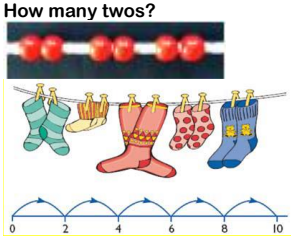
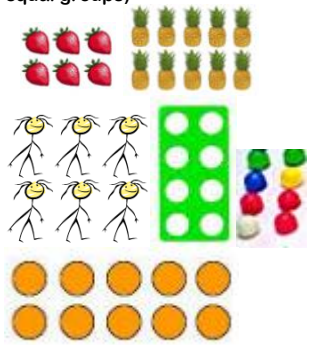
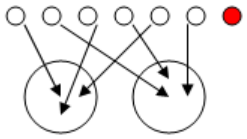
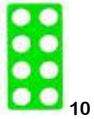
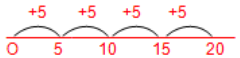
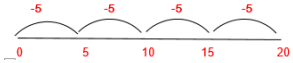
John Fletcher of Madeley Primary School

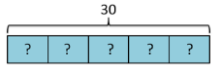
Calculation policy- DIVISION

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

<table>
<tr><th>Year</th><th colspan="2">1</th><th colspan="2">2</th></tr>
<tr><td>Overview and key vocabulary</td><td colspan="2">Sharing equally, grouping (grouping is a random arrangement of a quantity into equal groups) and halving in practical contexts.
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
share, one each, two each etc, How many (much) each? share equally between</td><td colspan="2">Work with a range of materials and contexts in which multiplication and division relate to grouping and sharing discrete and continuous quantities, to arrays and to repeated addition. Begin to relate these to fractions and measures, e.g. 40 ÷ 2 =20, 20 is half of 40.
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.
divide, divided by repeated addition, repeated subtraction, equal groups of, left, left over, remainder</td></tr>
<tr><td>Written Methods</td><td colspan="2"></td><td colspan="2">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: Equal-sharing
Inverse-of-multiplication 'How many groups of … in…?' (repeated subtraction from a given quantity, repeated addition to reach a given target)
If the answer is in the same units as the dividend, it is sharing. If the answer is in different units, it is grouping.
Ratio- inverse of scaling, i.e. finding the scale factor</td><td>Grouping/Sharing models
Using practical contexts and cross-curricular links (PE) such as socks and shoes; animals in the ark to get into groups.
Sharing models such as sharing pieces of fruit.

Sharing into equal groups
6 frogs shared equally between 2 lily pads gives 3 frogs on each lily pad
or
Grouping in equal groups
6 frogs grouped in 2s need 3 lily pads to sit on
 
How many twos?
  </td><td>Arrays
(rectangular arrangements to show equal groups)
 
Decision making
How many cars can you make if you have 8 wheels?
 
How many different ways can you arrange 12 buttons in equal groups?
  </td><td>Grouping/Sharing models
Introduce the ÷ symbol
 
15 frogs shared equally between three lily pads
15 ÷3 = 5
or
15 frogs grouped in 5s need 3 lily pads to sit on
15 ÷5 = 3

15 ÷ 3 = 5 groups of 3 (grouping)
 
20 ÷ 2 = 10
 
 
5 hops in 15. How big is each hop?
There are 7 cakes and 2 children. How many cakes will they get each? (Leftovers/remainders introduced)
 
7 ÷ 2 = 3r1</td><td>Arrays
  10 ÷ 2 = 5  and 10 ÷ 5 = 2
Repeated addition (to reach a given target)
 
There are 20 sweets in a bag. How many children can have 5 each?
 
Repeated subtraction (from a given quantity)
 
Links to tables
 
Use language of division linked to tables using counting stick

Representing problems
Jane has 30 cakes. She wants to share them equally between 5 boxes. How many cakes should go in each box?
 
30 ÷ 5 = 6
Number of cakes in each box = 6</td></tr>
<tr><td>With jottings… or in your head</td><td colspan="2">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="2">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="2">Count in multiples of twos, fives and tens.</td><td colspan="2">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 back in 2s</td><td>Halves up to 10</td><td>Division facts (2 x table)</td><td>Halves up to 20</td></tr>
<tr><td>Count back in 10s</td><td>Halve multiples of 10</td><td>Division facts (10 x table)</td><td>Review division facts (2 x, 5 x, 10 x tables)</td></tr>
<tr><td>Count back in 5s</td><td>How many 2s? 5s? 10s?</td><td>Division facts (5 x table)</td><td>Count back in 3s</td></tr>
</table>

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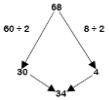
<table>
<tr><th>Year</th><th colspan="3">3</th><th colspan="3">4</th></tr>
<tr><td>Overview and key vocabulary</td><td colspan="2">Continue to practise mental recall of multiplication tables when calculating mathematical statements in order to improve fluency.
Estimate the answer to a calculation and 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>divided into</td><td colspan="2">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, e.g. 600 ÷ 3 = 200 can be derived from 2 x 3 = 6.
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.</td><td>divisible by, quotient, divisor, dividend</td></tr>
<tr><td>Written Methods</td><td colspan="3">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="3">Practise to become fluent in the formal written method of short division with exact answers (see Mathematics Appendix 1).</td></tr>
<tr><td>Developing Conceptual/ Procedural Understanding
Structures: Equal-sharing
Inverse-of-multiplication
'How many groups of … in…?' (repeated subtraction from a given quantity, repeated addition to reach a given target)
If the answer is in the same units as the dividend, it is sharing. If the answer is in different units, it is grouping.
Ratio- inverse of scaling, i.e. finding the scale factor</td><td colspan="2">Links to tables
 
Use language of division linked to tables using counting stick

Using known facts
If 3 x 2 = 6, then 30 x 2 = 60, 60 ÷3 = 20 and
30 = 60 ÷ 2.

Partitioning strategy to halve
Halve 68
 

Rearranging the dividend to find multiples of the divisor.
48 ÷ 3 =
'What do I know about the 3 x tables?'
"I know 3 x 10 = 30 and 3 x 6 = 18."
 

48 ÷ 3 = 16</td><td colspan="2">Place value materials to represent calculations
Diennes and then place value counters.

Short division
72 ÷ 3 =

2 4
3 | 7 12

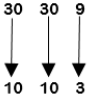
'72 divided by 3. 7 tens shared equally between 3 is 2 with a remainder of 1 ten. Exchange the 1 ten for 10 units. I now have 12 units which shared equally between 3 is 4. The answer is 24."

Decision making

"The missing number for the number sentence below must be greater than 50."
☐ ÷ 5 = 15

What do you think? Convince me.</td><td colspan="2">Links to tables
 
Use language of division linked to tables using counting stick

Using known facts
If 2 x 3 = 6 then 200 x 3 = 600 and 600 ÷3 = 200

Rearranging the dividend to find multiples of the divisor.
69÷ 3 =
'What do I know about the 3 x tables?'
"I know 3 x 10 = 30 and 3 x 3 = 9."
 

69 ÷ 3 = 23</td><td>Place value materials to represent calculations
Place value counters.

Short division
372 ÷ 6 =

0 6 2
6 | 3 37 12

'372 divided by 6. 3 hundreds cannot be shared equally between 6, so exchange the hundreds for 30 tens. I now have 37 tens which shared equally between 6 is 6 with a remainder of 1 ten. Exchange the ten for 10 units. I now have 12 units which shared equally between 6 is 2. The answer is 62."

Decision making
"When you divide an even number by 3, you will always have a remainder."
What do you think? Convince me.

Is it always, sometimes or never true that an even number that is divisible by 3 is also divisible by 6?

Is it always, sometimes or never true that the sum of four even numbers is divisible by 4?</td></tr>
<tr><td>With jottings… or in your head</td><td colspan="3">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 (12 sweets shared equally between 4 children; 4 cakes shared equally between 8 children).</td><td colspan="3">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.</td></tr>
<tr><td>Just know it!</td><td colspan="3">Recall and use x and ÷ facts for the 3, 4 and 8 x tables</td><td colspan="3">Recall x and ÷ facts for x tables up to 12 x 12.</td></tr>
<tr><td rowspan="3">Foundations</td><td>Review division facts (2 x, 5 x and 10 x tables)</td><td>Halve 2 digit numbers</td><td>Division facts (4x and 8x tables)</td><td colspan="2">10x smaller</td></tr>
<tr><td>Division facts (4 x table)</td><td>Division facts (3 x table)</td><td>Division facts (3 x, 6 x and 12 x tables)</td><td colspan="2">Halve larger numbers and decimals</td></tr>
<tr><td>Division facts (8 x table)</td><td>Division facts (6 x table)</td><td>Division facts (3 x and 9 x tables)</td><td colspan="2">Division facts (11 x and 7 x tables)</td></tr>
</table>

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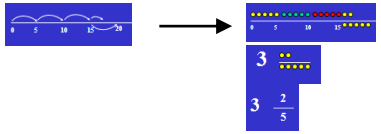
<table>
<tr><th>Year</th><th colspan="3">5</th><th colspan="3">6</th></tr>
<tr><td>Overview and key vocabulary</td><td colspan="2">Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy.
Promote decision making so that pupils choose an appropriate method/strategy.</td><td>divisibility</td><td colspan="2">Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.</td><td>If appropriate for mental methods- distributive
(a + b)÷c= (a ÷ c) + (a ÷ c) (a - b)÷c= (a ÷ c) +-(b ÷ c)</td></tr>
<tr><td>Written Methods</td><td colspan="3">Divide numbers up to 4 digits by a 1 digit number using the formal written method of short division and interpret remainders appropriately for the context (as remainders, as fractions, as decimals or by rounding, e.g. 98 ÷ 4 = $\frac{98}{4}$ = 24 r2 = 24 ½= 24.5 ≈ 25).
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="3">Divide numbers up to 4 digits by a 2 digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate to the context.
Divide numbers up to 4 digits by a 2 digit number using the formal written method of short division where appropriate, interpreting remainders according to the context.
Solve problems involving addition, subtraction, multiplication and division.</td></tr>
<tr><td>Developing Conceptual/ Procedural Understanding
Structures: Equal-sharing
Inverse-of-multiplication
'How many groups of … in…?' (repeated subtraction from a given quantity, repeated addition to reach a given target)
If the answer is in the same units as the dividend, it is sharing. If the answer is in different units, it is grouping.
Ratio- inverse of scaling, i.e. finding the scale factor</td><td colspan="2">Using known facts
If 6 ÷ 2 = 3 then 6000 ÷ 2 = 3000 and
6000 ÷ 20 = 300
Place value materials to represent calculations

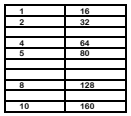
Place value counters.

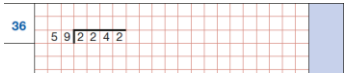
Short division
483 ÷ 7 =

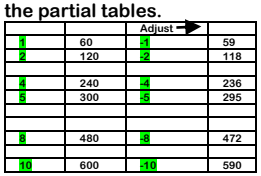
0 6 9 r1
7 | 4 48 64

"484 divided by 7. 4 hundreds cannot be shared equally between 7, so exchange the hundreds for 40 tens. I now have 48 tens which shared equally between 7 is 6 with a remainder of 6 tens. Exchange the 6 tens for 60 units, we now have 64 units. 64 shared equally between 7 equals 9 remainder 1. The answer is 69 r1."</td><td colspan="2"><u>Interpreting remainders</u>
17 ÷ 5
"What do I know? 17 is not a multiple of 5."
 
3 2/5 = 3.4
From knowledge of decimal/fraction equivalents or by converting $\frac{2}{5}$ into $\frac{4}{10}$.

Decision making
Children investigate alternative methods such as rearranging the standard written method, rearranging the dividend and partitioning and discuss when these might be most appropriate and efficient.
Examples:
 

581 ÷ 7 could be calculated by the formal written method of short division or it could be calculated by rearranging the dividend, using known facts, into 560 and 21.</td><td colspan="2">Using known facts
If 6 ÷ 2 = 3 then 6÷ 0.2 = 30 and
6 ÷ 0.02 = 300
Short division
97.6 ÷ 5 =
1 9 . 5 2
5 | 9 47. 26 10
"97.6 divided by 5. 9 tens shared equally between 5 is 1 with a remainder of 4 tens. Exchange the ten for 10 units. I now have 47 units which shared equally between 5 is 9 with a remainder of 2 units. Exchange the 2 units for 20 tenths, we now have 26 tenths. 26 shared equally between 5 equals 5 with a remainder of 1 tenth. Extend the dividend with a 0 in the hundredths column. Exchange the tenth for 10 hundredths. 10 shared equally between 5 equals 2. The answer is 19.52."
Long division
(thinking not generally recorded)
384 ÷ 16
 
"What do I know about the divisor?" Record partial tables.

24
16 | 384
-32 (38 tens ÷16 = 2 r6; 2 x 16 =32)
64 (bring the 4 down)
-64 (64 units ÷ 16 =4)
0 (no remainder)</td><td> 

With questions of this type where the divisor is close to a number linked to the times tables, encourage the children to use known facts and adjustment to set up the partial tables.
 

Decision making
Examples should be given where the calculation could be completed either by a short division or a long division method so that children can explore which is the most efficient method for them and/or where there are several different ways of recording the final answer e.g. 564 ÷ 13
564 ÷ 13 = 43 r5 = 43 $\frac{5}{13}$ =43.4(to 1dp)
Decide how to record answer according to the context.

"When one number is divided by another the answer will always be smaller."
What do you think? Convince me.</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</td><td colspan="3">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)
If appropriate- (Solve problems involving dividing, including using the distributive law to divide 2 digit numbers by 1 digit (92 ÷ 4 = 80 ÷ 4 + 12 ÷ 4 or 92 ÷ 4 = 100 ÷4 – 8 ÷ 4))</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</td><td colspan="3">Identify common factors, common multiples and prime numbers</td></tr>
<tr><td rowspan="3">Foundations</td><td>Division facts (4 x and 8 x tables)</td><td>100, 1000 times smaller</td><td rowspan="3">Division facts up to 12 x 12
Apply place value to derive division facts, e.g. 12 ÷3 = 4 so 1.2 ÷3 = 0. 4</td><td colspan="2" rowspan="3">Halve larger numbers and decimals
Partition to divide mentally including decimals</td></tr>
<tr><td>Division facts (3 x, 6 x and 12 x tables; 3 x and 9 x tables)</td><td>Partition to divide mentally</td></tr>
<tr><td>Division facts (11 x and 7 x tables)</td><td>Halve larger numbers and decimals</td></tr>
</table>