Mathematics Calculation

Policy

1	Summary	Calculation Policy			
2	Responsible person	Stephanie Crawford/ Emily Mortimer			
3	Accountable SLT member	Stephanie Crawford/ Tracey Johnson			
4	Applies to	☒All staff ☐Support staff ☐Teaching staff			
5	Who has overseen development of this policy	Stephanie Crawford/ Emily Mortimer			
6	Who has been consulted and recommended policy for approval	Governors			
7	Approved by and date	4.9.24			
8	Version number				
9	Available on	Every	☐Y ☐N	Trust website Academy website SharePoint	☐Y ☐N ☐Y ☐N ☐Y ☐N
10	Related documents (if applicable)				
11	Disseminated to	☐Trustees/governors ☒All staff ☐Support staff ☐Teaching staff			
12	Date of implementation (when shared)				
13	Consulted with recognised trade unions	☐Y ☐N			

Contents

1. Introduction

1.1. This policy exemplifies a recommended progression through the four operations, beginning in Foundation Stage and carrying on to Year 6, including the appropriate steps from the White Rose curriculum.

2. Scope of the policy

2.1. Children should begin by using mental calculations and then will build up towards written calculations.
This policy outlines which methods should be used in which year group and runs directly in line with the sequence and planning progression laid out in the White Rose Maths curriculum documents,

Children are ready to take on written calculations in addition and subtraction when:

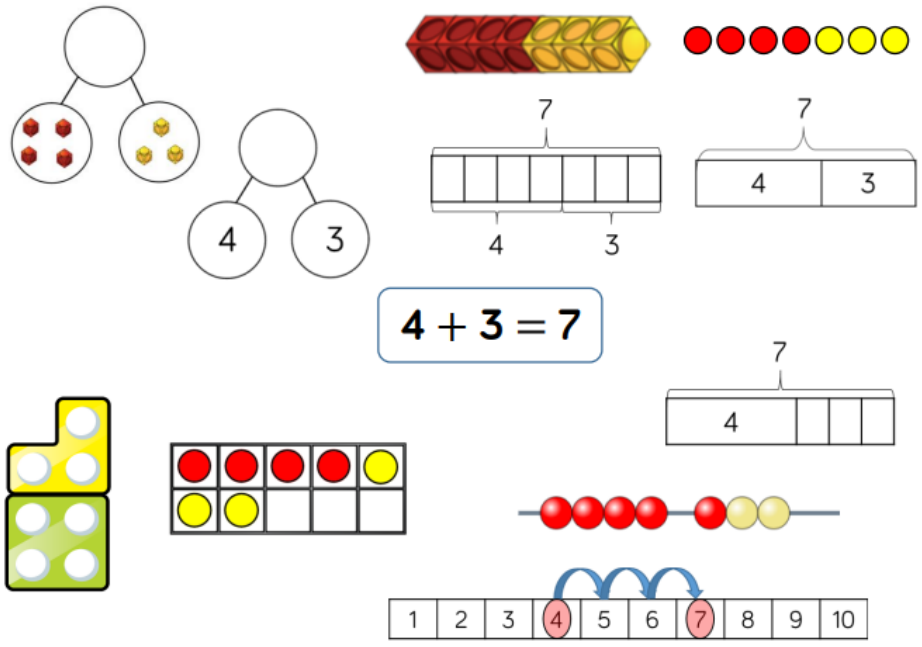
- Children know addition and subtraction facts to 20.
- They understand place value and can partition numbers into hundreds, tens and units.
- They use and apply commutative and associative laws of addition.
- They can add at least three 1-digit numbers mentally.
- They can add and subtract any pair of 2 digit numbers mentally.
- They can explain their mental strategies orally and can record those using informal jottings.
- Children are ready to take on written calculations in multiplication and division when:
- They know 2,3,4,5 and 10 times tables.
- They know the result of multiplying by 0 and 1
- They understand place value.
- They understand 0 as a place holder.
- Children can use their knowledge of tables to approximate.
- They can explain their mental strategies orally and record them using informal jottings.

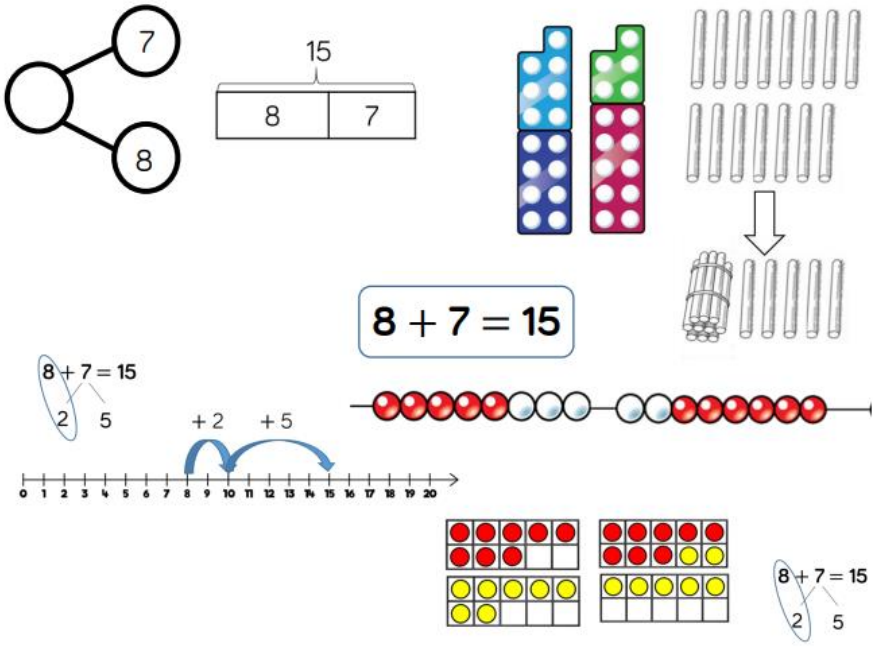
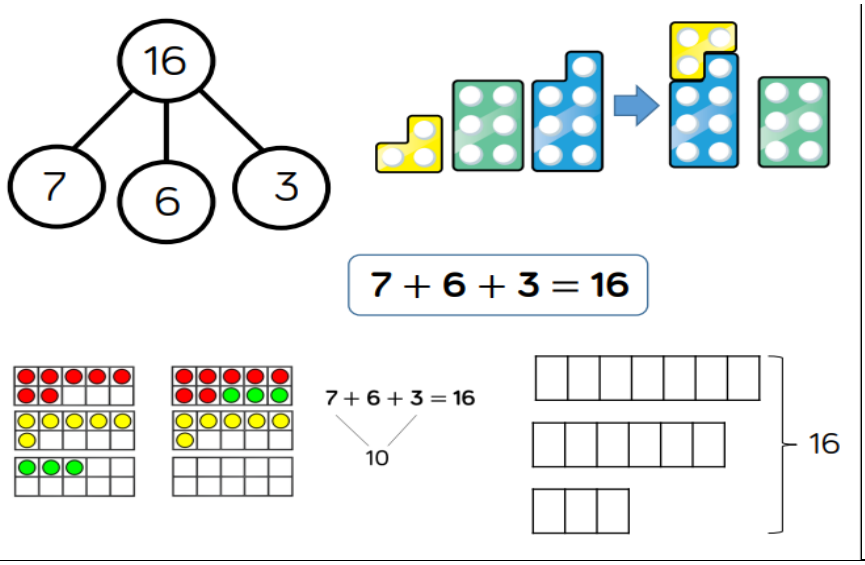
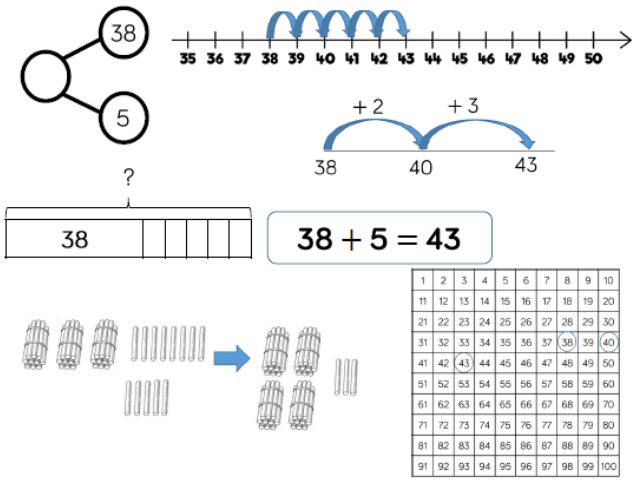
By the end of year 6, children will have a range of calculation methods, mental and written.

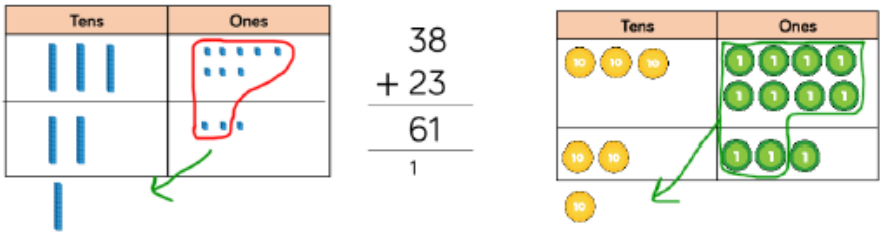
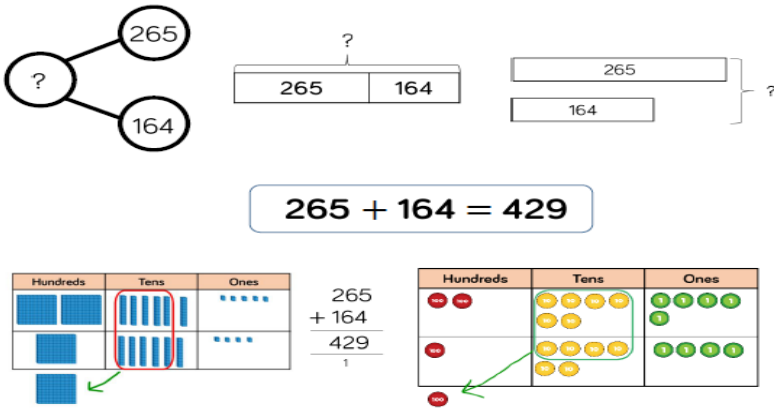
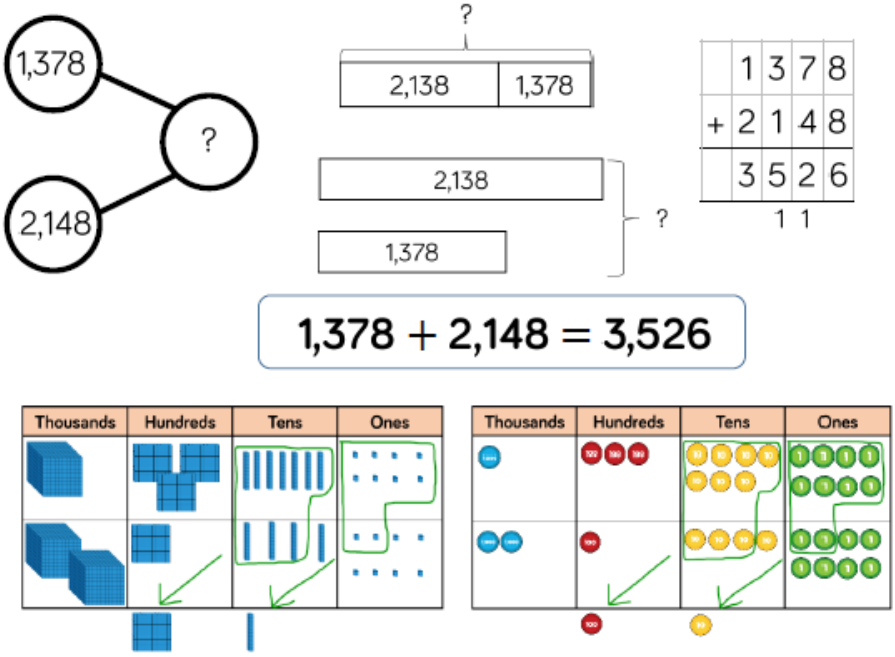
3. Implementation of the policy

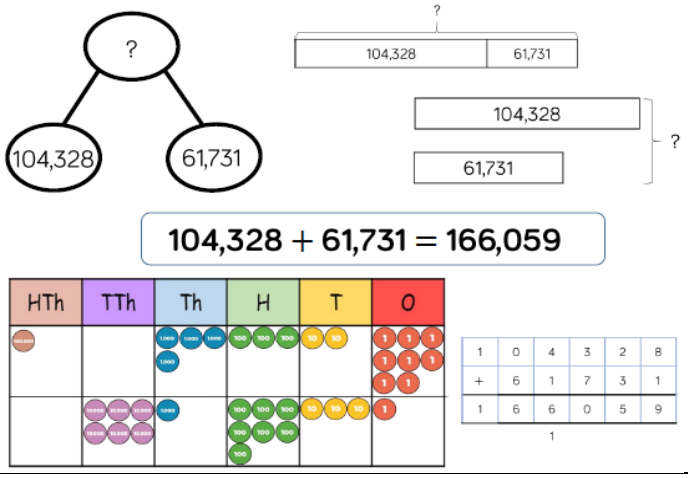
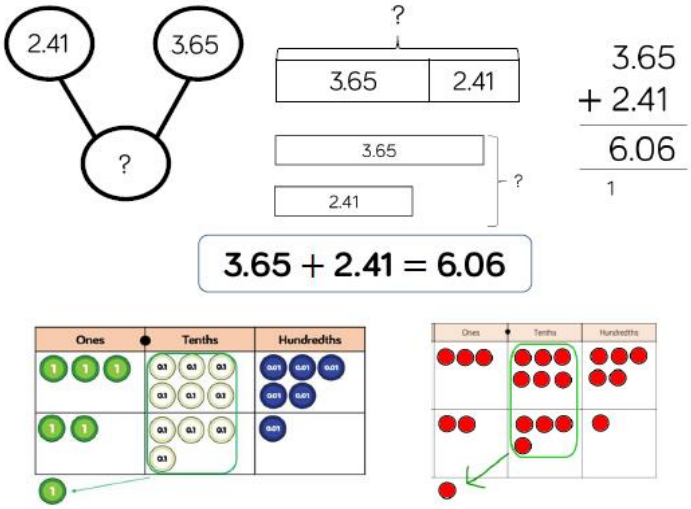
3.1. This policy will be used and followed within each Maths unit each term. The White Rose lesson structures, planning documents and work books out line which strategies will be used within each lesson and continue to progress throughout each year group. The new 3.0 scheme also addresses key teaching points from the previous year group to ensure any learning gaps are filled before moving onto a new skill.

4. Addition

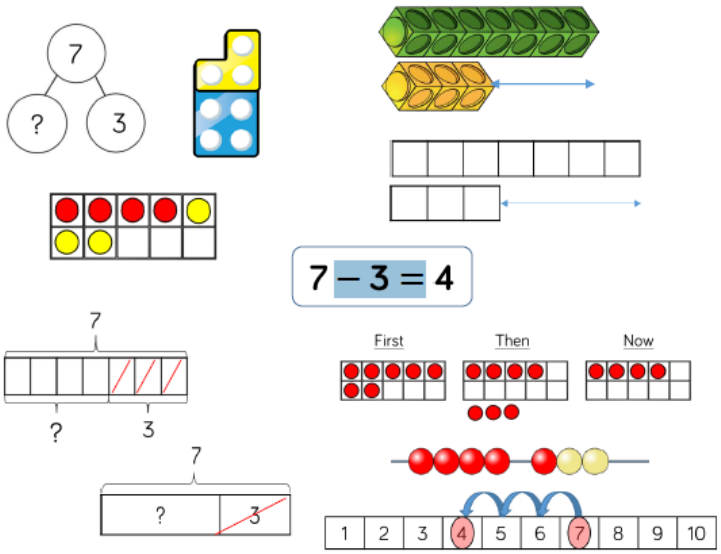
Year 1 When adding numbers to 10, children can explore both aggregation and augmentation. The part-whole model, discrete and continuous bar model, number shapes and ten frame support aggregation. The combination bar model, ten frame, bead string and number track all support augmentation	**Add 1d numbers within 10** 

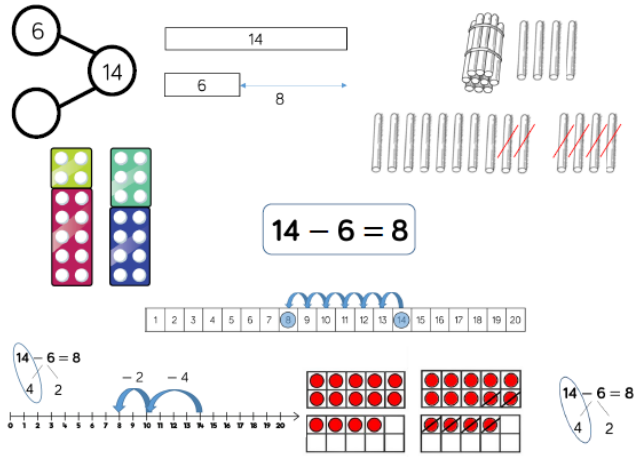
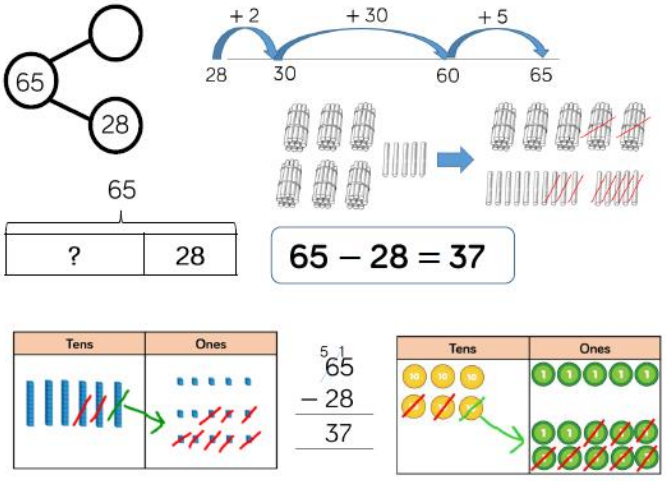
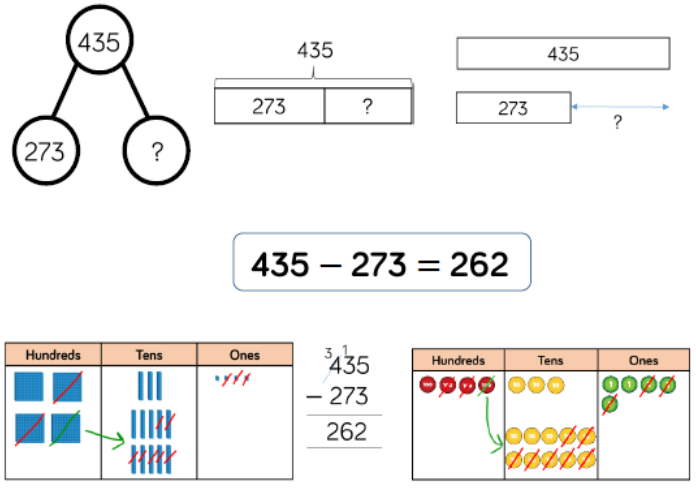
Year 1 / 2 When adding one - digit numbers that cross 10, it is important to highlight the importance of ten ones equalling one ten. In Year 1, this is only done just by counting on. From Year 2, use different manipulatives can be used to represent this exchange alongside number lines to support children in understanding how to partition their jumps.	**Add 1 and 2d numbers within 20** 
Year 2 When adding three 1 digit numbers, children should be encouraged to look for number bonds to 10 or doubles to add the numbers more efficiently. This supports children in their understanding of commutativity. Manipulatives that highlight number bonds to 10 are effective when adding three 1 digit numbers	**Add 3 1d numbers** 
Year 2/3 When adding single digits to a two-digit number, children should be encouraged to count on from the larger number. They should also apply their knowledge of number bonds to add more efficiently e.g. 8 + 5 = 13 so 38 + 5 = 43. Hundred squares and	**Add 1d and 2d numbers to 100** 

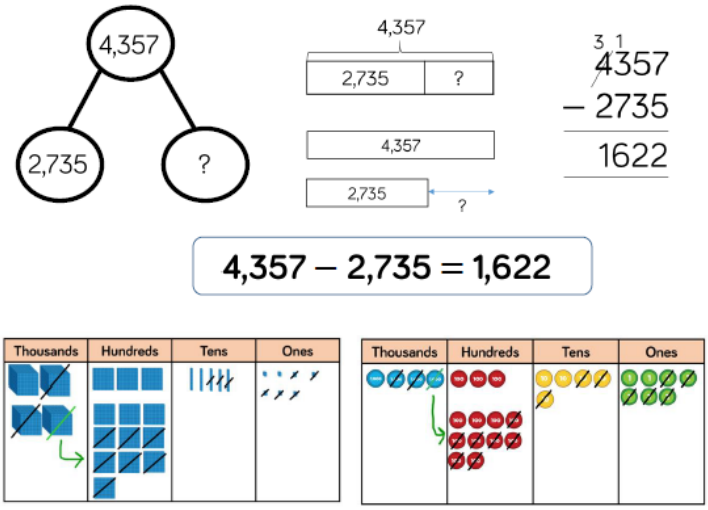
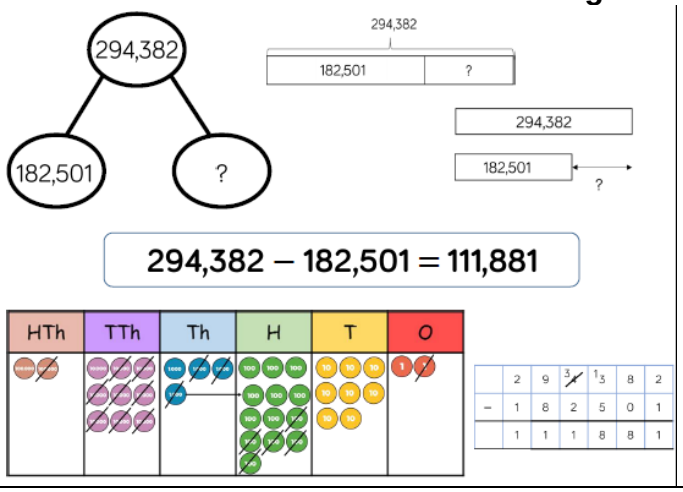
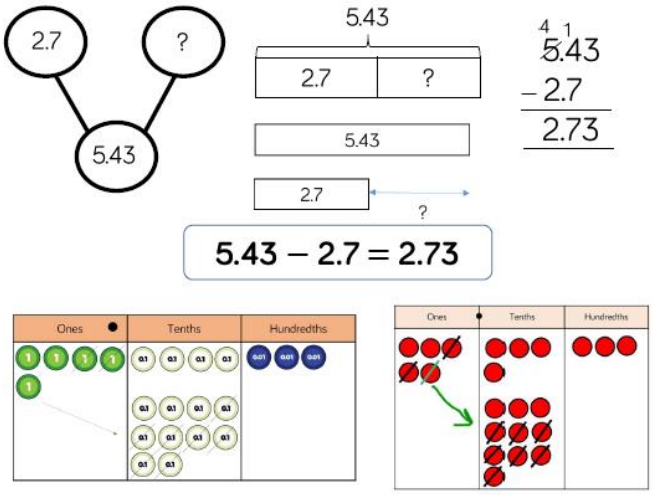
straws can support children to find the number bond to 10. Children can use a blank number line and other representations to count on to find the total. Encourage them to jump to multiples of 10 to become more efficient. From Year 3, encourage children to use the formal column method when calculating alongside straws, base 10 or place value counters. As numbers become larger, straws become less efficient.	**Add two 2d numbers to 100** 
Year 3 Base 10 and place value counters are the most effective manipulatives when adding numbers with up to 3 digits. Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method. Plain counters on a place value grid can also be used to support learning.	**Add numbers with up to 3 digits** 
Year 4 Base 10 and place value counters are the most effective manipulatives when adding numbers with up to 4 digits. Ensure children write out their calculation alongside any concrete resources so hey can see the links to the written column method. Plain counters on a place value grid can also be used to support learning.	**Add numbers with up to 4 digits** 

Year 5/6 Place value counters or plain counters on a place value grid are the most effective concrete resources when adding numbers with more than 4 digits. At this stage, children should be encouraged to work in the abstract, using the column method to add larger numbers efficiently.	**Add numbers with more than 4 digits** 
Year 5 Place value counters and plain counters on a place value grid are the most effective manipulatives when adding decimals with 1, 2 and then 3 decimal places. Ensure children have experience of adding decimals with a variety of decimal places. This includes putting this into context when adding money and other measures.	**Add with up to 3dp** 

5. Subtraction

Year 1 Part-whole models, bar models, ten frames and number shapes support partitioning. Ten frames, number tracks, single bar models and bead strings support reduction. Cubes and bar models with two bars can support finding the difference.	**Subtract 1d numbers within 10** 

Year 1/2 In Year 1, subtracting one-digit numbers that cross 10, is done by counting back, using objects, number tracks and number lines. From Year 2, children should be encouraged to find the number bond to 10 when partitioning the subtracted number. Ten frames, number shapes and number lines are particularly useful for this.	**Subtract 1 and 2 digit numbers to 20** 
Year 2/3 Children can also use a blank number line to count back to find the difference. Encourage them to jump to multiples of 10 to become more efficient. From Year 3, encourage children to use the formal column method when calculating alongside straws, base 10 or place value counters. As numbers become larger, straws become less efficient.	**Subtract 1 and 2 digit numbers to 100** 
Year 3 Base 10 and place value counters are the most effective manipulative when subtracting numbers with up to 3 digits. Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method. Plain counters on a place value grid can also be used to support learning.	**Subtract numbers with up to 3 digits** 
Year 4 Base 10 and place value counters are the most effective manipulatives when subtracting numbers with up to 4 digits.	**Subtract numbers with up to 3 digits**

Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method. Plain counters on a place value grid can also be used to support learning.	
Year 5/6 Place value counters or plain counters on a place value grid are the most effective concrete resource when subtracting numbers with more than 4 digits. At this stage, children should be encouraged to work in the abstract, using column method to subtract larger numbers efficiently	**\Subtract numbers with more than 4 digits** 
Year 5/6 Place value counters and plain counters on a place value grid are the most effective manipulative when subtracting decimals with 1, 2 and then 3 decimal places. Ensure children have experience of subtracting decimals with a variety of decimal places. This includes putting this into context when subtracting money and other measures.	**Subtract with up to 3 decimal places** 

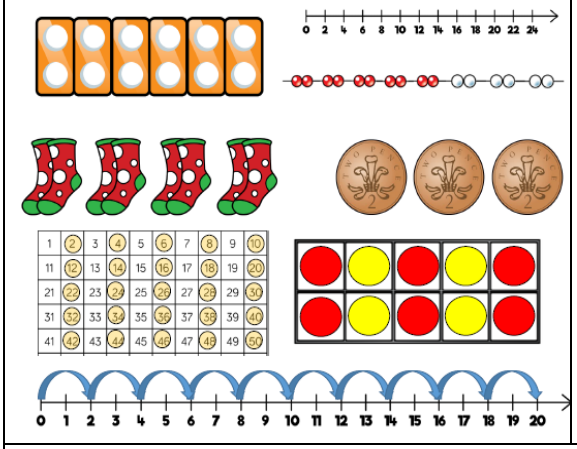
6. Times tables

Year 2

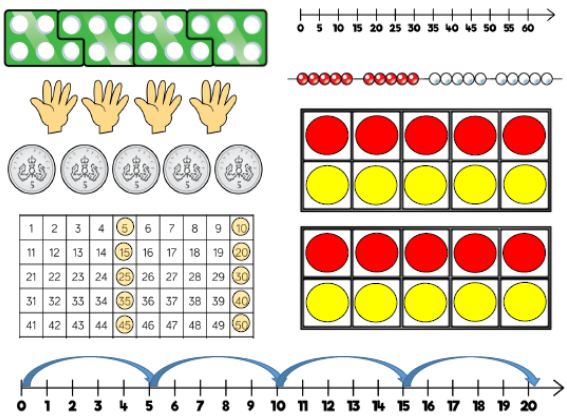
2X- Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square. Look for patterns in the two times table, using concrete manipulatives to support. Notice how all the numbers are even and there is a pattern in the ones. Use different models to develop fluency

5X- Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square. Look for patterns in the five times table, using concrete manipulatives to support. Notice the pattern in the ones as well as highlighting the odd, even, odd, even pattern.

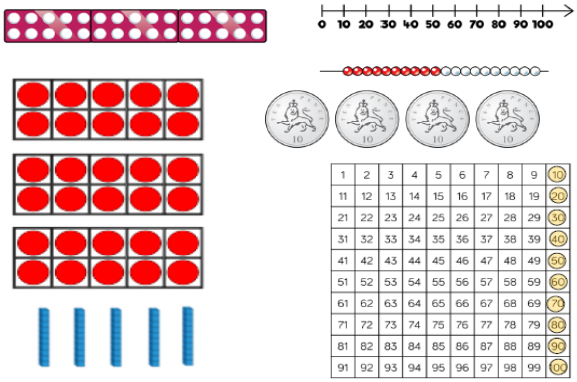
2x tables



5x tables



10x tables



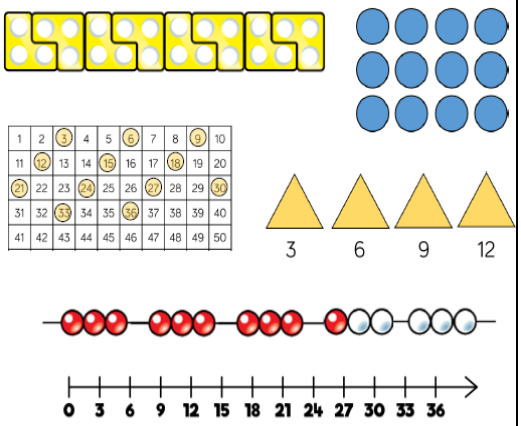
10X Encourage daily counting in multiples both forwards and
backwards. This can be supported using a number line or a hundred square. Look for patterns in the ten times table, using concrete manipulatives to support. Notice the pattern in the digits-the ones are always 0, and the tens increase by 1 ten each time.

Year 3

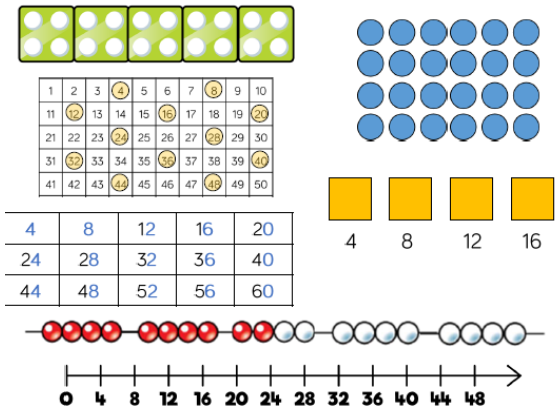
3X- Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square. Look for patterns in the three times table, using concrete manipulatives to support. Notice the odd, even, odd, even pattern using number shapes to support. Highlight the pattern in the ones using a hundred square.

4X- Encourage daily counting in multiples, supported by a number line or a hundred square. Look for patterns in the four times table, using manipulatives to support. Make links to the 2 times table, seeing how each multiple is double the twos. Notice the pattern in the ones
within each group of five multiples.
Highlight that all the multiples are even using number shapes to support.

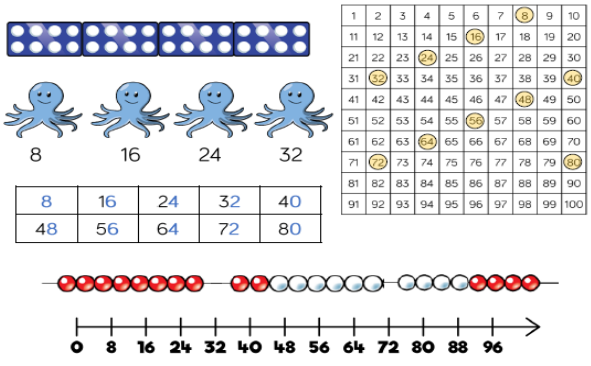
3x tables



4x tables



8x tables



8X Encourage daily counting in multiples, supported by a number line or a hundred square.
Look for patterns in the eight times table, using manipulatives to support. Make links to the 4 times table, seeing how each multiple is double the fours. Notice the pattern in the ones within each group of five multiples.
Highlight that all the multiples are even using number shapes to support.

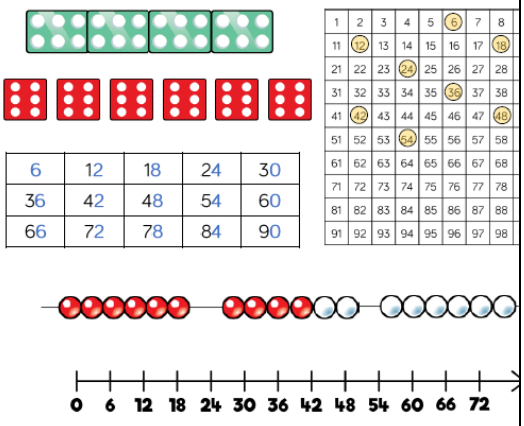
Year 4

6X- Encourage daily counting in multiples, supported by a number line or a hundred square. Look for patterns in the six times table, using manipulatives to support. Make links to the 3 times table, seeing how each multiple is double the threes. Notice the pattern in the ones within each group of five multiples.
Highlight that all the multiples are even using number shapes to support

9X- Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square.
Look for patterns in the nine times table, using concrete manipulatives to support. Notice the pattern in the tens and ones using the hundred square to support as well as noting the odd, even pattern within the multiples

7X- Encourage daily counting in multiples both forwards and backwards, supported by a number line or a hundred square.
The seven times table can be trickier to learn due to the lack of obvious pattern in the numbers, however they already know several facts due to commutativity.
Children can still see the odd, even pattern in the multiples using number shapes to support.

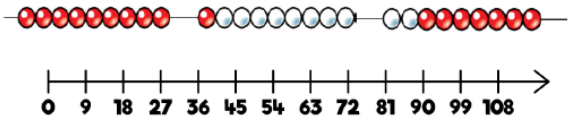
6x tables



6	12	18	24	30
36	42	48	54	60
66	72	78	84	90

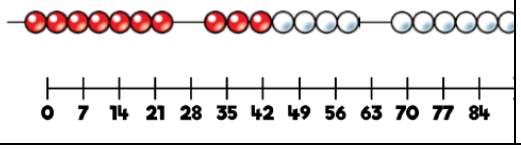
9x tables

9	18	27	36	45
54	63	72	81	90



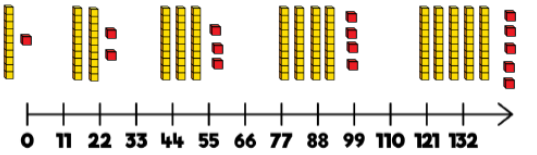
7x tables

7	14	21	28	35
42	49	56	63	70



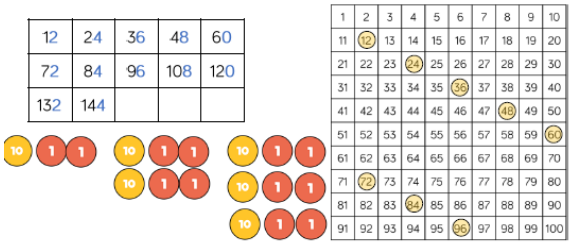
11x tables

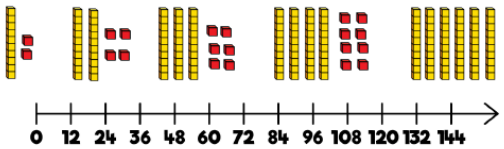
11	22	33	44	55	66
77	88	99	110	121	132



12x tables

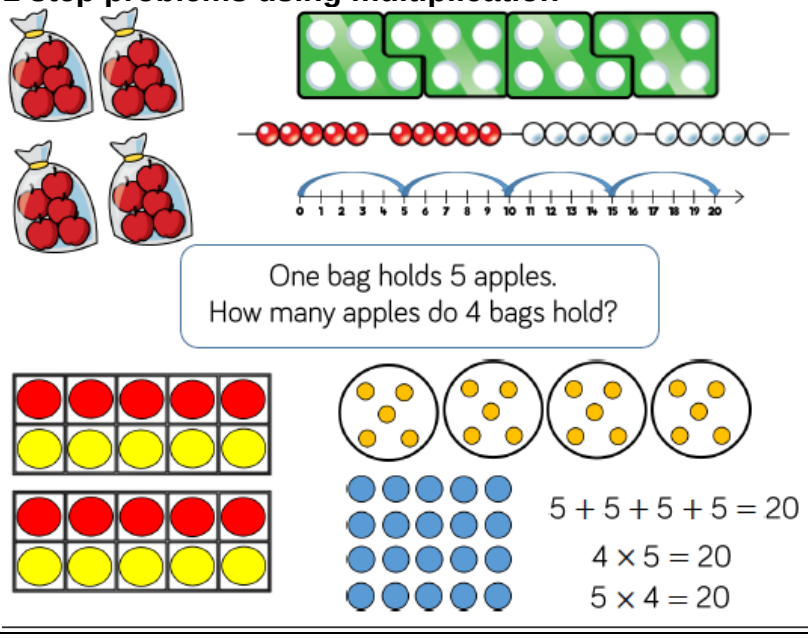
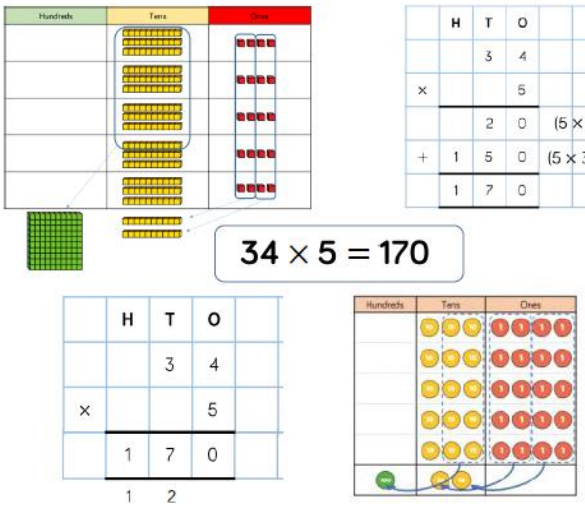
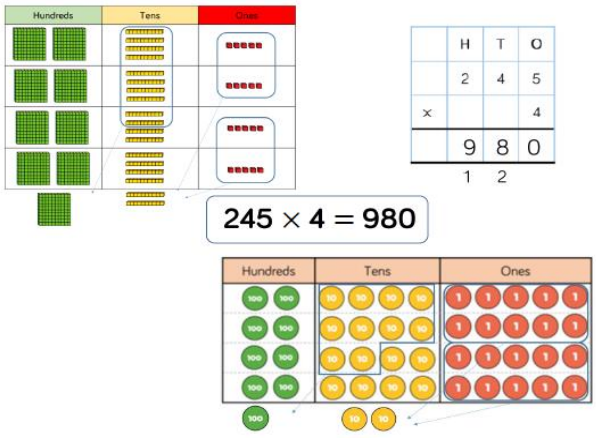
12	24	36	48	60
72	84	96	108	120
132	144			

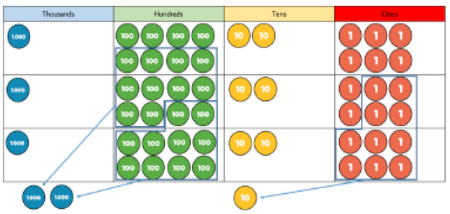
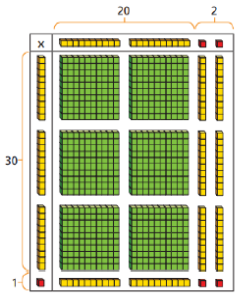
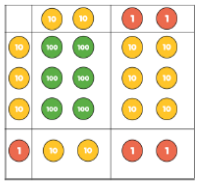
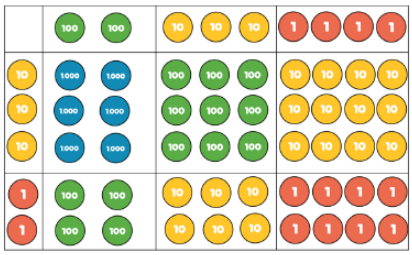




11X- Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square.
Look for patterns in the eleven times table, using concrete manipulatives to support. Notice the pattern in the tens and ones using the hundred square to support. Also consider the pattern after crossing 100.
12X- Encourage daily counting in multiples, supported by a number line or a hundred square. Look for patterns in the 12 times table, using manipulatives to support. Make links to the 6 times table, seeing how each multiple is double the sixes. Notice the pattern in the ones within each group of five multiples. The hundred square can support in highlighting this pattern.

7. Multiplication

Year 1/2 Children represent multiplication as repeated addition in many different ways. In Year 1, children use concrete and pictorial representations to solve problems. They are not expected to record multiplication formally. In Year 2, children are introduced to the multiplication symbol.	**1 step problems using multiplication** 
Year 3/4 Informal methods and the expanded method are used in Year 3 before moving on to the short multiplication method in Year 4. Place value counters should be used to support the understanding of the method rather than supporting the multiplication, as children should use times table knowledge	**2dx1d** 
Year 3/4 When moving to 3-digit by 1-digit multiplication, encourage children to move towards the short, formal written method. Base 10 and place value counters continue to support	**3dx1d** 

the understanding of the written method. Limit the number of exchanges needed in the questions and move children away from resources when multiplying larger numbers.	
Year 5 When multiplying 4-digit numbers, place value counters are the best manipulative to use to support children in their understanding of the formal written method. If children are multiplying larger numbers and struggling with their times tables, encourage the use of multiplication grids so children can focus on the use of the written method. When multiplying a multi-digit number by 2-digits, use the area model to help children understand the size of the numbers they are using. This links to finding the area of a rectangle by finding the space covered by the Base 10.The grid method matches the area model as an initial written method before moving on to the formal written multiplication method	**4x1d**  1,826 × 3 = 5,478 Th H T O 1 8 2 6 × 3 5 4 7 8 2 1 **2dx2d**   × 20 2 30 600 60 1 20 2 H T O 2 2 × 3 1 2 2 6 6 0 6 8 2 22 × 31 = 682 **3dX2d**  Th H T O 2 3 4 × 3 2 4 6 8 1 7 1 0 2 0 7 4 8 8 × 200 30 4 30 6,000 900 120 2 400 60 8 234 × 32 = 7,488 Children can continue to use the area model when multiplying 3-digits by 2-digits. Place value counters become more efficient to use but Base 10 can be used to highlight the size of numbers. Children should now move towards the formal written method, seeing the links with the grid method
Year 5/6 When multiplying 4-digits by 2-digits, children should be confident in using the formal written method. If they are still struggling with times tables, provide multiplication grids to support when they are focusing on the use of the method. Consider where exchanged digits are	**4dx2d** TTh Th H T O 2 7 3 9 × 2 8 2 1 9 1 2 2 5 3 7 5 4 7 8 0 1 1 7 6 6 9 2 1 2,739 × 28 = 76,692

placed and make sure this is consistent.	

8. Division

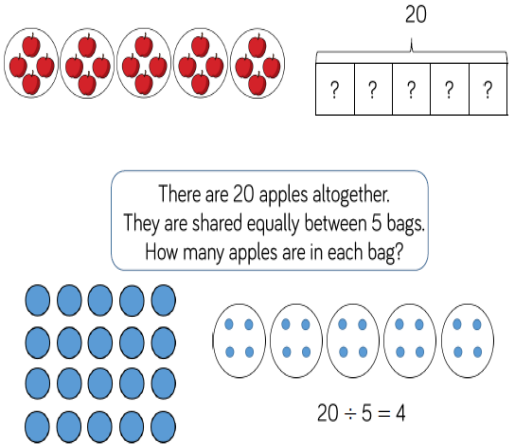
Year 1/2

Sharing- Children solve problems by sharing amounts into equal groups. In Year 1, children use concrete and pictorial representations to solve problems. They are not expected to record division formally.

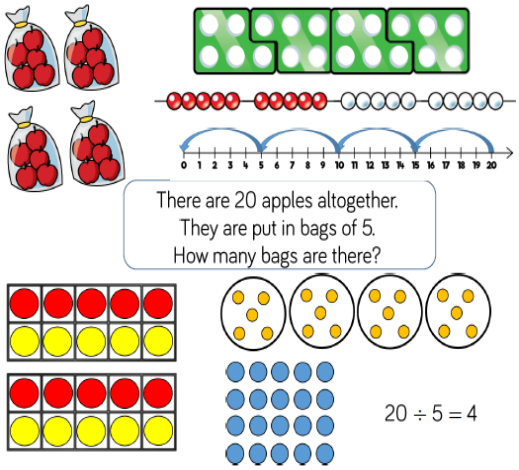
In Year 2, children are introduced to the division symbol.

Grouping- Children solve problems by grouping and counting the number of groups. Grouping encourages children to count in multiples and links to repeated subtraction on a number line. They can use concrete representations in fixed groups such as number shapes which helps to show the link between multiplication and division.

1 step problems- sharing



1 step problems- grouping

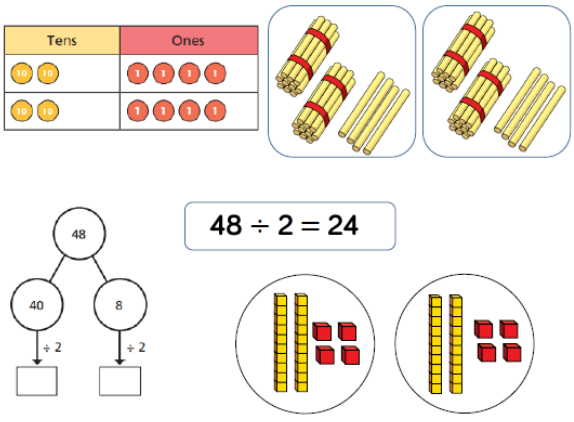


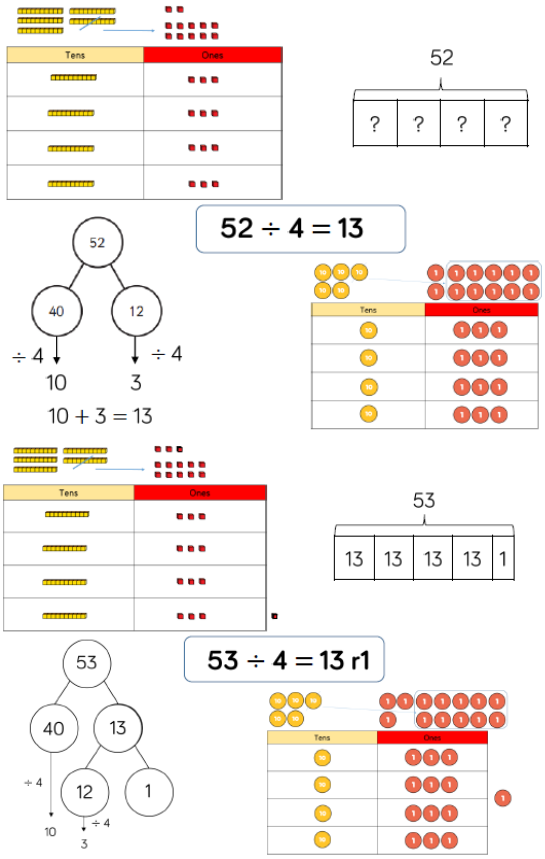
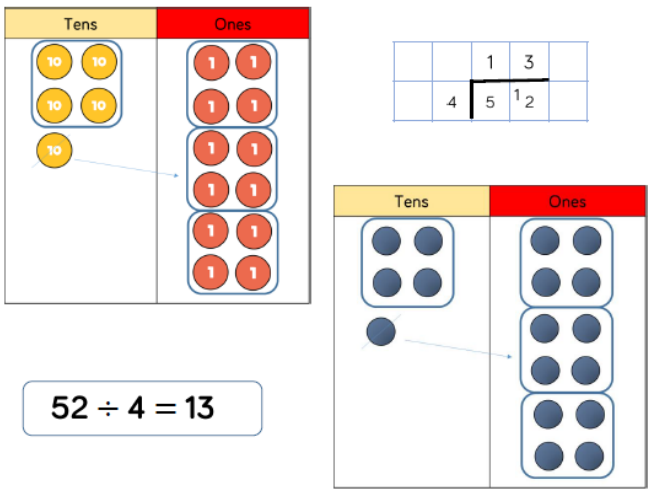
Year 3

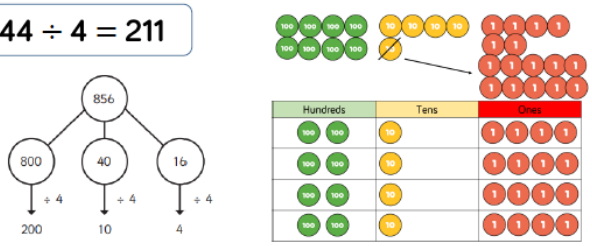
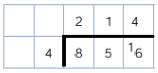
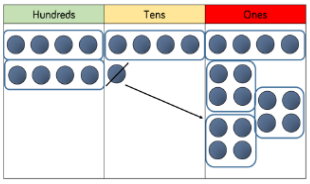
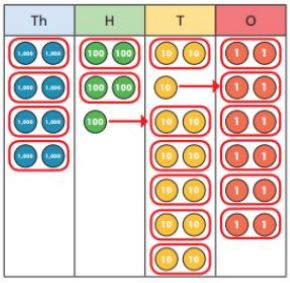
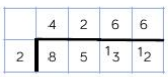
When dividing larger numbers, children can use manipulatives that allow them to partition into tens and ones.

Straws, Base 10 and place value counters can all be used to share numbers into equal groups.

Divide 2 by 1 digit (sharing with no exchanges)



Part-whole models can provide children with a clear written method that matches the concrete representation.	
Year 3/4 **Exchanges-** When dividing numbers involving an exchange, children can use Base 10 and place value counters to exchange one ten for ten ones. Children should start with the equipment outside the place value grid before sharing the tens and ones equally between the rows. Flexible partitioning in a part-whole model supports this method. **Sharing-** When dividing numbers with remainders, children can use Base 10 and place value counters to exchange one ten for ten ones. Starting with the equipment outside the place value grid will highlight remainders, as they will be left outside the grid once the equal groups have been made. Flexible partitioning in a part-whole model supports this method.	**Dividing 2d by 1d with exchanges** **Divide 2d by 1d with sharing/ remainders** 
Year 5 When using the short division method, children use grouping. Starting with the largest place value, they group by the divisor. Language is important here. Children should consider 'How many groups of 4 tens can we make?' and 'How many groups of 4 ones can we make?'	**Divide 2d by 1d- grouping** 

Remainders can also be seen as they are left ungrouped.	
Year 4 Children can continue to use place value counters to share 3-digit numbers into equal groups. Children should start with the equipment outside the place value grid before sharing the hundreds, tens and ones equally between the rows. This method can also help to highlight remainders. Flexible partitioning in a part-whole model supports this method.	**Divide 3d by 1d-sharing** 844 ÷ 4 = 211  844 ÷ 4 = 211 
Year 5 **3d by 1d-**Children can continue to use grouping to support their understanding of short division when dividing a 3-digit number by a 1-digit number. Place value counters or plain counters can be used on a place value grid to support this understanding. Children can also draw their own counters and group them through a more pictorial method. **4d by 1d-** Place value counters or plain counters can be used on a place value grid to support children to divide 4-digits by 1-digit. Children can also draw their own counters and group them through a more pictorial method. Children should be encouraged to move away from the concrete and pictorial when	**Divide 3d by 1d- grouping**    856 ÷ 4 = 214 **Divide 4d by 1d- grouping**   8,532 ÷ 2 = 4,266

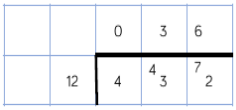
dividing numbers with multiple exchanges.

Year 6

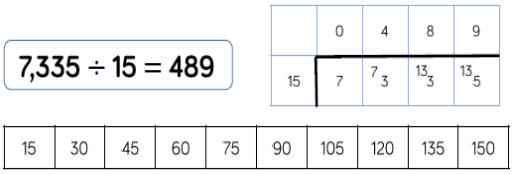
Short division- When children begin to divide up to 4- digits by 2-digits, written methods become the most accurate as concrete and pictorial representations become less effective. Children can write out multiples to support their calculations with larger remainders. Children will also solve problems with remainders where the quotient can be rounded as appropriate.

Multi digits- long division- Children can also divide by 2-digit numbers using long division. Children can write out multiples to support their calculations with larger remainders. Children will also solve problems with remainders where the quotient can be rounded as appropriate.

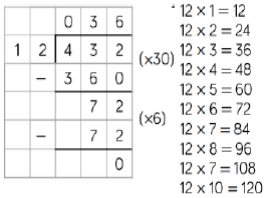
Divide multi digits- short division



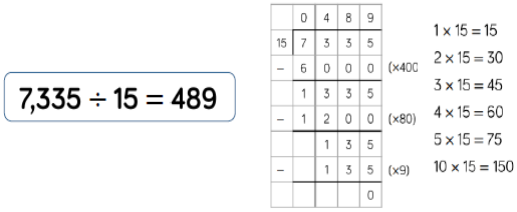
$432 \div 12 = 36$



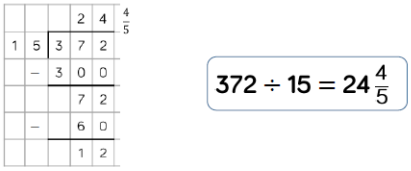
Divide multi-digits- long



$432 \div 12 = 36$



Divide multi -digits by 2d- long division



2d long division- When a remainder is left at the end of a calculation, children
can either leave it as a remainder or convert it to a fraction.
This will depend on the context of the question.
Children can also answer questions where the quotient needs to be rounded according to the context.