

Millhouse Primary School and Nursery

Calculation Policy

Aims

At Millhouse Primary School and Nursery we ensure our approach to teaching the four rules is consistent and progressive throughout the key stages, allowing children to develop an efficient, reliable, formal written method of calculation for all operations. Children use these methods fluently and with confidence and understanding.

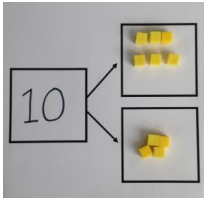
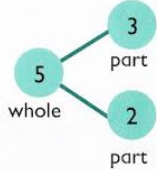
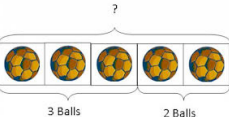
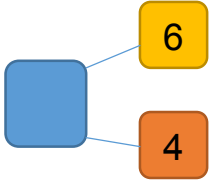
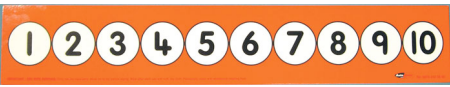
End of year age related expectations - ADDITION

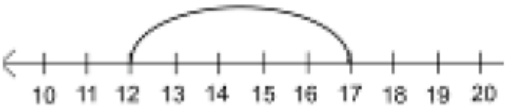
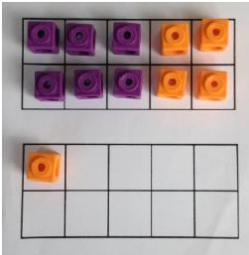
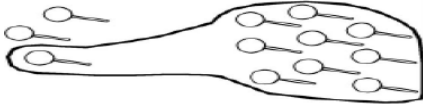
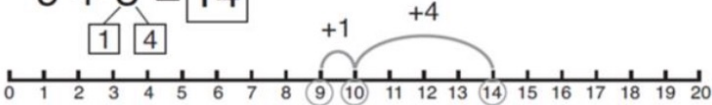
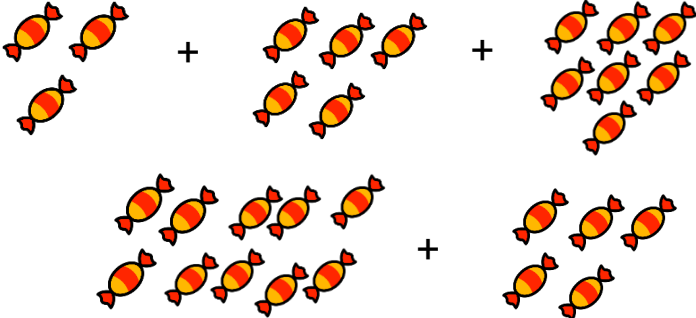
	EYFS	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6
Addition	To understand that adding involves an increase/more. To begin to use mathematical vocabulary involving addition (+) and the equal (=) sign. Relate addition to combining two	Read, write and interpret mathematical statements involving addition (+) and the equal (=) sign. Represent and use number bonds to 20. Add one-digit and two-digit numbers within 20, including zero.	Recall and use addition facts to 20 fluently and related facts to 100. Add numbers using concrete objects, pictorial representations and mentally, including: - A two-digit number and ones - A two-digit number and tens - Two	Add numbers with up to three digits, using formal written method of columnar addition.	Add numbers with up to 4 digits using the formal written method of columnar addition <u>where appropriate</u>.	Add whole numbers with more than 4 digits, including using formal written method (columnar addition).	No objectives have been included in the programmes of study explicitly related to written methods for addition in Yr6. However, there is an expectation that children will continue to practise and use the

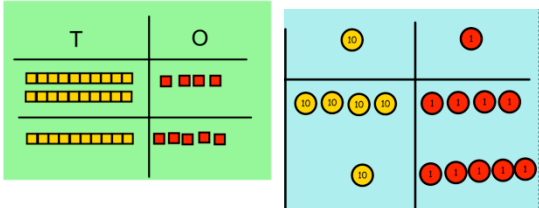
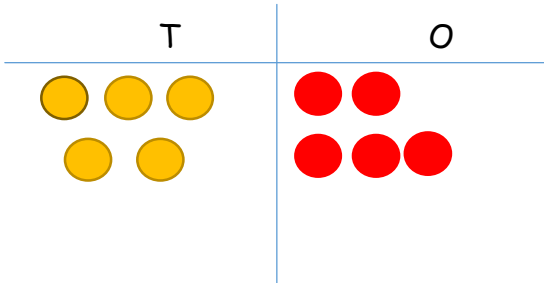
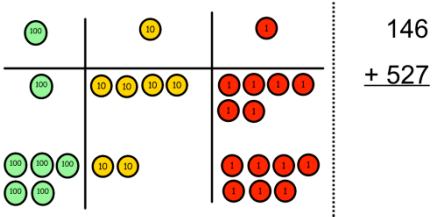
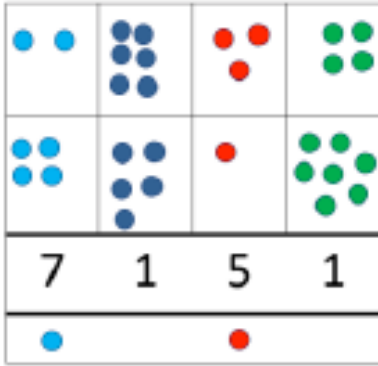
	groups of objects; first by counting all and then by counting on from the largest number. Using objects and by counting on, add two single-digit numbers Find one more than a number from 1-5 then 1-10.	Solve missing number problems e.g. $7 = \square + 2$	two-digit numbers • Three one-digit numbers.				formal written method for larger numbers and decimals and use these methods when solving problems.
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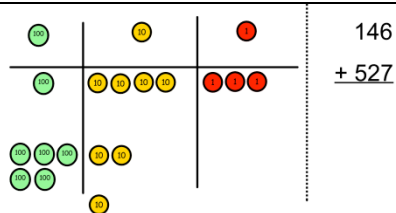
At Millhouse Primary School and Nursery, we understand how vital it is to support our children to develop a true conceptual understanding of the four rules so that they can master the objectives of the new curriculum. Therefore models, images and practical resources are incorporated into the teaching of the four rules, so that children can secure their understanding, before applying their skills to formal written methods. The table below displays the progressive stages for teaching addition and practical resources and pictorial representations that can be used to consolidate understanding.

Addition

Strategies for teaching addition	Concrete	Pictorial	Abstract
Combining two parts to make a whole: part- whole model	  Use cubes to add two numbers together as a group or in a bar. 	   Use pictures to add two numbers together as a group or in a bar. 	$4 + 3 = 7$ $10 = 6 + 4$  Use the part-part whole diagram as shown above to move into the abstract.
Starting at the bigger number and counting on		Use a number track to count on from the largest number: $5 + 4 = 9$  $12 + 5 = 17$	$5 + 12 =$ $12 + 5 = 17$ Place the larger number in your head and count on the smaller number

	Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.	 Start at the larger number on the number line and count on in ones, tens or in one jump to find the answer.	to find your answer.
Regrouping to make 10.	 $6 + 5 = 11$  Start with the bigger number and use the smaller number to make 10, then count on.	Use pictures or a number line. Regroup or partition the smaller number to make 10 (make links to the part whole model) and then count on.  $3 + 9 =$ $9 + 5 = 14$ 	$7 + 4 = 11$ 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. 	 Add together three groups of objects. Draw a picture to recombine the groups to make 10.	$4 + 7 + 6 = 10 + 7$ $= 17$ Combine the two numbers that make 10 and then add on the

	Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.		remainder.
Column method- no regrouping (no carrying)	$24 + 15 =$ 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. 	<u>Calculations</u> $21 + 42 =$ $\begin{array}{r} 21 \\ + 42 \\ \hline \end{array}$
Column method- regrouping (carrying)	Make both numbers on a place value grid.  Add up the units and exchange 10 ones for one 10.	Children can draw a pictorial representation of the columns and place value counters to further support their learning and understanding. 	$\begin{array}{r} 536 \\ + 85 \\ \hline 621 \\ 11 \end{array}$ As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here. $\begin{array}{r} 72.8 \\ + 54.6 \\ \hline 127.4 \\ 11 \end{array}$



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.

This can also be done with Base 10 to help children clearly see that 10 ones equal 1 ten and 10 tens equal 100.

As children move on to decimals, money and decimal place value counters can be used to support learning.

$$\begin{array}{r}
 \text{£ } 2 \text{ } 3 \text{ } . \text{ } 5 \text{ } 9 \\
 + \text{£ } \text{ } 7 \text{ } . \text{ } 5 \text{ } 5 \\
 \hline
 \text{£ } 3 \text{ } 1 \text{ } . \text{ } 1 \text{ } 4 \\
 \hline
 \end{array}$$

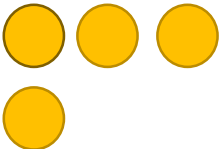
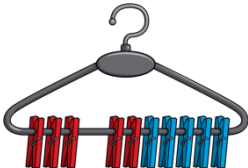
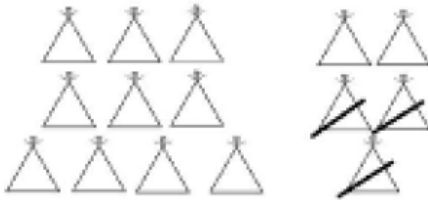
$$\begin{array}{r}
 2 \text{ } 3 \text{ } . \text{ } 3 \text{ } 6 \text{ } 1 \\
 9 \text{ } . \text{ } 0 \text{ } 8 \text{ } 0 \\
 5 \text{ } 9 \text{ } . \text{ } 7 \text{ } 7 \text{ } 0 \\
 + 1 \text{ } . \text{ } 3 \text{ } 0 \text{ } 0 \\
 \hline
 9 \text{ } 3 \text{ } . \text{ } 5 \text{ } 1 \text{ } 1 \\
 \hline
 2 \text{ } 1 \text{ } \text{ } 2
 \end{array}$$

End of year age related expectations - SUBTRACTION

	EYFS	Yr1	Yr2	Yr3	YR4	Yr5	Yr6
Subtraction	Find one less than a given number from 1-5, then 1-10. Begin to use mathematical vocabulary involving subtraction (-) and the equal (=) sign. Begin to relate subtraction to 'taking away'. Using objects and by counting on or	Read, write and interpret mathematical statements involving addition (+) and the equal (=) sign. Represent and use number bonds and related subtraction facts within 20. Subtract one-digit and two-	Recall and use subtraction facts to 20 fluently and related facts to 100. Subtract numbers using concrete objects, pictorial representations and mentally, including: • A two-digit number and ones • A two-digit number and tens • Two two-digit numbers	Subtract numbers with up to three digits, using formal written method of columnar subtraction.	Subtract numbers with up to 4 digits using the formal written method of columnar subtraction <u>where appropriate</u> .	Subtract whole numbers with more than 4 digits, including using formal written method (columnar subtraction).	No objectives have been included in the programmes of study explicitly related to written methods for subtraction in Yr6. However, there is an expectation that children will continue to practise and use the formal

	back, subtract two single-digit numbers.	digit numbers within 20, including zero. Solve missing number problems e.g. $7 = \square - 9$	Three one-digit numbers.				written method for larger numbers and decimals and use these methods when solving problems.
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Subtraction

Strategies for teaching subtraction	Concrete	Pictorial	Abstract
Taking away ones	Use physical objects, counters, cubes etc to show how objects can be taken away.  $6 - 2 = 4$    $10 - 7 = 3$	Cross out drawn objects to show what has been taken away.  $15 - 3 = \boxed{12}$	$18 - 3 = 15$ $8 - 2 = 6$

Counting back

Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.

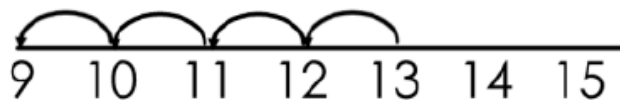
$$13 - 4$$



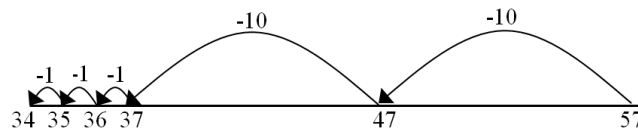
Use counters and move them away from the group as you take them away counting backwards as you go.



Count back on a number line or number track



Start at the bigger number and count back the smaller number showing the jumps on the number line.



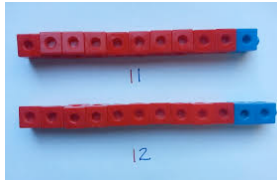
This can progress all the way to counting back using two 2 digit numbers.

Put 13 in your head, count back 4. What number are you at? Use your fingers to help.

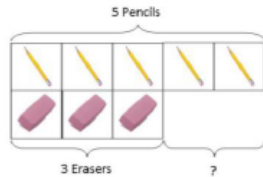
Find the difference

Compare amounts and objects to find the difference.

$$12 - 11 =$$

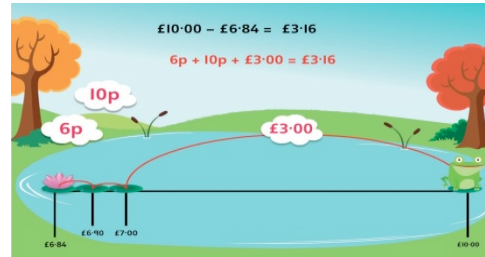


Use cubes to build towers or make bars to find the difference



Use basic bar models with items to find the difference

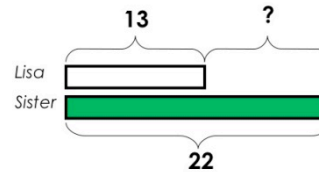
Draw number lines to count on and find the difference



Draw bars to find the difference between 2 numbers.

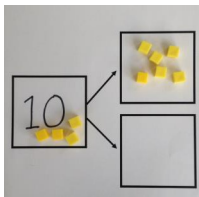
Comparison Bar Models

Lisa is 13 years old. Her sister is 22 years old.
Find the difference in age between them.



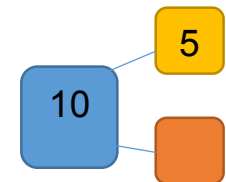
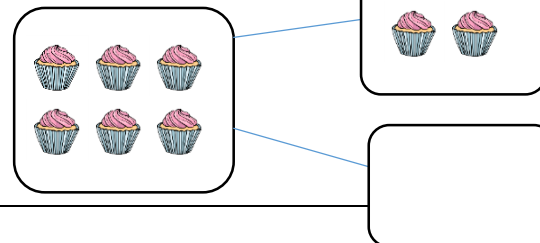
Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches.

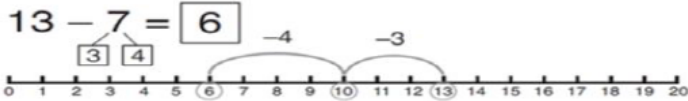
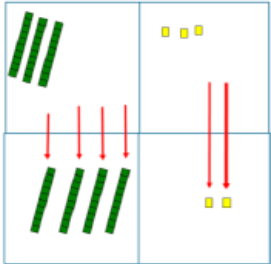
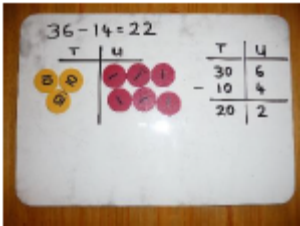
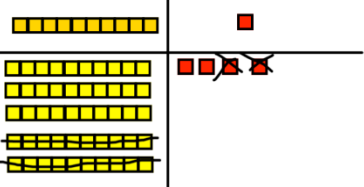
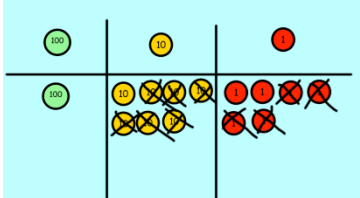
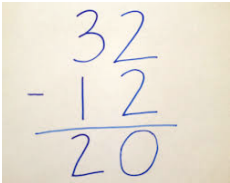
Part Whole Model



Link to addition-
use the part whole
model to help
explain the inverse
between addition
and subtraction.

Use a pictorial representation of objects to show the part whole model.

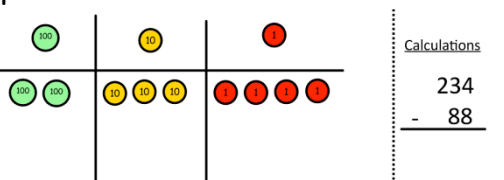


	If 10 is the whole and 6 is one of the parts. What is the other part? $10 - 6 =$		Move to using numbers within the part whole model.
Make 10	$14 - 9 =$  Make 14 on the ten frame. Take away the four first to make 10 and then take away one more so you have taken away 5. You are left with the answer of 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.	$16 - 8 =$ How many do we take off to reach the next 10? How many do we have left to take off?
Column method without regrouping	Tens Ones  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. 	 Calculations $\begin{array}{r} 54 \\ - 22 \\ \hline 32 \end{array}$  Calculations $\begin{array}{r} 176 \\ - 64 \\ \hline 112 \end{array}$ Draw the Base 10 or place value counters alongside the written calculation to help to show working.	This will lead to a clear written column subtraction. 

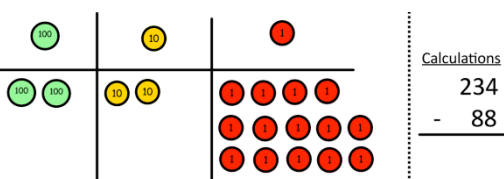
Column method with regrouping

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

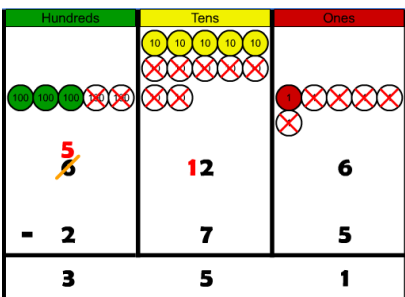
Make the larger number with the place value counters



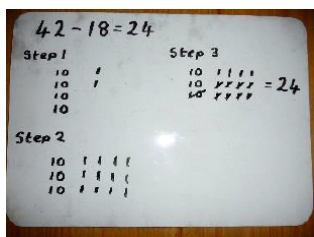
Start with the ones, can I take away 8 from 4 easily? I need to exchange one of my tens for ten ones.



Now I can subtract my ones.



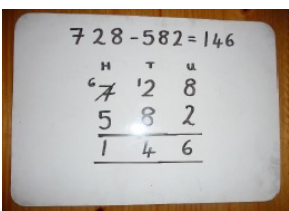
as clearly showing the exchanges you make.



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

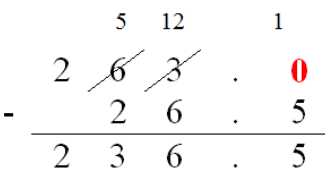
Just writing the numbers as shown here shows that the child understands the method and knows when to exchange/regroup.

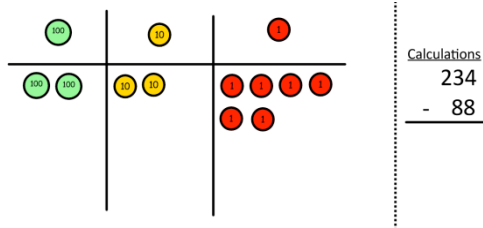
Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well



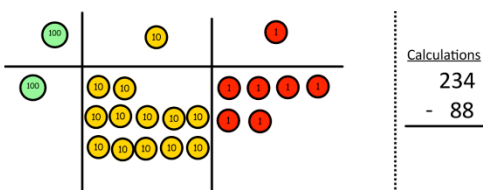
The children can then progress to using a compact method.

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

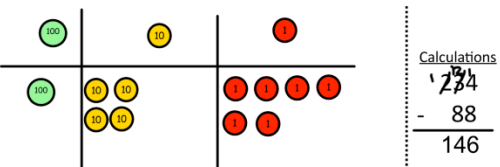




Now look at the tens, can I take away 8 tens easily? I need to exchange one hundred for ten tens.



Now I can take away eight tens and complete my subtraction



Show children how the concrete

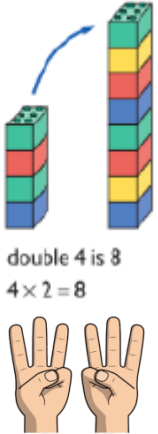
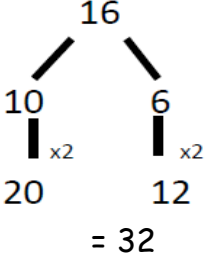
	method links to the written method alongside your working. Cross out the numbers when exchanging and show where we write our new amount.		
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End of year age related expectations - MULTIPLICATION

	EYFS	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6
Multiplication	To begin to count in 2s, 5s and 10s by recall and counting repeated groups of the same size (only once chn are confident at counting 1-20)	Solve one-step problems involving multiplication by calculating the answer using physical objects, pictorial representations and arrays with	Recall and use multiplication facts for the 2, 5 and 10 multiplication tables. Calculate mathematical statements for multiplication	Recall and use multiplication facts for the 3, 4 and 8 multiplication tables. (Through doubling, connect the 2,4 and 8 multiplication	Recall multiplication facts for multiplication tables up to 12 x 12. Multiply two-digit and three-digit numbers by a	Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit	Multiply multi-digit numbers up to 4 digits by a two digit whole number using the formal written method of long multiplication. Multiply one

	individually). To begin to solve problems involving doubling numbers 1-5, then 1-10, using fingers, cubes and beads etc.	the support of the teacher.	within the multiplication tables and write them using the multiplication ($\times$) and equals ($=$) signs. Show that multiplication of two numbers can be done in any order (commutative). Solve problems involving multiplication, using materials, arrays, repeated addition, mental methods, and multiplication facts, including problems in contexts.	tables). Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including two-digit numbers times one-digit numbers, using mental and progressing to a formal written method. (Short multiplication is not explicitly stated in the programmes of study but implied in the non-statutory guidance).	one-digit number using formal written layout.	numbers.	digit numbers with up to two decimal places by whole numbers.
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Multiplication

Strategies for teaching multiplication	Concrete	Pictorial	Abstract
Doubling	 Use practical activities to show how to double a number.	Draw pictures to show how to double a number. Double 4 is 8 	 Partition a number and then double each part

Double 3 is 6

before recombining it back together.

Counting in multiples

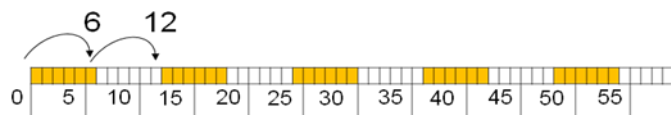
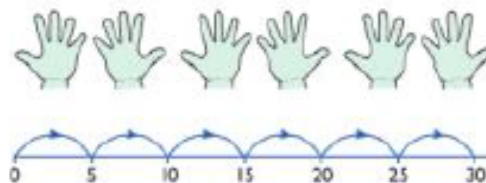


Count in multiples supported by concrete objects in equal groups.



Three pairs of socks. How many socks altogether?

2, 4, 6,



Use a number line or pictures to continue support in counting in multiples.

Count in multiples of a number aloud.

Write sequences with multiples of numbers.

2, 4, 6, 8, 10

5, 10, 15, 20, 25, 30

Repeated addition

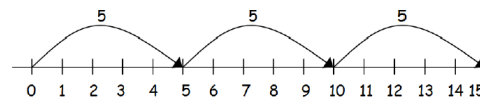


Use different objects to add equal groups.

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



2 add 2 add 2 equals 6



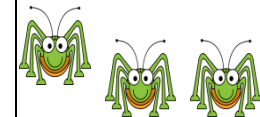
$$5 + 5 + 5 = 15$$

Write addition sentences to describe objects and pictures.



$$2 + 2 + 2 + 2 + 2 = 10$$

Find missing numbers.

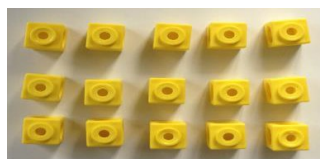


3 insects have _____ legs

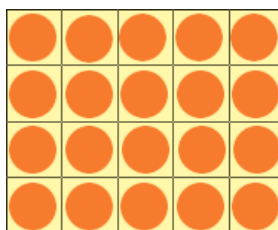
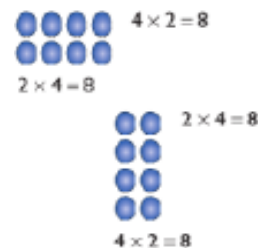
$$6 + 6 + 6 = 18$$

Arrays- showing commutative multiplication

Create arrays using counters/ cubes to show multiplication sentences.



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



Link arrays to area of rectangles.

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



$$5 + 5 + 5 = 15$$

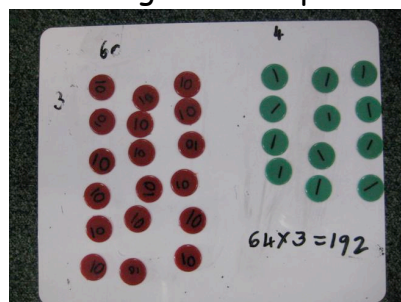
$$3 + 3 + 3 + 3 + 3 = 15$$

$$5 \times 3 = 15$$

$$3 \times 5 = 15$$

Column multiplication

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

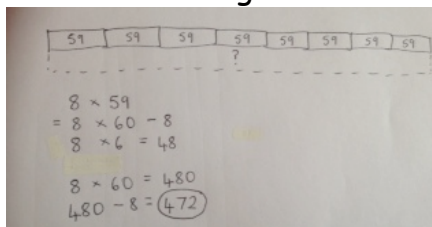


Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.

6cm 6cm 6cm



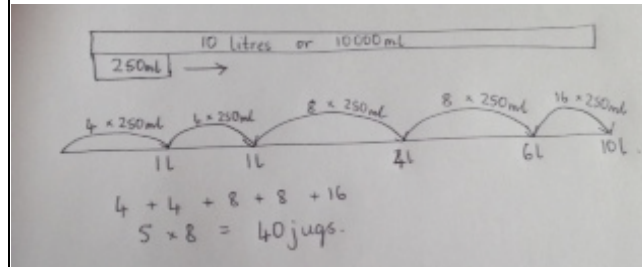
How long is this red line?



Start with short multiplication, reminding the children about lining up their numbers clearly in columns.

$$\begin{array}{r} 2 \ 3 \ 7 \\ \times \quad 4 \\ \hline 9 \ 4 \ 8 \\ 1 \ 2 \end{array}$$

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.



Then progress to long multiplication.

$$\begin{array}{r} 34 \\ \times 56 \\ \hline 204 \\ 1700 \\ \hline 1904 \end{array} \checkmark$$

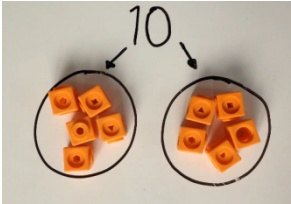
Extend with short and long multiplication of decimal numbers (initially in the context of money and measures).

End of year age related expectations - DIVISION

	EYFS	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6
Division	To begin to solve problems involving halving and sharing numbers up to 5, 10, using fingers, cubes and other practical equipment.	Solve one-step problems involving division by calculating the answer using physical objects, pictorial representations and arrays with the support of the teacher.	Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables. Calculate mathematical statements for division within the multiplication tables and write them using the division ($\div$) and equals (=) signs. Solve problems involving division, using materials, arrays, repeated	Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables. Write and calculate mathematical statements for division using the multiplication tables that they know, including for two-digit numbers divided by one-digit numbers, using mental and progressing to a formal written	Recall multiplication and division facts for multiplication tables up to 12 x 12. Divide two-digit and three-digit numbers by a one-digit number using formal written methods of short division (not explicitly stated in the programmes of study but implied in the non-statutory guidance).	Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context.	Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context. Divide numbers up to 4 digits by a two-digit number using the formal written method of short division where

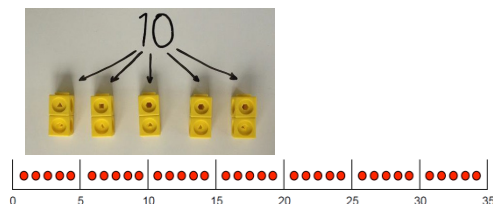
			subtraction, mental methods, and multiplication and division facts, including problems in contexts.	methods. (Short division is not explicitly stated in the programmes of study but implied in the non-statutory guidance).			appropriate, interpreting reminders according to the context.
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Division

Strategies for teaching division	Concrete	Pictorial	Abstract
Division as sharing	 I have 10 cubes, can you share them equally in 2 groups?  	Children use pictures or shapes to share quantities.   $8 \div 2 = 4$	Share 9 buns between three people. $9 \div 3 = 3$

Division as grouping

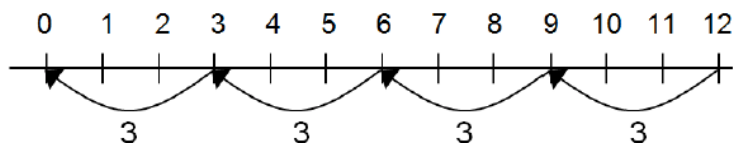
Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.



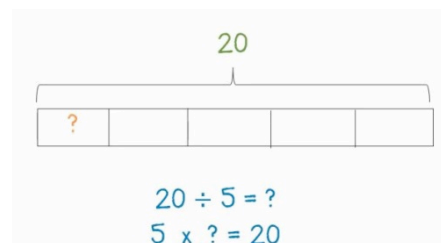
$$96 \div 3 = 32$$



Use a number line to show jumps in groups. The number of jumps equals the number of groups.



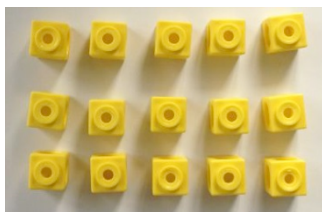
Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group.



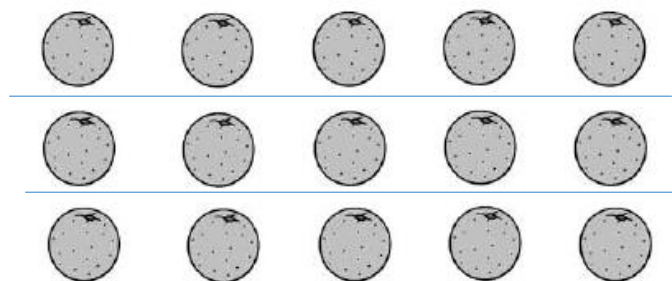
$$28 \div 7 = 4$$

Divide 28 into 7 groups. How many are in each group?

Division within arrays



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



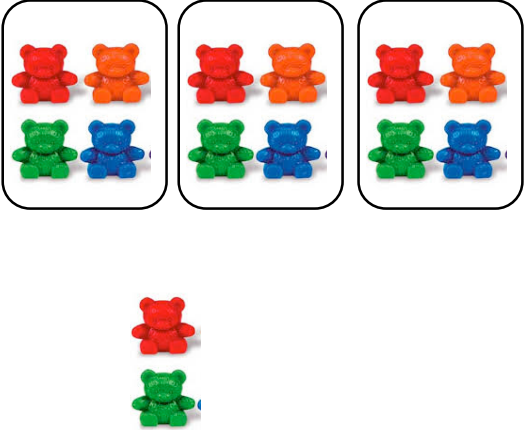
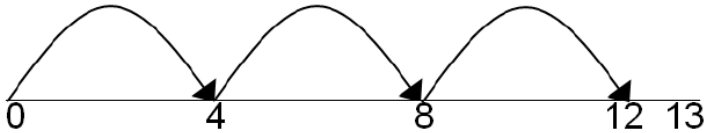
Find the inverse of multiplication and division sentences by creating four linking number sentences.

$$7 \times 4 = 28$$

$$4 \times 7 = 28$$

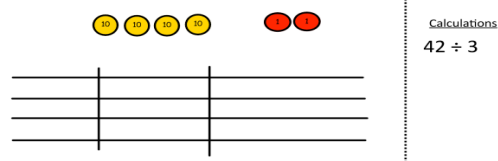
$$28 \div 7 = 4$$

$$28 \div 4 = 7$$

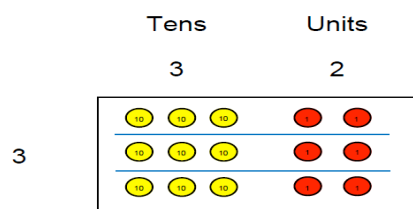
	Eg $15 \div 3 = 5$ $5 \times 3 = 15$ $15 \div 5 = 3$ $3 \times 5 = 15$	Draw an array and use lines to split the array into groups to make multiplication and division sentences.	
Division with a remainder	$14 \div 3 =$ Divide objects between groups and see how much is left over 	Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder. $13 \div 4 = 3 \text{ r}1$  Draw dots and group them to divide an amount and clearly show a remainder. $14 \div 3 = 4 \text{ r}2$ 	Complete written divisions and show the remainder using r. $29 \div 8 = 3 \text{ REMAINDER } 5$ ↑ ↑ ↑ ↑ dividend divisor quotient remainder

Short division

$$96 \div 3 = 32$$



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

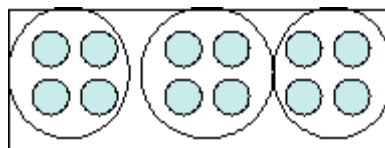


$$42 \div 3 =$$

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. $42 \div 3 =$

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

$$12 \div 4 = 3$$



Encourage them to move towards counting in multiples to divide more efficiently e.g. 4, 8, 12 = 3 groups.

Begin with divisions that divide equally with no remainder.

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

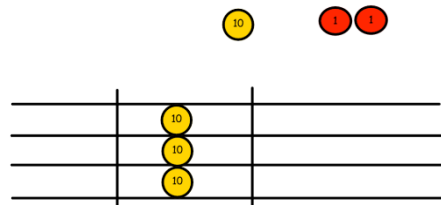
Then move onto divisions with a

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

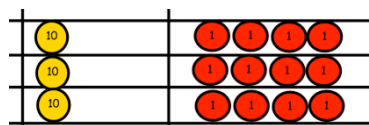
remainder

Express remainders as fractions and/or decimals.

Progress to using short division when dividing by a two-digit divisor. Use a 'thought bubble' to write out the multiples.



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.

$$547 \div 23 =$$

$$\begin{array}{r} 23 \overline{) 547} \\ \underline{46} \\ 87 \end{array}$$

$$547 \div 23 = 23 \text{ r}18$$

23
46
69
92

Finally move into decimal places to divide the total accurately.

$$\begin{array}{r} 14.6 \\ 35 \overline{) 547.0} \\ \underline{35} \\ 19 \\ \underline{16} \\ 30 \\ \underline{30} \\ 0 \end{array}$$

Finally introduce long division by repeatedly subtracting multiples of the divisor. Children will need to select the most effective method for each calculation they are faced with i.e. short or long division.

			28 r 12 15) 432 - <u>300</u> 132 - <u>120</u> 12 (15 x 20) (15 x 8)
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