan="2">11 x and 7 x tables</td><td>Double larger numbers and decimals</td><td></td></tr>
</table>