



St Joseph's Primary School Calculations Policy

This policy has been written using the NCETM Calculation Guidance and the DFE Non-Statutory Guidance. This policy should be read in conjunction with the Maths Progression document.

This policy is to ensure that pupils develop efficient strategies for solving calculations. Efficiency in calculation requires having a variety of mental strategies. Informal methods of recording calculations are an important stage to help children develop fluency with formal methods of recording.

Teaching column methods for calculation provides the opportunity to develop both procedural and conceptual fluency.

Children's conceptual understanding and fluency is strengthened if they experience concrete, visual, and abstract representations of a concept during a lesson. Moving between the concrete and the abstract helps children to connect abstract symbols with familiar contexts, thus providing the opportunity to make sense of, and develop fluency in the use of, abstract symbols.

Pupils should be able to choose and use efficient calculation methods for addition, subtraction, multiplication and division. They must also have automatic recall of a core set of multiplicative and additive facts to enable them to focus on learning new concepts.

Non-Statutory Guidance Calculation and Fluency

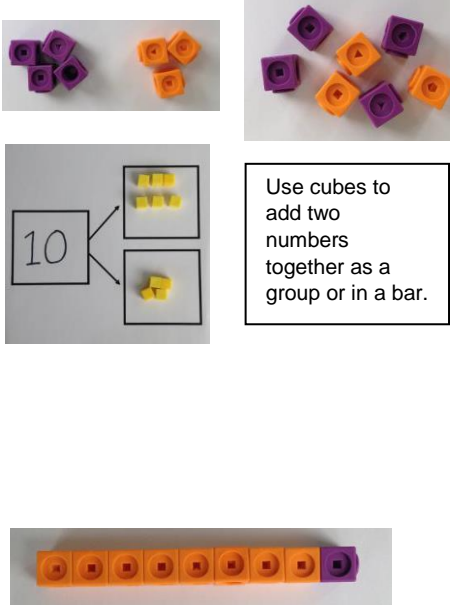
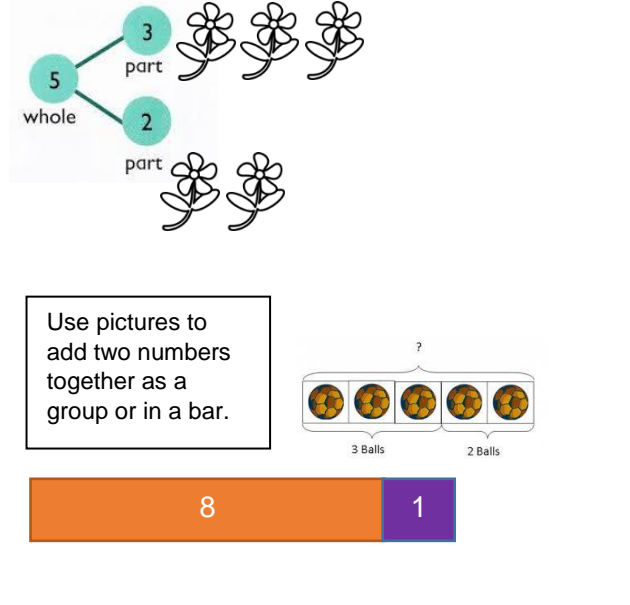
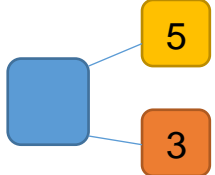

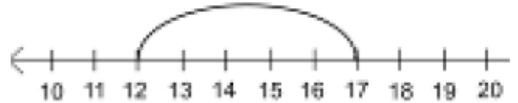
Year 1	The main addition and subtraction calculation focus in Year 1 is developing fluency in additive facts within 10. Fluency in these facts allows pupils to have a better understanding of addition and subtraction with 2 digit numbers in Year 2 and underpins future additive calculations. Pupils are to be taught to count in multiples of 2, 5 and 10.
Year 2	Pupils should now be able to carry out mental calculations for adding and subtracting across 10. Year 2 pupils will have lots of practice to be able to add and subtract across 10 with sufficient fluency to make progress with the Year 3 curriculum. They should also continue to practise adding and subtracting within 100 by applying related one digit addition and subtraction facts: add and subtract only ones or only tens to/from a two digit number. Pupils should be able to solve these calculations mentally and be able to demonstrate their reasoning either verbally or with manipulatives or drawings. When adding and subtracting any 2 digit numbers, pupils should learn how to record the steps using informal written notation or number sentences.
Key Stage 2	Representations such as place value counters and tens frames can be used initially to help pupils understand calculation strategies and make connections between known facts and related calculations. However, pupils should not rely on such representations for calculating. Pupils should be developing fluency in both written and mental methods for addition and subtraction and maintain them. Mental methods can include jottings to keep track of calculation, or language structures. Pupils should select the most efficient method to calculate depending on the numbers involved.
Year 3	Pupils should be able to add and subtract using the column method. Pupils should make sensible decisions about how and when to use column subtraction.

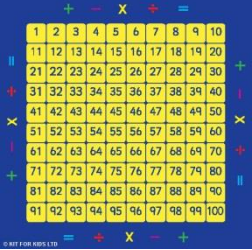
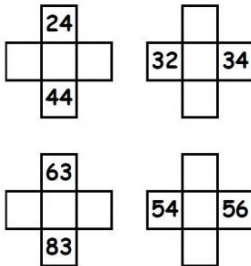

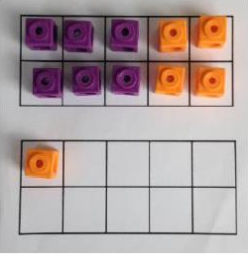
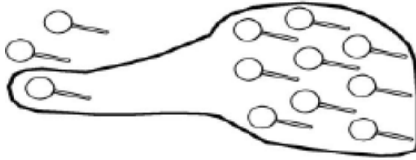
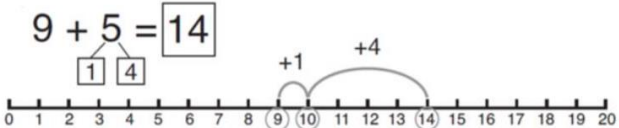


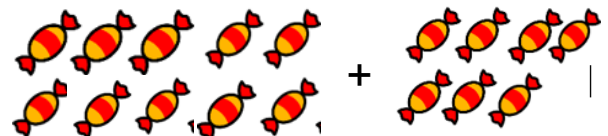
Year 4	Recall multiplication and division facts up to 12×12 and recognise products in multiplication tables as multiples of the corresponding number. Recall of all multiplication table facts should be the main multiplication calculation focus in Year 4. Pupils who leave Year 4 fluent in these facts have the best chance of mastering short multiplication in Year 5.
Year 5	Pupils who have automatic recall of multiplication table facts and corresponding division facts have the best chance of mastering formal written methods. The facts up to 9×9 are required for calculation within the columns during application of formal written methods, and all mental multiplicative calculation also depends on these facts. Pupils must be able to multiply using short multiplication and divide a number using short division.
Year 6	Pupils should be able to represent calculations using the formal method of long multiplication. For division, pupils should use short or long division as appropriate to the calculation. Pupils should learn to check all their calculations with a calculator so that they know how to use one. This will help pupils when they progress to Key Stage 3.

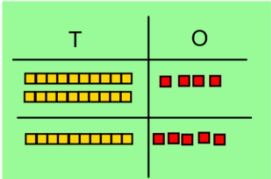
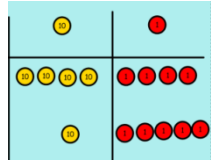
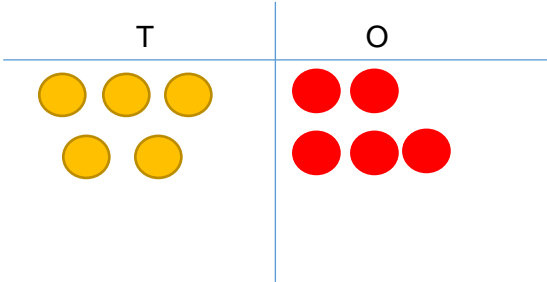
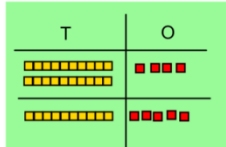
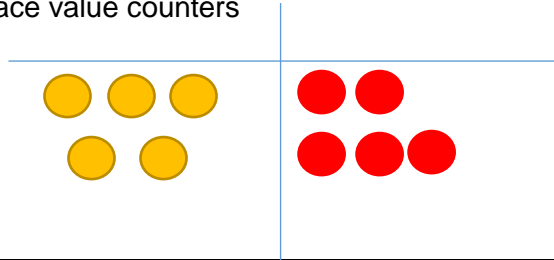
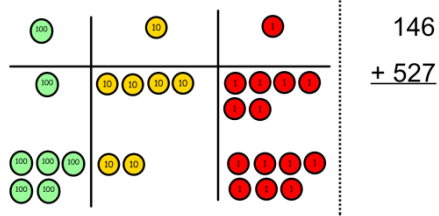
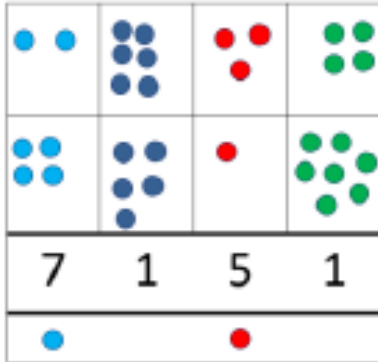
Progression in Calculations

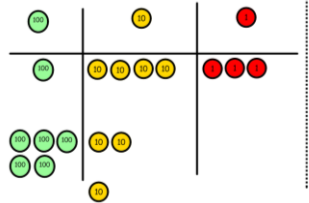
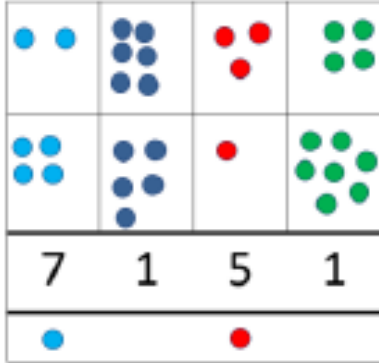
Addition

Vocabulary: Add, addition, total, plus, more than, and altogether, increase, equals, make, sum.

Calculation Stage	Objective and Strategies	Concrete	Pictorial	Abstract
<p>Stage 1: Concrete objects and pictorial representations.</p>	<p>Combining two parts to make a whole: part- whole model</p>	 <p>Use cubes to add two numbers together as a group or in a bar.</p>	 <p>Use pictures to add two numbers together as a group or in a bar.</p>	<p>$4 + 3 = 7$</p> <p>$10 = 6 + 4$</p>  <p>Use the part-part whole diagram as shown above to move into the abstract.</p>
<p>Stage 2: Number lines and 100 squares</p>	<p>Starting at the bigger number and counting on</p>	 <p>Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.</p>	<p>$12 + 5 = 17$</p>  <p>Start at the larger number on the number line and count on in ones or in one jump to find the answer.</p>	<p>$5 + 12 = 17$</p> <p>Place the larger number in your head and count on the smaller number to find your answer.</p>

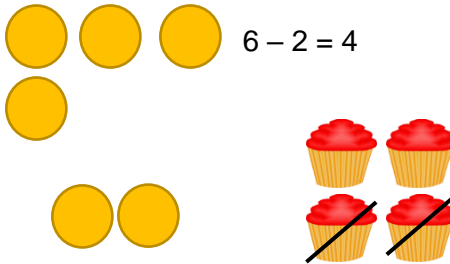
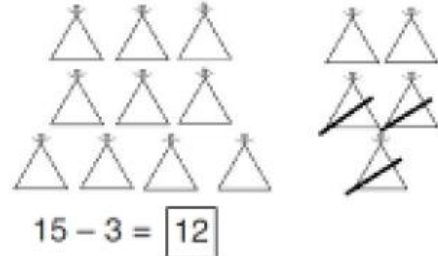


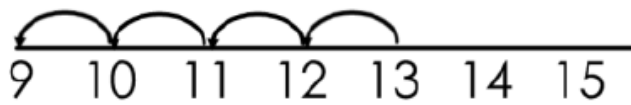
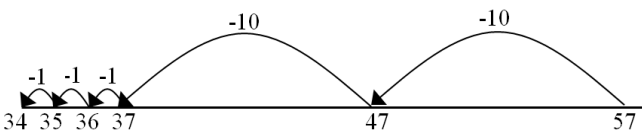
	<p>Using a 100 square – adding 10s by dropping down</p>		<p>Count on using a 100 square using counters. Drop down to add 10.</p>		<p>Find missing numbers from a 100 square by using knowledge and pre-existing skills.</p> <p>Drop down, count on and use pictorial representations.</p>	<p>17+11</p> <p>Drop down and count on in jumps.</p>
<p>Stage 3: Mental methods evolving into written methods</p>	<p>Regrouping to make 10.</p>	 <p>6 + 5 = 11</p>  <p>Start with the bigger number and use the smaller number to make 10.</p>	 <p>3 + 9 =</p> <p>Use pictures or a number line. Regroup or partition the smaller number to make 10.</p> 	<p>7 + 4 = 11</p> <p>If I am at seven, how many more do I need to make 10. How many more do I add on now?</p>		
	<p>Adding three single digits</p>	<p>4 + 7 + 6 = 17</p> <p>Put 4 and 6 together to make 10. Add on 7.</p>  <p>Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.</p>	 <p>Add together three groups of objects. Draw a picture to recombine the groups to make 10.</p> 	$\begin{aligned} 4 + 7 + 6 &= 10 + 7 \\ &= 17 \end{aligned}$ <p>Combine the two numbers that make 10 and then add on the remainder.</p>		

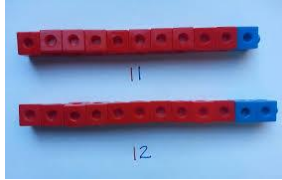
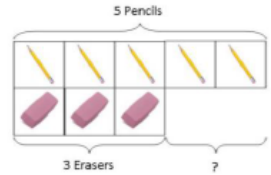
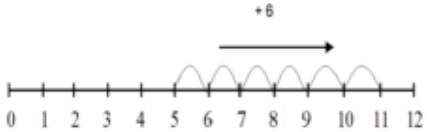
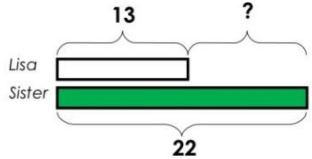
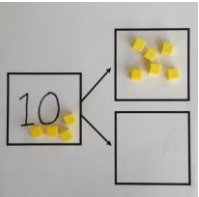
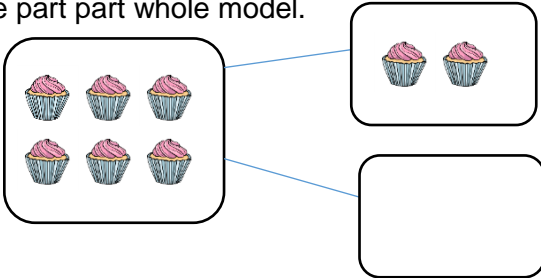
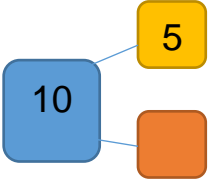
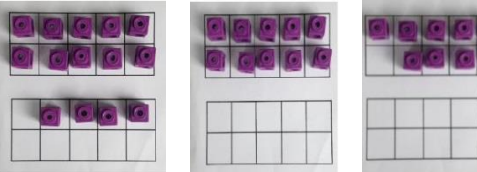
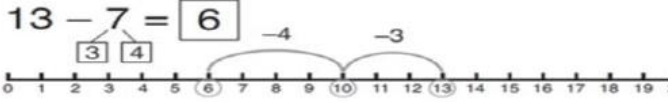
	<p>Column method- no regrouping</p>	<p>$24 + 15 =$ Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters.</p>  	<p>After practically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions.</p> 	<p style="text-align: center;"><u>Calculations</u></p> $21 + 42 =$ $\begin{array}{r} 21 \\ + 42 \\ \hline \end{array}$
	<p>Partitioning to add numbers mentally</p>	<p>Use Base 10 to represent numbers in their partitioned stages</p>  <p>Then, add the tens together, then the ones.</p>	<p>Children move on to draw base 10 blocks and place value counters</p> 	$\begin{array}{r} 20 + 5 \\ 40 + 8 \\ 60 + 13 = 73 \end{array}$
<p>Stage 4: Column Method</p>	<p>Column method- regrouping</p>	<p>Make both numbers on a place value grid.</p>  <p>Add up the units and exchange 10 ones for one 10.</p>	<p>Children can draw a pictorial representation of the columns and place value counters to further support their learning and understanding.</p> 	<p>Start by partitioning the numbers before moving on to clearly show the exchange below the addition.</p>

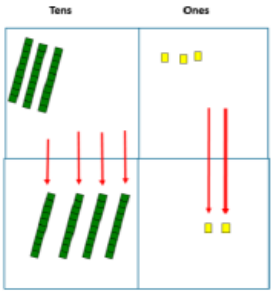
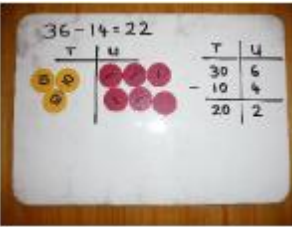
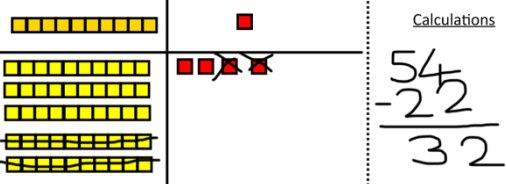
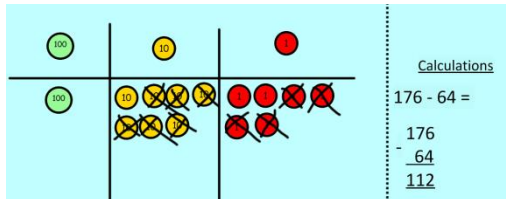
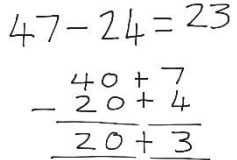
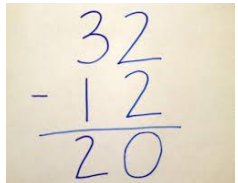
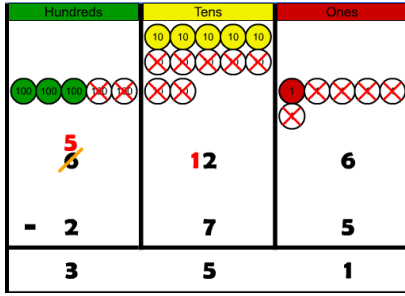
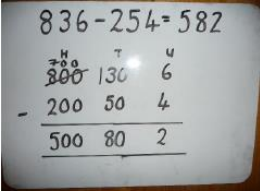
		 <p>146 + 527</p> <p>Add up the rest of the columns, exchanging the 10 counters from one column for the next place value column until every column has been added.</p> <p>This can also be done with Base 10 to help children clearly see that 10 ones equal 1 ten and 10 tens equal 100.</p> <p>As children move on to decimals, money and decimal place value counters can be used to support learning.</p>		<p>As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here.</p> $\begin{array}{r} 536 \\ + 85 \\ \hline 11 \\ \hline 621 \end{array}$
<p>Stage 5: Column addition, moving to decimals and larger numbers.</p>	<p>Column method moving to decimals and larger numbers/multiple numbers.</p>	<p>As above, use physical representations such as large decimal points on a WB, using a line of children as numbers.</p>	 <p>As with above, show another column with striking decimal points.</p>	<p>Use and represent 0 as a place holder and align the decimal points. Units of measurement come as final steps.</p> <p>Decimals on a line not in their own square</p> $\begin{array}{r} 23.361 \\ 9.080 \\ 59.770 \\ 1.300 \\ \hline 212 \\ \hline 93.511 \end{array}$

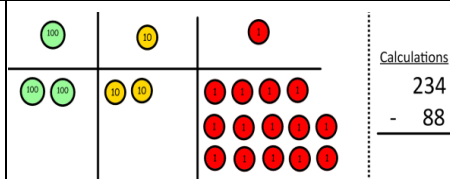
Subtraction

Vocabulary: Subtract, subtraction, take away, minus, less than, difference, decrease, leave, how many left.

Calculation Stage	Objective and Strategies	Concrete	Pictorial	Abstract
<p>Stage 1: Concrete objects and pictorial representations</p>	<p>Taking away ones</p>	<p>Use physical objects, counters, cubes etc to show how objects can be taken away.</p>  <p>$6 - 2 = 4$</p>	<p>Cross out drawn objects to show what has been taken away.</p>  <p>$15 - 3 = 12$</p>	<p>$18 - 3 = 15$</p> <p>$8 - 2 = 6$</p>
	<p>Counting back</p>	<p>Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.</p>  <p>$13 - 4$</p> <p>Use counters and move them away from the group as you take them away counting backwards as you go.</p> 	<p>Count back on a number line or number track</p>  <p>Start at the bigger number and count back the smaller number showing the jumps on the number line.</p>  <p>This can progress all the way to counting back using two 2 digit numbers.</p>	<p>Put 13 in your head, count back 4. What number are you at? Use your fingers to help.</p>

<p>Stage 2: Number lines and 100 squares</p>	<p>Find the difference</p>	<p>Compare amounts and objects to find the difference.</p>  <p>Use cubes to build towers or make bars to find the difference</p>  <p>Use basic bar models with items to find the difference</p>	 <p>Count on to find the difference.</p> <p>Comparison Bar Models</p> <p>Lisa is 13 years old. Her sister is 22 years old. Find the difference in age between them.</p>  <p>Draw bars to find the difference between 2 numbers.</p>	<p>Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches.</p>
	<p>Part, Part Whole Model</p>	 <p>Link to addition-use the part whole model to help explain the inverse between addition and subtraction.</p> <p>If 10 is the whole and 6 is one of the parts. What is the other part? $10 - 6 =$</p>	<p>Use a pictorial representation of objects to show the part part whole model.</p> 	 <p>Move to using numbers within the part whole model.</p>
<p>Stage 3: Linking concrete to abstract to decompose</p>	<p>Make 10</p>	<p>$14 - 9 =$</p>  <p>Make 14 on the ten frame. Take away the four first to make 10 and then takeaway one more so you</p>	<p>$13 - 7 = 6$</p>  <p>Start at 13. Take away 3 to reach 10. Then take away the remaining 4 so you have taken away 7 altogether. You have reached your answer.</p>	<p>$16 - 8 =$</p> <p>How many do we take off to reach the next 10?</p> <p>How many do we have left to take off?</p>

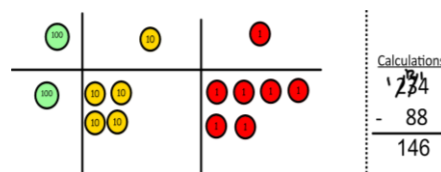
		<p>have taken away 5. You are left with the answer of 9.</p>		
	<p>Column method without regrouping</p>	<p>Use Base 10 to make the bigger number then take the smaller number away.</p>  <p>Show how you partition numbers to subtract. Again make the larger number first.</p> 	<p>Draw the Base 10 or place value counters alongside the written calculation to help to show working.</p>  	<p>This will lead to a clear written column subtraction.</p>  
<p>Stage 4: Compact decomposition, moving to larger numbers and decimals</p>	<p>Column method with regrouping</p>	<p>Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges.</p> <p>Make the larger number with the place value counters Start with the ones, can I take away 8 from 4 easily? I need to exchange one of my tens for ten ones.</p>		



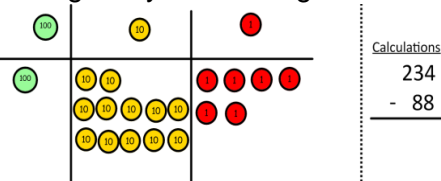
Now I can subtract my ones.

Now look at the tens, can I take away 8 tens easily? I need to exchange one hundred for ten tens.

Now I can take away eight tens and complete my subtraction



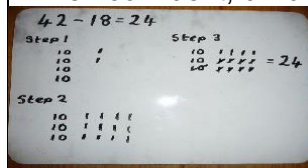
Show children how the concrete method links to the written method alongside your working. Cross out



the numbers when exchanging and show where we write our new amount.

Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well as clearly showing the exchanges you make.

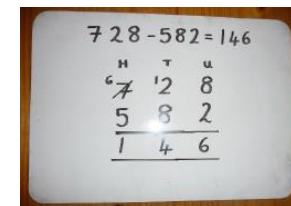
When confident, children can find their own way to record the exchange/regrouping.



Just writing the numbers as shown here shows

that the child understands the method and knows when to exchange/regroup.

Children can start their formal written method by partitioning the number into clear place value columns.



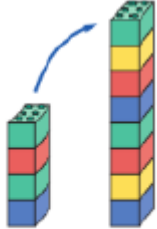

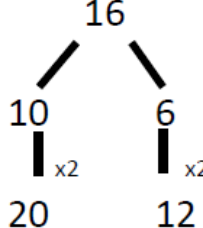
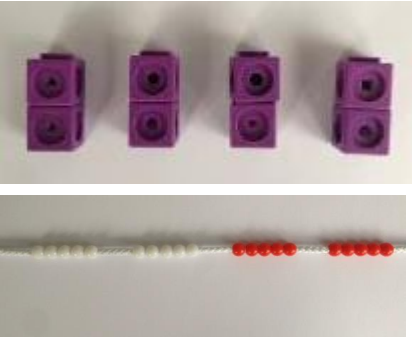
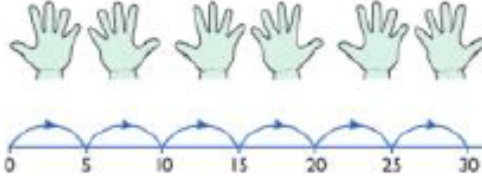
Moving forward the children use a more compact method.



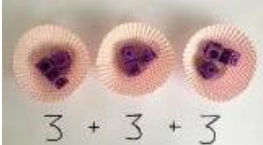

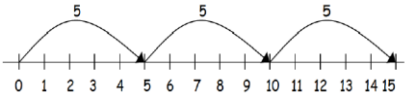

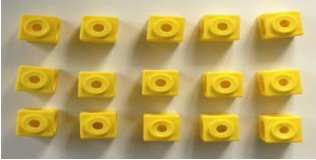




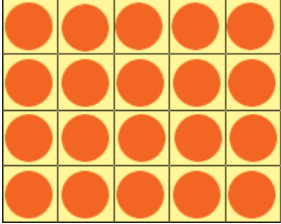

This will lead to an understanding of subtracting any number including decimals.

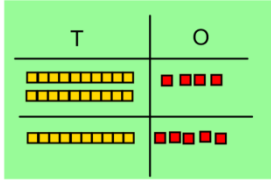
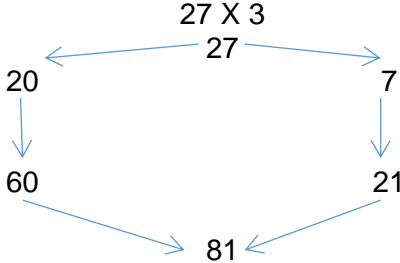
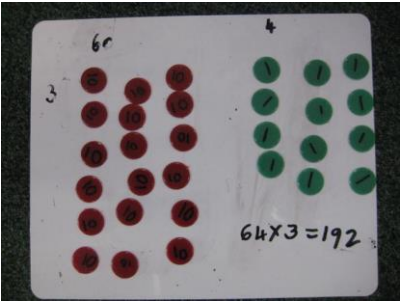
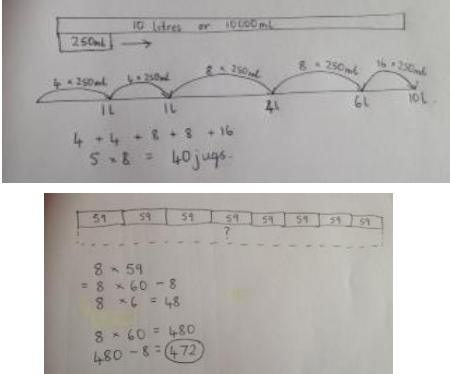
$$\begin{array}{r}
 5 12 1 \\
 2 6 3 0 \\
 - 2 6 5 \\
 \hline
 2 3 6 5
 \end{array}$$

Multiplication

Vocabulary: Multiply, multiplication, multiple, times, lots of, groups of, product, __times.

Calculation Stage	Objective and Strategies	Concrete	Pictorial	Abstract
<p>Stage 1: Concrete objects and pictorial representations</p>	<p>Doubling</p>	<p>Use practical activities to show how to double a number.</p>  <p>double 4 is 8 $4 \times 2 = 8$</p>	<p>Draw pictures to show how to double a number.</p> <p style="text-align: center;">Double 4 is 8</p> 	 <p>Partition a number and then double each part before recombining it back together.</p>
	<p>Counting in multiples</p>	 <p>Count in multiples supported by concrete objects in equal groups.</p>	 <p>Use a number line or pictures to continue support in counting in multiples.</p>	<p>Count in multiples of a number aloud.</p> <p>Write sequences with multiples of numbers.</p> <p>2, 4, 6, 8, 10</p> <p>5, 10, 15, 20, 25, 30</p>

<p>Stage 2: Repeated addition linking to practical apparatus</p>	<p>Repeated addition</p>	<p>Use different objects to add equal groups.</p>    <p>$3 + 3 + 3$</p>	<p>There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there?</p>  <p>2 add 2 add 2 equals 6</p>  <p>$5 + 5 + 5 = 15$</p>	<p>Write addition sentences to describe objects and pictures.</p>  <p>$2 + 2 + 2 + 2 + 2 = 10$</p>
<p>Stage 3: Arrays</p>	<p>Arrays- showing commutative multiplication</p>	<p>Create arrays using counters/ cubes to show multiplication sentences.</p>  	<p>Draw arrays in different rotations to find commutative multiplication sentences. Link arrays to area of rectangles.</p>    	<p>Use an array to write multiplication sentences and reinforce repeated addition.</p>  <p>$5 + 5 + 5 = 15$ $3 + 3 + 3 + 3 + 3 = 15$</p> <p>$5 \times 3 = 15$ $3 \times 5 = 15$</p>

<p>Stage 4: Number partitioning</p>		<p>Use Base 10 to show a number partitioned into tens and ones.</p>  <p>Multiple each piece using known tables.</p>	<p>Partition numbers into 10s and 1s and multiply each part before recombining.</p> 	<p>Use clear, well-formed number sentences and line up column values</p> 27×3 $20 \times 3 = 60$ $7 \times 3 = 21$ <hr/> $60 + 21 = 81$
<p>Stage 5: Compact method 2x1 and 3x1</p>	<p>Column multiplication</p>	<p>Children can continue to be supported by place value counters at this stage of multiplication.</p>  <p>It is important at this stage that they always multiply the ones first and note down their answer followed by the tens which they note below.</p>	<p>Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.</p> 	$\begin{array}{r} \text{H T O} \\ 476 \\ \times \quad 4 \\ \hline 1904 \end{array}$ <p>Numbers are carried above and should be written slightly smaller than the other numbers in the calculation. Cross out when carried. Label columns if needed.</p>

Stage 6:
Compact method
2x2 and 3x2 and
beyond

With long multiplication,
remind the children
about lining up their
numbers clearly in
columns.

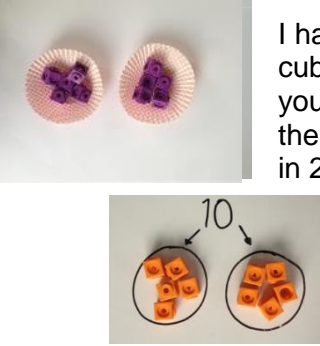
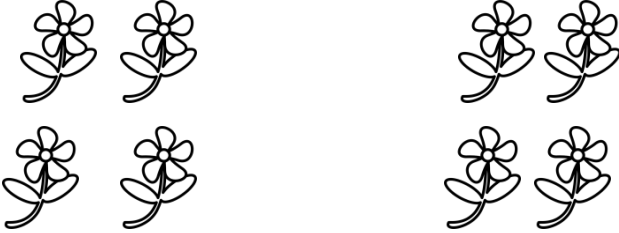
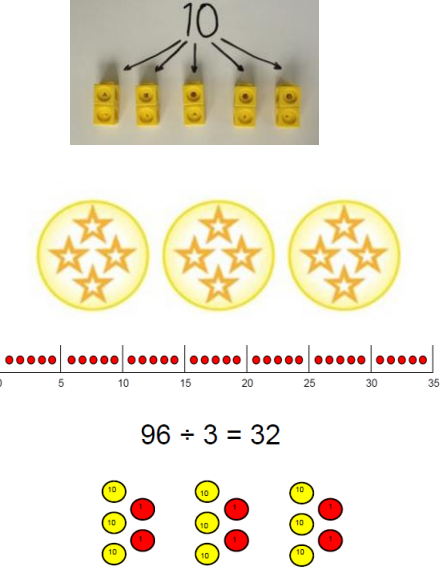
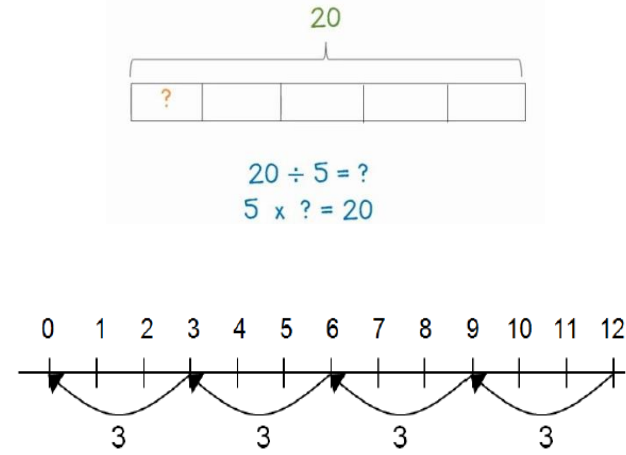
If it helps, children can
write out what they are
solving next to their
answer.

$$\begin{array}{r} 1342 \\ \times 18 \\ \hline 10736 \\ 13420 \\ \hline 24156 \end{array}$$

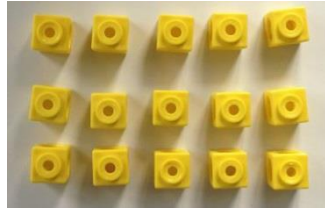
$$\begin{array}{r} 32 \\ \times 24 \\ \hline 8 \quad (4 \times 2) \\ 120 \quad (4 \times 30) \\ 40 \quad (20 \times 2) \\ \hline 600 \quad (20 \times 30) \\ \hline 768 \end{array}$$

Division

Vocabulary: Multiply, multiplication, multiple, times, lots of, groups of, product, ___times.

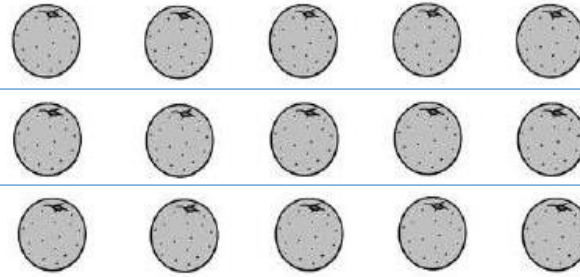
Calculation Stage	Objective and Strategies	Concrete	Pictorial	Abstract
<p>Stage 1: Concrete objects and pictorial representations</p>	<p>Sharing objects into groups</p>	 <p>I have 10 cubes, can you share them equally in 2 groups?</p>	<p>Children use pictures or shapes to share quantities.</p>  <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> $8 \div 2 = 4$ </div>	<p>Share 9 buns between three people.</p> $9 \div 3 = 3$
<p>Stage 2: Grouping or repeated subtraction</p>	<p>Division as grouping</p>	<p>Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.</p>  $96 \div 3 = 32$	<p>Use a number line to show jumps in groups. The number of jumps equals the number of groups.</p> <p>Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group.</p>  $20 \div 5 = ?$ $5 \times ? = 20$	$28 \div 7 = 4$ <p>Divide 28 into 7 groups. How many are in each group?</p>

Division within arrays



Link division to multiplication by creating an array and thinking about the number sentences that can be created.

Eg $15 \div 3 = 5$ $5 \times 3 = 15$
 $15 \div 5 = 3$ $3 \times 5 = 15$



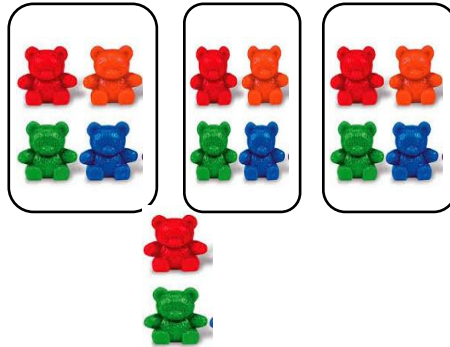
Draw an array and use lines to split the array into groups to make multiplication and division sentences.

Find the inverse of multiplication and division sentences by creating four linking number sentences.

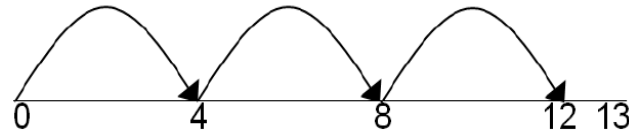
$7 \times 4 = 28$
 $4 \times 7 = 28$
 $28 \div 7 = 4$
 $28 \div 4 = 7$

Division with a remainder

$14 \div 3 =$
 Divide objects between groups and see how much is left over



Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.



Draw dots and group them to divide an amount and clearly show a remainder.



Complete written divisions and show the remainder using r.

$29 \div 8 = 3 \text{ REMAINDER } 5$
 ↑ ↑ ↑ ↑
 dividend divisor quotient remainder

Stage 3: Short division

Short division

Use place value counters to divide using the bus stop method alongside

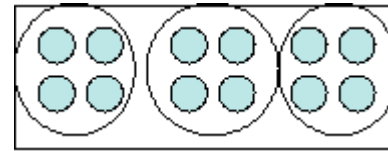
$$42 \div 3 =$$

Start with the biggest place value, we are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over.

We exchange this ten for ten ones and then share the ones equally among the groups.

We look how much in 1 group so the answer is 14.

Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.



Encourage them to move towards counting in multiples to divide more efficiently.

Write down higher multiplication tables to help with trickier numbers:

- 16
- 32
- 48
- 64
- 80
- 96
- 112
- 128

Begin with divisions that divide equally with no remainder.

$$\begin{array}{r} 218 \\ 3 \overline{) 872} \end{array}$$

Move onto divisions with a remainder.

$$\begin{array}{r} 86 \text{ r } 2 \\ 3 \overline{) 432} \end{array}$$

<p>Stage 4: Long division</p>	<p>Long division</p>			$\begin{array}{r} 14.6 \\ 35 \overline{) 511.0} \\ \underline{35} \\ 161 \\ \underline{140} \\ 210 \\ \underline{210} \\ 0 \end{array}$ <p>Finally move into decimal places to divide the total accurately.</p> $\begin{array}{r} 2191 \\ 4 \overline{) 8764} \\ \underline{8} \\ 07 \\ \underline{4} \\ 36 \\ \underline{36} \\ 04 \\ \underline{4} \\ 0 \end{array}$ $\begin{array}{r} 21 \\ 216 \overline{) 4536} \\ \underline{432} \\ 216 \\ \underline{216} \\ 0 \end{array}$
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