Burnt Tree Primary School

Calculation Policy

September 2023

'Where everyone matters'

Addition, Subtraction, Multiplication, Division

Burnt Tree Primary School

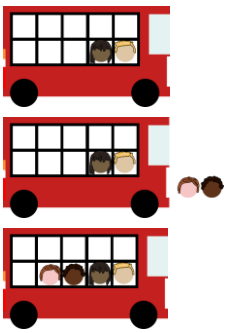
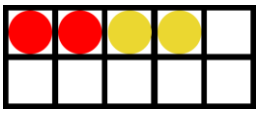
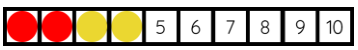
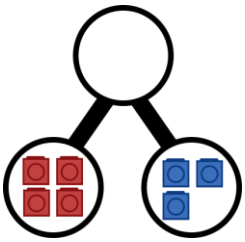
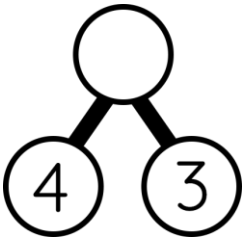
Addition

Calculation Policy

Addition, Subtraction, Multiplication, Division

Addition

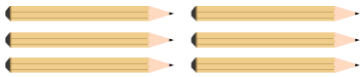
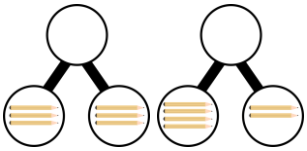
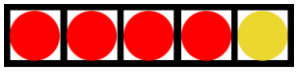
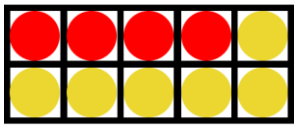
In EYFS			
Vocabulary taught:	first, then, now, add, plus, altogether, total, part, whole	Manipulatives and models used:	Five and ten frames Fingers Numicon Interlocking cubes Bead strings Double sided counters Part-whole model

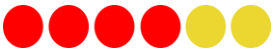
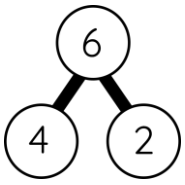
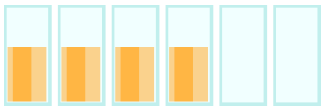
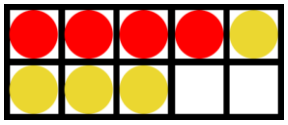
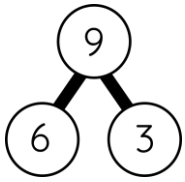
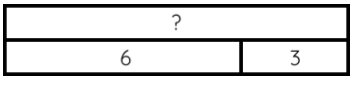
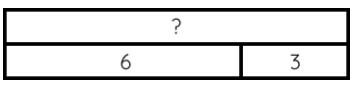
Strategy:	Concrete:	Pictorial:	Abstract:
Adding more	Ask children to show you five fingers. Then ask them to show you two more. How many fingers now? Did you count them all? 1,2,3,4,5,6,7 Is there another way to count them?  Children could also do this with double sided counters, numicon pieces, cubes or bead strings.	Use first, then, now stories to provide meaningful context. First there were 2 people on the bus, then 2 more people got on the bus, now there are 4 people on the bus.   	I have four apples, now I add three more apples. How many do I have now?   4 + 3 =

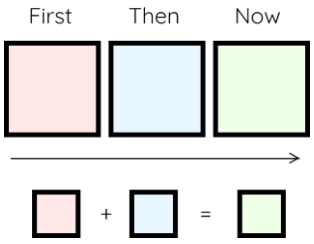
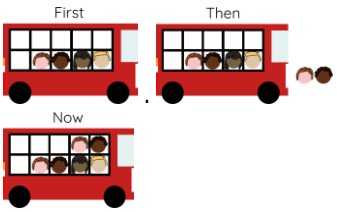
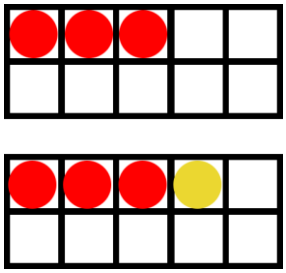
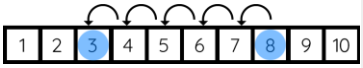
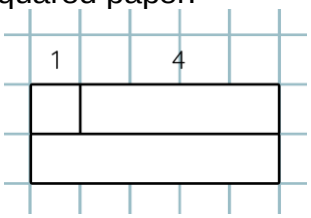
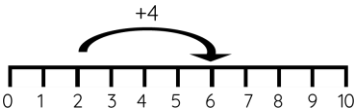
KIRFs:	Recall number bonds up to 5 and related subtraction facts
Notes:	At first children may need to recount all the objects to find how many they have altogether. However, when they are ready they should be supported to count on from the largest number as this supports understanding of the commutativity of addition. Links should also be made to subitising, encouraging children to recognise how many objects there are in a group, without counting.

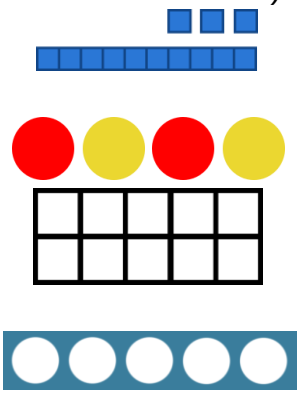
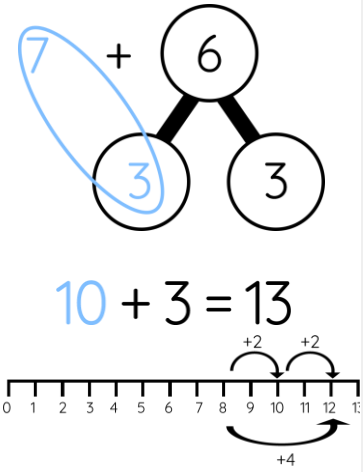
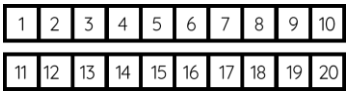
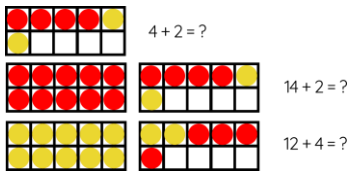
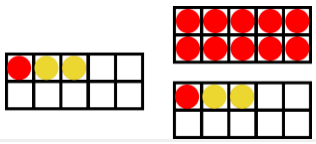
Addition

In Year 1			
Vocabulary:	add, plus, altogether, total, part, whole, number bonds, facts, 2 digit number, sum, addend.	Manipulatives and models used:	Ten frames Numicon Interlocking cubes Bead strings Double-sided counters Part-Whole Model Bar Model (With pictorial representations)

Skill:	Concrete:	Pictorial:	Abstract:
Understanding part-whole relationship	Sort objects into parts and understand the relationship with the whole. Play games such as trying to throw 5 beanbags into a hoop and seeing how many land in the hoop and how many outside it. Initially the part-whole model isn't introduced, rather the children are given a chance to explore the concept through play and practical activities.	Children draw to represent the part-whole relationship.  *E.g*: Draw a ring around the whole group of pencils. Draw a ring around part of the whole group of pencils. 	Use a part-whole model with numerals.
Number bonds within and to 10	Explore breaking apart a group of objects *(e.g. using cubes, bead string, counters)* and putting them back together to find different number bonds.	Use five and ten frames to show number bonds.  4 + 1 = 5  4 + 6 = 10 Use a part-whole model (alongside other	6 + 3 = ___ 5 + ____= 10

		representations) to find number bonds.  	
Adding by counting all (aggregation)	Use objects to explore adding two discrete groups together (could be used within a ten frame or part-whole model).	Use pictures to add two groups together.     Then use the part-whole model and bar model to move on.    	2 + 6 = Sam has four yellow trucks and some green trucks. He has less than 10 trucks altogether. How many green trucks could Sam have? .

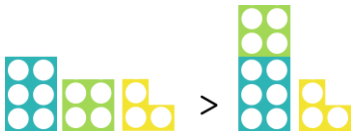
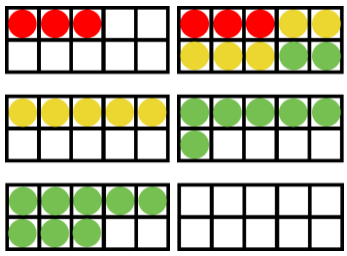
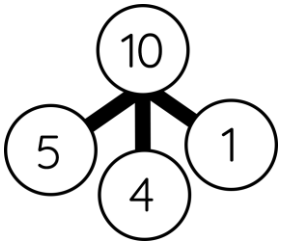
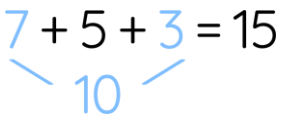
Adding by counting on (augmentation)	Children act out/practically use concrete objects to show 'first..then…now' stories. E.g. **First** three children were sitting on the carpet. **Then** two more children came to the carpet. **Now** five children are on the carpet. A rekenrek could also be used here. Push 3 beads on a rekenrek. Now push 4 more beads. How many beads have you pushed altogether. Use first, then, now cards and counters to enable children to create their own counting on stories.  	Build on the story context but add pictorial representations.   Link to using a number line or number track.  Bar model with squared paper.   	4 + 5 = Pat has 5 apples. Her mum gives her 3 more apples. How many does she have now?
Bridging 10	Act out stories - 'A train has ten seats in each carriage. You have to fill up a whole carriage before you can use a new one. There are seven children in the first carriage. Five more get on. How many are there altogether?'	Use pictures or a number line to show how to partition the smaller number and bridge 10.  Use a number line or part-whole model.	7 + 5 = ___ ____= 9 + 6

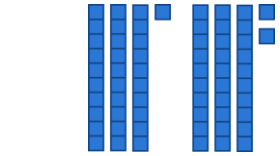
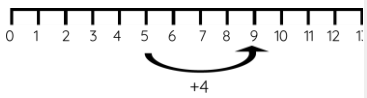
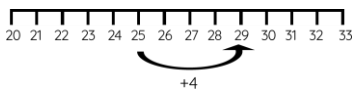
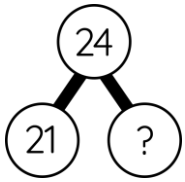
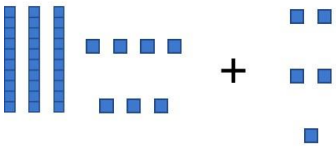
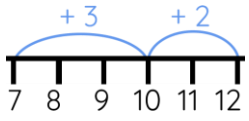
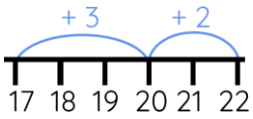
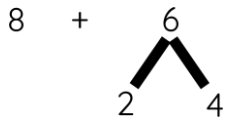
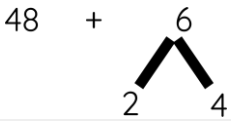
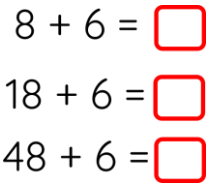
	Provide concrete objects to allow children to regroup ten ones as one ten (numicon, dienes, ten frames and counters). 		
Adding to 20 (adding ones)	Using two parallel number tracks (1-10 and 11-20), explore what happens when one child starts at 1 and another 11, and they both jump along the track the same number of times. 	Use images of tens frames and counters or dienes tens and ones. 	1 + ___= 6 1 + ___= 16 4 + ____= 16 ‘I know 4 and 2 are a number bond to 6, so the missing number must be 12’. Do you agree?
Number bonds to 20	Explore different ways of making 20 by sorting objects into two sets.	Use images of tens frames and counters. This could then move onto part-whole models. Make the link back to number bonds to 10. 	Continue the pattern to find the number bonds to 20: 0 + 20 = 20 1 + 19 = 20 2 + 18 = 20 3 + 17 = 20 4 + 16 = 20

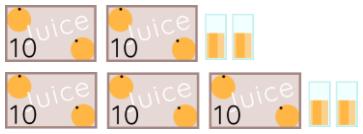
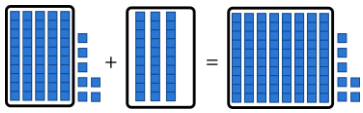
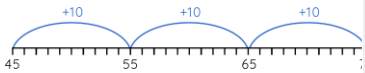
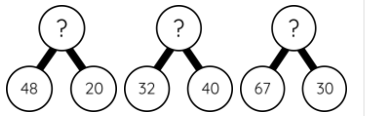
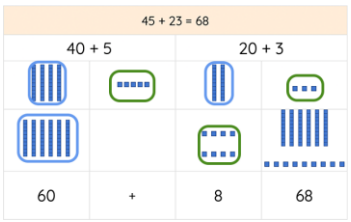
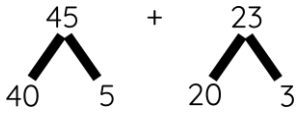
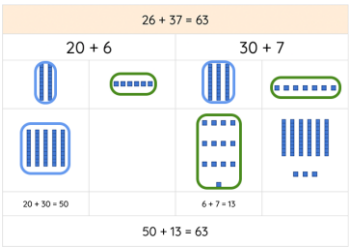
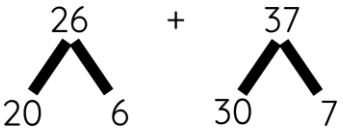
KIRFs:	Recall all number bonds within 10. Recall all number bonds to 10. Recall all number bonds within 20. Recall all number bonds to 20. Recall all doubles and halves to 20
Notes:	Remember to vary the position of the equals sign. Remember to include opportunities to add 0.

Addition

In Year 2			
Vocabulary taught:	add, plus, tens, together, total, part, whole, number bonds, facts, 2 digit number, sum, addend, commutative	Manipulatives and models used:	Ten frames Numicon Dienes/Base 10 Bead strings Double-sided counters Part-Whole Model Bar Model (With dienes, counters progressing to numbers) Rekenrek

Skill:	Concrete:	Pictorial:	Abstract:
Add three 1-digit numbers	Use concrete objects to explore adding three 1 digit numbers - examples could be rekenrek or tens frames and counters.	Use images of objects/tens frames and counters etc. to support.   Reiterate importance of making ten (links back to Year 1). Use part-part-part whole model. Draw attention to known facts. 	Use written equations. Draw attention to known facts. 

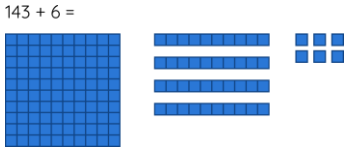
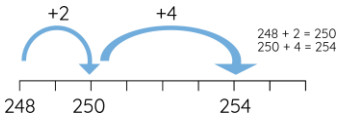
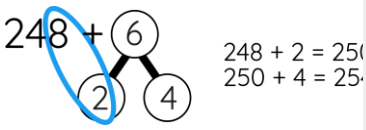
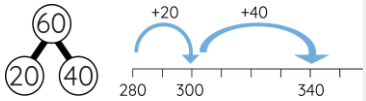
Add a 1-digit number to a 2-digit number (not bridging ten)	Use concrete objects to explore adding the ones. Children should start to spot patterns. *E.g. if they know 3+1=4, they should use this to understand 23+1=24 and 43+1=44.* Children should notice the tens have stayed the same in each calculation, only the ones have changed.	Use images of counters, dienes, number lines, part-whole model etc.     	13 + 3 = 23 + 3 = 33 + 3 = 43 + 3 = What do you notice? I know that ____+ ____= ____so ____+ ____ = ____ 27 + 2 = Circle the number fact I can use to help solve this number sentence. 4 + 5 = 9 7 + 2 = 9 3 + 6 = 9 Explain why I can use this number fact. Word problems: Peter bought a chocolate bar for 43p and some sweets for 5p. How much did he spend altogether?
Add a 1-digit number to a 2-digit number (bridging 10)	Use ten frame and counters/numicon to allow children to explore . Link back to learning on bridging 10 when adding two 1-digit numbers.	     	 Sam is collecting water in a measuring cylinder. At first it had 33ml but then he added 9ml. How much does he have now?

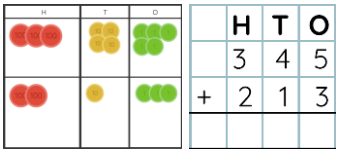
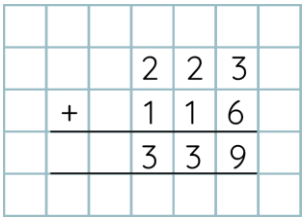
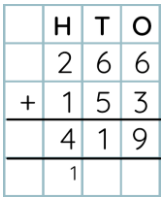
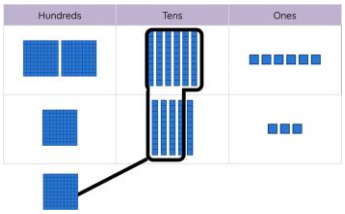
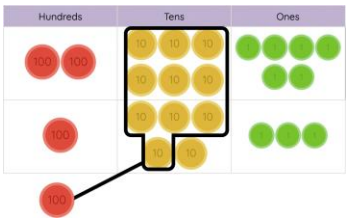
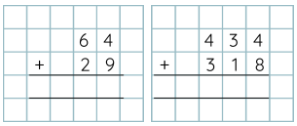
Add a multiple of ten to a 2-digit number	Add the tens and then recombine (use known facts). Use dienes/rekenreks, tens frames and counters to explore practically. Children should be supported to notice only the tens digit changes.	Use pictorial representations to consolidate adding tens.     *Again, focus on adding tens first (using known facts) then ones. Children should be supported to notice only the tens digit changes.*	14 + 20 = ☐ 14 + 20 = ☐ 14 + 30 = ☐ 24 + 20 = ☐ 14 + 40 = ☐ 34 + 20 = ☐ 14 + 40 = ☐ 44 + 20 = ☐ Class 7 has 24 pencils in September. They are given 30 more pencils in January. How many pencils do they have now?
Add a 2-digit number to a 2-digit number (not bridging a multiple of 10).	Use concrete resources to enable children to explore practically. **Teach children:** > Partition both 2 digit numbers into tens and ones. > Add the tens > Add the ones > Find the total	Use images of dienes  	 40 + 20 = 60 5 + 3 = 8 60 + 8 = 68
Add a 2-digit number to a 2-digit number (bridging a multiple of 10)	Use concrete resources to enable children to explore practically. **Teach children:** > Partition both 2 digit numbers into tens and ones. > Add the tens > Add the ones > Find the total	 	 20 + 30 = 50 6 + 7 = 13 50 + 13 = 63

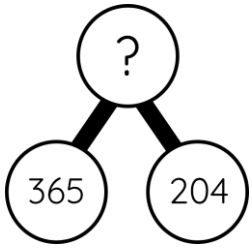
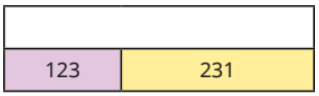
KIRFs:	Recall number bonds to 100 (Multiples of 10) Recall number bonds to 100 (Multiples of 5)
Notes:	

Addition

In Year 3			
Vocabulary taught:	add, plus, altogether, total, part, whole, number bonds, facts, 2 digit number, sum, addend, commutative, tens boundary, exchange, regroup, hundreds boundary	Manipulatives and models used:	Dienes/Base 10 Place value counters Part-Whole Model Bar Model (With dienes, counters progressing to numbers)

Skill:	Concrete:	Pictorial:	Abstract:
Adding 1s, 10s or 100s - without crossing a 10 or 100 (focusing on mental strategies)	Use place value counters to explore what happens when 1s, 10s or 100s are added to a three-digit number. This builds on learning from previous years.	Use images of place value chart with counters or dienes 	463 + 5 = 324 + 50 = 183 + 600 = Fill in the missing digits 452 0 = 412
Adding 1s when crossing a 10 or 100 (focusing on mental strategies)		Use number lines to find the jump to the next multiple of 10.  Part-whole models can also be used. 	346 + 8 = 727 + ___= 732
Adding 10s when crossing a 10 or 100 (focusing on mental strategies)		Use number lines to find the jump to the next multiple of 100, alongside use of part-whole model. 	463 + 70 = 397 + ___= 427

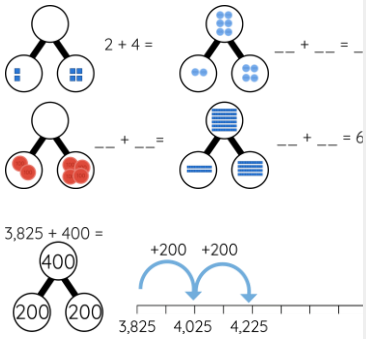
Column addition (no regrouping)	Use dienes first, then move onto place value counters. -Add the ones. -Add the tens. -Add the hundreds Children should rearrange the tens and ones into columns, but **DO NOT** label them as tens and ones as this results in an incorrect representation of their value at this stage.	Use pictorial representations to help children solve the equations - these can be provided or children can draw their own.  Again, children should add the ones first, then the tens, then the hundreds.	
Column addition (regrouping)	Use dienes first, then move onto place value counters. -Add the ones -Regroup (if needed) ten ones as one ten and place in tens column. -Add the tens -Regroup (if needed) ten tens as one hundred and place in hundreds column -Add the hundreds	Use pictorial representations to help children solve the equations - these can be provided or children can draw their own.    Part/whole models and the bar model can also be introduced.	

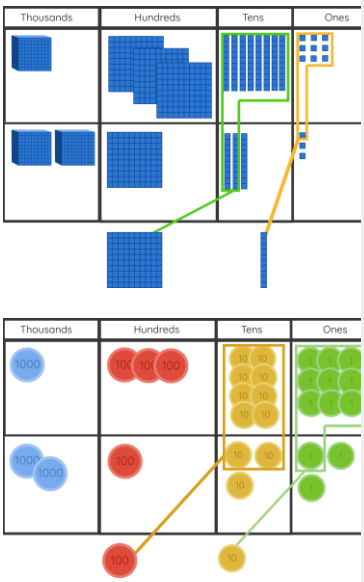
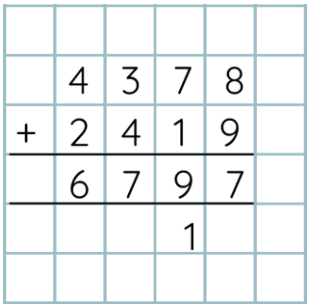
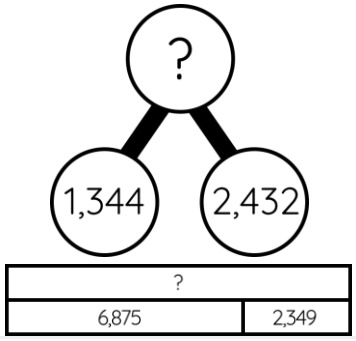
		 	

KIRFs:	Recall number bonds to 100 (Multiples of 10) Recall number bonds to 100 (Multiples of 5)
Notes:	It is important that the place value of each digit is verbalised when modelling the process, e.g. 4 ones add 3 ones; 7 tens add 4 tens; 6 hundreds add 5 hundreds etc. *Written formal method but model and encourage arithmetic strategies to be most efficient* Is the written method most appropriate? This is especially the case when adding ones, multiples of tens or hundreds.

Addition

In Year 4			
Vocabulary taught:	add, plus, altogether, total, part, whole, number bonds, facts, 2 digit number, sum, addend, commutative, tens boundary, exchange, regroup, hundreds boundary, thousands	Manipulatives and models used:	Dienes/Base 10 Place value counters Part-Whole Model Bar Model (with numbers)

Skill:	Concrete:	Pictorial:	Abstract:
Adding 1s, 10s, 100s and 1000s	Use place value counters if needed to explore practically.	Part-whole models, number lines and place value chart. 	3279 + 8 = ____ 4653 + 3000 = ____ 2375 + ____= 2675

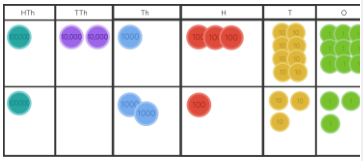
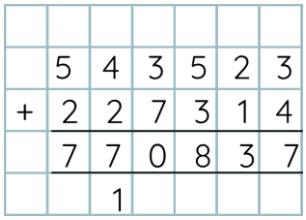
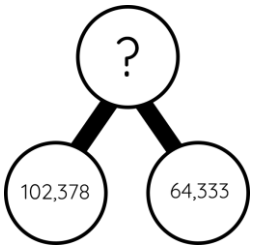
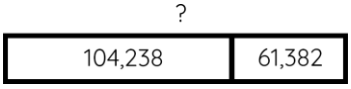
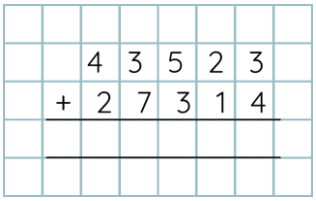
Add numbers with up to 4 digits	Initially, use dienes and then move onto place value counters. > Add the ones > Regroup (if needed) ten ones as one ten and place in the tens column. > Add the tens > Regroup (if needed) ten tens as one hundred and place in the hundreds column > Add the hundreds > Regroup (if needed) ten hundreds as one thousand > Add the thousands Ensure children write out the calculation alongside any manipulatives so they can see the links to the written column method.	 Ensure children write out the calculation alongside any pictorial resources so they can see the links to the written column method.	
		The part/whole model and bar model can also be used. 	

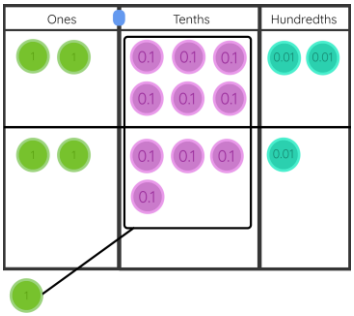
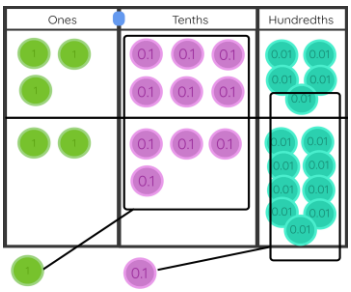
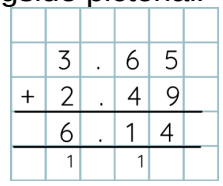
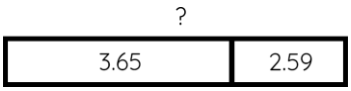
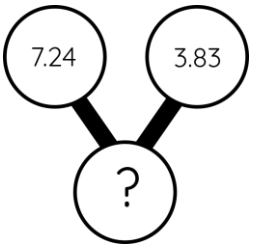
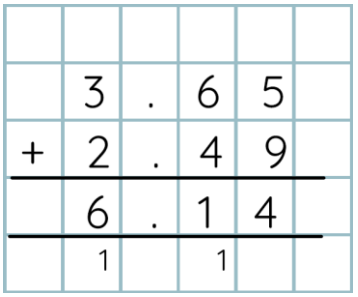
KIRFs:	Recall number bonds to 1000 (By making 900 with the hundreds, 90 with the tens and 10 with the ones)
Notes:	It is important that the place value of each digit is verbalised when modelling the process, e.g. 4 ones add 3 ones; 7 tens add 4 tens; 6 hundreds add 5 hundreds etc.

Addition

In Year 5 and 6

Vocabulary taught:	add, plus, altogether, total, part, whole, number bonds, facts, 2 digit number, sum, commutative, tens boundary, exchange, regroup, hundreds addend, boundary, thousands, ten thousands, hundred thousands, millions	Manipulatives and models used:	Place value counters Part-Whole Model Bar Model (With numbers)

Skill:	Concrete:	Pictorial:	Abstract:
Add numbers with more than 4 digits.	Use place value counters to explore practically. Ensure children write out the calculation alongside the manipulatives. > Align digits in the correct place value column > Starting from the right, add each column in turn. Regroup to the next column if the total adds to more than 9.	    	

Add using up to three decimal places.	Place value counters and double sided counters on a place value grid.	  Use abstract representation alongside pictorial.   	

KIRFs:	N.A.
Notes:	At this stage, children should be encouraged to work in the abstract. It is important that the place value of each digit is verbalised when modelling the process, e.g. 4 ones add 3 ones; 7 tens add 4 tens; 6 hundreds add 5 hundreds etc.

Burnt Tree Primary School

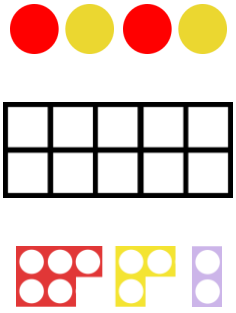
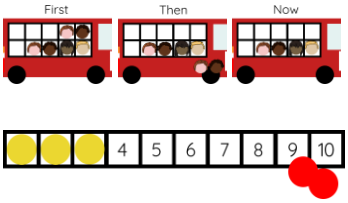
Subtraction

Calculation Policy

Addition, Subtraction, Multiplication, Division

Subtraction

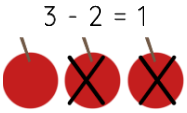
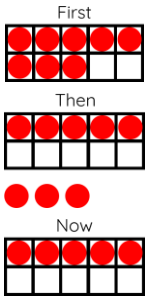
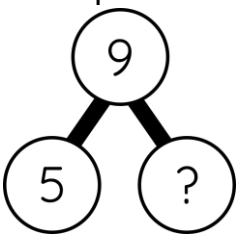
In EYFS			
Vocabulary taught:	first, then, now, take away, minus, part, whole, subtract	Manipulatives and models used:	Five and ten frames Fingers Numicon Interlocking cubes Bead strings Double sided counters Part-whole model

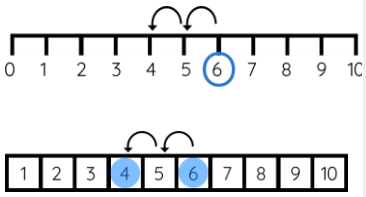
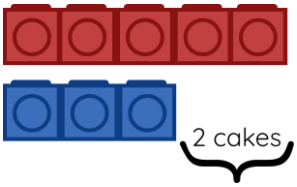
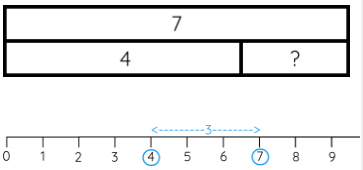
Strategy:	Concrete:	Pictorial:	Abstract:
Taking away	Use real objects to explore the concept that the quantity of a group can be changed by taking away. Bead strings, numicon, ten frames, objects could all be used. 	Use stories alongside images to provide meaningful context. First there were six people on the bus. Then two people got off the bus. Now there are four people left.  	There are six cakes in the shop, three cakes are eaten. How many are left?

KIRFs:	Recall number bonds up to 5 and related subtraction facts
Notes:	

Subtraction

In Year 1			
Vocabulary taught:	first, then, now, take away, minus, part, whole, subtract, take away, less, fewer, difference between, **subtract**	Manipulatives and models used:	Double sided counters Bead strings Ten frames Part-whole model Dienes Bar model Rekenrek

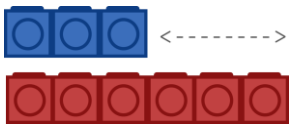
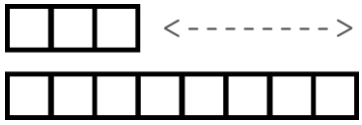
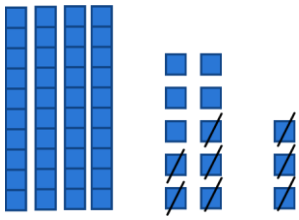
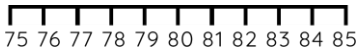
Skill:	Concrete:	Pictorial:	Abstract:
Taking away	Use physical objects e.g. double sided counters, cubes, bead strings etc. to show how objects can be taken away.	Cross out drawn objects to show what has been taken away.   Use a part-whole model 	6 - 5 = ___ There are 9 children on a train. 5 children get off the train. How many are left?
Counting back	> Use a bead string Make the larger number on your bead string. Move your beads along the bead string as you count backwards in ones.	Count back on a number line or number track. 	Put 9 in your head, count back 4. What number are you at? E.g. Zara counts backwards from 8. How many jumps would it take to get back to 3? Write this as a number

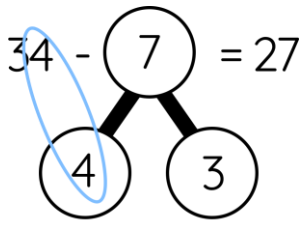
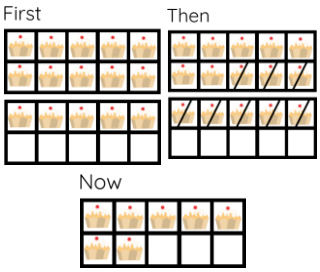
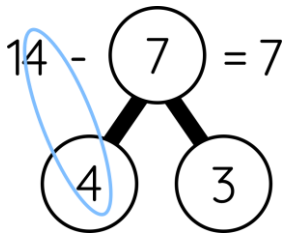
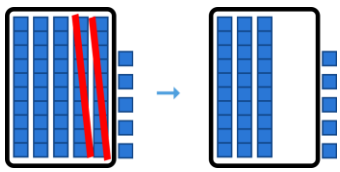
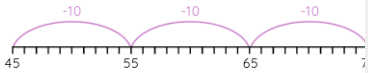
			sentence.
Finding the difference	Explore practically using objects. For example, give 5 children an apple and 3 children a banana. Line them up in two lines next to each other, ensuring they are standing in pairs. What is the difference between the number of children with an apple and those with a banana.	Use images of objects or manipulatives. How many more cakes does George have?  George has ____ more cakes than Claire.  A bar model or number line can also be used.  	Sam has 3 cars. Jack has 5 cars. How many more cars does Jack have?

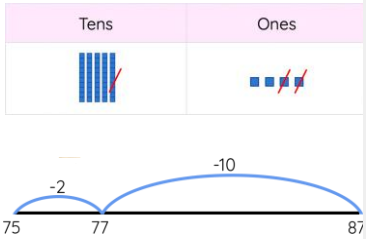
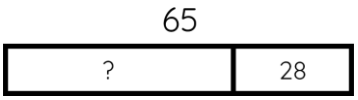
KIRFs:	Recall number bonds to 10 and corresponding subtraction facts Recall number bonds to 20 and corresponding subtraction facts Recall all doubles and halves to 20
Notes:	

Subtraction

In Year 2			
Vocabulary taught:	first, then, now, take away, minus, part, whole, subtract, take away, less, fewer, difference between, subtract, **tens boundary**	Manipulatives and models used:	Interlocking cubes Bead strings Bar model Part-whole model Double sided counters Tens frame Dienes

Objective:	Concrete:	Pictorial:	Abstract:
Finding the difference	Compare amounts and objects to find the difference. Use cubes to build bars or towers to find the difference. 	Use a bar model with two bars to help support finding the difference.  	Hannah has 8 goldfish. Helen has 3 goldfish. Find the difference between the number of goldfish the girls have.
Subtract a 1-digit number from a 2-digit number	Use rekenrek and dienes as manipulatives. Reinforce the concept that one ten is the same as ten ones as this is crucial. For example; 53 - 8 = 	Use number line/images of tens frames and counters/part-whole model.  83-6=77 83-3=80 80-3=77 Children should apply previous learning of crossing 10 by partitioning the 6 into 3 and 3 to subtract through the multiple of 10.	75 - 8 =

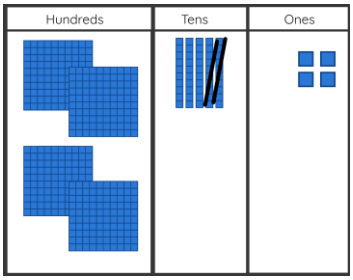
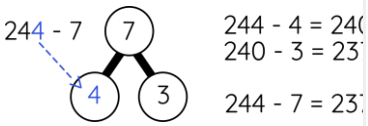
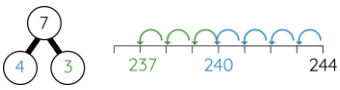
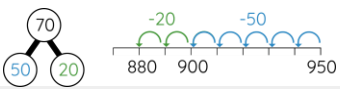
		 34 - 4 = 30 30 - 3 = 27	
Subtraction a 1 digit number from a 2 digit number (crossing 10)	Act out stories - First there were 12 children on the train. Then 4 children got off. Now there are 8 children on the train.	Use ten frames and counters, number line, part-whole model to show the children how they can subtract through ten.   	16 - 9 = ___ Tom had 27 sweets. He ate 8. How many did he have left?
Subtract a multiple of 10 from a 2-digit number	Use rekenrek, dienes, bead strings to explore subtracting a multiple of 10 from a 2-digit number.	Use pictorial representations to consolidate subtracting multiple of 10. Children should notice only the tens digit changes.  	80 - 10 = 72 - 10 = 80 - 20 = 72 - 20 = 80 - 30 = 72 - 30 = 80 - 40 = 72 - 40 =

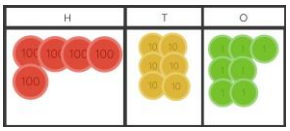
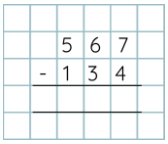
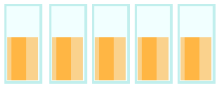
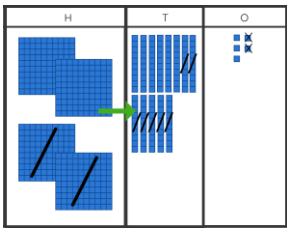
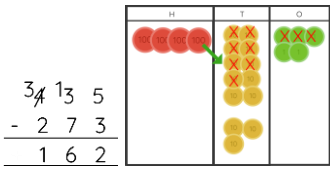
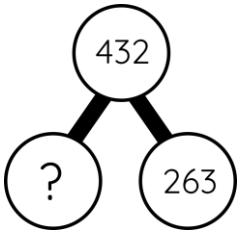
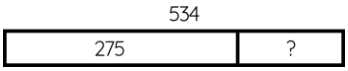
Subtract a 2-digit number from a 2-digit number (not bridging a multiple of 10)	Use concrete resources such as dienes for children to explore practically. 1. Partition the smaller into tens and ones. 2. Subtract the tens	Use images of dienes/number line  	75 - 18 = ☐ 75 - 28 = ☐ 75 - 38 = ☐ 75 - 48 = ☐
Subtract a 2-digit number from a 2-digit number (bridging a multiple of 10)	Use concrete resources such as dienes for children to explore practically.	Use images of dienes.  Bar models can also be used. 	

KIRFs:	Recall number bonds to 100
Notes:	

Subtraction

In Year 3			
Vocabulary taught:	first, then, now, take away, minus, part, whole, subtract, take away, less, fewer, difference between, subtract, tens boundary, hundreds boundary	Manipulatives and models used:	Interlocking cubes Bar model Part-whole model Double sided counters Tens frame Dienes Place value counters

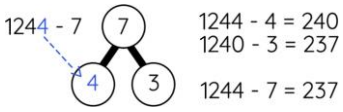
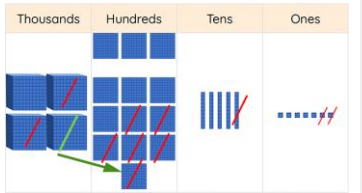
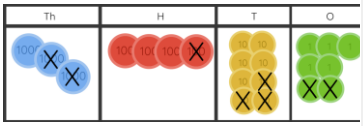
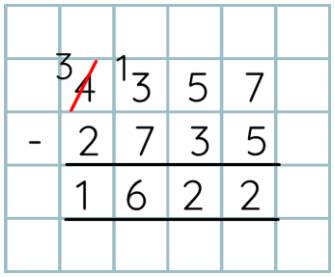
Skill:	Concrete:	Pictorial:	Abstract:
Subtracting 1s, 10s, or 100s without crossing a 10 or 100 (focusing on mental strategies)	Use place value counters to explore what happens when 1s, 10s or 100s are subtracting from a three-digit number. This builds on learning from previous years.	Use images of place value counters or dienes on a place value chart. 	Penelope makes a 3-digit number.  She subtracts 50 from her number What is her number now?
Subtracting 1s when crossing 10s or 100s (focusing on mental strategies)		Use number lines and part-whole model.  	336 - 9 =
Subtracting 10s when crossing a 10 or 10 (focussing on mental strategies)		Use number lines and part-whole model. 	728 - 50 =
Column subtraction (no exchanging)	Use dienes first, then move onto place value counters.	Use pictorial representations to help children solve the equations - these can be	

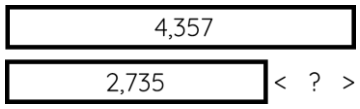
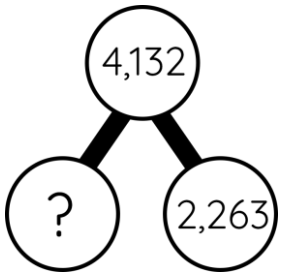
		provided or children can draw their own.   	 Tom has 73 drinks. He gives 29 to Mary. How many does he have left?
Column subtraction (exchanging)	Use dienes first, then move onto place value counters.  	Use pictorial representations to help children solve the equations - these can be provided or children can draw their own.    	534 -275 = ___

KIRFs:	Recall all number bonds to 100
Notes:	

Subtraction

In Year 4			
Vocabulary taught:	first, then, now, take away, minus, part, whole, subtract, take away, less, fewer, difference between, subtract, tens boundary, hundreds boundary	Manipulatives and models used:	Interlocking cubes Bar model Part-whole model Double sided counters Tens frame Dienes Place value counters

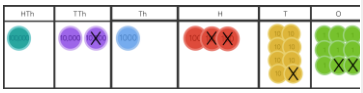
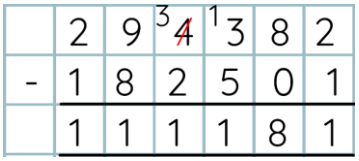
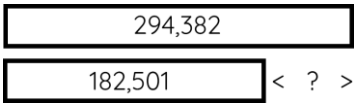
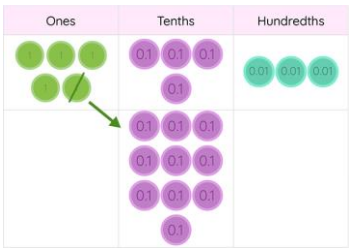
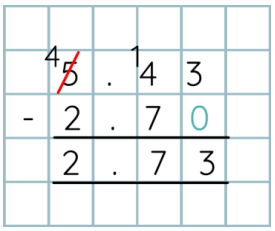
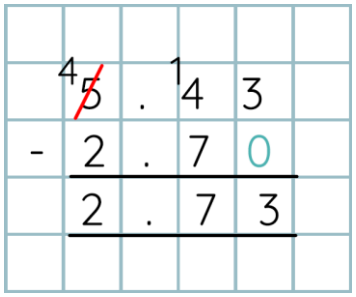
Objective:	Concrete:	Pictorial:	Abstract:
Subtracting 1s, 10s, 100s and 1000s	Use place value counters if needed to explore practically.	Part-whole models, number lines and place value chart. 	2316 - 600 = 3792 - 8 = 8482 - ____= 3482
Subtract numbers with up to 4 digits.	Use dienes (initially if needed) and then place value counters. Use dienes first, then move onto place value counters. Ensure children write out the calculation alongside any manipulatives so they can see the links to the written column method.	  3 4 8 7 - 2 1 3 2 1 3 5 5 Ensure children write out the calculation alongside any pictorial resources so they can see the links to the written column method.	

KIRFs:	Recall number bonds to 1000.
Notes:	

Subtraction

In Year 5 and 6			
Vocabulary taught:	first, then, now, take away, minus, part, whole, subtract, take away, less, fewer, difference between, subtract, tens boundary, hundreds boundary, **thousands boundary**	Manipulatives and models used:	Place value counters Bar model Part-whole model Double sided counters

Objective:	Concrete:	Pictorial:	Abstract:
Subtract numbers with more than 4 digits	Use place value counters or double sided counters on a place value grid. At this stage children should be encouraged to work in the abstract wherever possible.	  	294,382 - 182,501 = 111,181
Subtract numbers up to 3 decimal places	Use place value counters or double sided counters on a place value grid.	  Use pictorial representations alongside abstract.	

		5.43 2.7 < ? >	

KIRFs:	
Notes:	

Burnt Tree Primary School

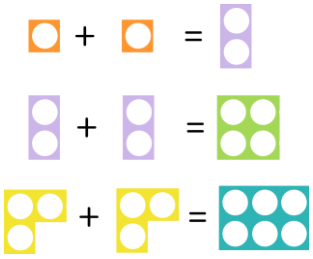
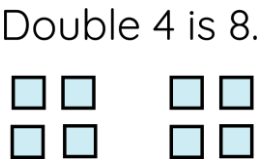
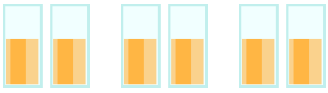
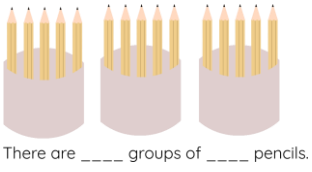
Multiplication

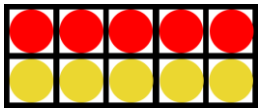
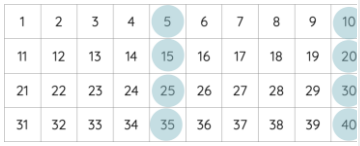
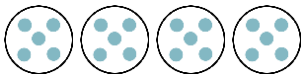
Calculation Policy

Addition, Subtraction, Multiplication, Division

Multiplication

In Year 1			
Vocabulary taught:	equal, unequal, group, odd, even, array, multiple, multiplication, multiplied by, division, dividing, grouping, groups of	Manipulatives and models used:	Bar model Numicon Ten frames Double sided counters Bead strings Number lines

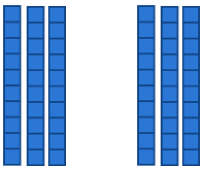
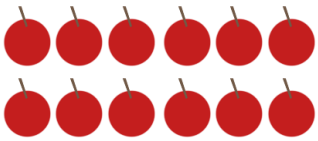
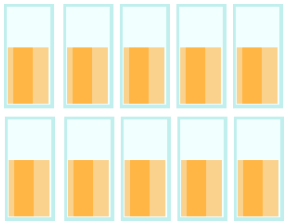
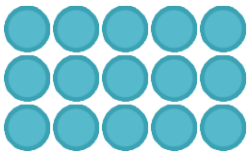
Skill:	Concrete:	Pictorial:	Abstract:
Doubling	Use practical activities such as cubes and numicon to illustrate doubling. 	Draw pictures to show how to double numbers. 	What is double 6? For numbers larger than 10, partition the number into tens and ones, double each part and then recombine.
Recognising equal groups	Putting objects into groups - initially children might just explore putting objects into groups, then move onto making these groups equal.	Use images to identify equal groups.  Use images to explain how many equal groups there are and how many are in each group. 	

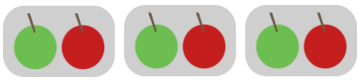
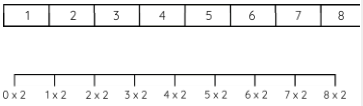
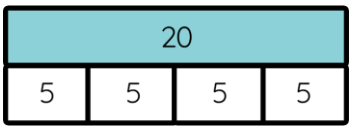
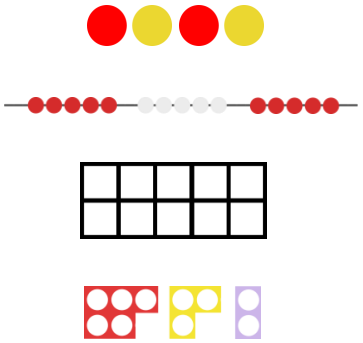
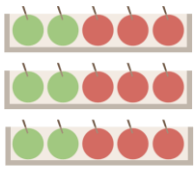
Adding equal groups	Use real life objects to explore this concept (e.g. scooters from outside - there are 4 scooters, how many wheels are there?)	Images of objects or tens frames and counters. 	What is 2 groups of 10? 'I think 4 groups of 5 is greater than 2 groups of 10 because 10 is greater than 5'. Do you agree?
Counting in multiples (2s, 5s, 10s)	Bead strings Interlocking cubes Numicon    Count the groups while skip counting.	Use images to show counting in multiples.   Children make representations to show counting in multiples. 	Count in multiples of a number aloud. Write and continue sequences counting in multiples.
Arrays	Use objects set out in arrays to find the answer to 2 lots of 5 etc. 	Draw representations of arrays to show understanding.	

KIRFs:	-Count in 10s to 100 -Count in 5s to 50 -Count in 2s to 20 -Recall all doubles and halves to 20
Notes:	

Multiplication

In Year 2			
Vocabulary taught:	equal, unequal, group, odd, even, array, multiple, multiplication, multiplied by, **times, repeated addition, row, column**	Manipulatives and models used:	Bar model Numicon Ten frames Double sided counters Bead strings Number lines

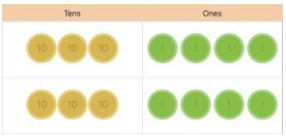
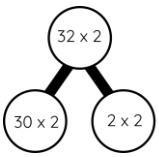
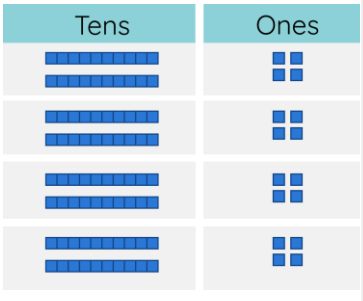
Skill:	Concrete:	Pictorial:	Abstract:
Doubling	Use dienes to explore doubling. 	Draw pictures and use representations to show how to double numbers. 	Partition a number, then double each part before recombining it.
Arrays	Explore making arrays using counters or cubes.	Images of arrays   Children write addition and multiplication sentences to match the arrays. These could be scafolded with sentence stems.	

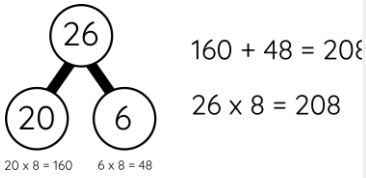
The 2, 5 and 10 times tables	Use concrete resources such as bead strings, the rekenrek, double sided counters and cubes to represent the times tables.	Images of objects grouped in 2s, 5s and 10s to match to/write multiplication sentences.  Number tracks and number lines  Bar model  	5 x 10 = ___ 10 x___= 60 2 x 5 = ___
Solving one-step problems involving multiplication	Use numicon, tens frames and counters, bead strings. 	 One box contains 5 apples. How many apples do 3 boxes hold?	$5+5+5+5=20$ $4 \times 5 = 20$ $5 \times 4 = 20$

KIRFs:	Recall 5x and 10x table multiplication and division facts Recall 2x table multiplication and division facts
Notes:	

Multiplication

In Year 3			
Vocabulary taught:	equal, unequal, group, odd, even, array, multiple, multiplication, multiplied by, times, repeated addition, row, column, **factor, product**	Manipulatives and models used:	Dienes Place value counters Place value chart

Skill:	Concrete:	Pictorial:	Abstract:
Multiply 2-digit numbers by 1-digit numbers (no exchange)	Use dienes and place value counters with a place value chart. 34 x 2  	Children can draw/images can be provided to support children to solve calculations. 3 tens x 2 = ____ tens 2 ones x 2 = ___ ones ___ + ___ = ___ 32 x 2 = ___ A part-whole model can also be used.  30 x 2 = 60 2 x 2 = 4 32 x 2 = 64	Complete the number sentences: 36 x 3 = = __tens x 3 + __ ones x 3 = ___+ ___ = ___ At this stage, the focus is on the structure of multiplication - the formal short multiplication method is introduced in Y4.
Multiply 2-digit numbers by 1-digit numbers (with exchange)	Use dienes and place value counters with a place value chart.  	Children can draw/images can be provided to support children to solve calculations.  	Work out: 66 x 3 = At this stage, the focus is on the structure of multiplication - the formal short multiplication method is introduced in Y4.

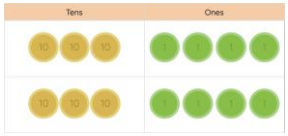
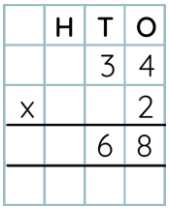
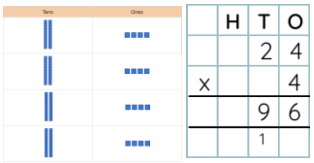
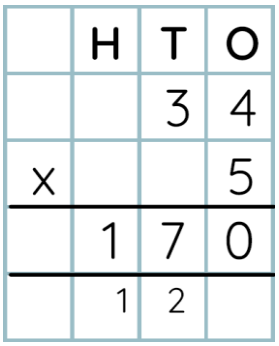
		24 x 4 = 2 tens x 4 = 8 tens 4 ones x 4 = 16 ones 24 x 4 = 8 tens + 16 ones= 9 tens and 6 ones 24 x 4 = 96 A part-whole model can also be used.  	

KIRFs:	Recall 3x table multiplication and division facts Recall 4x table multiplication and division facts Recall 8x table multiplication and division facts
Notes:	

Multiplication

In Year 4

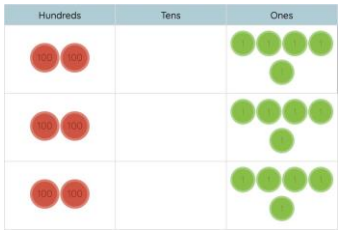
Vocabulary taught:	equal, unequal, group, odd, even, array, multiple, multiplication, multiplied by, times, repeated addition, row, column, factor, product	Manipulatives and models used:	Dienes Place value counters

Objective:	Concrete:	Pictorial:	Abstract:
Multiply 2 digit numbers by 1 digit numbers	Use dienes and place value counters. These should be used to support understanding of the method rather than supporting the multiplication, as pupils should use their times table knowledge. The expanded method can be used initially to support.   	Children can draw/images can be provided to support children to solve calculations.	

	H	T	O
		3	4
x			2
		6	8

	H	T	O
		2	4
x			4
		9	6
		1	

	H	T	O
		3	4
x			5
	1	7	0
	1	2	

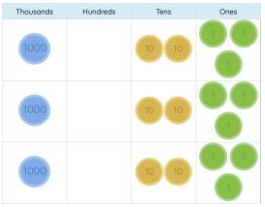
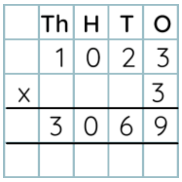
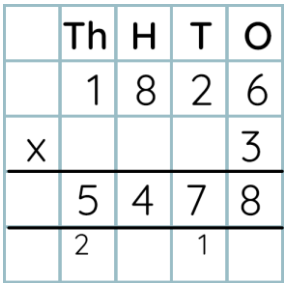
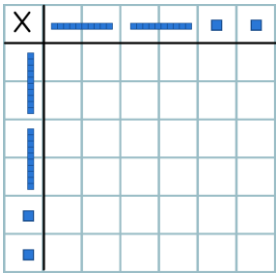
	 H T O 3 4 x 5 1 7 0 1 2		
Multiply 3-digit numbers by 1 digit numbers	Use dienes and place value counters to support formal written methods.  H T O 2 0 5 x 3	Use images/draw pictures of dienes and place value counters to support formal written method	H T O 2 4 5 x 4 9 8 0 1 2

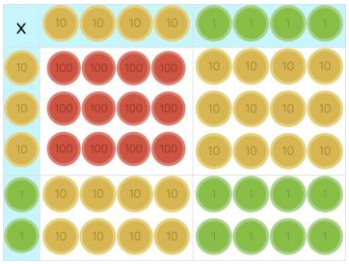
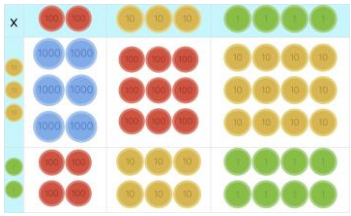
KIRFs:	-Recall 6x table multiplication and division facts -Recall 7x table and 9x table multiplication and division facts -Recall 11x and 12x table multiplication and division facts -Recall all times tables up to 12x12
Notes:	

Multiplication

In Year 5 and Year 6

Vocabulary taught:	equal, unequal, group, odd, even, array, multiple, multiplication, multiplied by, times, repeated addition, row, column, factor, product	Manipulatives and models used:	Place value counters Dienes Multiplication square

Objective:	Concrete:	Pictorial:	Abstract:
Multiply 4-digit numbers by 1-digit numbers	Use place value counters if children still need to use a concrete resource.  	Children could draw images of place value counters to support if needed. A multiplication square could also be used if children need support with times tables facts.	
Multiply 2-digit numbers by 2-digit numbers	Use the area model with dienes to help children understand the size of the numbers they are using.  This can be adapted to use place value counters and links to the grid method.	Children could draw images of place value counters/dienes to support if needed. A multiplication square could also be used if children need support with times tables facts.	

	 | x | 40 | 4 | |---|---|---| | 30 | 1200 | 120 | | 2 | 80 | 8 |		
Multiply 3-digit numbers by 2-digit numbers	Continue to use the area model, but with place value counters as this is more effcient. 234x32  	Children could draw images of place value counters to support if needed. A multiplication square could also be used if children need support with times tables facts.	| | Th | H | T | O | |---|---|---|---|---| | | | 2 | 3 | 4 | | x | | | 3 | 2 | | | | 4 | 6 | 8 | | | 7 | 0 | 2 | 0 | | | 7 | 4 | 8 | 8 |
Multiply 4-digit numbers by 2-digit numbers	Children should be confident in the written method. If they are struggling with times tables, provide multiplication grids to support the written method.	Children should be confident in the written method. If they are struggling with times tables, provide multiplication grids to support the written method.	| | Tth | Th | H | T | O | |---|---|---|---|---|---| | | | 2 | 7 | 3 | 9 | | x | | | | 2 | 8 | | | 2 2 | 5 1 | 3 9 | 7 1 | 2 | | | 1 5 | 4 1 | 7 | 8 | 0 | | | 7 | 6 | 6 | 9 | 2 |

KIRFs:	
Notes:	

Burnt Tree Primary School

Division

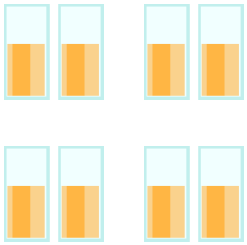
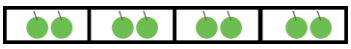
Calculation Policy

Addition, Subtraction, Multiplication, Division

Division

In Year 1

Vocabulary taught:	equal, unequal, group, even, odd, division, dividing, grouping, groups of	Manipulatives and models used:	Bar model Real life objects Double-sided counters Bead strings Ten frames Numicon

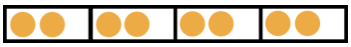
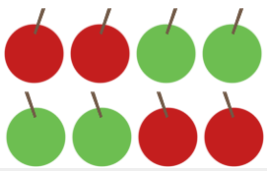
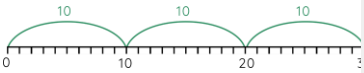
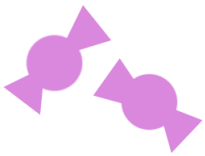
Skill:	Concrete:	Pictorial:	Abstract:
Make equal groups (grouping)	Give children a set number of objects (e.g. 10 counters) and make groups of an equal amount. Focus on 2, 5 and 10 times tables. 	Children circle pictorial representation in equal groups. 	The focus in Year 1 is on exploring division using concrete and pictorial representations.
Make equal groups (sharing)	Give children a set number of objects. They share them into equal groups using 1:1 correspondence.. Focus on 2, 5 and 10 times tables. 	Children draw pictures in circles or rectangles split into parts to represent sharing. NB: Link to fractions. 	The focus in Year 1 is on exploring division using concrete and pictorial representations.

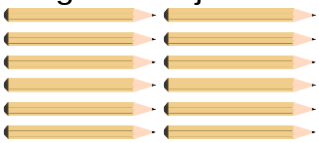
KIRFs:	-Count in 10s to 100 -Count in 5s to 50 -Count in 2s to 20 -Recall all doubles and halves to 20
Notes:	

Division

In Year 2

Vocabulary taught:	equal, unequal, group, even, odd, division, dividing, grouping, groups of	Manipulatives and models used:	Bar model Real life objects Double-sided counters Bead strings Ten frames Numicon

Skill:	Concrete:	Pictorial:	Abstract:
Make equal groups (sharing)	Children share objects into equal groups using 1:1 correspondence. They need experience doing this with concrete materials in a range of contexts. Examples and contexts should be based on multiplication tables covered - 2s, 5s and 10s.	Use a bar model split into equal parts. Children share by drawing dots, one at a time into each part, from left to right. 	20 ÷ 5 =
Make equal groups (grouping)	Children are given a set of objects and need to group the objects into equal groups. Examples and contexts should be based on multiplication tables covered - 2s, 5s and 10s. 	Use a number line to work out how many equal groups can be made from a given number. 	There are 15 sweets. If I put them into bags of five, how many bags will I need? 

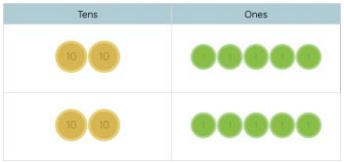
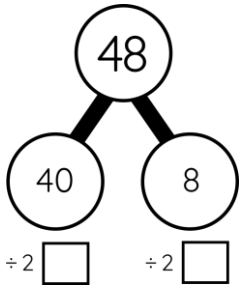
Dividing by 2, 5 and 10	Use counters or cubes - put them into groups of 2, 5 or 10, depending on which times table is the focus.	Images of objects  12 ÷ 2= Arrays	Pat has 30p in his pocket. It is made up of 5p coins. How many coins does he have?
		 12 ÷ 2 = Number lines  30 ÷ 10 =	

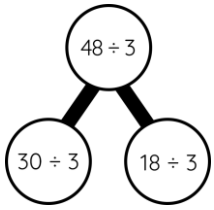
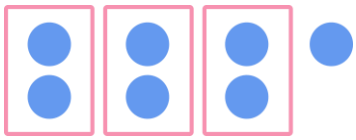
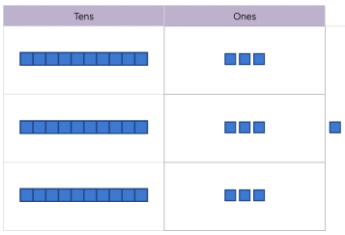
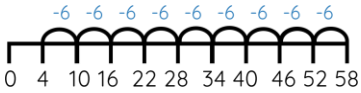
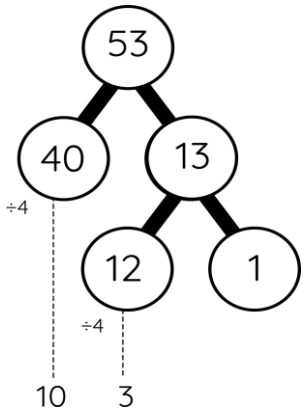
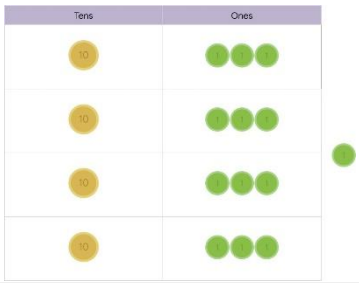
KIRFs:	Recall 5x and 10x table multiplication and division facts Recall 2x table multiplication and division facts
Notes:	

Division

In Year 3

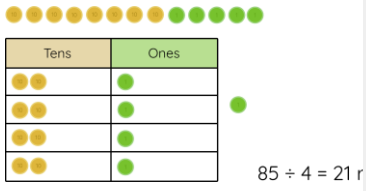
Vocabulary taught:	equal, unequal, group, even, odd, division, dividing, grouping, groups of	Manipulatives and models used:	Dienes Place value counters Place value grid

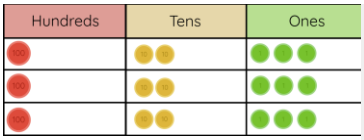
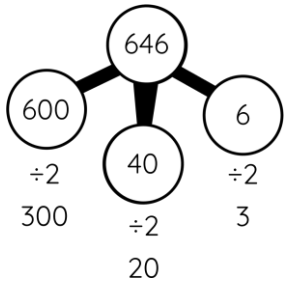
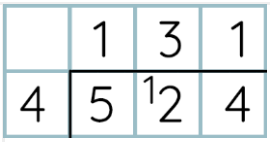
Skill:	Concrete:	Pictorial:	Abstract:
Divide a 2-digit number by a 1-digit number (sharing with no exchange)	Use dienes and place value counters to partition into equal groups, sharing the tens and ones. NB: Children should be taught to divide the tens first and then the ones. 	Draw pictorial representations of dienes/place value counters, sharing the tens and ones. A part-whole model is useful to use alongside this. 	Calculate: 69 ÷ 3 =
Divide a 2-digit number by a 1-digit number (sharing with an exchange)	Use dienes and place value counters to exchange one ten for ten ones. Children start with equipment outside the place value grid before sharing the tens and ones equally between rows.	Use images/drawings of dienes/place value counters, alongside a part-whole model. 	Complete the statement using <, > or = 42 ÷ 3 ☐ 52 ÷ 4

			
Division with remainders	Children explore grouping a given quantity of counters with a remainder.  Use dienes and place value counters so children can exchange one ten for ten ones. Start with dienes or place value counters outside the grid as they will be left outside the grid once the equal groups have been made. 	Jump back equal jumps on a number line then see how many are left to find the remainder.  Draw dots and group them to divide an amount and clearly show a remainder. Use images/drawings of dienes/place value counters, alongside a part-whole model.  	Complete the calculation and show the remainder using r. 38 ÷ 3 = 12 r 2
KIRFs:	Recall 3x table multiplication and division facts Recall 4x table multiplication and division facts Recall 8x table multiplication and division facts		
Notes:			

Division

In Year 4			
Vocabulary taught:	equal, unequal, group, even, odd, division, dividing, grouping, groups of	Manipulatives and models used:	Place value counters Place value grid Double sided counters

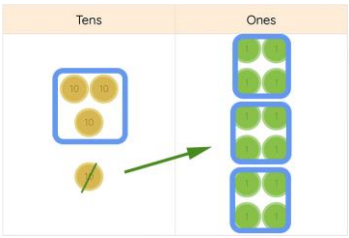
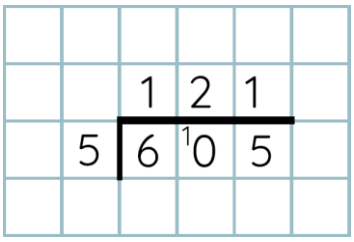
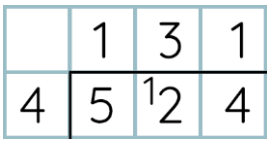
Skill:	Concrete:	Pictorial:	Abstract:
Divide a 2-digit number by a 1-digit number	Use place value counters and a place value chart to work out the calculations.	Use images of place value counters/children can draw place value counters along with a place value chart. 	96 ÷ 3 =
Divide a 2-digit number by a 1 digit number (with remainders)	Use place value counters and a place value chart to work out the calculations.	Use images of place value counters/children can draw place value counters along with a place value chart. 	83 ÷ 3 = ___r____
Divide a 3-digit number by a 1-digit number	Use place value counters and a place value chart to work out the calculations.	Use images of place value counters/children can draw place value counters along with a place value chart. 	208 ÷ 8 =

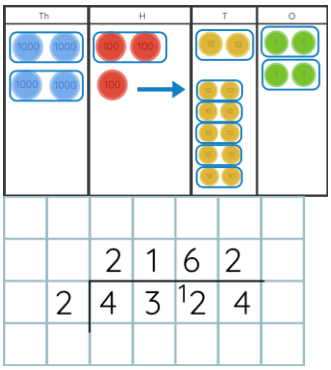
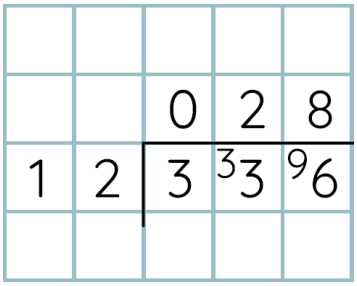
			
		The part-whole model is also useful to show how flexible partitioning supports the process of division. 	 Begin to introduce the formal short division method.

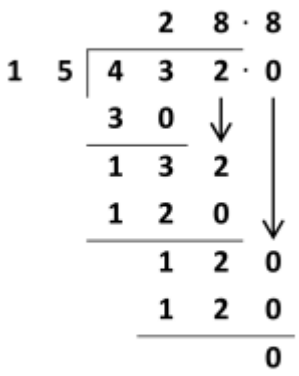
KIRFs:	-Recall 6x table multiplication and division facts -Recall 7x table and 9x table multiplication and division facts -Recall 11x and 12x table multiplication and division facts -Recall all times tables up to 12x12
Notes:	For guidance on teaching dividing 2-digit numbers by 1-digit numbers, please refer to the Year 3 page.

Division

In Year 5 and Year 6			
Vocabulary taught:	equal, unequal, group, even, odd, division, dividing, grouping, groups of	Manipulatives and models used:	Place value counters Place value grid Double sided counters

Skill:	Concrete:	Pictorial:	Abstract:
Divide a 3-digit number by a 1-digit number (short division)	Use place value or double sided counters in a place value grid alongside the bus stop method. Children need to group the place value counters by the divisor, starting with the largest place value. For example: 42 ÷ 3 Start by asking - 'How many groups of 3 tens can we make?' (any remaining tens will be exchanged for ten ones) Then 'How many groups of 3 ones can we make?'  	Children can continue to use drawn diagrams using circles to represent double-sided or place value counters.   	 Following the short division method.
Divide a 4 digit number by a 1 digit number Short division	Use place value or double sided counters in a place value grid alongside the bus stop	Children can continue to use drawn diagrams using circles to represent double-sided or place	What is 2240 divided by 7?

	method. Children need to group the place value counters by the divisor, starting with the largest place value.  	value counters.	
Divide multi-digits by 2 digits (short division)	Concrete and pictorial methods become less effective so written methods should be used.		
Divide multi-digits by 2 digits (long division)	Concrete and pictorial methods become less effective so written methods should be used.		When there is a remainder, children can either leave it as a remainder or convert it to a fraction.

		432 ÷ 15 becomes  Answer: 28·8

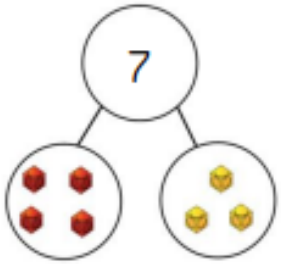
KIRFs:	
Notes:	Children should be encouraged to move away from concrete and pictorial methods when dealing with multiple exchanges,

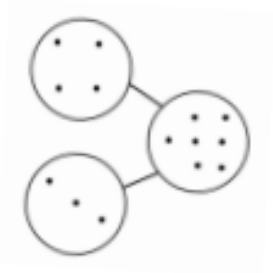
Burnt Tree Primary School

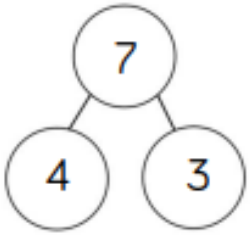
Models and Representations Addition and Subtraction

Addition, Subtraction, Multiplication, Division

Part-Whole Model

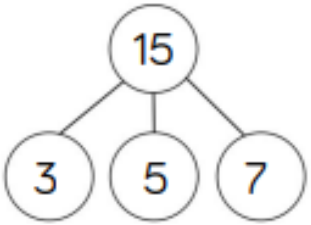


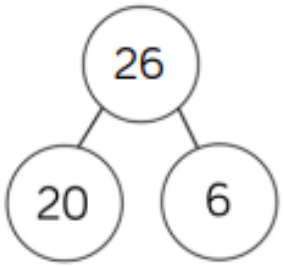


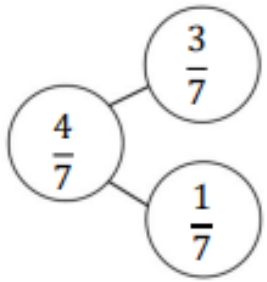


$7 = 4 + 3$
$7 = 3 + 4$

$7 - 3 = 4$
$7 - 4 = 3$







Benefits

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.

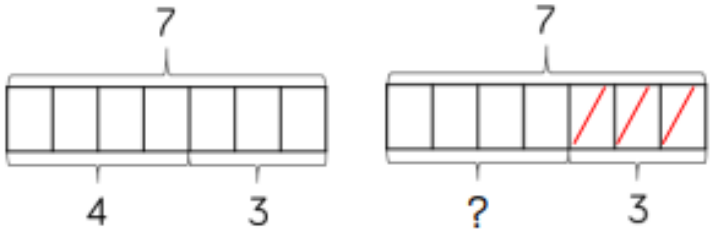
Part-whole models can be used to partition a number into two or more parts, or to help children to partition a number into tens and ones or other place value columns.

In KS2, children can apply their understanding of the part-whole model to add and subtract fractions, decimals and percentages.

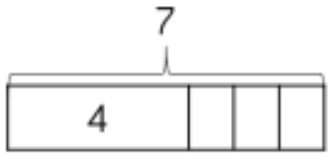
Bar Model (single)

Concrete

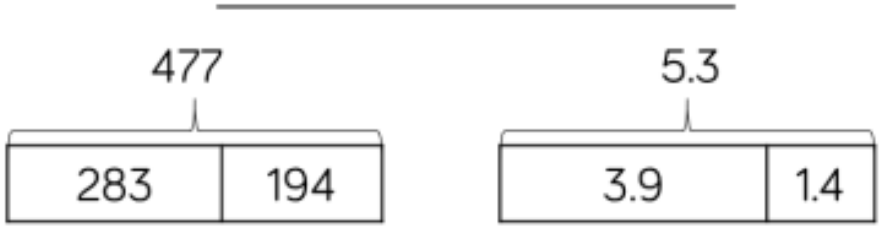
Discrete



Combination



Continuous



Benefits

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.

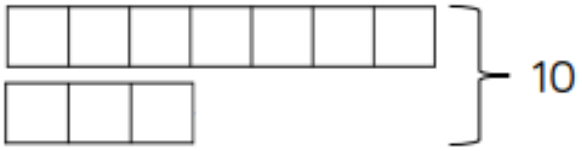
The combination bar model can support children to calculate by counting on from the larger number. It is a good stepping stone towards the continuous bar model.

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)

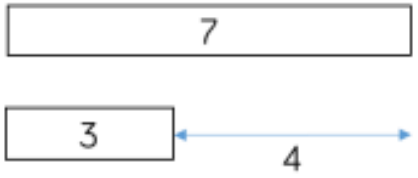
Discrete



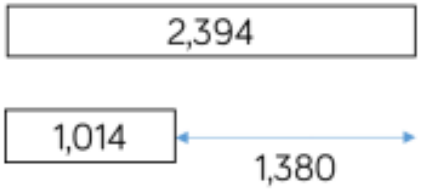
$7 + 3 = 10$

$7 - 3 = 4$

Continuous



$7 - 3 = 4$



$2{,}394 - 1{,}014 = 1{,}380$

Benefits

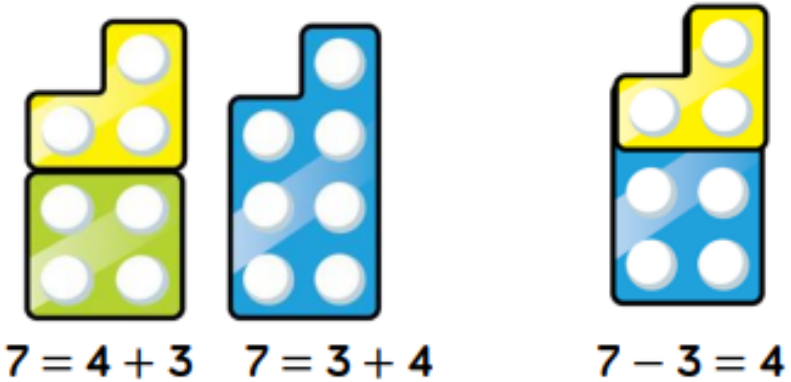
The multiple bar model is a good way to compare quantities whilst still unpicking the structure.

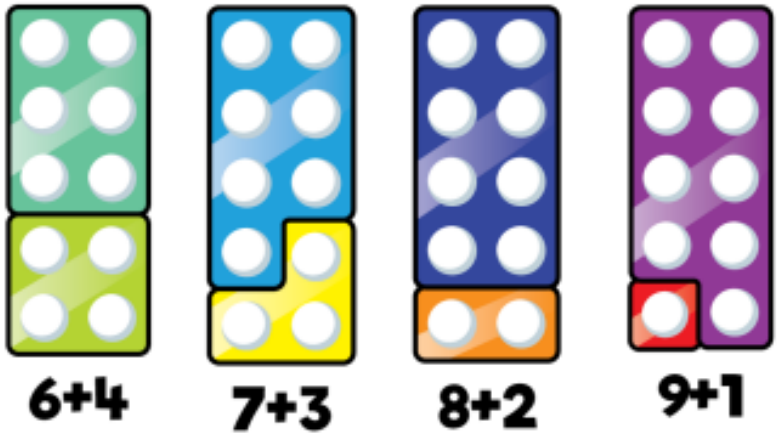
Two or more bars can be drawn, with a bracket labelling the whole positioned on the right hand side of the bars. Smaller numbers can be represented with a discrete bar model whilst continuous bar models are more effective for larger numbers.

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





Benefits

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.

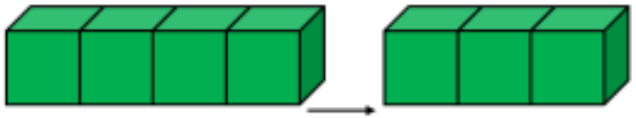
When subtracting numbers, children can start with the whole and then place one of the parts on top of the whole to see what part is missing. Again, children will start to be able to subitise the part that is missing due to their familiarity with the shapes.

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.

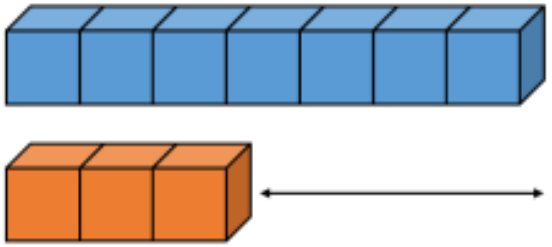
Cubes

$7 = 4 + 3$

$7 = 3 + 4$



$7 - 3 = 4$



$7 - 3 = 4$

Benefits

Cubes can be useful to support children with the addition and subtraction of one-digit numbers.

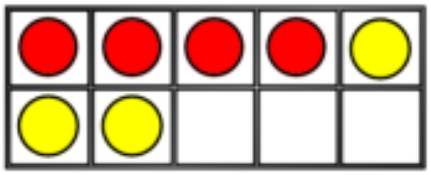
When adding numbers, children can see how the parts come together to make a whole. Children could use two different colours of cubes to represent the numbers before putting them together to create the whole.

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.

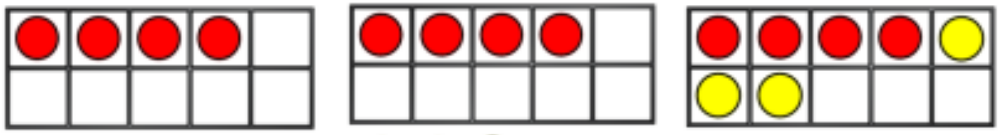
Ten Frames (within 10)



$4 + 3 = 7$
$3 + 4 = 7$
$7 - 3 = 4$
$7 - 4 = 3$

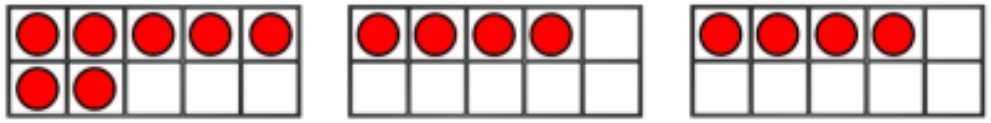
4 is a part.
3 is a part.
7 is the whole.

First Then Now



$4 + 3 = 7$

First Then Now



$7 - 3 = 4$

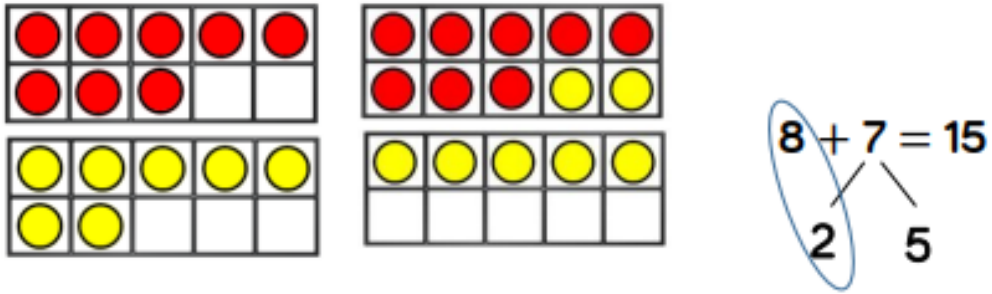
Benefits

When adding and subtracting within 10, the ten frame 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 frame can enable children to find all the number bonds for a number.

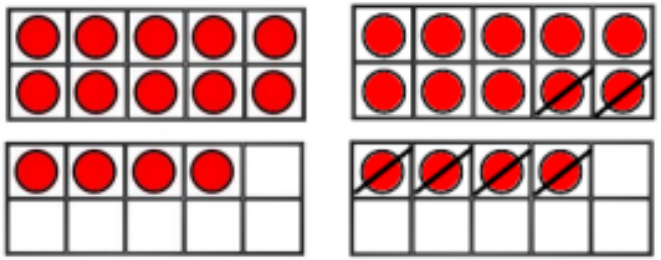
Children can also use ten frames to look at augmentation (increasing a number) and take-away (decreasing a number). This can be introduced through a first, then, now structure which shows the change in the number in the 'then' stage. This can be put into a story structure to help children understand the change e.g. First, there were 7 cars. Then, 3 cars left. Now, there are 4 cars.

Ten Frames (within 20)



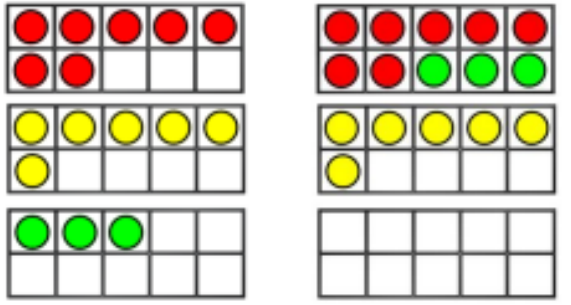
$8 + 7 = 15$

$2 \quad 5$



$14 - 6 = 8$

$4 \quad 2$



$7 + 6 + 3 = 16$

10

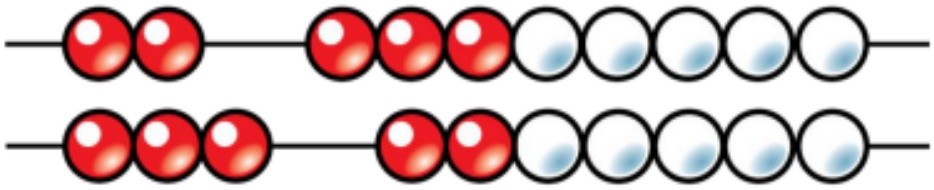
Benefits

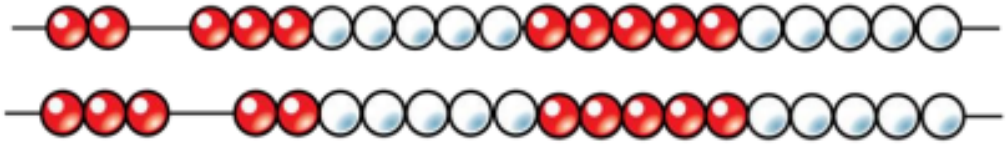
When adding two single digits, children can make each number on separate ten frames before moving part of one number to make 10 on one of the ten frames. This supports children to see how they have partitioned one of the numbers to make 10, and makes links to effective mental methods of addition.

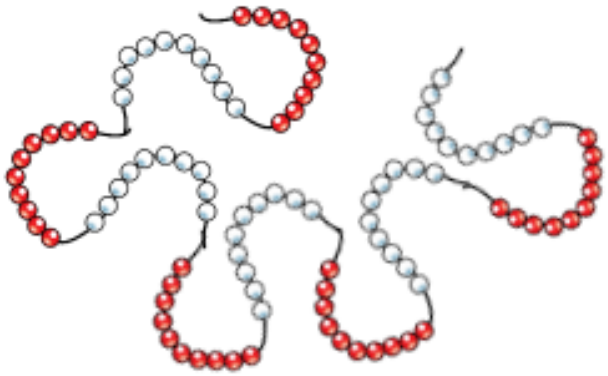
When subtracting a one-digit number from a two-digit number, firstly make the larger number on 2 ten frames. Remove the smaller number, thinking carefully about how you have partitioned the number to make 10, this supports mental methods of subtraction.

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.

Bead Strings







Benefits

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.

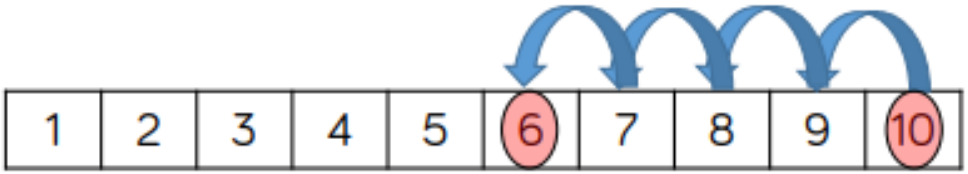
Bead strings to 20 work in a similar way but they also group the beads in fives. Children can apply their knowledge of number bonds to 10 and see the links to number bonds to 20.

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 Tracks

$5 + 3 = 8$

$10 - 4 = 6$



$8 + 7 = 15$

Benefits

Number tracks are useful to support children in their understanding of augmentation and reduction.

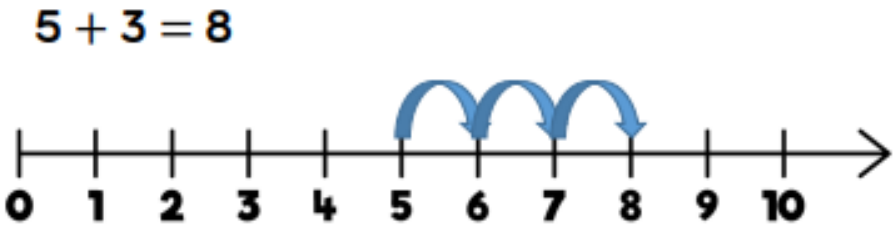
When adding, children count on to find the total of the numbers. On a number track, children can place a counter on the starting number and then count on to find the total.

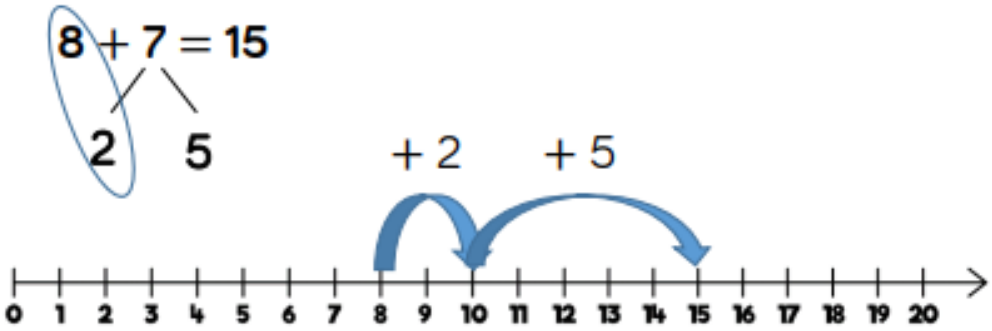
When subtracting, children count back to find their answer. They start at the minuend and then take away the subtrahend to find the difference between the numbers.

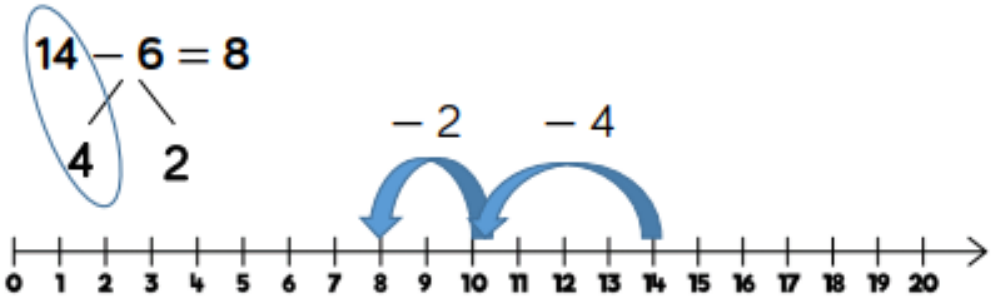
Number tracks can work well alongside ten frames and bead strings which can also model counting on or counting back.

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 Lines (labelled)







Benefits

Labelled number lines support children in their understanding of addition and subtraction as augmentation and reduction.

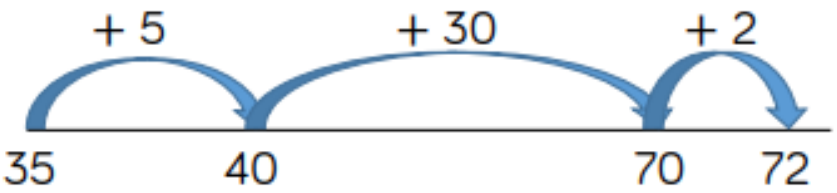
Children can start by counting on or back in ones, up or down the number line. This skill links directly to the use of the number track.

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.

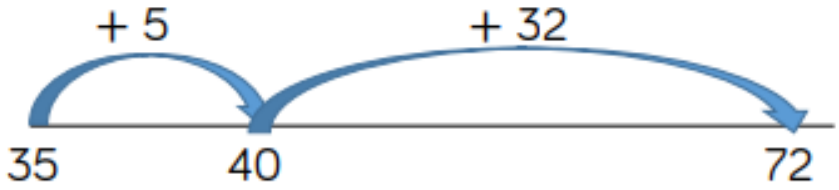
Children can subtract numbers by firstly jumping to the nearest 10. Again, this can be supported by ten frames so children can see how they partition the smaller number into the two separate jumps.

Number Lines (blank)

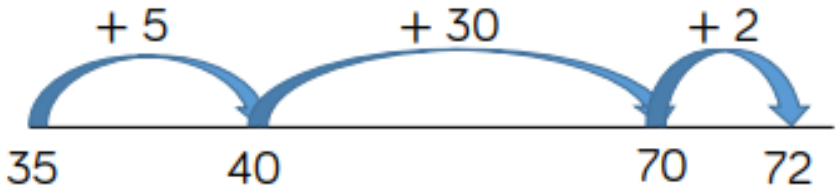
35 + 37 = 72



35 + 37 = 72



72 − 35 = 37



Benefits

Blank number lines provide children with a structure to add and subtract numbers in smaller parts.

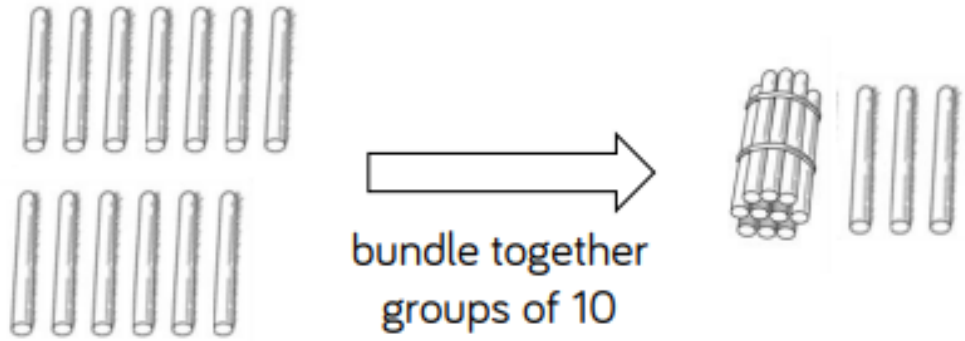
Developing from labelled number lines, children can add by jumping to the nearest 10 and then adding the rest of the number either as a whole or by adding the tens and ones separately.

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.

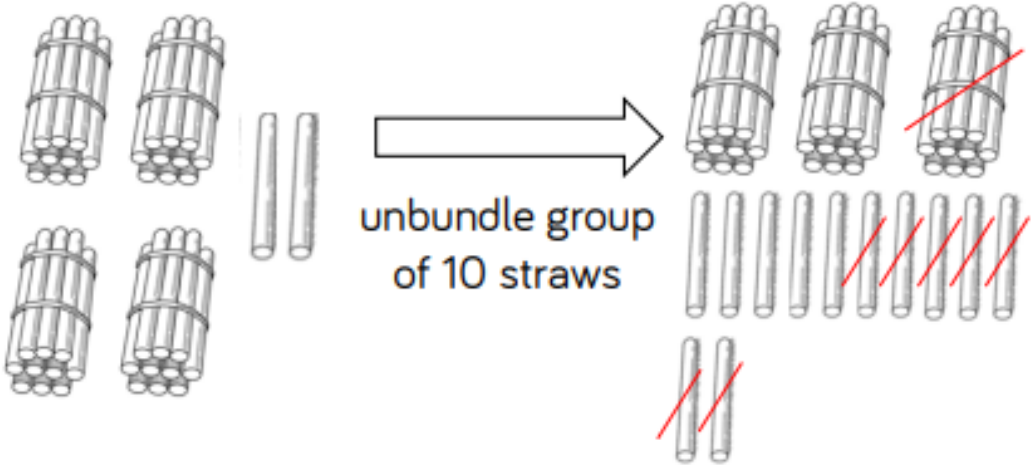
Blank number lines can also be used effectively to help children subtract by finding the difference between numbers. This can be done by starting with the smaller number and then counting on to the larger number. They then add up the parts they have counted on to find the difference between the numbers.

Straws

$7 + 6 = 13$



$42 - 17 = 25$



Benefits

Straws are an effective way to support children in their understanding of exchange when adding and subtracting 2-digit numbers.

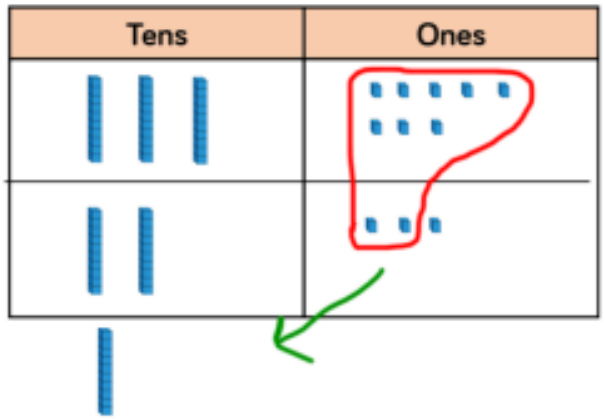
Children can be introduced to the idea of bundling groups of ten when adding smaller numbers and when representing 2-digit numbers. Use elastic bands or other ties to make bundles of ten straws.

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.

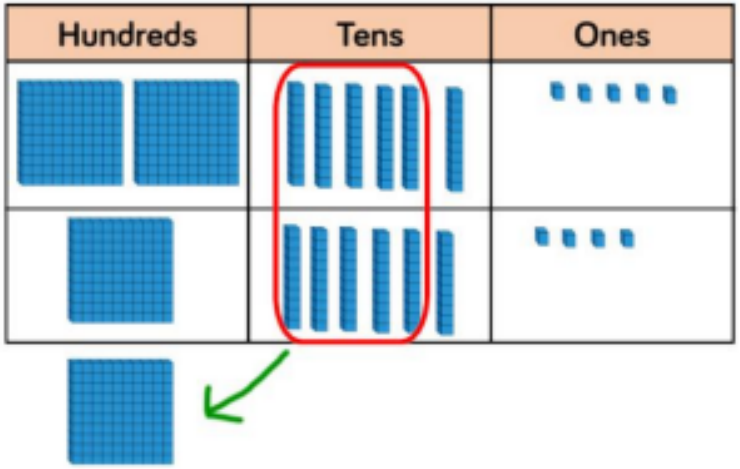
When subtracting numbers, children unbundle a group of 10 straws to represent the exchange from 1 ten to 10 ones.

Straws provide a good stepping stone to adding and subtracting with Base 10/Dienes.

Base 10/Dienes (addition)



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



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

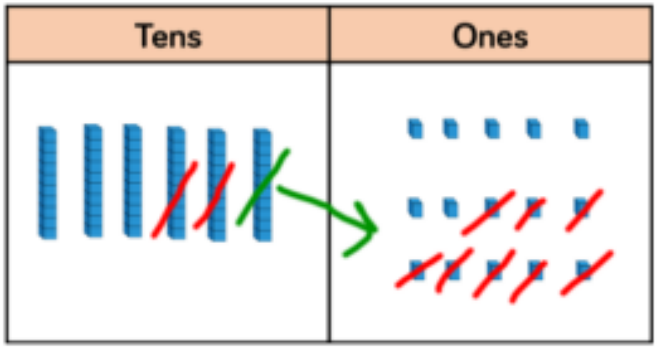
Benefits

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.

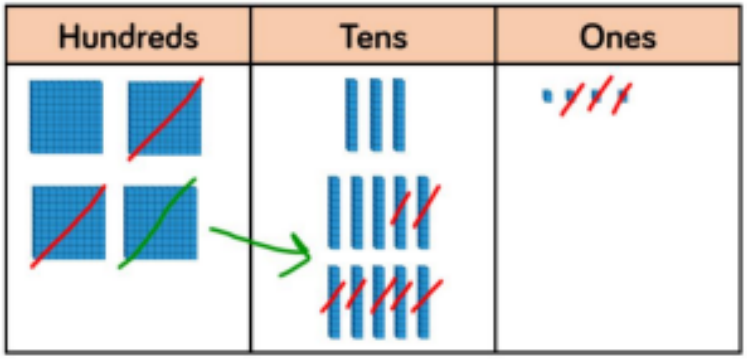
Children should first add without an exchange before moving on to addition with exchange.. The representation becomes less efficient with larger numbers due to the size of Base 10. In this case, place value counters may be the better model to use.

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/Dienes (subtraction)



$$\begin{array}{r} {}^{5}\not{6}\,{}^{1}5 \\ -\ 28 \\ \hline 37 \end{array}$$



$$\begin{array}{r} {}^{3}\not{4}\,{}^{1}35 \\ -\ 273 \\ \hline 262 \end{array}$$

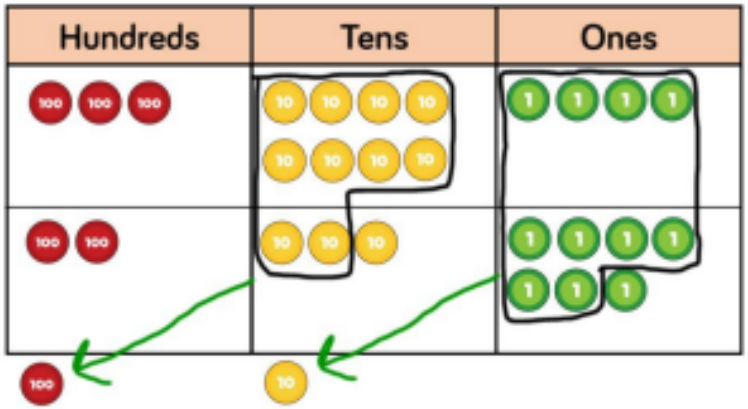
Benefits

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.

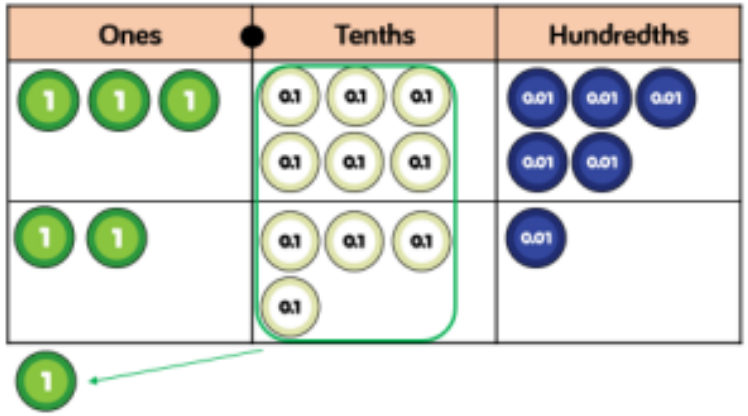
Children should first subtract without an exchange before moving on to subtraction with exchange. When building the model, children should just make the minuend using Base 10, they then subtract the subtrahend. Highlight this difference to addition to avoid errors by making both numbers. Children start 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)



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



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

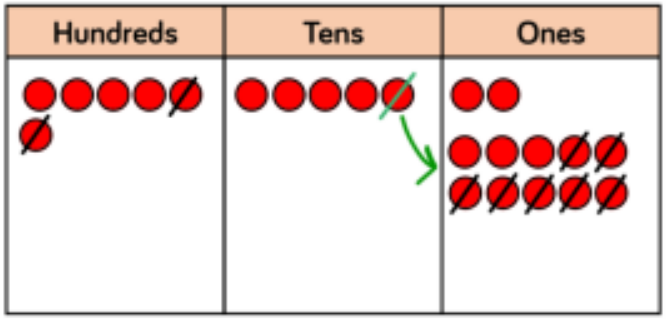
Benefits

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.

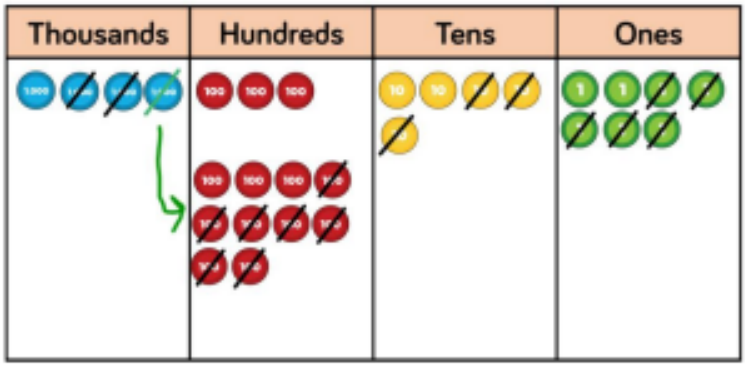
Children should first add without an exchange before moving on to addition with exchange. Different place value counters can be used to represent larger numbers or decimals. If you don't have place value counters, use normal counters on a place value grid to enable children to experience the exchange 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)



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



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

Benefits

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.

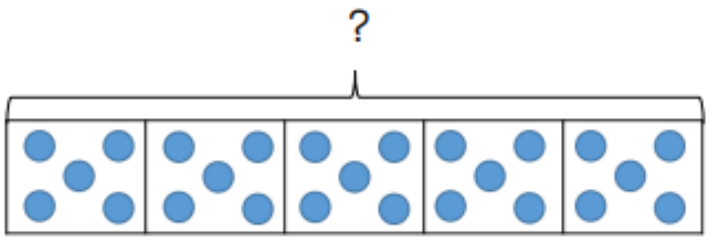
When building the model, children should just make the minuend using counters, they then subtract the subtrahend. Children start with the smallest place value column. When there are not enough ones/tens/hundreds to subtract in a column, children need to move to the column to the left and exchange e.g. exchange 1 ten for 10 ones. They can then subtract efficiently.

Burnt Tree Primary School

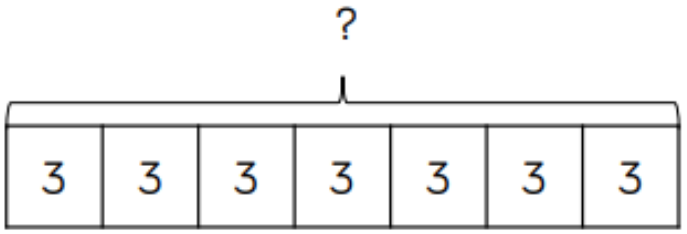
Models and Representations Multiplication and Division

Addition, Subtraction, Multiplication, Division

Bar Model

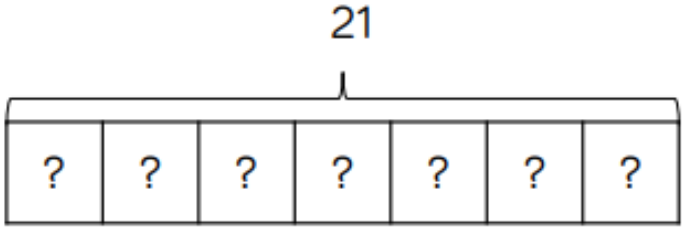


$5 \times 5 = 25$

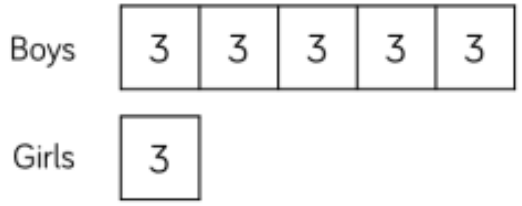


$3 \times 7 = 21$

$7 \times 3 = 21$



$21 \div 7 = 3$



Benefits

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.

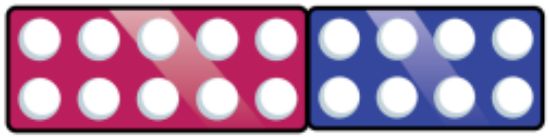
It is important when solving word problems that the bar model represents the problem.

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.

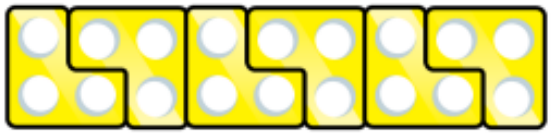
Number Shapes

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

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



$18 \div 3 = 6$



Benefits

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.

Bead Strings

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

$15 \div 3 = 5$

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

$15 \div 5 = 3$

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

$20 \div 4 = 5$

Benefits

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.

Number Tracks

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

$18 \div 3 = 6$

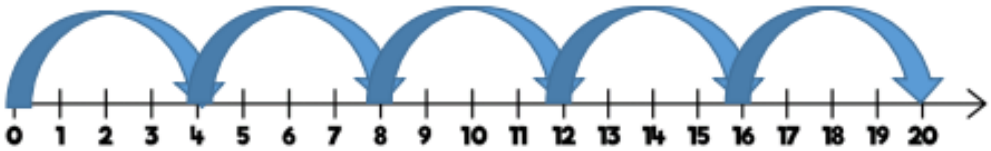
Benefits

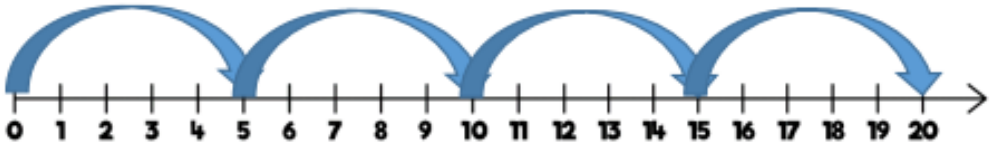
Number tracks are useful to support children to count in multiples, forwards and backwards. Moving counters or cubes along the number track can support children to keep track of their counting. Translucent counters help children to see the number they have landed on whilst counting.

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.

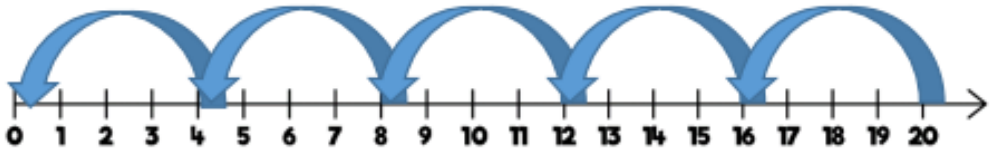
Number Lines (labelled)





$4 \times 5 = 20$

$5 \times 4 = 20$



$20 \div 4 = 5$

Benefits

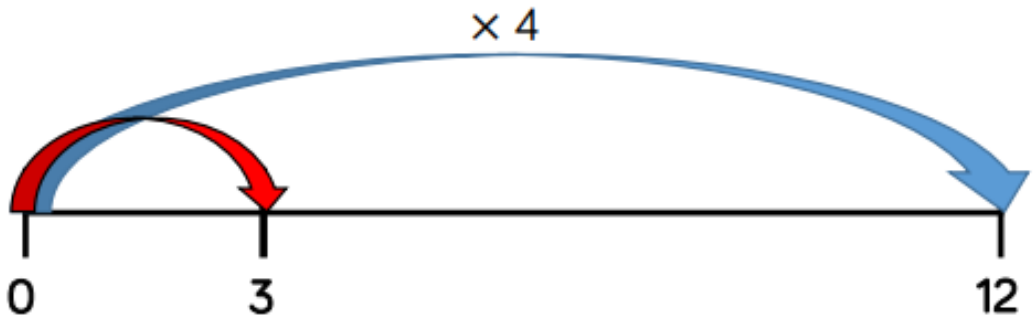
Labelled number lines are useful to support children to count in multiples, forwards and backwards as well as calculating single-digit multiplications.

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.

Number Lines (blank)

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?

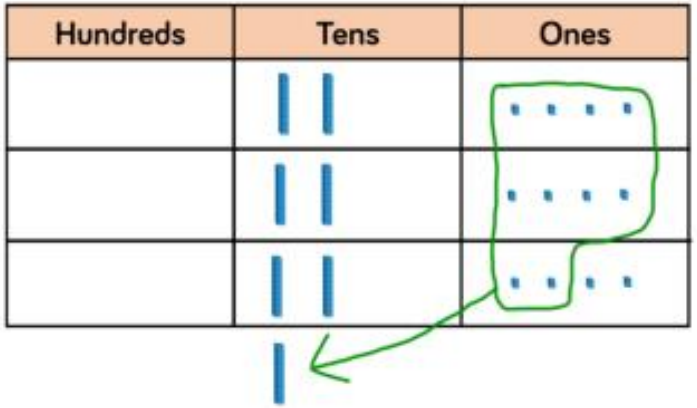
Benefits

Children can use blank number lines to represent scaling as multiplication or division.

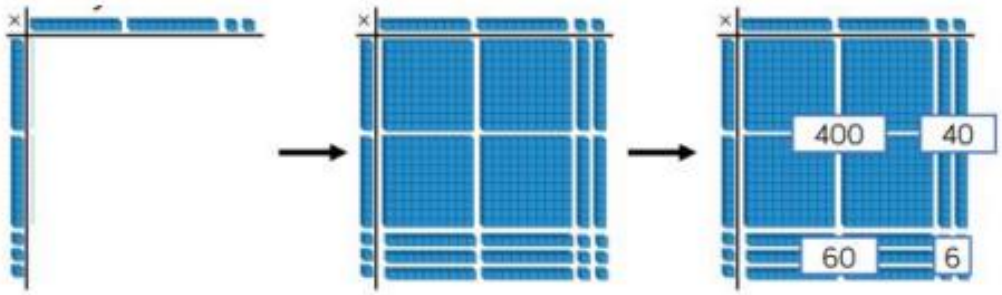
Blank number lines with intervals can support children to represent scaling accurately. Children can label intervals with multiples to calculate scaling problems.

Blank number lines without intervals can also be used for children to represent scaling.

Base 10/Dienes (multiplication)



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



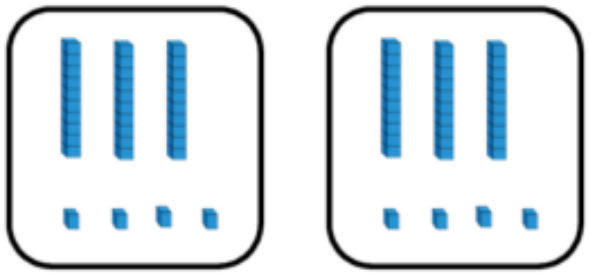
Benefits

Using Base 10 or Dienes 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.

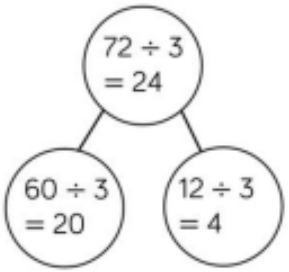
Base 10/Dienes (division)



$68 \div 2 = 34$

Tens	Ones

$72 \div 3 = 24$



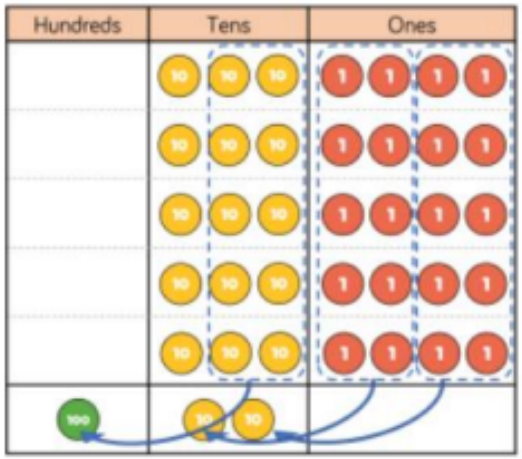
Benefits

Using Base 10 or Dienes is an effective way to support children's understanding of division.

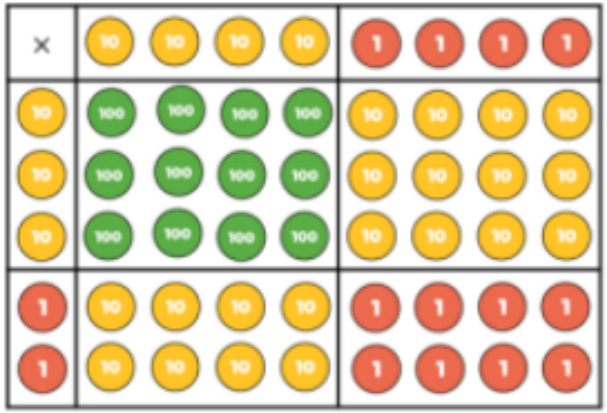
When numbers become larger, it can be an effective way to move children from representing numbers as ones towards representing them as tens and ones in order to divide. Children can then share the Base 10/ Dienes between different groups e.g. by drawing circles or by rows on a place value grid.

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.

Place Value Counters (multiplication)



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



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

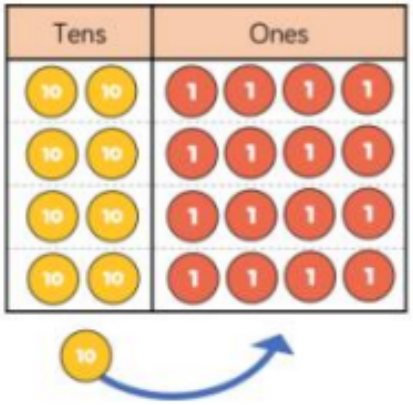
Benefits

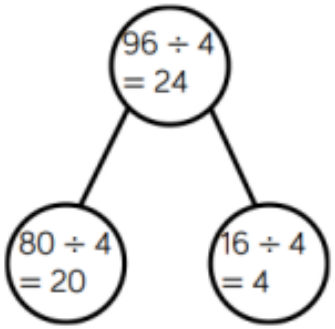
Using place value counters is an effective way to support children's understanding of column multiplication. It is important that children write out their calculation alongside the equipment so they can see how the concrete and written match.

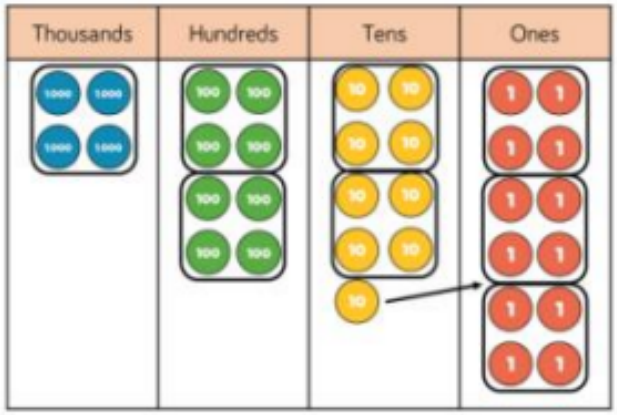
As numbers become larger in multiplication or the amounts of groups becomes higher, Base 10 / Dienes becomes less efficient due to the amount of equipment and number of exchanges needed The counters should be used to support the understanding of the written method rather than support the arithmetic.

Place value counters also support the area model of multiplication well. Children can see how to multiply 2-digit numbers by 2-digit numbers.

Place Value Counters (division)







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

Benefits

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.