Maths Calculation Policy

Updated: July 2025

Welcome to Christ Church Academy's Calculation Policy. This document is broken down into the expectations in calculation for each year group. Guidance is given on teaching sequence of addition, subtraction, multiplication and division.

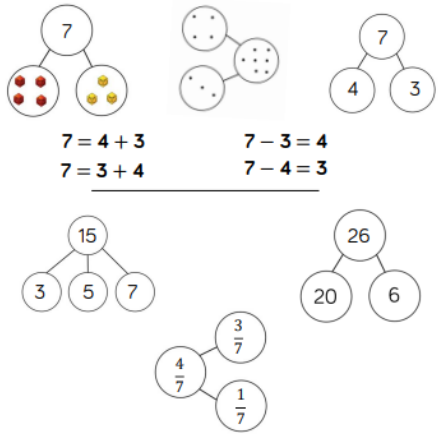
Approaches:

- It is essential that children should be taught maths throughout school through a variety of role play, with links to skills needed in everyday life, real life problems and through cross curricular work where appropriate.
- Children will build mathematical skills and vocabulary by having regular opportunities to talk to each other about their maths and practise explaining the steps taken to reach an answer
- Practical equipment will be used throughout school to support and stimulate children's understanding and reasoning skills; this is underpinned by a concrete, pictorial and abstract approach to all lessons (CPA approach).
- The use of visual aids and practical equipment will be interlinked as often as possible through teaching and learning to stimulate the children's learning and help create an image of numbers and calculations in their mind.
- Use IWB tools/visuals where appropriate to teach calculation strategies.
- Children across school should be confident in using concrete objects, and understand how to represent work pictorially before progressing to abstract forms.
- • Use IWB tools/visuals where appropriate to teach calculation strategies.
- Children will have the opportunity to practise their fluency skills through daily Number Sense sessions where they are able to quickly and accurately recall mathematical facts and concepts (e.g. 3 + 7 = 10, then I know 30 + 70= 100) Through a range of daily teaching and learning strategies carefully selected by teachers, mental recall of number facts are secure e.g. bonds to 10/20, multiplication and division facts.
- The following methods in this policy are to be used with year group and ability as appropriate (i.e. Key Stage 2 with SEND may still need to use Key Stage 1 methods).
- Where the level is not appropriate, children assessed as working three years or more behind their year group will follow a cognitive learning strategy.
- • All teaching staff and support staff must use the language of calculation from the policy consistently across school. Vocabulary will be clearly displayed to match learning from current unit.

At the start of each policy, there is an overview of the different models and images that can support the teaching of different concepts. These provide explanations of the benefits of using the models and show the links between different operations. Each operation is then broken down into skills and each skill has a dedicated page showing the different models and images that could be used to effectively teach that concept.

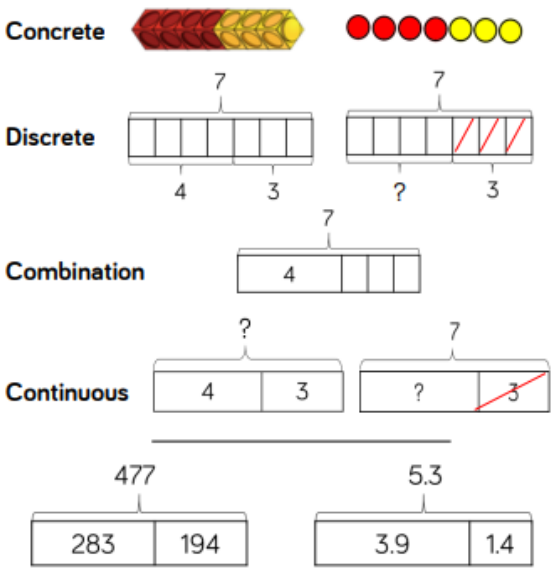
Addition and Subtraction

Part-Part Whole Model



This part-whole model supports children in their understanding of aggregation and partitioning. Due to its shape, it can be referred to as a cherry part-whole model. When the parts are complete and the whole is empty, children use aggregation to add the parts together to find the total. When the whole is complete and at least one of the parts is empty, children use partitioning (a form of subtraction) to find the missing part. Part-whole models can be used to partition a number into two or more parts, or to help children to partition a number into tens and ones or other place value columns. In KS2, children can apply their understanding of the part-whole model to add and subtract fractions, decimals and percentages.

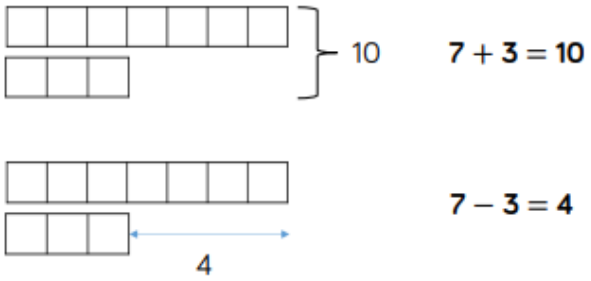
Bar Model (single)



The single bar model is another type of a part-whole model that can support children in representing calculations to help them unpick the structure. Cubes and counters can be used in a line as a concrete representation of the bar model. Discrete bar models are a good starting point with smaller numbers. Each box represents one whole. The combination bar model can support children to calculate by counting on from the larger number. It is a good stepping stone towards the continuous bar model. Continuous bar models are useful for a range of values. Each rectangle represents a number. The question mark indicates the value to be found. In KS2, children can use bar models to represent larger numbers, decimals and fractions.

Bar Model (multiple)

Discrete



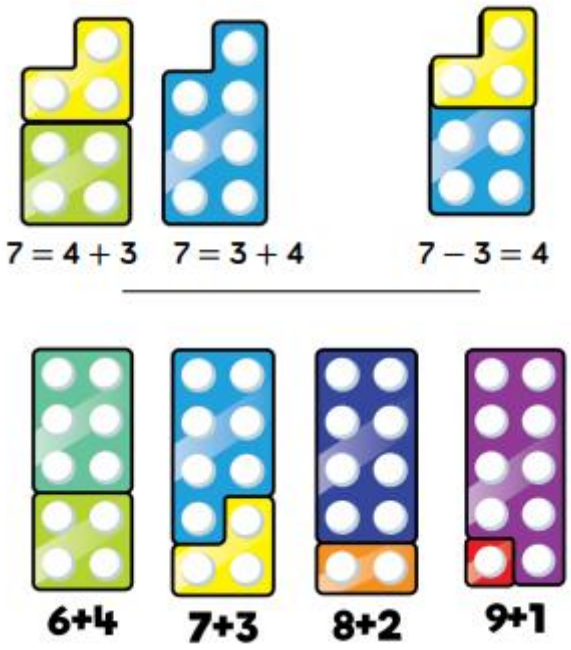
Continuous

7 − 3 = 4

2,394 − 1,014 = 1,380

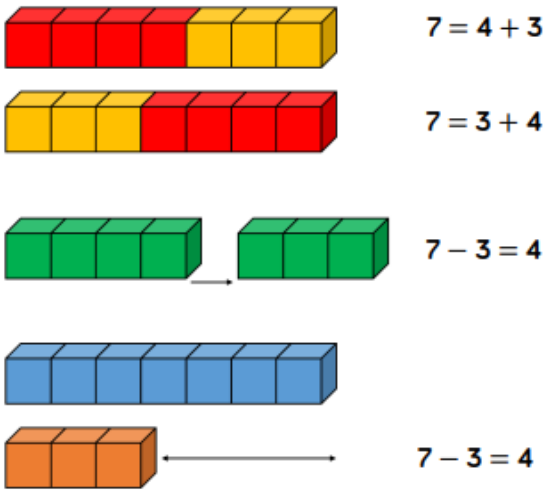
The multiple bar model is a good way to compare quantities whilst still unpicking the structure. Two or more bars can be drawn, with a bracket labelling the whole positioned on the right-hand side of the bars. Smaller numbers can be represented with a discrete bar model whilst continuous bar models are more effective for larger numbers. Multiple bar models can also be used to represent the difference in subtraction. An arrow can be used to model the difference. When working with smaller numbers, children can use cubes and a discrete model to find the difference. This supports children to see how counting on can help when finding the difference

Number Shapes



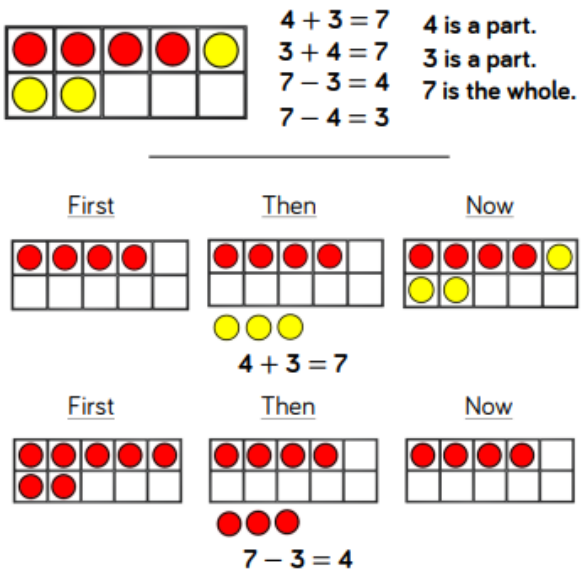
Number shapes can be useful to support children to subitise numbers as well as explore aggregation, partitioning and number bonds. When adding numbers, children can see how the parts come together making a whole. As children use number shapes more often, they can start to subitise the total due to their familiarity with the shape of each number. When subtracting numbers, children can start with the whole and then place one of the parts on top of the whole to see what part is missing. Again, children will start to be able to subitise the part that is missing due to their familiarity with the shapes. Children can also work systematically to find number bonds. As they increase one number by 1, they can see that the other number decreases by 1 to find all the possible number bonds for a number.

Cubes



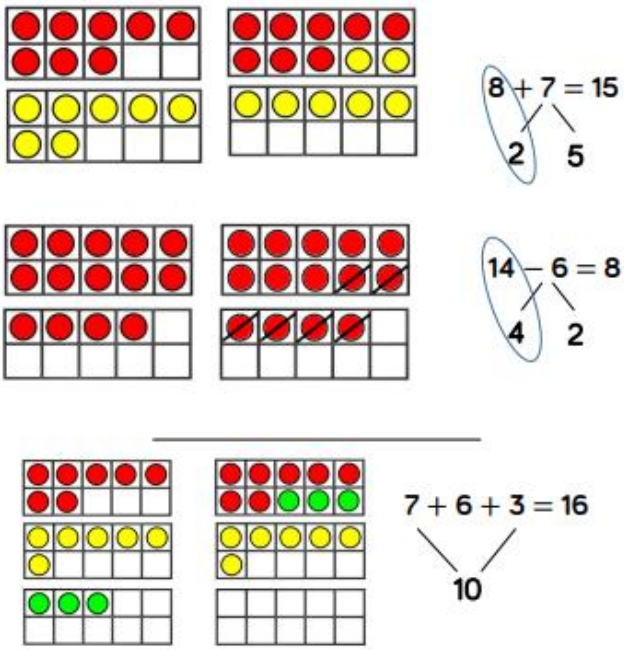
Cubes can be useful to support children with the addition and subtraction of one-digit numbers. When adding numbers, children can see how the parts come together to make a whole. Children could use two different colours of cubes to represent the numbers before putting them together to create the whole. When subtracting numbers, children can start with the whole and then remove the number of cubes that they are subtracting in order to find the answer. This model of subtraction is reduction, or take away. Cubes can also be useful to look at subtraction as difference. Here, both numbers are made and then lined up to find the difference between the numbers. Cubes are useful when working with smaller numbers but are less efficient with larger numbers as they are difficult to subitise and children may miscount them.

Ten Frames (to 10)



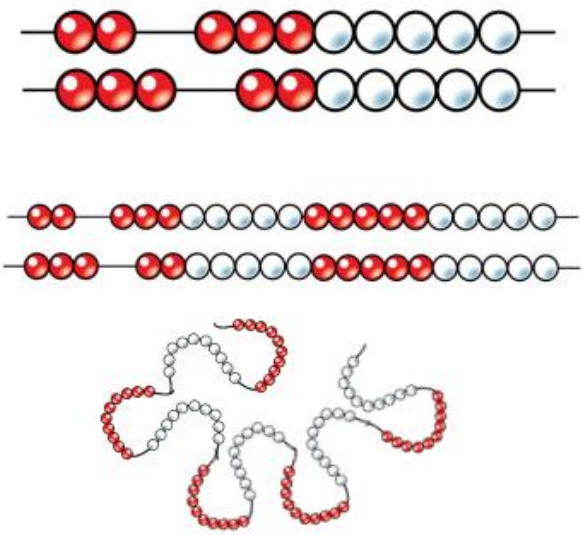
When adding and subtracting within 10, the ten frames can support children to understand the different structures of addition and subtraction. Using the language of parts and wholes represented by objects on the ten frame introduces children to aggregation and partitioning. Aggregation is a form of addition where parts are combined together to make a whole. Partitioning is a form of subtraction where the whole is split into parts. Using these structures, the ten frames can enable children to find all the number bonds for a number. Children can also use ten frames to look at augmentation (increasing a number) and take-away (decreasing a number). This can be introduced through a first, then, now structure which shows the change in the number in the 'then' stage. This can be put into a story structure to help children understand the change e.g. First, there were 7 cars. Then, 3 cars left. Now, there are 4 cars.

Ten Frame (to 20)



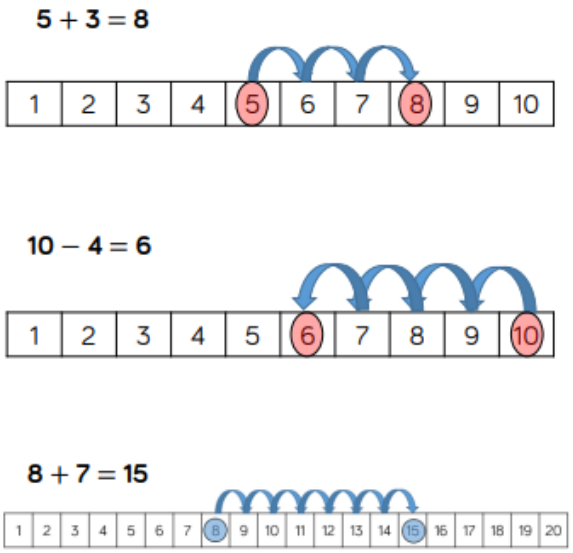
When adding two single digits, children can make each number on separate ten frames before moving part of one number to make 10 on one of the ten frames. This supports children to see how they have partitioned one of the numbers to make 10, and makes links to effective mental methods of addition. When subtracting a one-digit number from a two-digit number, firstly make the larger number on 2 ten frames. Remove the smaller number, thinking carefully about how you have partitioned the number to make 10, this supports mental methods of subtraction. When adding three single-digit numbers, children can make each number on 3 separate 10 frames before considering which order to add the numbers in. They may be able to find a number bond to 10 which makes the calculation easier. Once again, the ten frames support the link to effective mental methods of addition as well as the importance of commutativity.

Rekenrek / Bead Strings



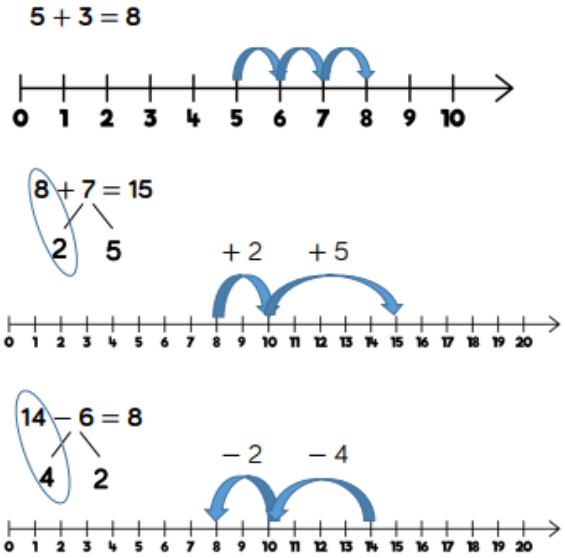
Different sizes of bead strings can support children at different stages of addition and subtraction. Bead strings to 10 are very effective at helping children to investigate number bonds up to 10. They can help children to systematically find all the number bonds to 10 by moving one bead at a time to see the different numbers they have partitioned the 10 beads into e.g. 2 + 8 = 10, move one bead, 3 + 7 = 10. Bead strings to 20 work in a similar way but they also group the beads in fives. Children can apply their knowledge of number bonds to 10 and see the links to number bonds to 20. Bead strings to 100 are grouped in tens and can support children in number bonds to 100 as well as helping when adding by making ten. Bead strings can show a link to adding to the next 10 on number lines which supports a mental method of addition

Number track



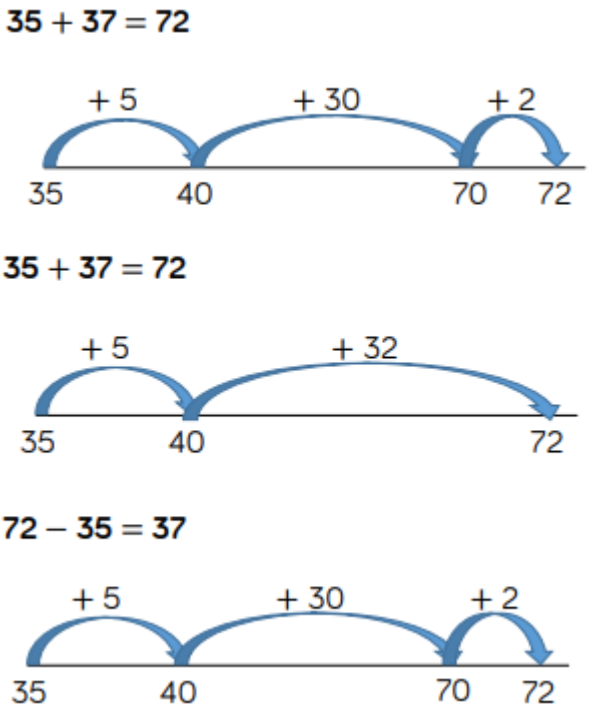
Number tracks are useful to support children in their understanding of augmentation and reduction. When adding, children count on to find the total of the numbers. On a number track, children can place a counter on the starting number and then count on to find the total. When subtracting, children count back to find their answer. They start at the minuend and then take away the subtrahend to find the difference between the numbers. Number tracks can work well alongside ten frames and bead strings which can also model counting on or counting back. Playing board games can help children to become familiar with the idea of counting on using a number track before they move on to number lines.

Number line (labelled)



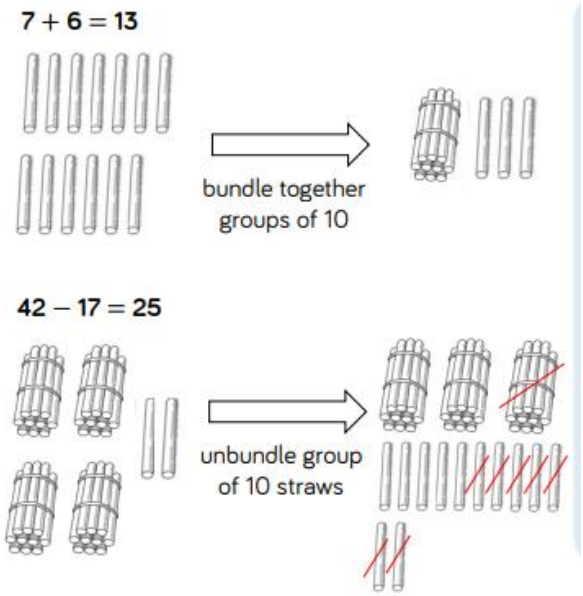
Labelled number lines support children in their understanding of addition and subtraction as augmentation and reduction. Children can start by counting on or back in ones, up or down the number line. This skill links directly to the use of the number track. Progressing further, children can add numbers by jumping to the nearest 10 and then jumping to the total. This links to the making 10 method which can also be supported by ten frames. The smaller number is partitioned to support children to make a number bond to 10 and to then add on the remaining part. Children can subtract numbers by firstly jumping to the nearest 10. Again, this can be supported by ten frames so children can see how they partition the smaller number into the two separate jumps.

Number lines (blank)



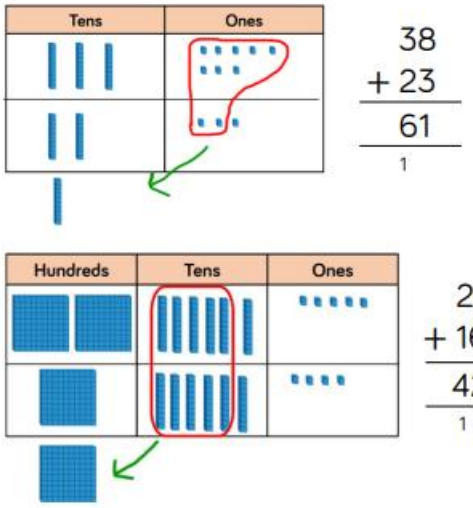
Blank number lines provide children with a structure to add and subtract numbers in smaller parts. Developing from labelled number lines, children can add by jumping to the nearest 10 and then adding the rest of the number either as a whole or by adding the tens and ones separately. Children may also count back on a number line to subtract, again by jumping to the nearest 10 and then subtracting the rest of the number. Blank number lines can also be used effectively to help children subtract by finding the difference between numbers. This can be done by starting with the smaller number and then counting on to the larger number. They then add up the parts they have counted on to find the difference between the numbers.

Straws



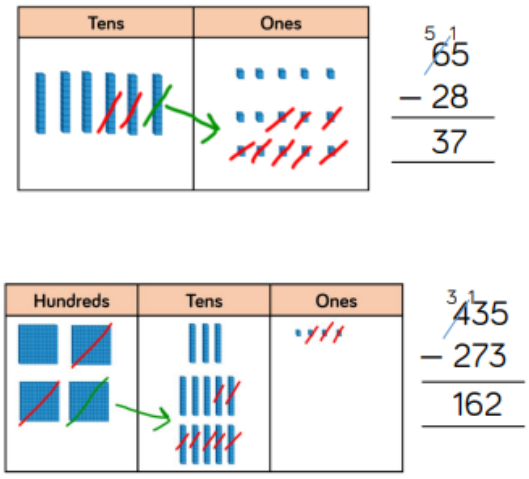
Straws are an effective way to support children in their understanding of exchange when adding and subtracting 2-digit numbers. Children can be introduced to the idea of bundling groups of ten when adding smaller numbers and when representing 2-digit numbers. Use elastic bands or other ties to make bundles of ten straws. When adding numbers, children bundle a group of 10 straws to represent the exchange from 10 ones to 1 ten. They then add the individual straws (ones) and bundles of straws (tens) to find the total. When subtracting numbers, children unbundle a group of 10 straws to represent the exchange from 1 ten to 10 ones. Straws provide a good stepping stone to adding and subtracting with Base 10/Dienes.

Base 10 (addition)



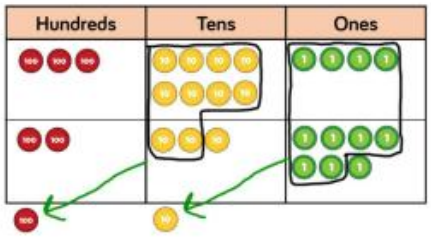
Using Base 10 or Dienes is an effective way to support children's understanding of column addition. It is important that children write out their calculations alongside using or drawing Base 10 so they can see the clear links between the written method and the model. Children should first add without an exchange before moving on to addition with exchange. The representation becomes less efficient with larger numbers due to the size of Base 10. In this case, place value counters may be the better model to use. When adding, always start with the smallest place value column. Here are some questions to support children. How many ones are there altogether? Can we make an exchange? (Yes or No) How many do we exchange? (10 ones for 1 ten, show exchanged 10 in tens column by writing 1 in column) How many ones do we have left? (Write in ones column) Repeat for each column.

Base 10 (subtraction)

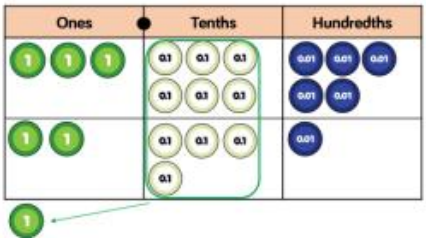


Using Base 10 or Dienes is an effective way to support children's understanding of column subtraction. It is important that children write out their calculations alongside using or drawing Base 10 so they can see the clear links between the written method and the model. Children should first subtract without an exchange before moving on to subtraction with exchange. When building the model, children should just make the minuend using Base 10, they then subtract the subtrahend. Highlight this difference to addition to avoid errors by making both numbers. Children start with the smallest place value column. When there are not enough ones/tens/hundreds to subtract in a column, children need to move to the column to the left and exchange e.g. exchange 1 ten for 10 ones. They can then subtract efficiently. This model is efficient with up to 4-digit numbers. Place value counters are more efficient with larger numbers and decimals.

Place Value Counters (addition)



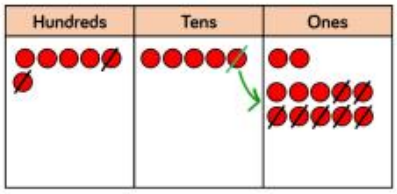
$$\begin{array}{r} 384 \\ +\ 237 \\ \hline 621 \\ \hline {\scriptstyle 1\ 1} \end{array}$$



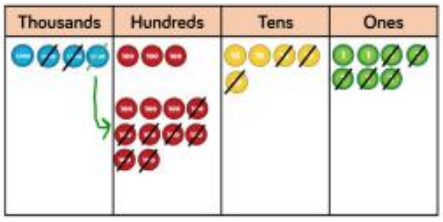
$$\begin{array}{r} 3.65 \\ +\ 2.41 \\ \hline 6.06 \\ \hline {\scriptstyle 1} \end{array}$$

Using place value counters is an effective way to support children's understanding of column addition. It is important that children write out their calculations alongside using or drawing counters so they can see the clear links between the written method and the model. Children should first add without an exchange before moving on to addition with exchange. Different place value counters can be used to represent larger numbers or decimals. If you don't have place value counters, use normal counters on a place value grid to enable children to experience the exchange between columns. When adding money, children can also use coins to support their understanding. It is important that children consider how the coins link to the written calculation especially when adding decimal amounts.

Place Value Counters (subtraction)



$$\begin{array}{r} {\scriptstyle 4\ 1} \\ 6\not{5}2 \\ -\ 207 \\ \hline 445 \\ \hline \end{array}$$



$$\begin{array}{r} {\scriptstyle 3\ 1} \\ 4\not{3}57 \\ -\ 2735 \\ \hline 1622 \\ \hline \end{array}$$

Using place value counters is an effective way to support children's understanding of column subtraction. It is important that children write out their calculations alongside using or drawing counters so they can see the clear links between the written method and the model. Children should first subtract without an exchange before moving on to subtraction with exchange. If you don't have place value counters, use normal counters on a place value grid to enable children to experience the exchange between columns. When building the model, children should just make the minuend using counters, they then subtract the subtrahend. Children start with the smallest place value column. When there are not enough ones/tens/hundreds to subtract in a column, children need to move to the column to the left and exchange e.g. exchange 1 ten for 10 ones. They can then subtract efficiently.

Addition

Year Group	Skill	Representations	Model (Manipulatives)
1	Add two 1-digit numbers to 10	Part-whole model Bar model Number shapes	Ten frames (within 10) Bead strings (10) Number tracks
1	Add 1 and 2-digit numbers to 20	Part-whole model Bar model Number shapes Ten frames (within 20)	Bead strings (20) Number tracks Number lines (labelled) Straws
2	Add three 1-digit numbers	Part-whole model Bar model	Ten frames (within 20) Number shapes
2	Add 1 and 2-digit numbers to 100	Part-whole model Bar model Number lines (labelled)	Number lines (blank) Straws Hundred square
2	Add two 2-digit numbers	Part-whole model Bar model Number lines (blank) Straws	Base 10 Place value counters
3	Add with up to 3-digits	Part-whole model Bar mode	Base 10 Place value counters Column addition
4	Add with up to 4-digits	Part-whole model Bar model	Base 10 Place value counters Column addition
5/6	Add with more than 4 digits	Part-whole model Bar model	Place value counters Column addition
5	Add with up to 3 decimal places	Part-whole model Bar model	Place value counters Column addition

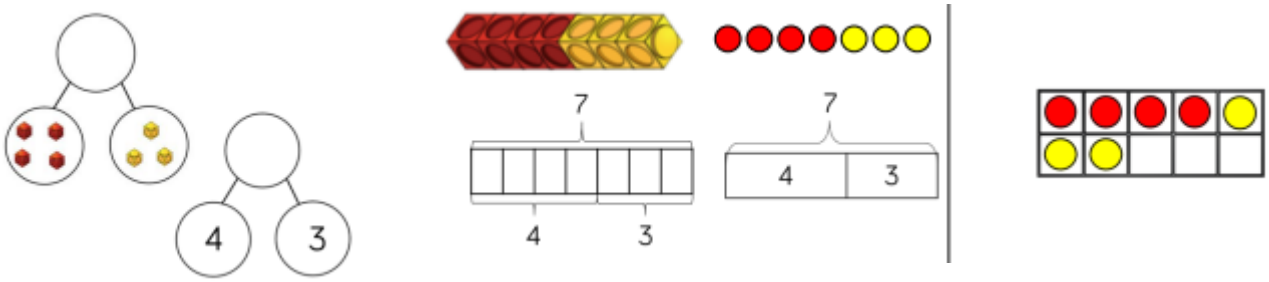
Year 1:

Add two 1-digit numbers to 10

In Key Stage 1 and with less able children in other key stages partitioning work should be supported by practical work using resources such as base 10, ten frames, counters, cubes and Numicon. Practical equipment used should be used as concrete objects before progressing to recording this in pictorial form along with the abstract calculation. Children will continue to use a range of practical equipment such as counters combining groups of objects to find the total by counting all or counting on.

The part-whole model, discrete and continuous bar model, number shapes and ten frame support aggregation (where two or more parts are combined to make a whole).

e.g.:



The combination bar model, ten frame, bead string and number track all support augmentation (having one total and adding onto it).

Once children have an understanding of this they should progress to the abstract method of writing addition questions.

e.g.

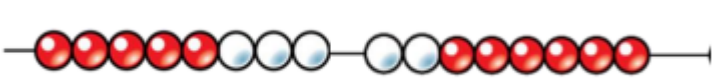
$$4 + 3 = 7$$

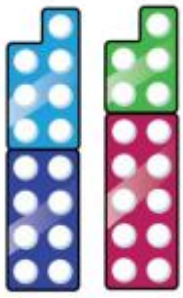
Year 1:

Add 1 and 2 -digit numbers to 20

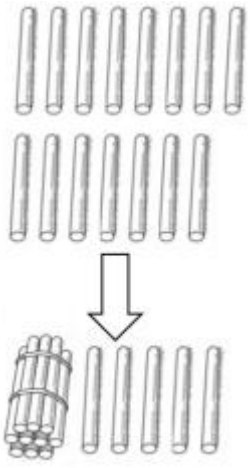
When adding one - digit numbers that cross 10, it is important to highlight the importance of ten ones equalling one ten. In Year 1, this is only done just by counting on.

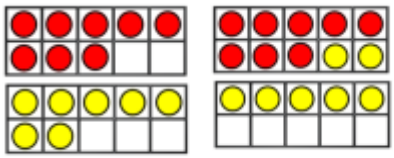
e.g. They may use beads, counters or Numicon to recognise counting on.

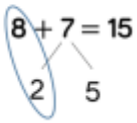


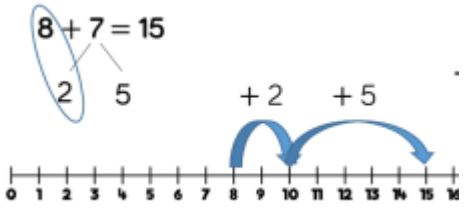


From Year 2, use different manipulatives can be used to represent this exchange alongside number lines to support children in understanding how to partition their jumps. Children will gain a better understanding of place value and addition by having the chance to explore using concrete resources and practise exchanging ones for a ten. Number sentences should be closely linked so children are able to recognise concrete and pictorial representations alongside abstract numbers.







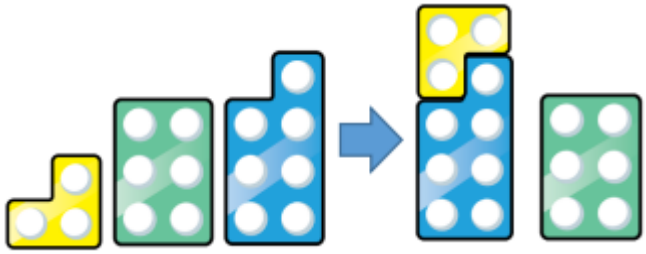


Year 2:

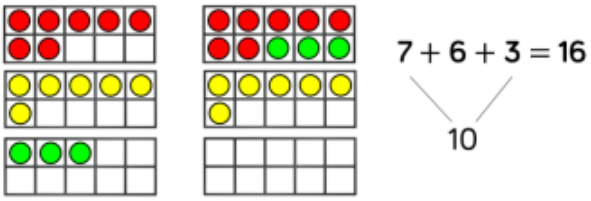
Add three 1 -digit number

When adding three 1 - digit numbers, children should be encouraged to look for number bonds to 10 or doubles to add the numbers more efficiently. This supports children in their understanding of commutativity.

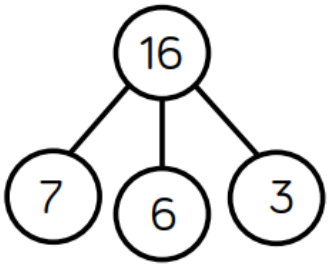
e.g. Numicon may be used to allow children to see how the numbers 'fit' together to make a 10.

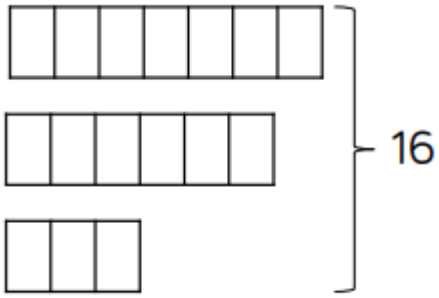


Manipulatives that highlight number bonds to 10 are effective when adding three 1 -digit numbers.



From this point children should then be able to apply their knowledge to pictorial and abstract methods, using part-part whole, bar models to support answering addition questions. All representations should link to the abstract sentences so children are able to make links with number bonds and doubles when adding.



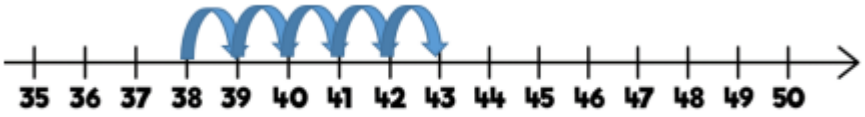


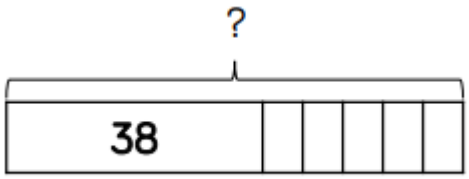
$7 + 6 + 3 = 16$

Year 2:

Add 1-digit and 2-digit numbers to 100

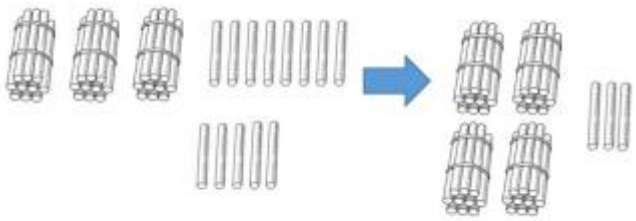
When adding single digits to a two-digit number, children should be encouraged to count on from the larger number. This can be done using a range of concrete and pictorial methods to support a deeper understanding. Hundred squares and straws can support children to find the number bond to 10.





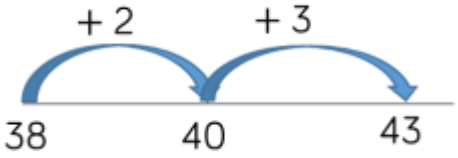
Hundred squares and straws can support children to find the number bond to 10.

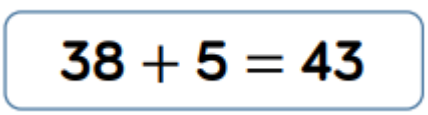
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



Use of the following resources can then be linked into using more formal written methods, where they should be able to apply their knowledge of number bonds to add more efficiently

e.g. 8 + 5 = 13 so 38 + 5 = 43.

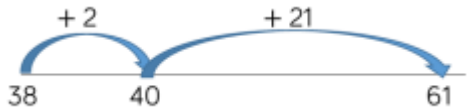


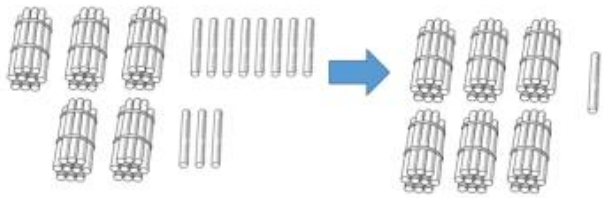


Year 2:

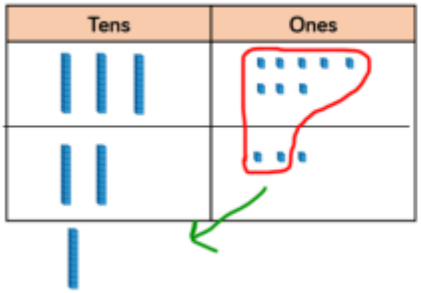
Add two 2-digit numbers to 100

Children can use a blank number line and other representations to count on to find the total. Encourage them to jump to multiples of 10 to become more efficient. As numbers become larger, straws become less efficient.

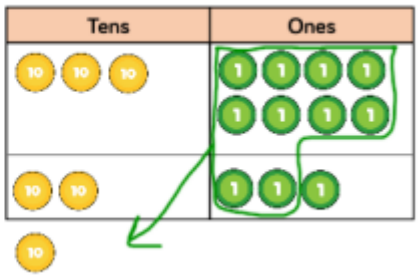




From Year 3, encourage children to use the formal column method when calculating alongside base 10 or place value counters. Using a structured place value frame will support children in visualising the exchange of 10 ones for a 10 while completing the column method.



$$\begin{array}{r} 38 \\ +\ 23 \\ \hline 61 \\ \hline 1 \end{array}$$

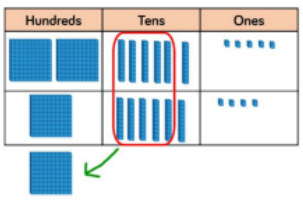


Year 3:

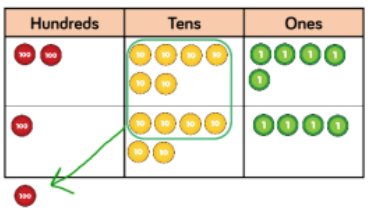
Add numbers with up to 3 digits

Base 10 and place value counters are the most effective manipulatives when adding numbers with up to 3 digits. Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method. Plain counters on a place value grid can also be used to support learning.

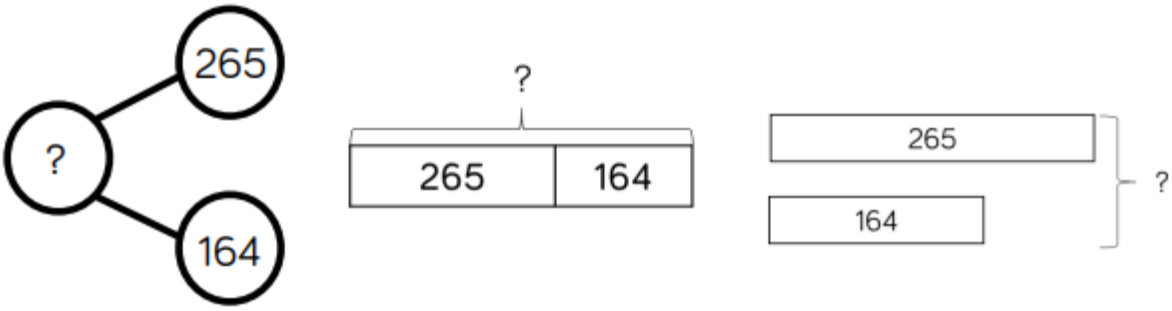
$$265 + 164 = 429$$



$$\begin{array}{r} 265 \\ +\ 164 \\ \hline 429 \\ \hline 1 \end{array}$$



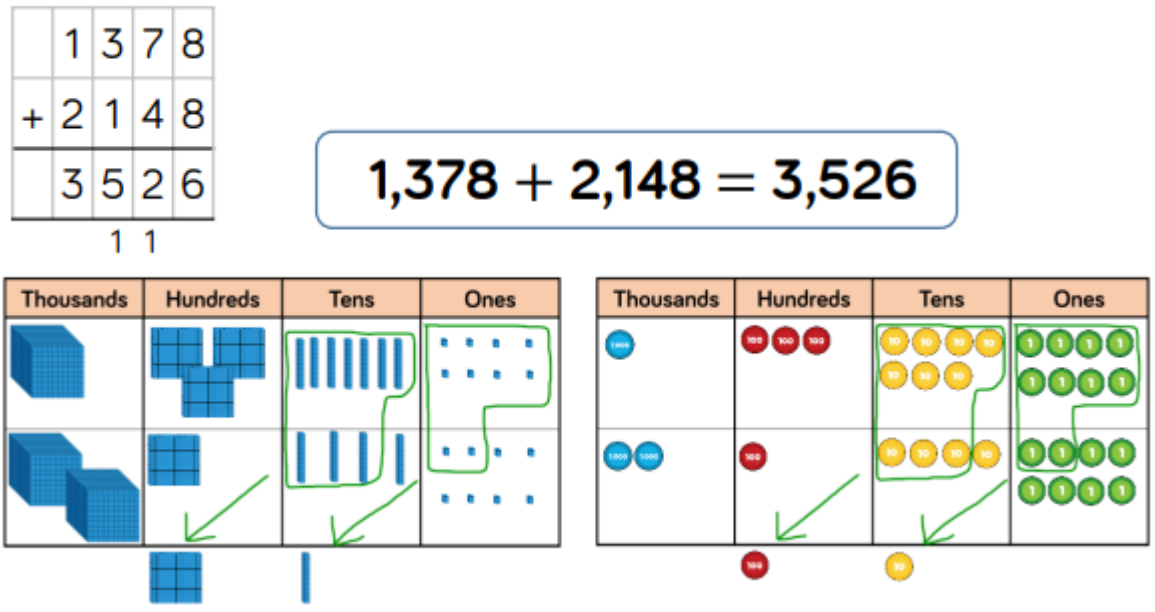
Pictorial representations such as bar models, and part-part whole methods can be useful to support children in visualising word-based problems or missing number problems. It can support their reasoning and problem-solving skills in choosing the correct calculation method.



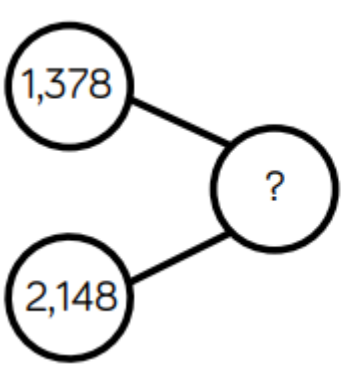
Year 4:

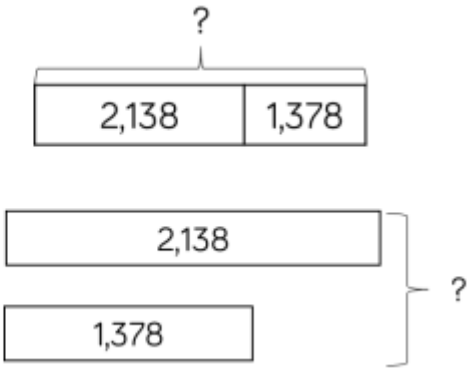
Add numbers with up to 4 digits

Base 10 and place value counters are the most effective manipulatives when adding numbers with up to 4 digits. Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method. Plain counters on a place value grid can also be used to support learning.



As in previous year groups, modelling the use of part-part whole and bar models when faced with missing number or worded problems can support children in recognising the type of problem they are faced with and support their ability to apply their knowledge to a problem-based question.

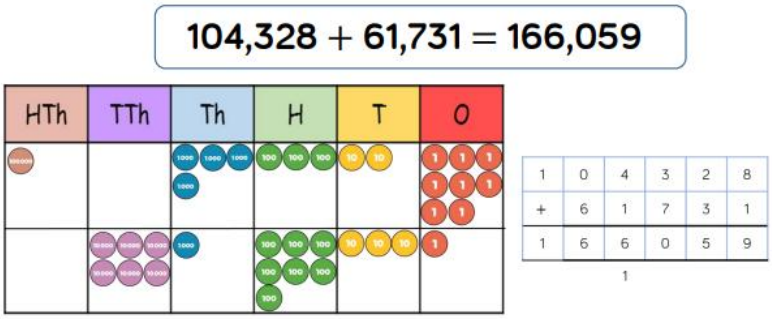




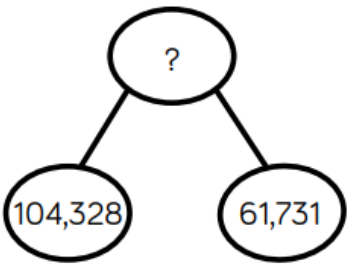
Year 5/6:

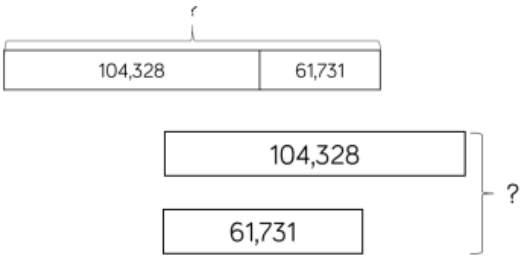
Add numbers with more than 4 digits

Place value counters or plain counters on a place value grid are the most effective concrete resources when adding numbers with more than 4 digits. At this stage, children should be encouraged to work in the abstract, using the column method to add larger numbers efficiently. Counters with a place value frame can still be used for children with an SEN or those still struggling with the concept.



Again, links should still be made to pictorial representations able to support children in Year 5 and Year 6 to solve more difficult worded questions or missing number questions (for example, a subtraction where the inverse operation is needed). In Year 6 children should be able to apply their knowledge to solve a range of addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.



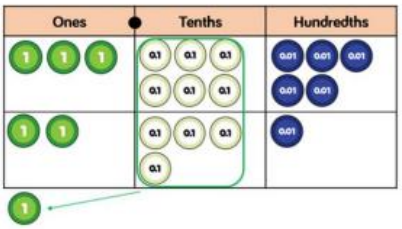


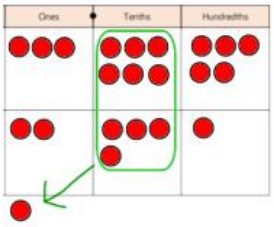
Year 5/6:

Add with up to 3 decimal places

Place value counters and plain counters on a place value grid are the most effective manipulatives when adding decimals with 1, 2 and then 3 decimal places. Ensure children have experience of adding decimals with a variety of decimal places. This includes putting this into context when adding money and other measures. Ensure the abstract method is demonstrated alongside the place value grid.

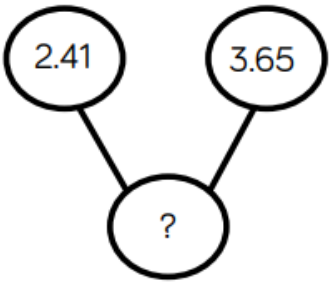
$$3.65 + 2.41 = 6.06$$

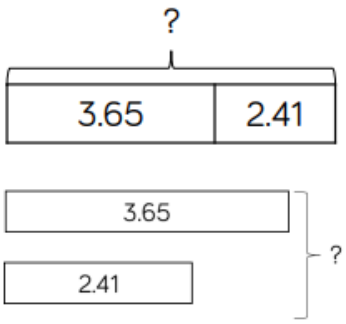




$$\begin{array}{r} 3.65 \\ +\ 2.41 \\ \hline 6.06 \\ \hline 1 \end{array}$$

As in previous addition, continue to use a range of pictorial methods to support understanding when looking at problem solving and reasoning-based questions.





$$3.65 + 2.41 = 6.06$$

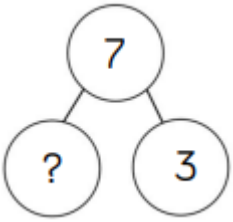
Subtraction

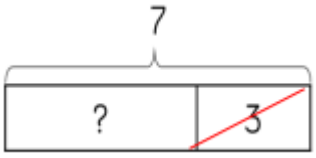
Year Group	Skill	Representations	Model (Manipulatives)
1	Subtract two 1-digit numbers to 10	Part-whole model Bar model Number shapes	Ten frames (within 10) Bead strings (10) Number track
½	Subtract 1 and 2-digit numbers to 20	Part-whole model Bar model Number shapes Ten frames (within 20)	Bead string (20) Number tracks Number lines (labelled) Straws
2	Subtract 1 and 2-digit numbers to 100	Part-whole model Bar model Number lines (labelled)	Number lines (blank) Straws Hundred square
2	Subtract two 2-digit numbers	Part-whole model Bar model Number lines (blank) Straws	Base 10 Place value counters
3	Subtract with up to 3- digits	Part-whole model Bar model	Base 10 Place value counters Column subtraction
4	Subtract with up to 4- digits	Part-whole model Bar mode	Base 10 Place value counters Column subtraction
5	Subtract with more than 4 digits	Part-whole model Bar model	Place value counters Column subtraction
5	Subtract with up to 3 decimal places	Part-whole model Bar model	Place value counters Column subtraction

Year 1:

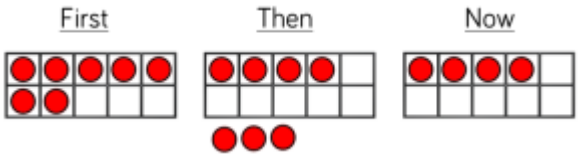
Subtract 1-digit numbers within 10

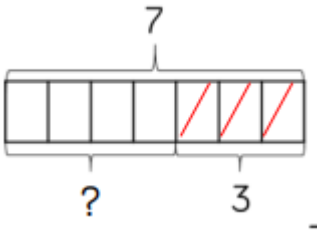
Part-whole models, bar models, ten frames and number shapes support partitioning.

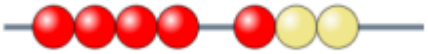




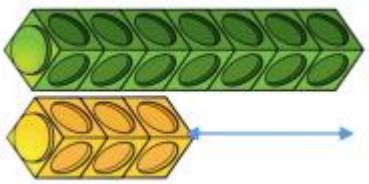
Ten frames, number tracks, single bar models and bead strings support reduction.





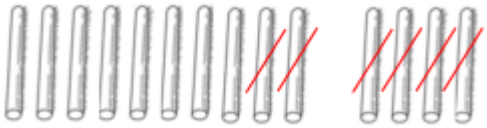


Cubes and bar models with two bars can support fin ding the difference.

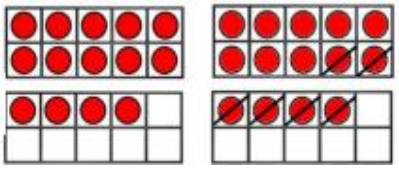


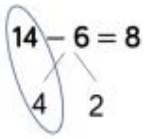
Year 1: Subtract 1 and 2-digit numbers to 20

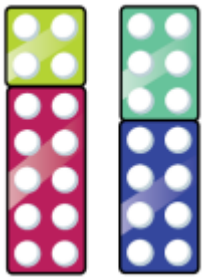
In Year 1, subtracting one-digit numbers that cross 10, is done by counting back, using objects, number tracks and number lines.

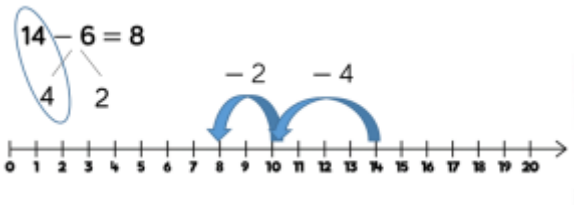


From Year 2, children should be encouraged to find the number bond to 10 when partitioning the subtracted number. Ten frames, number shapes and number lines are particularly useful for this.

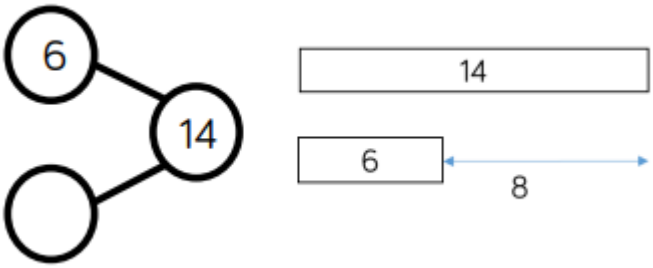








When completing subtractions, pictorial representations such as bar models and part-part whole representations can be useful for children to see how the numbers make up a whole and support them in reasoning and problem-solving based questions.

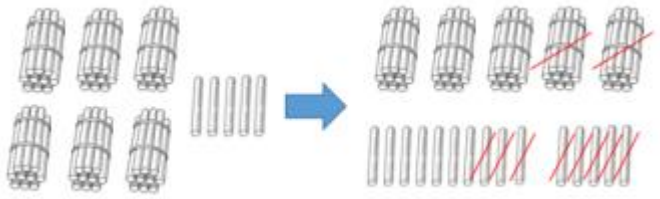


Year 2:

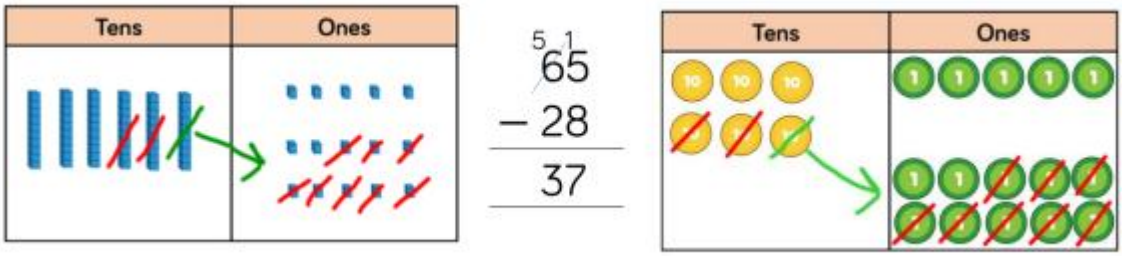
Subtract 1- and 2-digit numbers to 100

Children can also use a blank number line to count back to find the difference. Encourage them to jump to multiples of 10 to become more efficient. Numbers in the abstract form should be shown alongside pictorial and abstract methods so children are able to link the amount to the number.

$$65 - 28 = 37$$



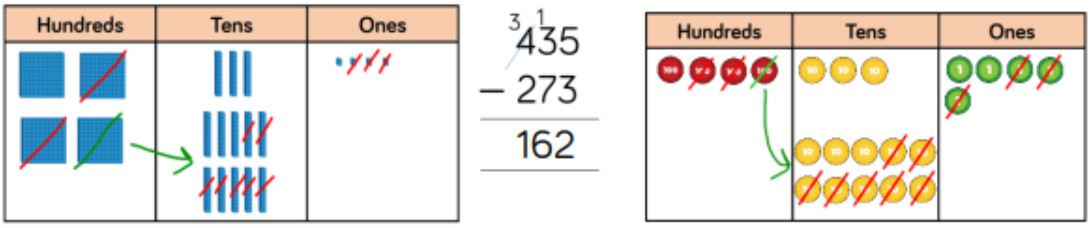
From Year 3, encourage children to use the formal column method when calculating alongside straws, base 10 or place value counters. As numbers become larger, straws become less efficient.



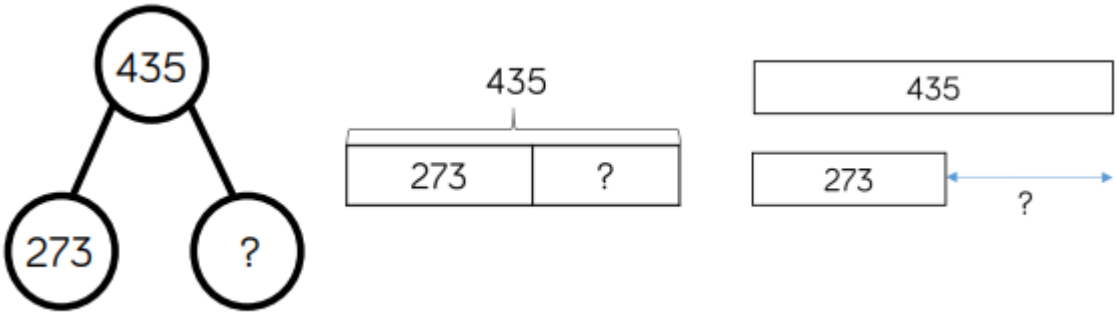
Year 3:

Subtract numbers with up to 3 digits

Base 10 and place value counters are the most effective manipulative when subtracting numbers with up to 3 digits. Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method. Plain counters on a place value grid can also be used to support learning.



Part-part whole and bar models can support problem solving as in previous year groups as it allows children to visualise the missing number and how it can be found.

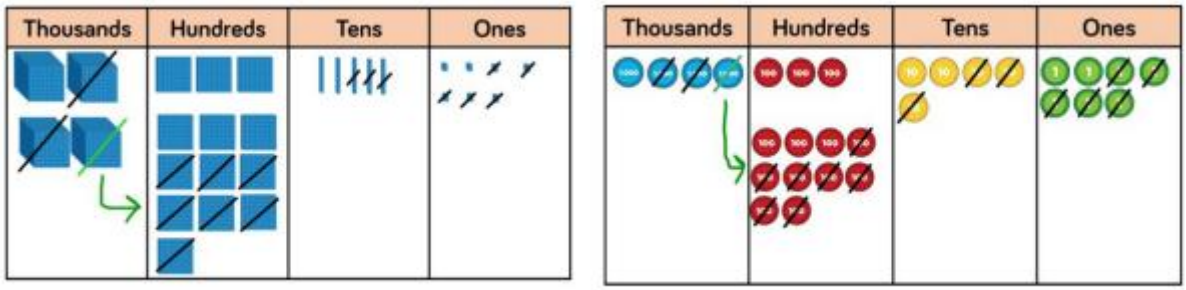


Year 4:

Subtract numbers with up to 4 digits

Base 10 and place value counters are the most effective manipulatives when subtracting numbers with up to 4 digits. Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method. Plain counters on a place value grid can also be used to support learning

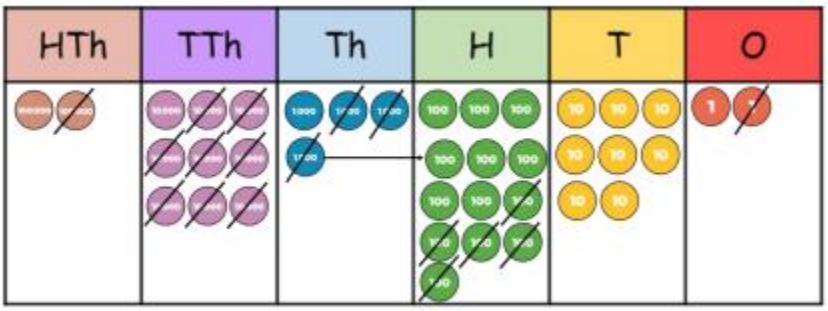
$$\begin{array}{r} {}^{3}\not{4}^{1}357 \\ -\ 2735 \\ \hline 1622 \end{array}$$



Year 5/6:

Subtract numbers with more than 4 digits

Place value counters or plain counters on a place value grid are the most effective concrete resource when subtracting numbers with more than 4 digits. At this stage, children should be encouraged to work in the abstract, using column method to subtract larger numbers efficiently. SEN children and children working at a lower ability level may still need concrete resources and place value grid to support understanding. If so ensure this is still done alongside the abstract method to encourage a more thorough understanding.



	2	9	$\cancel{3}^{2}$	$^{1}3$	8	2
−	1	8	2	5	0	1
	1	1	1	8	8	1

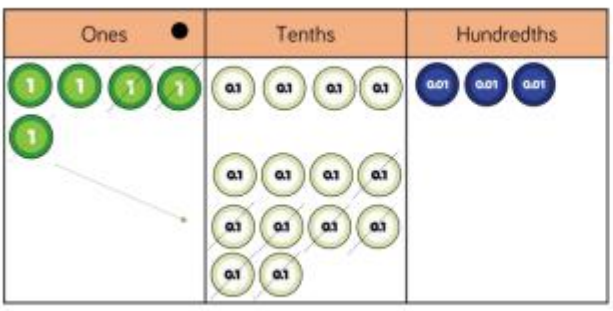
Year 5/6:

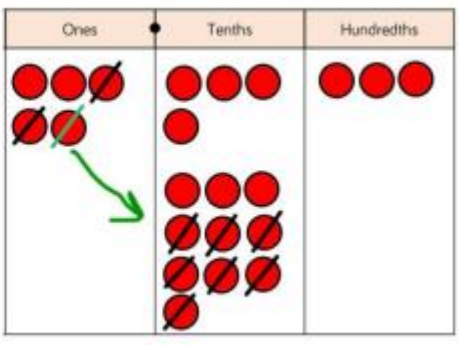
Subtract with up to three decimal places

Place value counters and plain counters on a place value grid are the most effective manipulative when subtracting decimals with 1, 2 and then 3 decimal places. Ensure children have experience of subtracting decimals with a variety of decimal places. It is essential children are exposed to the abstract form as a number sentence and then given the chance to put this into the column method so they are able to subtract a variety of numbers with different decimal places. This includes putting this into context when subtracting money and other measures.

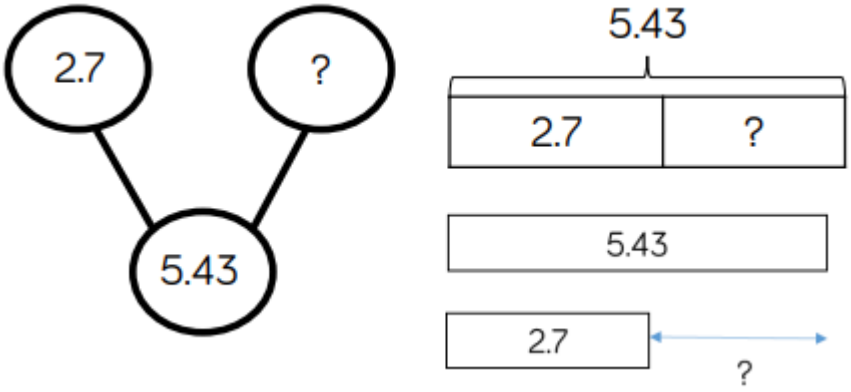
$$\begin{array}{r} {}^{4}\cancel{5}.{}^{1}43 \\ -\ 2.7 \\ \hline 2.73 \end{array}$$

$$5.43 - 2.7 = 2.73$$





In problem solving contexts, it is essential to show children that other pictorial methods such as part-part whole and bar models are still able to be used for numbers with decimal places. This includes putting this into context when subtracting money and other measures.



Glossary

Addend - A number to be added to another.

Aggregation - combining two or more quantities or measures to find a total.

Augmentation - increasing a quantity or measure by another quantity.

Commutative – numbers can be added in any order.

Complement – in addition, a number and its complement make a total e.g. 300 is the complement to 700 to make 1,000

Difference – the numerical difference between two numbers is found by comparing the quantity in each group.

Exchange – Change a number or expression for another of an equal value.

Minuend – A quantity or number from which another is subtracted.

Partitioning – Splitting a number into its component parts.

Reduction – Subtraction as take away.

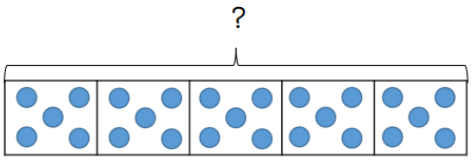
Subitise – Instantly recognise the number of objects in a small group without needing to count.

Subtrahend - A number to be subtracted from another.

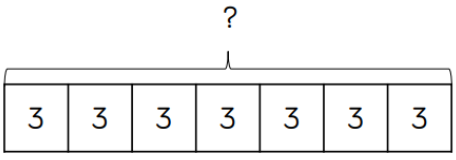
Sum - The result of an addition.

Total – The aggregate or the sum found by addition.

Multiplication and Division

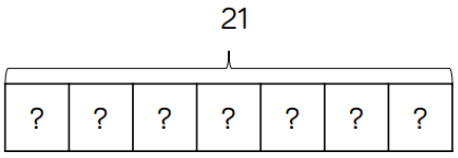


$5 \times 5 = 25$

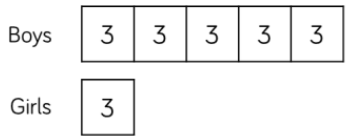


$3 \times 7 = 21$

$7 \times 3 = 21$



$21 \div 7 = 3$



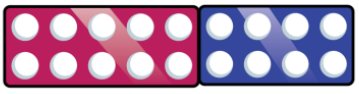
Children can use the single bar model to represent multiplication as repeated addition. They could use counters, cubes or dots within the bar model to support calculation before moving on to placing digits into the bar model to represent the multiplication. Division can be represented by showing the total of the bar model and then dividing the bar model into equal groups. It is important when solving word problems that the bar model represents the problem. Sometimes, children may look at scaling problems. In this case, more than one bar model is useful to represent this type of problem, e.g. There are 3 girls in a group. There are 5 times more boys than girls. How many boys are there? The multiple bar model provides an opportunity to compare the groups.

$5 \times 4 = 20$

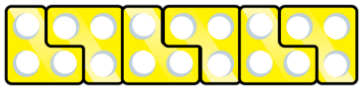
$4 \times 5 = 20$

$5 \times 4 = 20$

$4 \times 5 = 20$



$18 \div 3 = 6$



Number shapes support children's understanding of multiplication as repeated addition. Children can build multiplications in a row using the number shapes. When using odd numbers, encourage children to interlock the shapes so there are no gaps in the row. They can then use the tens number shapes along with other necessary shapes over the top of the row to check the total. Using the number shapes in multiplication can support children in discovering patterns of multiplication e.g. odd × odd = even, odd × even = odd, even × even = even. When dividing, number shapes support children's understanding of division as grouping. Children make the number they are dividing and then place the number shape they are dividing by over the top of the number to find how many groups of the number there are altogether e.g. There are 6 groups of 3 in 18.

$5 \times 3 = 15$
$3 \times 5 = 15$

$15 \div 3 = 5$

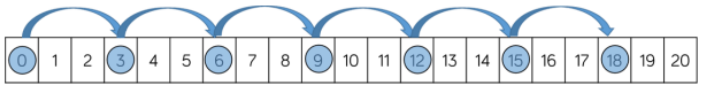
$5 \times 3 = 15$
$3 \times 5 = 15$

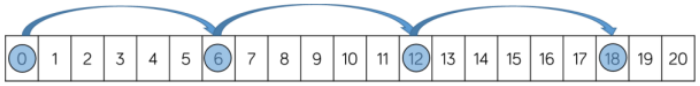
$15 \div 5 = 3$

$4 \times 5 = 20$
$5 \times 4 = 20$

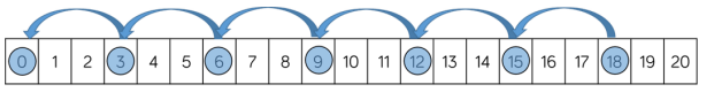
$20 \div 4 = 5$

Bead strings to 100 can support children in their understanding of multiplication as repeated addition. Children can build the multiplication using the beads. The colour of beads supports children in seeing how many groups of 10 they have, to calculate the total more efficiently. Encourage children to count in multiples as they build the number e.g. 4, 8, 12, 16, 20. Children can also use the bead string to count forwards and backwards in multiples, moving the beads as they count. When dividing, children build the number they are dividing and then group the beads into the number they are dividing by e.g. 20 divided by 4 – Make 20 and then group the beads into groups of four. Count how many groups you have made to find the answer.



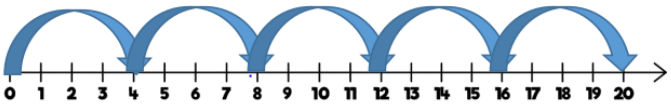


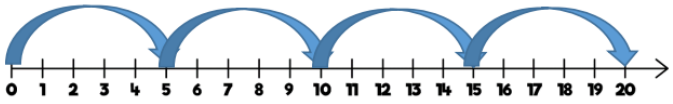
$6 \times 3 = 18$
$3 \times 6 = 18$



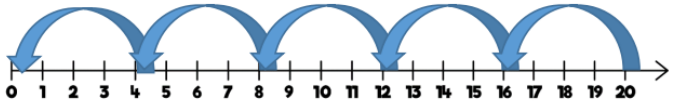
$18 \div 3 = 6$

Number tracks are useful to support children to count in multiples, forwards and backwards. Moving counters or cubes along the number track can support children to keep track of their counting. Translucent counters help children to see the number they have landed on whilst counting. When multiplying, children place their counter on 0 to start and then count on to find the product of the numbers. When dividing, children place their counter on the number they are dividing and the count back in jumps of the number they are dividing by until they reach 0. Children record how many jumps they have made to find the answer to the division. Number tracks can be useful with smaller multiples but when reaching larger numbers, they can become less efficient.



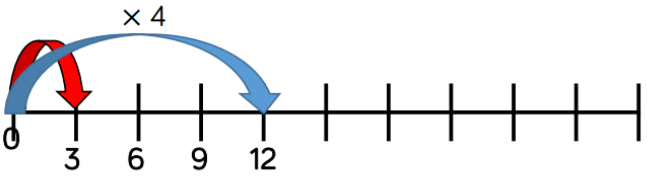


$4 \times 5 = 20$
$5 \times 4 = 20$

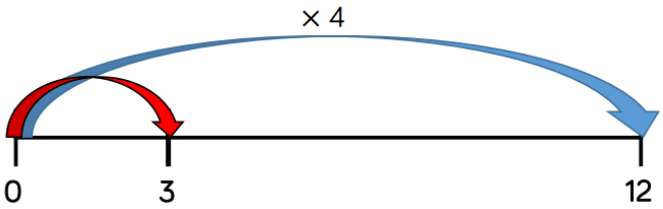


$20 \div 4 = 5$

Labelled number lines are useful to support children to count in multiples, forwards and backwards as well as calculating single-digit multiplications. When multiplying, children start at 0 and then count on to find the product of the numbers. When dividing, start at the number they are dividing and the count back in jumps of the number they are dividing by until they reach 0. Children record how many jumps they have made to find the answer to the division. Labelled number lines can be useful with smaller multiples, however they become inefficient as numbers become larger due to the required size of the number line.

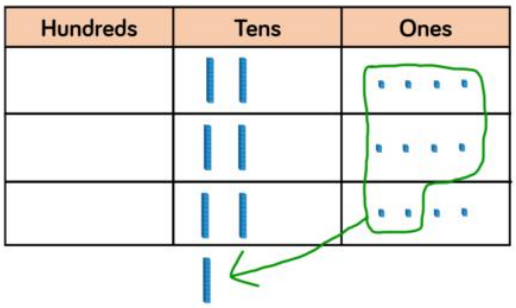


A red car travels 3 miles.
A blue car 4 times further.
How far does the blue car travel?

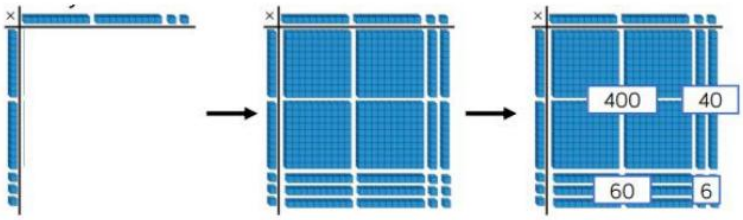


A blue car travels 12 miles.
A red car 4 times less.
How far does the red car travel?

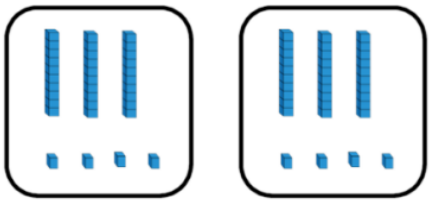
Children can use blank number lines to represent scaling as multiplication or division. Blank number lines with intervals can support children to represent scaling accurately. Children can label intervals with multiples to calculate scaling problems. Blank number lines without intervals can also be used for children to represent scaling.



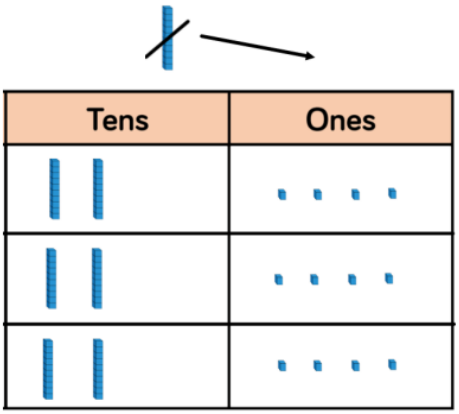
$$\begin{array}{r} 24 \\ \times\ 3 \\ \hline 72 \\ \hline 1 \end{array}$$



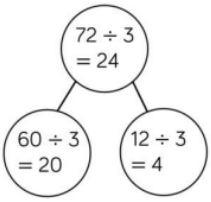
Using Base 10 is an effective way to support children's understanding of column multiplication. It is important that children write out their calculation alongside the equipment so they can see how the concrete and written representations match. As numbers become larger in multiplication or the amounts of groups becomes higher, Base 10 / Dienes becomes less efficient due to the amount of equipment and number of exchanges needed. Base 10 also supports the area model of multiplication well. Children use the equipment to build the number in a rectangular shape which they then find the area of by calculating the total value of the pieces This area model can be linked to the grid method or the formal column method of multiplying 2-digits by 2-digits.



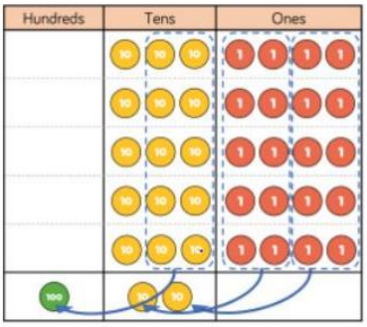
$$68 \div 2 = 34$$



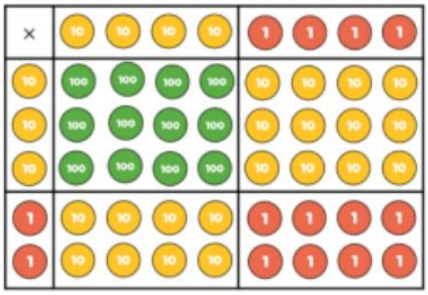
$$72 \div 3 = 24$$



Using Base 10 is an effective way to support children's understanding of division. When numbers become larger, it can be an effective way to move children from representing numbers as ones towards representing them as tens and ones in order to divide. Children can then share the Base 10/ Dienes between different groups e.g. by drawing circles or by rows on a place value grid. When they are sharing, children start with the larger place value and work from left to right. If there are any left in a column, they exchange e.g. one ten for ten ones. When recording, encourage children to use the part whole model so they can consider how the number has been partitioned in order to divide. This will support them with mental methods.

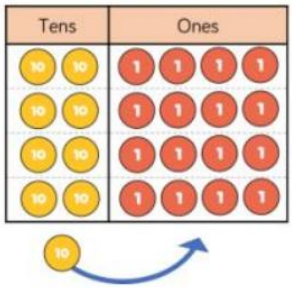


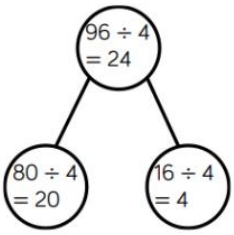
$$\begin{array}{r} 34 \\ \times\ 5 \\ \hline 170 \\ \hline 1\ 2 \end{array}$$

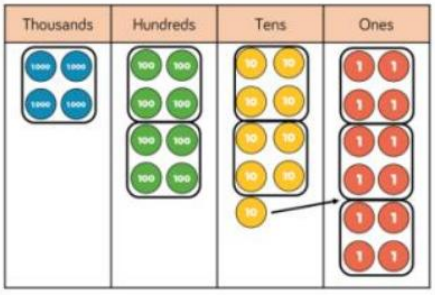


$$\begin{array}{r} 44 \\ \times\ 32 \\ \hline 8 \\ 80 \\ 120 \\ +\ 1200 \\ \hline 1408 \\ \hline 1 \end{array}$$

Using place value counters is an effective way to support children's understanding of column multiplication. It is important that children write out their calculation alongside the equipment so they can see how the concrete and written match. As numbers become larger in multiplication or the amounts of groups becomes higher, Base 10 / Dienes becomes less efficient due to the amount of equipment and number of exchanges needed the counters should be used to support the understanding of the written method rather than support the arithmetic. Place value counters also support the area model of multiplication well. Children can see how to multiply 2- digit numbers by 2-digit numbers.







$$\begin{array}{r} 1223 \\ 4\overline{)\,4892^{1}} \end{array}$$

Using place value counters is an effective way to support children's understanding of division. When working with smaller numbers, children can use place value counters to share between groups. They start by sharing the larger place value column and work from left to right. If there are any counters left over once they have been shared, they exchange the counter e.g. exchange one ten for ten ones. This method can be linked to the part-whole model to support children to show their thinking. Place value counters also support children's understanding of short division by grouping the counters rather than sharing them. Children work from left to right through the place value columns and group the counters in the number they are dividing by. If there are any counters left over after they have been grouped, they exchange the counter e.g. exchange one hundred for ten tens.

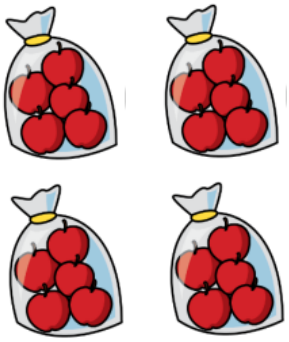
Multiplication

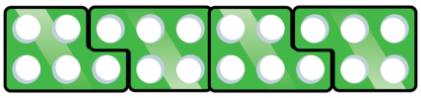
Year Group	Skill	Representations	Model (Manipulatives)
1/2	Solve one-step problems with multiplication	Bar model Number shapes Counters	Ten frames Bead strings Number lines
3/4	Multiply 2-digit by 1- digit numbers	Place value counters Base 10	Expanded written method Short written method
4	Multiply 3-digit by 1- digit numbers	Place value counters Base 10	Short written method
5	Multiply 4-digit by 1- digit numbers	Place value counters	Short written method
5	Multiply 2-digit by 2- digit numbers	Place value counters Base 10	Short written method Grid method
5	Multiply 2-digit by 3- digit numbers	Place value counters	Short written method Grid method
5/6	Multiply 2-digit by 4- digit numbers	Formal Written Method	

Year 1:

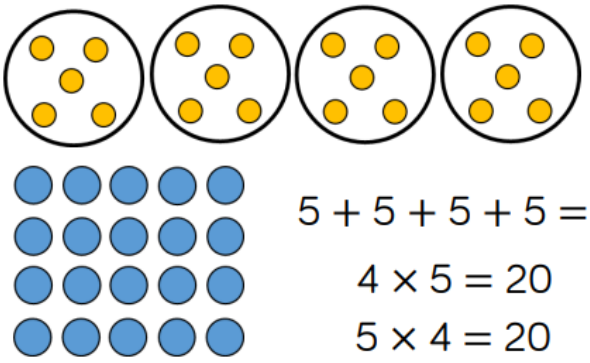
Subtract numbers with more than 4 digits

Children represent multiplication as repeated addition in many different ways. In Year 1, children use concrete and pictorial representations to solve problems. They are not expected to record multiplication formally, but can recognise grouping and multiplication through practical and pictorial examples. E.g.





In Year 2, children are introduced to the multiplication symbol. It is important children are exposed to a range of conceptual variation, where they are able to experience a concept such as grouping and arrays both by using concrete resources and pictorially alongside the formal written method to ensure it is thoroughly embedded.



$5 + 5 + 5 + 5 = 20$

$4 \times 5 = 20$

$5 \times 4 = 20$

Year 3/4:

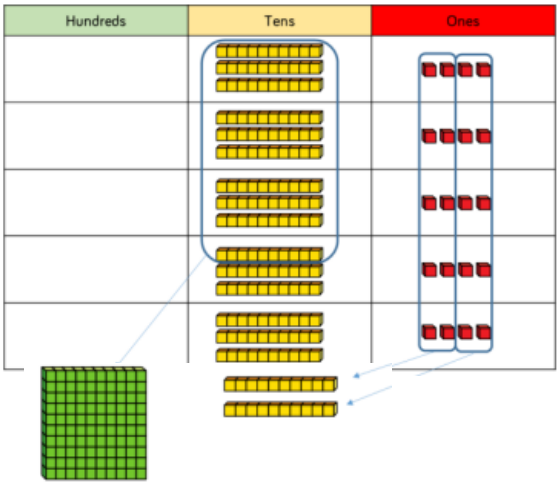
Multiply 2-digit number by a 1-digit number

Informal methods and the expanded method are used in Year 3 before moving on to the short multiplication method in Year 4. Place value counters should be used to support the understanding of the method rather than supporting the multiplication, as children should use times table knowledge.

$$34 \times 5 = 170$$

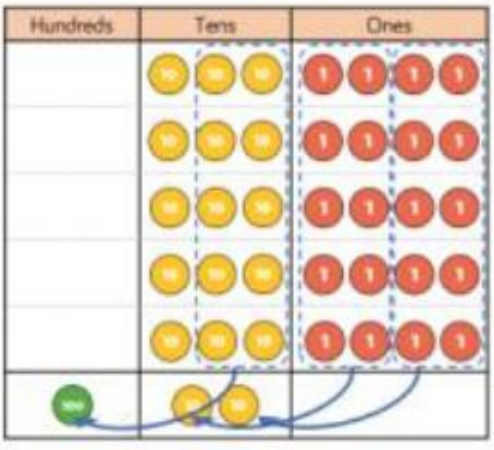
Year 3:

	H	T	O	
		3	4	
×			5	
		2	0	(5 × 4)
+	1	5	0	(5 × 30)
	1	7	0	



Year 4:

	H	T	O	
		3	4	
×			5	
	1	7	0	
	1	2		



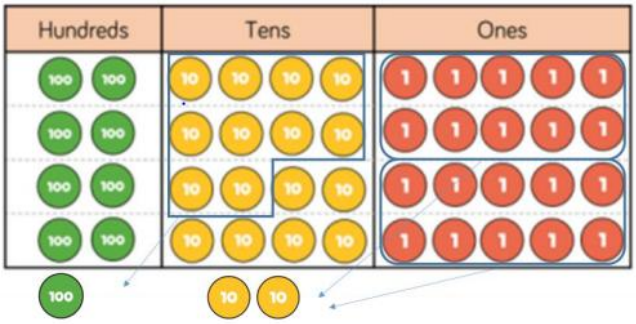
Year 4:

Multiply 3-digit numbers by a 1-digit number

When moving to 3- digit by 1-digit multiplication, encourage children to move towards the short, formal written method. Place value counters continue to support the understanding of the written method. Limit the number of exchanges needed in the questions and move children away from resources when multiplying larger numbers.

e.g.

$$245 \times 4 = 980$$



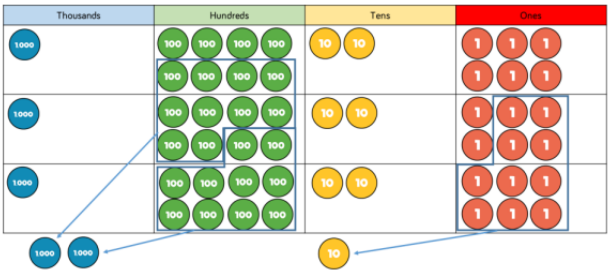
	H	T	O
	2	4	5
×			4
	9	8	0
	1	2	

Year 5:

Multiply 4-digit numbers by a 1-digit number

When multiplying 4- digit numbers, place value counters are the best manipulative to use to support children in their understanding of the formal written method. If children are multiplying larger numbers and struggling with their times tables, encourage the use of multiplication grids so children can focus on the use of the written method.

$$1{,}826 \times 3 = 5{,}478$$



	Th	H	T	O
	1	8	2	6
×				3
	5	4	7	8
	2		1	

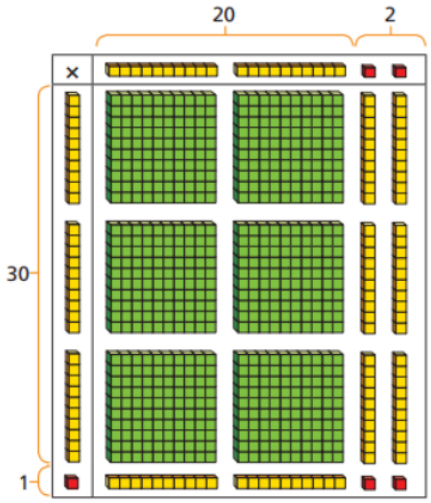
Year 4:

Multiply 3-digit numbers by a 1-digit number

When multiplying a multi-digit number by 2-digits, use the area model to help children understand the size of the numbers they are using. This links to finding the area of a rectangle by finding the space covered by the Base 10. The grid method matches the area model as an initial written method before moving on to the formal written multiplication method.

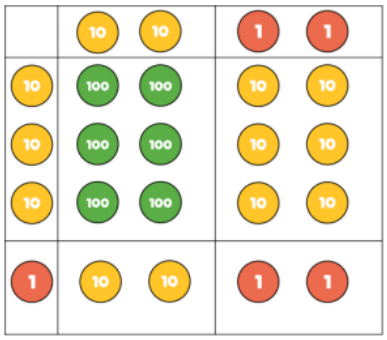
E.G

$$22 \times 31 = 682$$



×	20	2
30	600	60
1	20	2

Once children have achieved this they can move into the more formal written method using place value counters alongside if needed.



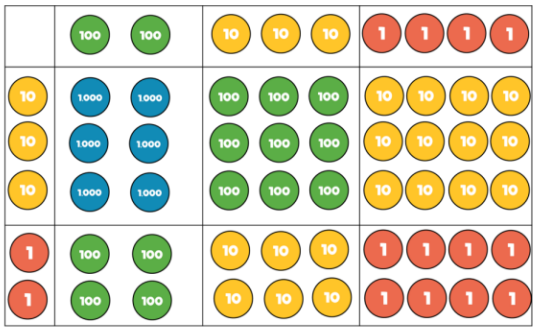
	H	T	O
		2	2
×		3	1
		2	2
	6	6	0
	6	8	2

Year 5:

Multiply 3-digit numbers by a 2-digit number

Children can continue to use the area model when multiplying 3- digits by 2-digits. Place value counters become more efficient to use but Base 10 can be used to highlight the size of numbers. Children should now move towards the formal written method, seeing the links with the grid method.

$$234 \times 32 = 7{,}488$$



×	200	30	4
30	6,000	900	120
2	400	60	8

Th	H	T	O
	2	3	4
×		3	2
	4	6	8
1 7	1 0	2	0
7	4	8	8

Year 5/6:

Multiply 4-digit numbers by a 2-digit number

TTh	Th	H	T	O
	2	7	3	9
×			2	8
2 2	1 5	9 3	1 7	2
5 1	4	7 1	8	0
7	6	6	9	2
		1		

When multiplying 4- digits by 2-digits, children should be confident in using the formal written method. If they are still struggling with times tables, provide multiplication grids to support when they are focusing on the use of the method. Consider where exchanged digits are placed and make sure this is consistent

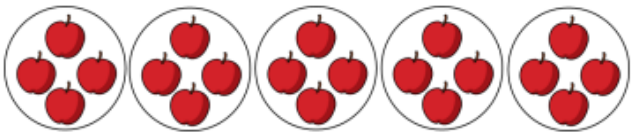
Division

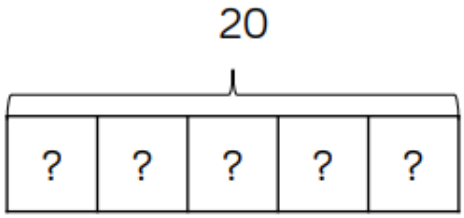
Year Group	Skill	Representations	Model (Manipulatives)
½	Solve one-step problems with division (sharing)	Bar model Real life objects	Arrays Counters
½	Solve one-step problems with division (grouping)	Real life objects Number shapes Bead strings Ten frames	Number lines Arrays Counters
3	Divide 2-digits by 1- digit (no exchange sharing)	Straws Base 10 Bar model	Place value counters Part-whole mode
3	Divide 2-digits by 1- digit (sharing with exchange)	Straws Base 10 Bar model	Place value counters Part-whole model
3/4	Divide 2-digits by 1- digit (sharing with remainders)	Straws Base 10 Bar model	Place value counters Part-whole model
4/5	Divide 2-digits by 1- digit (grouping)	Place value counters Counters	Place value grid Written short division
4	Divide 3-digits by 1- digit (sharing with exchange)	Base 10 Bar model	Place value counters Part-whole model
4/5	Divide 3-digits by 1- digit (grouping)	Place value counters Counters	Place value grid Written short division
5	Divide 4-digits by 1- digit (grouping)	Place value counters Counters	Place value grid Written short division
6	Divide multi-digits by 2-digits (short division)	Written short division	List of multiples
6	Divide multi-digits by 2-digits (long division)	Written short division	List of multiples

Year 1/2:

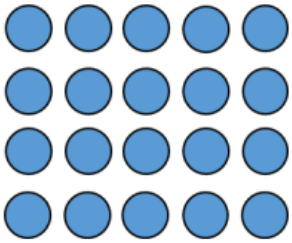
Solve 1-step problems using multiplication (sharing)

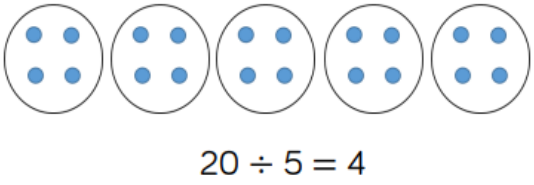
Children solve problems by sharing amounts into equal groups. In Year 1, children use concrete and pictorial representations to solve problems. They are not expected to record division formally.





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

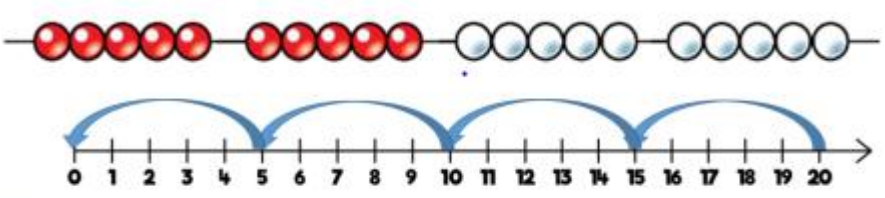




Year 1/2:

Solve 1-step problems using multiplication (grouping)

Children solve problems by grouping and counting the number of groups. Grouping encourages children to count in multiples and links to repeated subtraction on a number line.

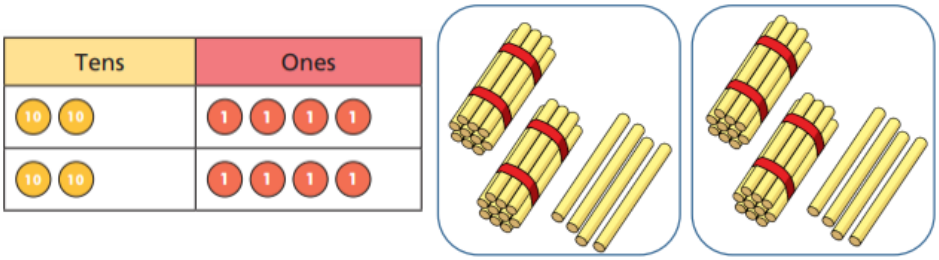


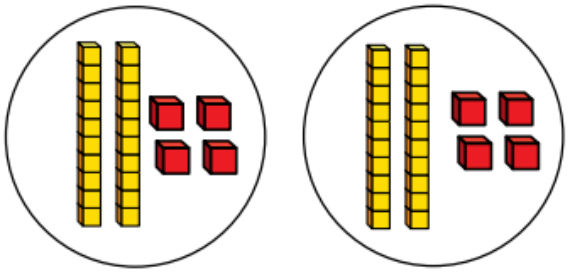
They can use concrete representations in fixed groups such as number shapes which helps to show the link between multiplication and division.

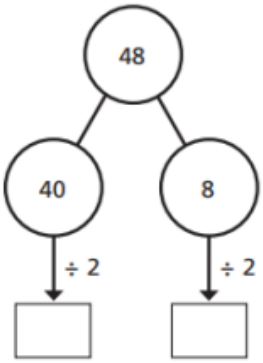
Year 3:

Divide 2 digits by 1-digit (sharing no exchange)

When dividing larger numbers, children can use manipulatives that allow them to partition into tens and ones. Straws, Base 10 and place value counters can all be used to share numbers into equal groups.



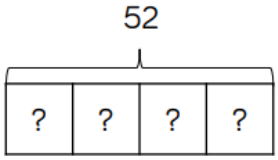


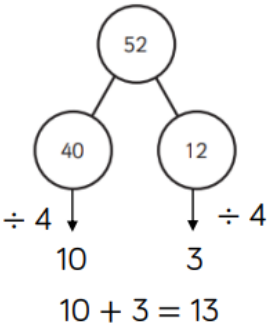


Part-whole models can provide children with a clear written method that matches the concrete representation.

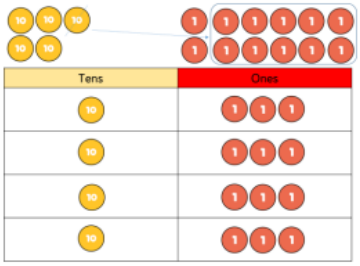
Year 3/4:

Divide 2 digits by 1-digit (sharing with exchange)





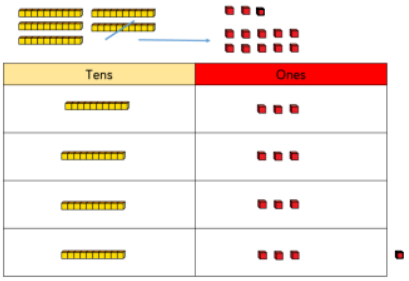
52 ÷ 4 = 13

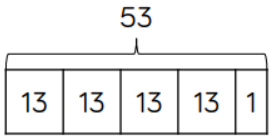


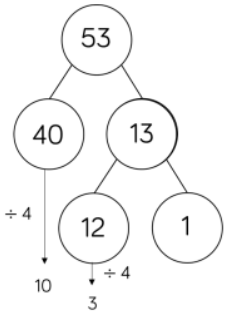
When dividing numbers involving an exchange, children can use Base 10 and place value counters to exchange one ten for ten ones. Children should start with the equipment outside the place value grid before sharing the tens and ones equally between the rows. Flexible partitioning in a part-whole model supports this method.

Year 3/4:

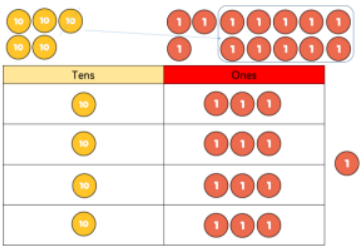
Divide 2 digits by 1-digit (sharing with remainders)







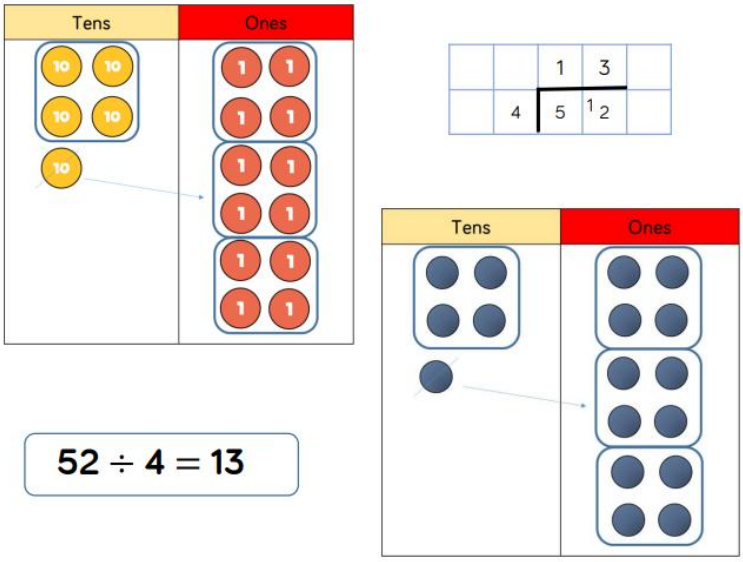
53 ÷ 4 = 13 r1



When dividing numbers with remainders, children can use Base 10 and place value counters to exchange one ten for ten ones. Starting with the equipment outside the place value grid will highlight remainders, as they will be left outside the grid once the equal groups have been made. Flexible partitioning in a part-whole model supports this method.

Year 4/5:

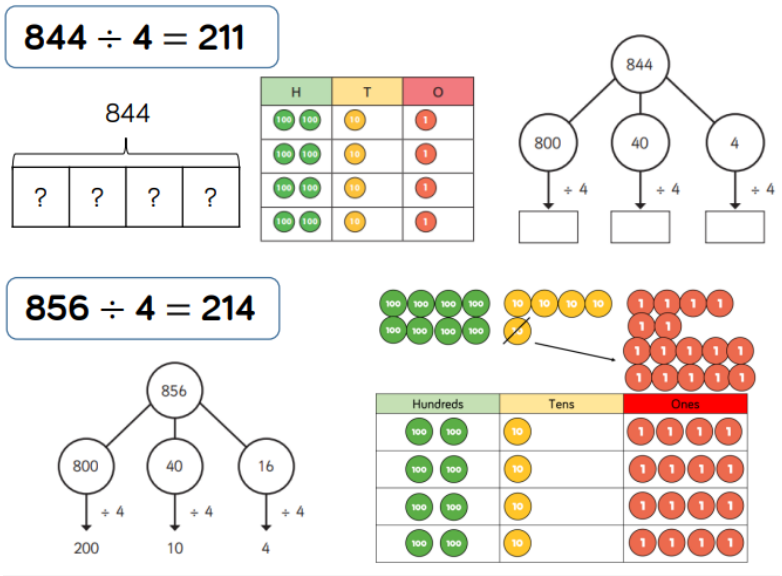
Divide 2 digits by 1-digit (grouping)



When using the short division method, children use grouping. Starting with the largest place value, they group by the divisor. Language is important here. Children should consider 'How many groups of 4 tens can we make?' and 'How many groups of 4 ones can we make?' Remainders can also be seen as they are left ungrouped.

Year 5:

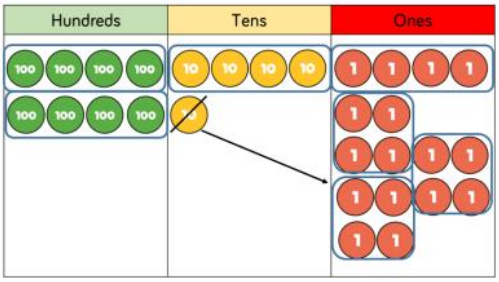
Divide 3 digits by 1-digit (sharing)



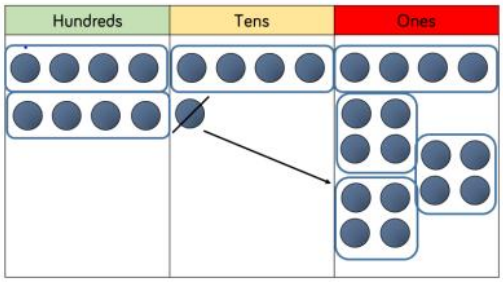
Children can continue to use place value counters to share 3- digit numbers into equal groups. Children should start with the equipment outside the place value grid before sharing the hundreds, tens and ones equally between the rows. This method can also help to highlight remainders. Flexible partitioning in a part-whole model supports this method.

Year 5:

Divide 3 digits by 1-digit (Grouping)



		2	1	4
	4	8	5	$^{1}6$

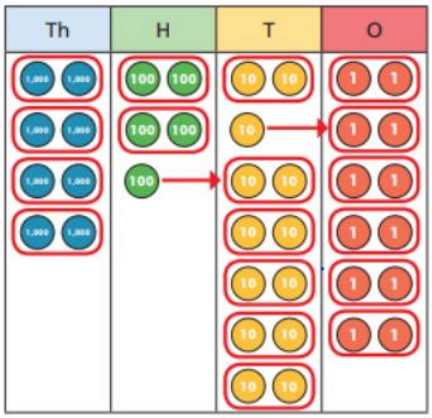


$856 \div 4 = 214$

Children can continue to use grouping to support their understanding of short division when dividing a 3-digit number by a 1-digit number. Place value counters or plain counters can be used on a place value grid to support this understanding. Children can also draw their own counters and group them through a more pictorial method.

Year 5:

Divide 4 digits by 1-digit (Grouping)



	4	2	6	6
2	8	5	$^{1}3$	$^{1}2$

$8{,}532 \div 2 = 4{,}266$

Place value counters or plain counters can be used on a place value grid to support children to divide 4- digits by 1-digit. Children can also draw their own counters and group them through a more pictorial method. Children should be encouraged to move away from the concrete and pictorial when dividing numbers with multiple exchanges.

Year 6:

Divide multi-digits by 2 digits (short division)

		0	3	6
	12	4	$^{4}3$	$^{7}2$

$$432 \div 12 = 36$$

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

$$7{,}335 \div 15 = 489$$

	0	4	8	9
15	7	$^{7}3$	$^{13}3$	$^{13}5$

15	30	45	60	75	90	105	120	135	150

Year 6:

Divide multi-digits by 2 digits (long division)

		0	3	6
1	2	4	3	2
	–	3	6	0
			7	2
	–		7	2
				0

(×30)

(×6)

$12 \times 1 = 12$
$12 \times 2 = 24$
$12 \times 3 = 36$
$12 \times 4 = 48$
$12 \times 5 = 60$
$12 \times 6 = 72$
$12 \times 7 = 84$
$12 \times 8 = 96$
$12 \times 7 = 108$
$12 \times 10 = 120$

$$432 \div 12 = 36$$

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

$$7{,}335 \div 15 = 489$$

	0	4	8	9
15	7	3	3	5
–	6	0	0	0
	1	3	3	5
–	1	2	0	0
		1	3	5
–		1	3	5
				0

(×400

(×80)

(×9)

$1 \times 15 = 15$
$2 \times 15 = 30$
$3 \times 15 = 45$
$4 \times 15 = 60$
$5 \times 15 = 75$
$10 \times 15 = 150$

Year 6:

Divide multi-digits by 2 digits (long division remainder)

$372 \div 15 = 24\ r12$

			2	4	r	1	2
1	5	3	7	2			
	–	3	0	0			
			7	2			
	–		6	0			
			1	2			

$1 \times 15 = 15$
$2 \times 15 = 30$
$3 \times 15 = 45$
$4 \times 15 = 60$
$5 \times 15 = 75$
$10 \times 15 = 150$

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

			2	4	$\frac{4}{5}$
1	5	3	7	2	
	–	3	0	0	
			7	2	
	–		6	0	
			1	2	

$372 \div 15 = 24\frac{4}{5}$

Glossary:

Array – An ordered collection of counters, cubes or other item in rows and columns.

Commutative – Numbers can be multiplied in any order.

Dividend – In division, the number that is divided.

Divisor – In division, the number by which another is divided.

Exchange – Change a number or expression for another of an equal value.

Factor – A number that multiplies with another to make a product.

Multiplicand – In multiplication, a number to be multiplied by another.

Partitioning – Splitting a number into its component parts.

Product – The result of multiplying one number by another.

Quotient – The result of a division

Remainder – The amount left over after a division when the divisor is not a factor of the dividend.

Scaling – Enlarging or reducing a number by a given amount, called the scale factor