



Gaddesden Row JMI- Calculation policy 2020/21 Reception- Year 6

Adapted from the White Rose Calculation policy



Gaddesden Row JMI – Maths Calculation Policy (CPA approach)



This policy supports the White Rose maths scheme of work and the programme of study in the 2014 National Curriculum.

It should be used to support children to develop a deep understanding of number and calculation and should be used in conjunction with the White Rose scheme of work with specific attention focused on the vocabulary being used to describe the models and explanations.

This policy has been developed to teach children through the use of concrete pictorial and abstract representations.





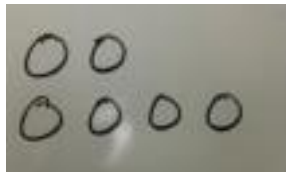

Concrete representations- a pupil will first be introduced to a skill by using real objects/manipulatives. This should be the foundation for conceptual understanding.

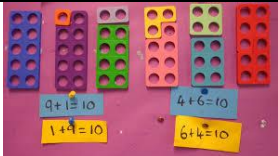



Pictorial representations- a pupil should have sufficient understanding with using manipulatives and should be moved onto using diagram and pictures to solve a calculation.






Abstract representation- a pupil is now capable of representing calculations and problems by using mathematical notations. For example $12 \times 2 = 24$, $32 + 21 = 53$

It is important to go back and forth between all C,P,A representations, to ensure that all procedures and understand is secure.

EYFS

Skill	Concrete	Pictorial	Abstract
<p>Counting fluently to 20</p> <p>Representing Numbers to 20</p>	   <p>Use different equipment to represent numbers: Small world, numicon, multilink,</p>	<p>Tens frames</p>  <p>Drawings</p> 	<p>Numberlines</p>
<p>One more and one less</p>		<p>Showing pictures and crossing out or adding another.</p> <p>Use tens frame and part whole models</p>	<p>Number lines, Written calculations</p>

	Using equipment to add one more and one less.		
Add two 1 digit number to 10	 <p>Using numicon, multilink, double sided counters, bar models</p>	 <p>Recording calculations with pictures</p> <p>Tens frames and part whole models.</p>	Number lines, Written calculations, Part whole models with numbers
Subtract 1 digit number	<p>Taking away after counting out practical equipment. . Children would be encouraged to physically remove these using touch counting.</p> 	<p>Using pictures, tens frame to cross out to 'take away'</p> 	Number lines, Written calculations

		 $8 - 4 = \underline{\quad}$	
Doubling	  <p>Double 4</p> <p>'4 and 4 equals 8' '4 + 4 = 8'</p>  <p>Use equipment to show that there are 2 groups of the same number.</p> <p>Numicon, small world, double sided counters, multiplink.</p>	<p>Draw pictures to show 2 groups and the same amount in each.</p> 	2 groups with the numbers in.
Sharing/Halving	Use different types of equipment to show that the children need to share equally into groups.	Drawing circles or dots to share a number into groups.	



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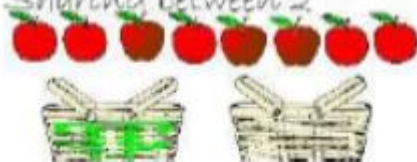


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Half of 8 is 4



sharing between 2





Addition- Year 1-6

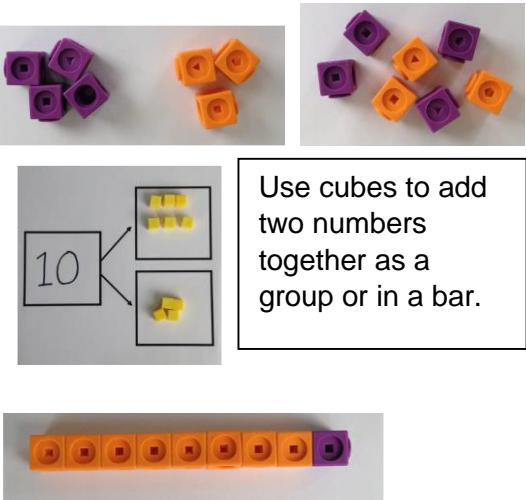
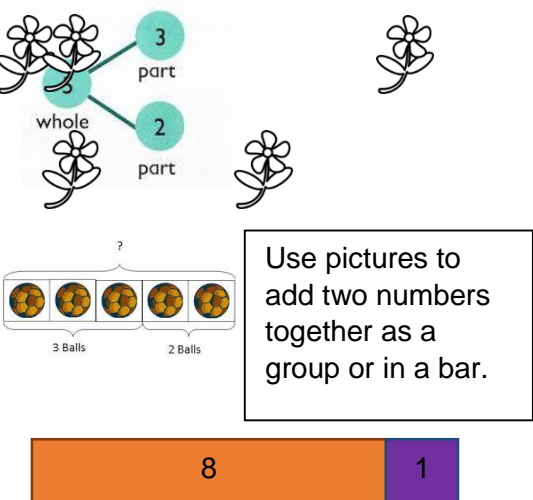
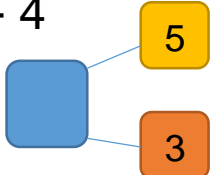

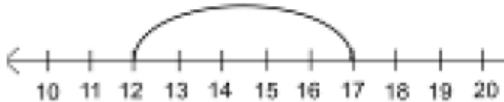
Skill	Year	Representations and models	
Add two 1-digit numbers to 10	1	Part-whole model Bar model Number shapes	Ten frames (within 10) Bead strings (10) Number tracks
Add 1 and 2-digit numbers to 20	1	Part-whole model Bar model Number shapes Ten frames (within 20)	Bead strings (20) Number tracks Number lines (labelled) Straws
Add three 1-digit numbers	2	Part-whole model Bar model	Ten frames (within 20) Number shapes
Add 1 and 2-digit numbers to 100	2	Part-whole model Bar model Number lines (labelled)	Number lines (blank) Straws Hundred square



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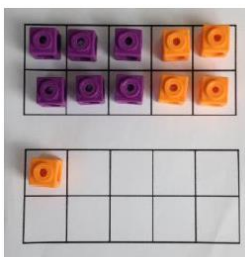
Skill	Year	Representations and models	
Add two 2-digit numbers	2	Part-whole model Bar model Number lines (blank) Straws	Base 10 Place value counters Column addition
Add with up to 3-digits	3	Part-whole model Bar model	Base 10 Place value counters Column addition
Add with up to 4-digits	4	Part-whole model Bar model	Base 10 Place value counters Column addition
Add with more than 4 digits	5	Part-whole model Bar model	Place value counters Column addition
Add with up to 3 decimal places	5	Part-whole model Bar model	Place value counters Column addition

Objective and Strategies	Concrete	Pictorial	Abstract
<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>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>

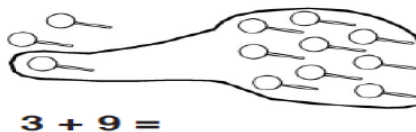
Regrouping to make 10.



$$6 + 5 = 11$$



Start with the bigger number and use the smaller number to make 10.



Use pictures or a number line. Regroup or partition the smaller number to make 10.

$9 + 5 = 14$

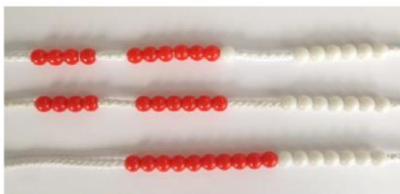
7 + 4 = 11

If I am at seven, how many more do I need to make 10. How many more do I add on now?

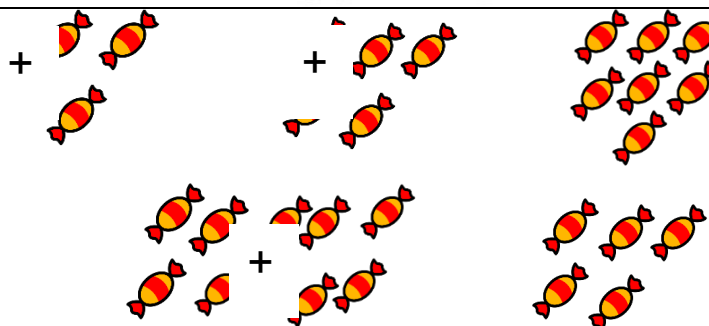
Adding three single digits

$$4 + 7 + 6 = 17$$

Put 4 and 6 together to make 10. Add on 7.



Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.



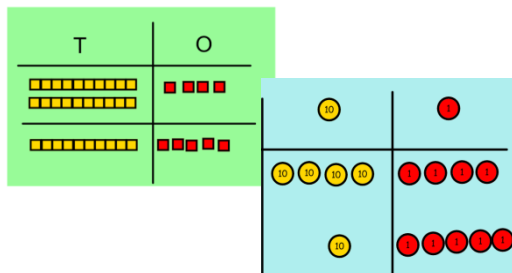
Add together three groups of objects. Draw a picture to recombine the groups to make 10.

$$\begin{aligned} (4 + 7) + 6 &= 10 + 7 \\ &= 17 \end{aligned}$$

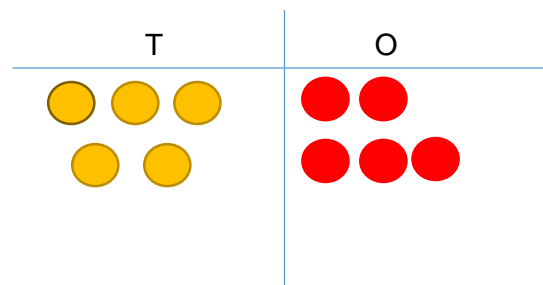
Combine the two numbers that make 10 and then add on the remainder.

Column method- no regrouping

$24 + 15 =$
Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters.



After practically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions.



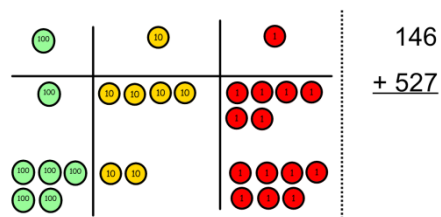
Calculations

$$21 + 42 =$$

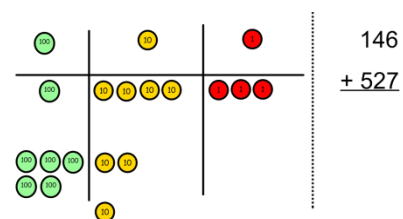
$$\begin{array}{r} 21 \\ + 42 \\ \hline \end{array}$$

Column method- regrouping

Make both numbers on a place value grid.

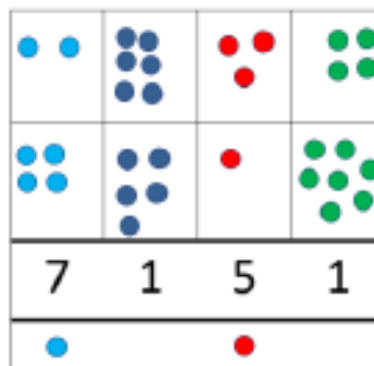


Add up the units and exchange 10 ones for one 10.



Add up the rest of the columns, exchanging the 10 counters from one

Children can draw a pictorial representation of the columns and place value counters to further support their learning and understanding.



Start by partitioning the numbers before moving on to clearly show the exchange below the addition.

$$\begin{array}{r} 20 + 5 \\ 40 + 8 \\ 60 + 13 = 73 \end{array}$$

$$\begin{array}{r} 536 \\ + 85 \\ \hline 621 \\ 11 \end{array}$$



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	<p>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> <div><div><div>72.8</div><div>+ 54.6</div><div><div><div>127.4</div><div>11</div></div></div></div><div><div><div>£ 2 3 . 5 9</div><div>+ £ 7 . 5 5</div><div><div>£ 3 1 . 1 4</div><div>1 1 1</div></div></div></div><div><div><div>2 3 . 3 6 1</div><div>9 . 0 8 0</div><div>5 9 . 7 7 0</div><div>+ 1 . 3 0 0</div><div><div>9 3 . 5 1 1</div><div>2 1 2</div></div></div></div></div>
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Subtraction- Year 1-6

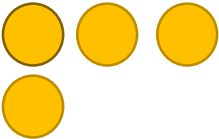

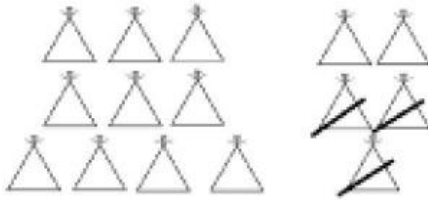


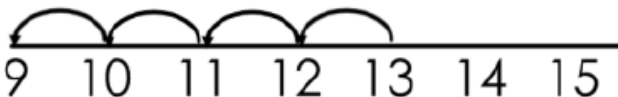
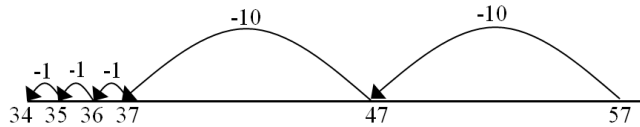
Skill	Year	Representations and models	
Subtract two 1-digit numbers to 10	1	Part-whole model Bar model Number shapes	Ten frames (within 10) Bead strings (10) Number tracks
Subtract 1 and 2-digit numbers to 20	1	Part-whole model Bar model Number shapes Ten frames (within 20)	Bead string (20) Number tracks Number lines (labelled) Straws
Subtract 1 and 2-digit numbers to 100	2	Part-whole model Bar model Number lines (labelled)	Number lines (blank) Straws Hundred square
Subtract two 2-digit numbers	2	Part-whole model Bar model Number lines (blank) Straws	Base 10 Place value counters Column addition

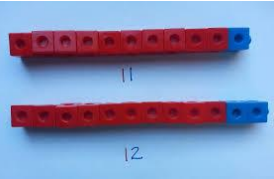
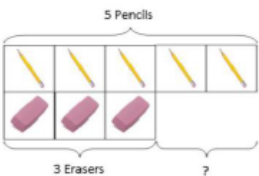
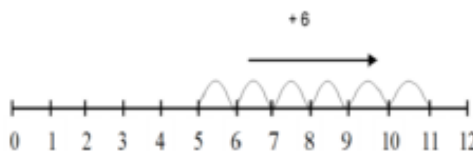
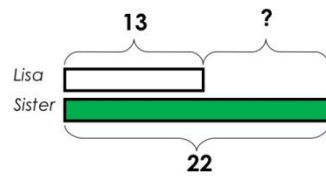
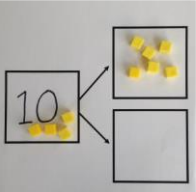
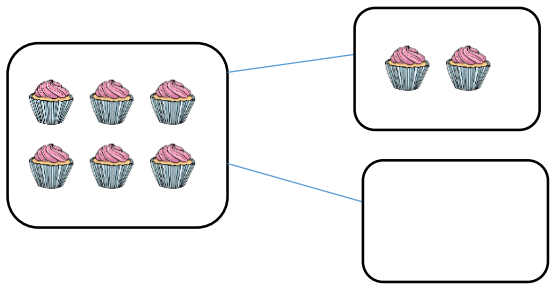
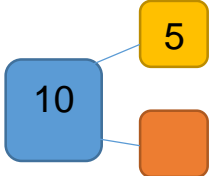


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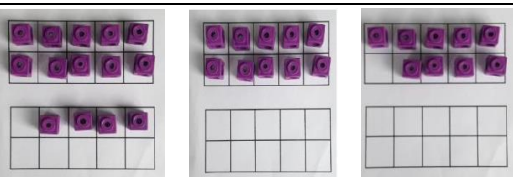


Skill	Year	Representations and models	
Subtract with up to 3-digits	3	Part-whole model Bar model	Base 10 Place value counters Column addition
Subtract with up to 4-digits	4	Part-whole model Bar model	Base 10 Place value counters Column addition
Subtract with more than 4 digits	5	Part-whole model Bar model	Place value counters Column addition
Subtract with up to 3 decimal places	5	Part-whole model Bar model	Place value counters Column addition

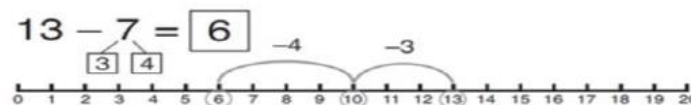
Objective and Strategies	Concrete	Pictorial	Abstract
<p>Taking away ones</p>	<p>Use physical objects, counters, cubes etc to show how objects can be taken away.</p> <p>  $6 - 2 = 4$ </p> <p>  </p>	<p>Cross out drawn objects to show what has been taken away.</p> <p>  $15 - 3 = 12$ </p>	<p>$18 - 3 = 15$</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>  </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>  </p>	<p>Count back on a number line or number track</p> <p>  </p> <p>Start at the bigger number and count back the smaller number showing the jumps on the number line.</p> <p>  </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>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>Draw bars to find the difference between 2 numbers.</p> <p>Lisa is 13 years old. Her sister is 22 years old. Find the difference in age between them.</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?</p> <p>$10 - 6 =$</p>	<p>Use a pictorial representation of objects to show the part whole model.</p> 	 <p>Move to using numbers within the part whole model.</p>
<p>Make 10</p>	<p>$14 - 9 =$</p>		<p>$16 - 8 =$</p> <p>How many do we take off to reach the next 10?</p>

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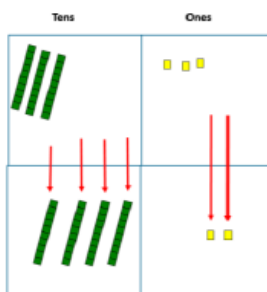
Make 14 on the ten frame. Take away the four first to make 10 and then takeaway one more so you have taken away 5. You are left with the answer of 9.



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.

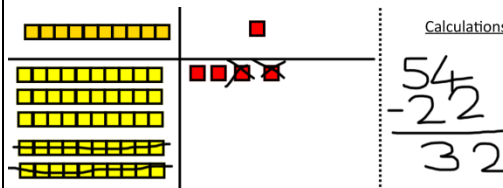
How many do we have left to take off?

Column
method
without
regrouping

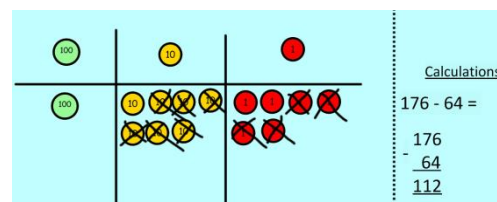


Use Base 10 to make the bigger number then take the smaller number away.

Show how you partition numbers to subtract. Again make the larger number first.



Draw the Base 10 or place value counters alongside the written calculation to help to show working.



$$47 - 24 = 23$$

$$\begin{array}{r} 40 + 7 \\ - 20 + 4 \\ \hline 20 + 3 \end{array}$$

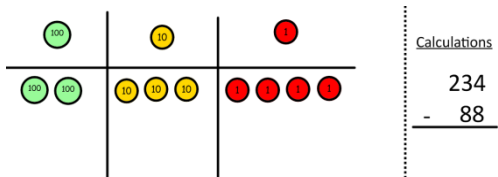
This will lead to a clear written column subtraction.

$$\begin{array}{r} 32 \\ - 12 \\ \hline 20 \end{array}$$

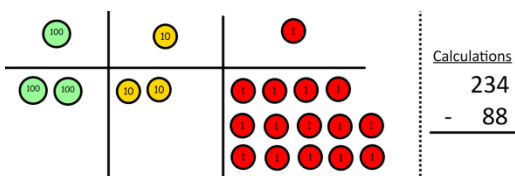
Column method with regrouping

Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges.

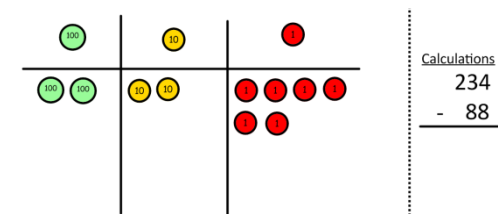
Make the larger number with the place value counters



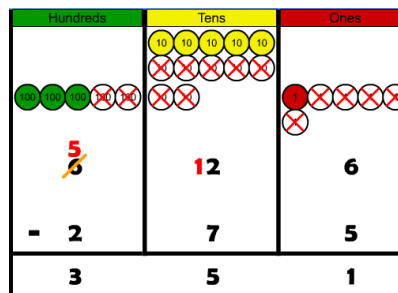
Start with the ones, can I take away 8 from 4 easily? I need to exchange one of my tens for ten ones.



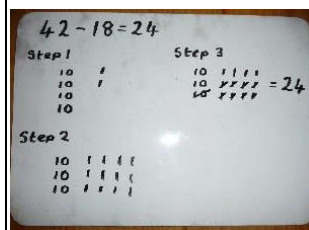
Now I can subtract my ones.



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



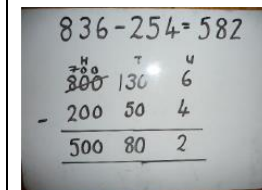
Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well as clearly showing the exchanges you make.



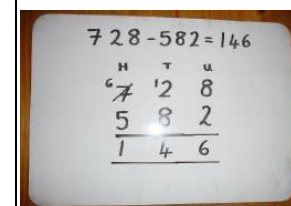
When confident, children can find their own way to record the exchange/regrouping.

Just writing the numbers as shown here shows that the child understands the method and

knows when to exchange/regroup.

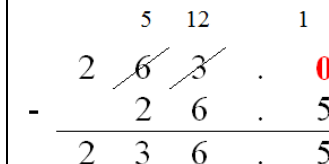


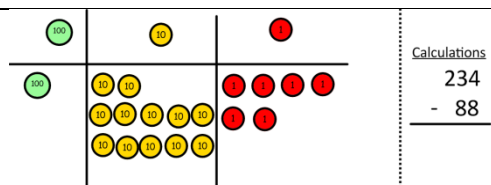
Children can start their formal written method by partitioning the number into clear place value columns.



Moving forward the children use a more compact method.

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

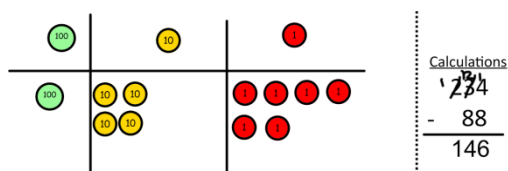




Calculations

$$\begin{array}{r} 234 \\ - 88 \\ \hline \end{array}$$

Now I can take away eight tens and complete my subtraction



Calculations

$$\begin{array}{r} 234 \\ - 88 \\ \hline 146 \end{array}$$

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.



Multiplication- Year 1-6



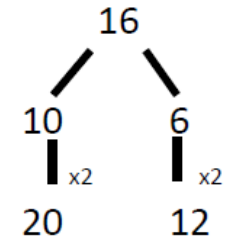
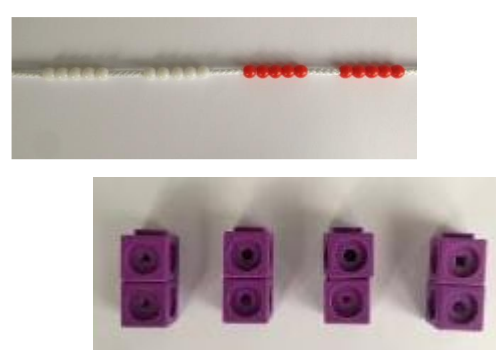
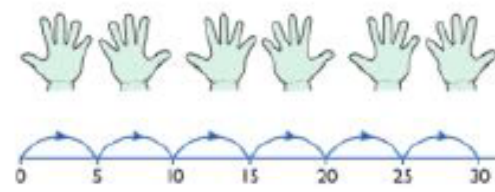
Skill	Year	Representations and models	
Solve one-step problems with multiplication	1/2	Bar model Number shapes Counters	Ten frames Bead strings Number lines
Multiply 2-digit by 1-digit numbers	3/4	Place value counters Base 10	Short written method Expanded written method
Multiply 3-digit by 1-digit numbers	4	Place value counters Base 10	Short written method
Multiply 4-digit by 1-digit numbers	5	Place value counters	Short written method





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Skill	Year	Representations and models
Multiply 2-digit by 2-digit numbers	5	Place value counters Base 10 Short written method Grid method
Multiply 2-digit by 3-digit numbers	5	Place value counters Short written method Grid method
Multiply 2-digit by 4-digit numbers	5/6	Formal written method

Objective and Strategies	Concrete	Pictorial	Abstract
Doubling	<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>Double 4 is 8</p> 	 <p>Partition a number and then double each part before recombining it back together.</p>
Counting in multiples	 <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>

Repeated addition





3 + 3 + 3

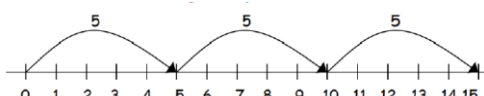


Use different objects to add equal groups.

There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there?



2 add 2 add 2 equals 6



5 + 5 + 5 = 15

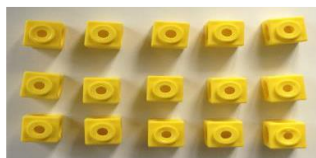
Write addition sentences to describe objects and pictures.




2 + 2 + 2 + 2 + 2 = 10

Arrays- showing commutative multiplication


Create arrays using counters/ cubes to show multiplication sentences.



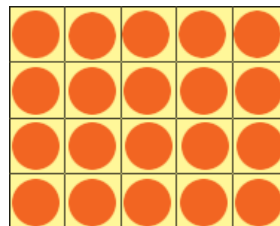
Draw arrays in different rotations to find **commutative** multiplication sentences.



$4 \times 2 = 8$



$2 \times 4 = 8$



Link arrays to area of rectangles.

Use an array to write multiplication sentences and reinforce repeated addition.



$$5 + 5 + 5 = 15$$

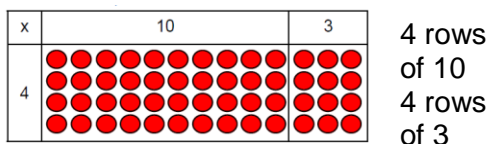
$$3 + 3 + 3 + 3 + 3 = 15$$

$$5 \times 3 = 15$$

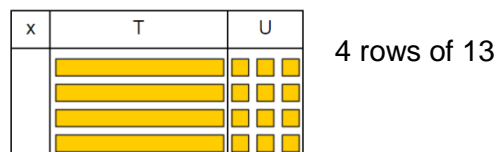
$$3 \times 5 = 15$$

Grid Method

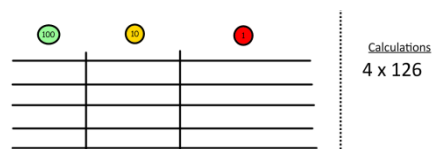
Show the link with arrays to first introduce the grid method.



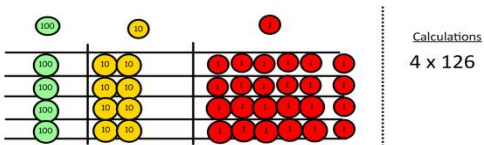
Move on to using Base 10 to move towards a more compact method.



Move on to place value counters to show how we are finding groups of a number. We are multiplying by 4 so we need 4 rows.



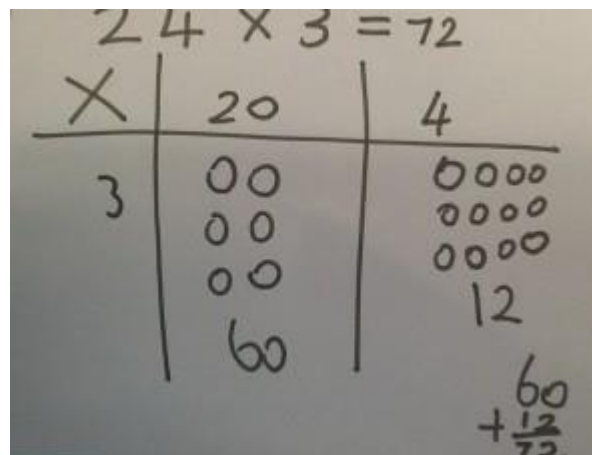
Fill each row with 126.



Add up each column, starting with the ones making any exchanges needed.

Children can represent the work they have done with place value counters in a way that they understand.

They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking as shown below.



Start with multiplying by one digit numbers and showing the clear addition alongside the grid.

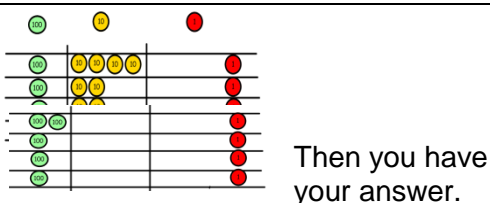
x	30	5
7	210	35

$$210 + 35 = 245$$

Moving forward, multiply by a 2 digit number showing the different rows within the grid method.

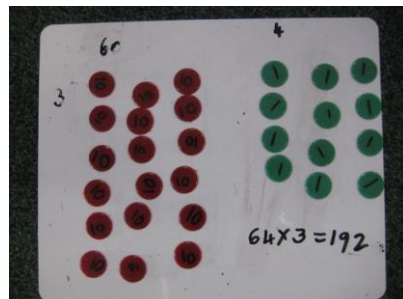
	10	8
10	100	80
3	30	24

x	1000	300	40	2
10	10000	3000	400	20
8	8000	2400	320	16



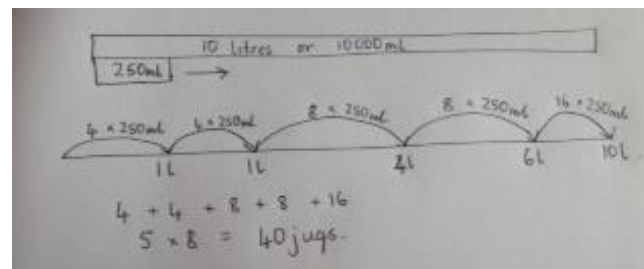
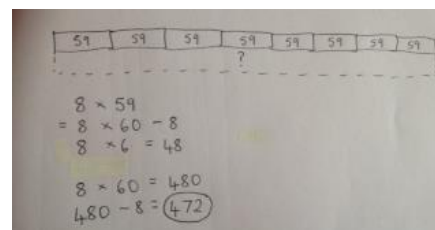
Column multiplication

Children can continue to be supported by place value counters at the stage of multiplication.



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.

Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.



Start with long multiplication, reminding 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.

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



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$$\begin{array}{r} 74 \\ \times 63 \\ \hline 12 \\ 210 \\ 240 \\ + 4200 \\ \hline 4662 \end{array}$$

This
moves to
the more
compact

$$\begin{array}{r} 2 \\ 1342 \\ \times 18 \\ \hline 13420 \\ 10736 \\ \hline 24156 \\ \end{array}$$

method.



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Division- Year 1-6


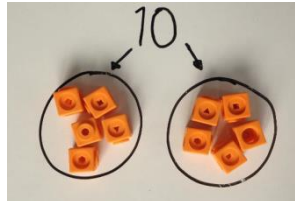
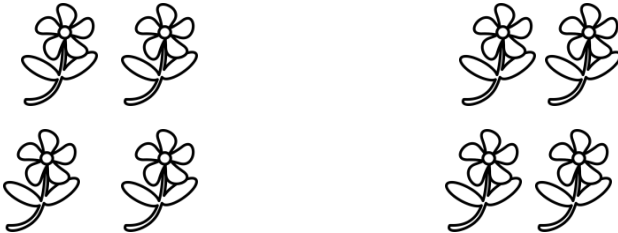
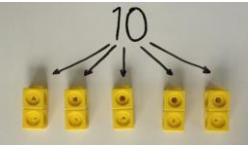


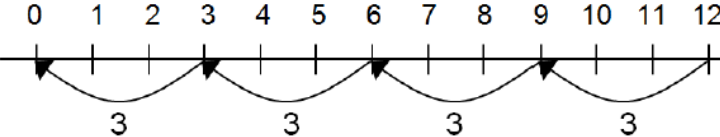
Skill	Year	Representations and models	
Solve one-step problems with division (sharing)	1/2	Bar model Real life objects	Arrays Counters
Solve one-step problems with division (grouping)	1/2	Real life objects Number shapes Bead strings Ten frames	Number lines Arrays Counters
Divide 2-digits by 1-digit (no exchange sharing)	3	Straws Base 10 Bar model	Place value counters Part-whole model
Divide 2-digits by 1-digit (sharing with exchange)	3	Straws Base 10 Bar model	Place value counters Part-whole model



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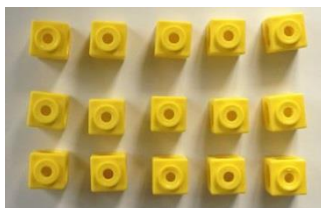
Skill	Year	Representations and models	
Divide 2-digits by 1-digit (sharing with remainders)	3/4	Straws Base 10 Bar model	Place value counters Part-whole model
Divide 2-digits by 1-digit (grouping)	4/5	Place value counters Counters	Place value grid Written short division
Divide 3-digits by 1-digit (sharing with exchange)	4	Base 10 Bar model	Place value counters Part-whole model
Divide 3-digits by 1-digit (grouping)	4/5	Place value counters Counters	Place value grid Written short division

Objective and Strategies	Concrete	Pictorial	Abstract
Sharing objects into groups	<div></div> <div><p>I have 10 cubes, can you share them equally in 2 groups?</p></div> <div></div>	<div>Children use pictures or shapes to share quantities.</div> <div></div> <div><div>8 ÷ 2 = 4</div></div>	<div>Share 9 buns between three people.</div> <div>9 ÷ 3 = 3</div>
Division as grouping	<div>Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.</div> <div></div> <div></div> <div></div>	<div>Use a number line to show jumps in groups. The number of jumps equals the number of groups.</div> <div></div> <div>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.</div> <div><div><div>20</div><div><div>?</div><div></div><div></div><div></div><div></div></div></div><div>20 ÷ 5 = ? 5 x ? = 20</div></div>	<div>28 ÷ 7 = 4</div> <div>Divide 28 into 7 groups. How many are in each group?</div>

$$96 \div 3 = 32$$

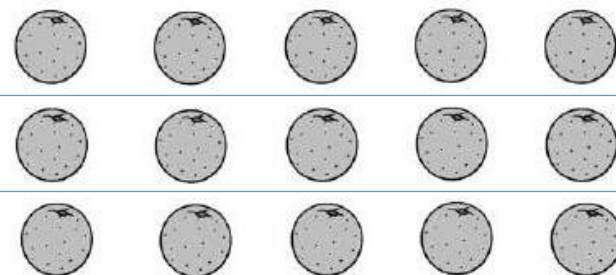


Division within arrays



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.

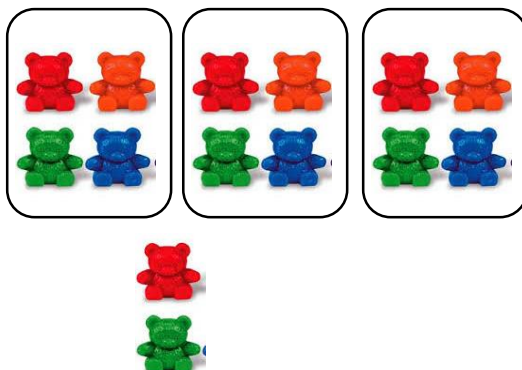
Find the inverse of multiplication and division sentences by creating four linking number sentences.

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

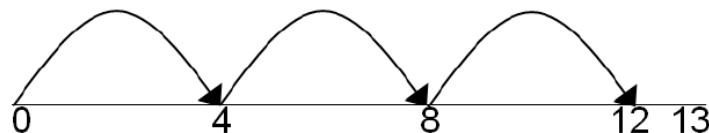
Division with a remainder

$$14 \div 3 =$$

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.

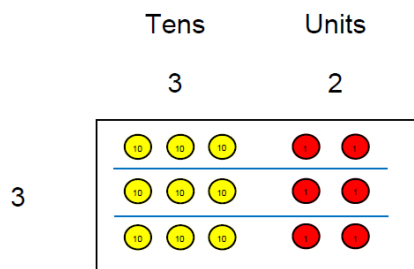


Complete written divisions and show the remainder using r.

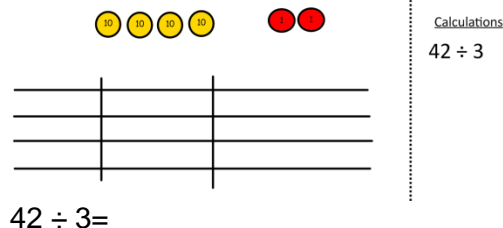
$$29 \div 8 = 3 \text{ REMAINDER } 5$$

dividend divisor quotient remainder

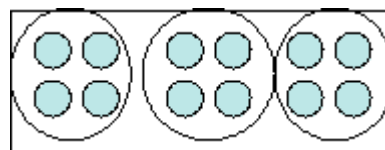
Short division



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



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.

Begin with divisions that divide equally with no remainder.

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

Move onto divisions with a remainder.

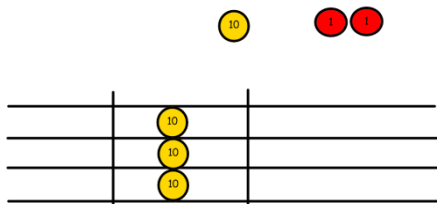
$$\begin{array}{r} 86 \text{ r } 2 \\ 3 \overline{) 432} \end{array}$$



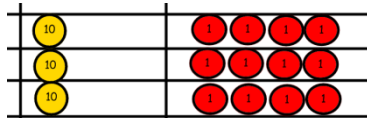
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Start with the biggest place value, we are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over.



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.

Finally move into decimal places to divide the total accurately.

$$\begin{array}{r}
 14.6 \\
 35 \overline{) 511.0} \\
 \underline{35} \\
 161 \\
 \underline{150} \\
 110 \\
 \underline{105} \\
 50
 \end{array}$$