Aston Clinton School

Calculation policy, Reception

Calculation policy Reception

Numicon

In recent years, there has been a growing evidence base in the field of embodied cognition. This fascinating area of research is concerned with the idea that children don't just think all alone in their head. The mind is connected to a complicated nervous system that has all sorts of sensory input. Using our hands, eyes and voices enables children to use rich learning experiences. It's these types of sensory activities that help make abstract concepts more concrete. Along with other effective teaching tools such as dienes blocks, these types of visual teaching strategies enable primary school children to access what are sometimes quite abstract maths concepts.

Being a physical resource, each Numicon shape offers an image of how a number looks like. Children start to see the connection between numbers, with each piece containing one hole more than the previous one. It complements children's strong sense of pattern and allows them to understand how each number has a connection with other numbers.

Numicon is multisensory. Multisensory activities are essential because these activities involve whole-brain learning. Multisensory techniques mostly include concrete objects and visual teaching strategies. These include methods such as gems, unifix cubes and counters. They are especially helpful in teaching particular math concepts/skills as children can both feel and see the characteristics of concrete objects they are using. This is the idea that children think not only with just their heads but their hands and body too.

Being able to hold a physical representation of something helps children to understand an abstract concept. These building resources have been shown to make a learning activity more engaging and less theoretical. As children build and make connections with a concrete object, they grasp more difficult concepts. These teaching materials act as a concrete-pictorial-abstract approach that enables children to develop their problem-solving skills.

Numicon Shapes will help to support children to communicate mathematically and sets a solid foundation for future curriculum links. Numicon maths helps children to reason mathematically, by talking alongside pictorial and concrete representations to elaborate and justify their ideas. This strategy of learning and teaching is called the **CPA** or **Concrete-Pictorial-Abstract teaching.**

Concrete representation – using physical objects to solve mathematical problems
Pictorial representation – using drawing to represent mathematical problems
Abstract representation – solving mathematical problems using numerals.

The ideas at the heart of the CPA approach are also at the heart of Numicon itself. Specifically, we consider Bruner's three phases:

• **Enactive**: The Numicon invitation to start by 'doing' – the manipulation of concrete resources in order to scaffold thinking.
• **Iconic:** Here, as children continue to work with the Numicon Shapes and become familiar with the quantities they represent, they are able to draw the Shapes, dot patterns, or use pegs or other countable items in pictorial form to represent the number.
• **Symbolic:** Finally, as children develop an abstract concept image for a number, they can begin to recall it whenever they see the symbol that they have learn to associate with that number, e.g. '5'.

The Numicon Approach

Early years - Preparation for school - Firm Foundations

- Playing with patterns and discovery of their relationships
- A sense of numbers and what they mean through play and discovery
- Counting to find out how many in 1-10
- Reading numerals that matches the words they are saying when they count 1-10
- Seeing and playing with patterns of numbers 1-10
- Exploring relationships with 1-10

Year 0- Firm Foundations

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Children are introduced to the world of mathematics through conversation, story, song with many hands-on activities to develop:

- Playing with patterns and discovery of their relationships
- A sense of numbers and what they mean through play and discovery
- Counting to find out how many in 1-10
- Reading numerals that matches the words they are saying when they count 1-10
- Seeing and playing with patterns of numbers 1-10
- Exploring relationships with 1-10
- Joining patterns together
- Separating patterns of numbers
- Reasoning about numbers and describing them

Numicon and The Number Early Learning Goals

There are six Early Learning Goals for mathematics: three for Number and three for Numerical Patterns. This section outlines the expectations of the goals and explains how Numicon Firm Foundations meets each one.

New Number Early Learning Goals
Children are expected to:
Have a deep understanding of numbers to 10, including the composition of each number.
Unlike other apparatus, such as counters, Numicon apparatus is specifically designed to represent the structure of numbers and the relationships between them. In the practical adding and subtracting activities shown on the Activity Cards, children learn the composition of each number by combining and comparing Numicon Shapes or number rods.

Subitise (recognise quantities without counting) up to 5.
In Numicon Firm Foundations, children find 'how many' without counting, by arranging objects into Numicon Shape patterns. This is a key step towards children recognising quantities to 5 and beyond. This work prepares children for adding and subtracting with whole numbers without counting on and back on a number line.

Automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts.
Children get a visual and tactile experience of number bonds both in play and in taught activities with Numicon apparatus. Children regularly explore compositions to 10, talking with their friends and with adults about what they are doing. This multisensory experience makes their learning memorable, and supports them as they start to recall adding, subtracting and doubles facts automatically

New Numerical Patterns Early Learning Goals
Children are expected to:
Verbally count beyond 20, recognising the pattern of the counting system. Numicon Firm Foundations provides Daily Counting activities to help children realise that we count when we need to know 'how many'. Children extend their verbal counting range beyond 20, learn to see patterns in the sequence of number names and learn to count objects accurately to 20 and beyond. All this counting is supported by the structured images on the Numicon number lines.

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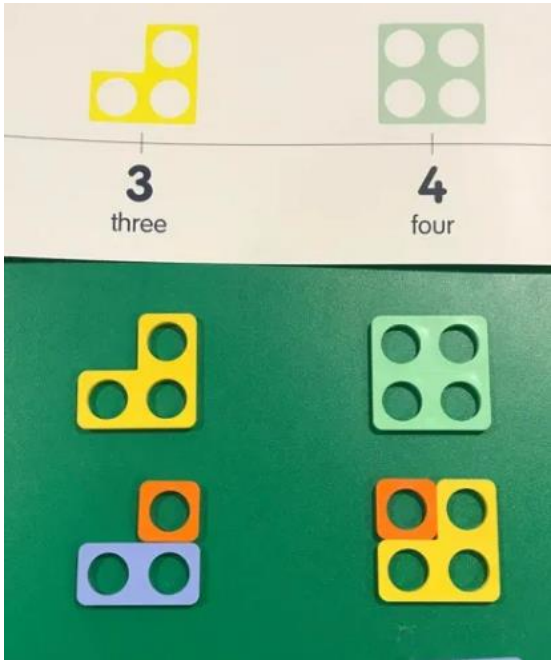
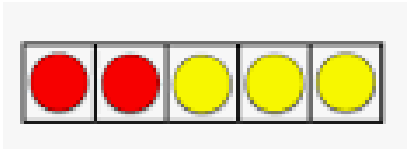
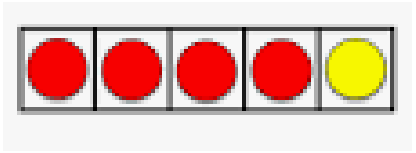
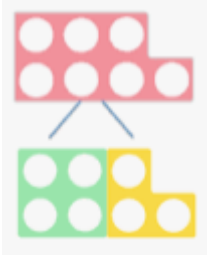
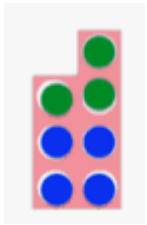
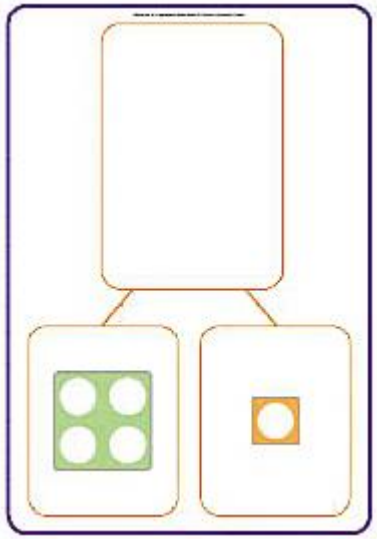
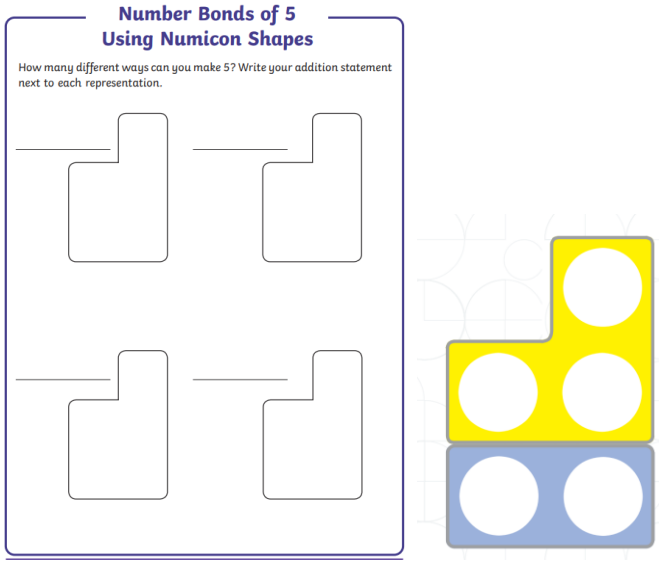
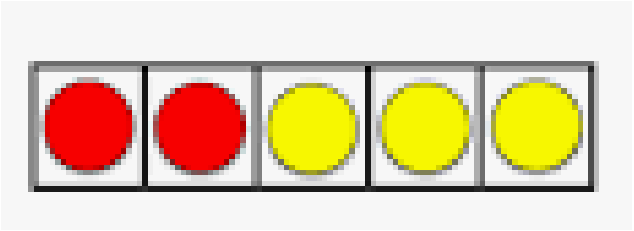
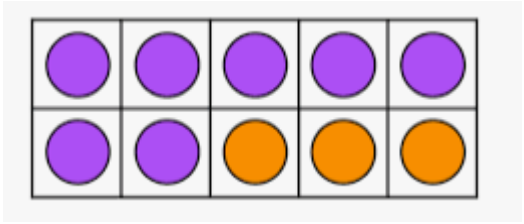
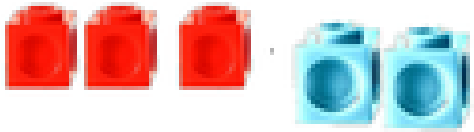
Compare quantities up to 10 in different contexts, recognising when one quantity is greater than, less than or the same as the other quantity.
In Numicon Firm Foundations, children initially explore the Numicon Shapes and build their patterns, before moving on to learn the cardinal value of numbers 1–10 and beyond. They learn how to compare sets of objects by counting and by arranging objects into Numicon patterns to find ‘how many more’ and ‘how many fewer’. From here they can develop the vocabulary of adding and subtracting.

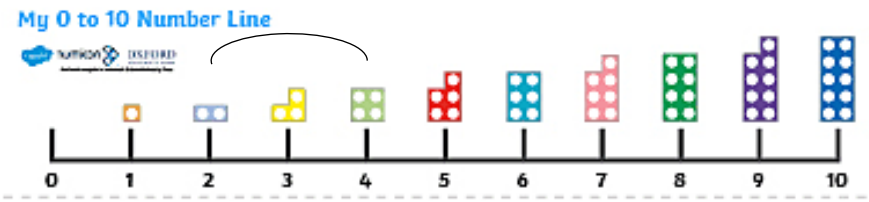
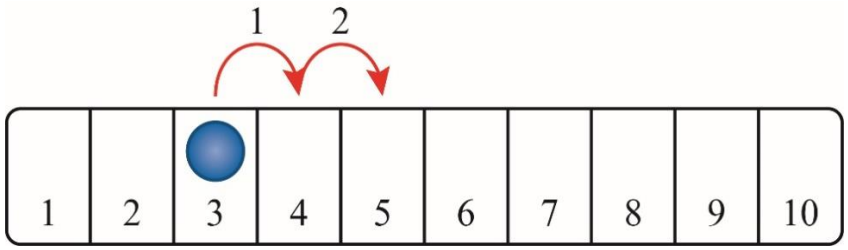
Explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally. The Numicon Firm Foundations teaching programme and the structured apparatus are designed to help children notice numerical patterns and describe relationships between numbers. They learn to answer questions such as, ‘is it big or small?’, ‘odd or even?’, ‘which number comes before?’, ‘which comes after?’ and ‘what patterns can you see in the number?’. The Numicon Shapes lend themselves to learning about odd and even numbers in a visual and tactile way. Later in the programme, children use the confident understanding of number they have gained to halve collections and share them equally.

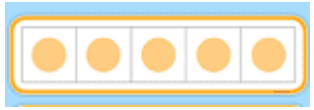
***Power Maths* calculation policy Reception**		
Children develop the core ideas that underpin all calculation. They begin by connecting calculation with counting on and counting back, but they should learn that understanding wholes and parts will enable them to calculate efficiently and accurately, and with greater flexibility. Children record their calculations in their own ways, there is no expectation of number sentences at this stage, however children may choose this way to record their thinking.		
Key language: count, forwards, backwards, whole, part, recombine, break apart, ones, ten, tens, number bond, add, adding together, addition, plus, total, altogether, first, then, now, subtract, subtraction, find the difference, take away, minus, left, less, more, fewer, group, share, equal, equals, is equal to, groups, equal groups, divide, share, shared equally		
Addition: Children start to explore addition by sorting groups. They then use sorting to develop their understanding of parts and wholes. Children combine groups to find the whole, using a part-whole model to support their thinking. They also use the part-whole model to find number bonds within and to 10. Using a five frame and ten frame, children add by counting on. They start by finding one more before adding larger numbers using counters or cubes on the frames. Children use a number track to add by counting on. Linking this learning to playing board games is an effective way to support children's addition.	**Subtraction:** Children start to explore subtraction by sorting groups. They use sorting to develop their understanding of parts and wholes. When comparing groups, children use the language more than and fewer than. This will lead to finding the difference when they move into KS1. Children then connect subtraction with the idea of counting back and finding one less using a five frame to support their thinking. They explore subtraction by breaking apart a whole to find a missing part. This links to their developing recall of number bonds. Children count back within 20 using number tracks and ten frames to see the effect of taking away.	**Multiplication and Division:** Children first start to look at the idea of equal groups through their exploration of doubles. They use five frames and objects to check that groups are equal. Children then explore halving numbers by making two equal groups. They highlight patterns between doubling and halving seeing that double 2 is 4 and half of 4 is 2. As well as halving, children also explore sharing into more than two equal groups. They share objects one by one, ensuring that each group has an equal share.

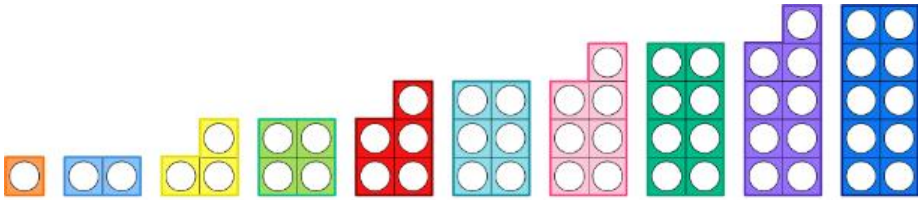
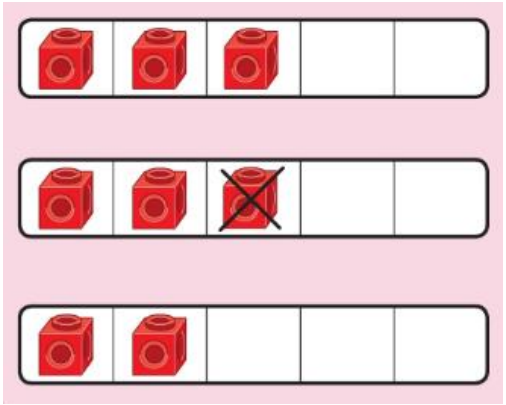
Reception		
	Numicon	**Other representations**
Addition	**Counting and adding more (within 5)** Children two Numicon shapes together to find the total amount.   Two add one is three. Three add one is four.	**Counting and adding more (within 5)**   Using 5 frames to represent ways of making 5.  Combining groups of objects together to find the total amount.

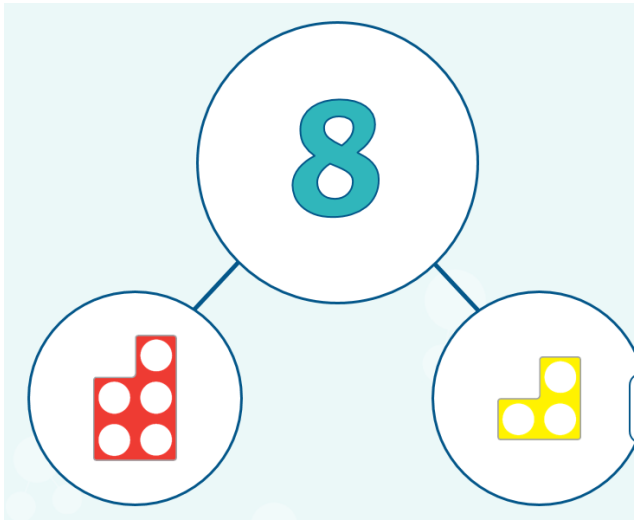
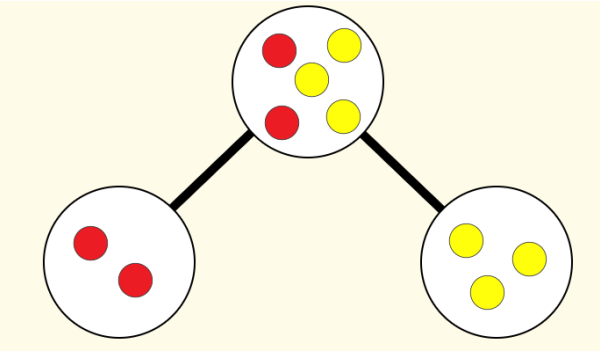
	Combining groups to find the whole Children sort Numicon into parts and combine them to find the whole.   The parts are 3 and 4. The whole is 7.  The parts are 4 and 1. The whole is 5.	**Combining groups to find the whole** Children use objects in a part-whole model to find the whole.  The parts are 3 and 4. The whole is 7.

	Finding number bonds to 5 and then 10 Children combine two groups to find a number bond to 5 (10).  What shapes will make the total of 5? Can you find all the Numicon pairs that make 5 (10)?  Making Numicon towers.	**Finding number bonds to 5 and then 10** Use five frames and part-whole models to represent key number bonds.  2 and 3 equal 5.  7 and 3 equals 10.  3 cubes add 2 more equals 5.

	Adding by counting on (number track)  2 add 2 more is 4. Children put a counter on the starting number and then move it on the required amount to find the total.  Children make Numicon number lines outside and move along the number track.	**Adding by counting on (number track)** Children use a number track and a counter. They start at the larger number and count on the smaller number to find the total. 

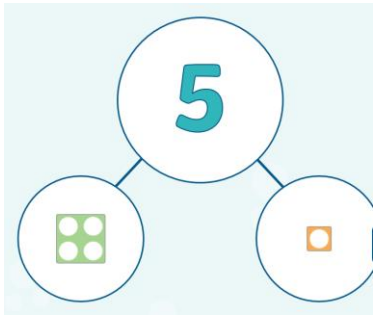
Subtraction	**Subtracting within 5 then 10.** Children use subtraction covers or their hands to cover the Numicon holes. They then move on to visualing the shape that is left when some are taken away.   9 subtract 3 equals 6. 10 subtract 3 equals 7.	**Subtracting within 5 then 10.** Children are encouraged to touch and count the objects. They then touch, count and remove the appropriate number of objects. They then count the remaining objects left to find the total left.  Children use counters on a 5/10 frame to support subtraction by removing counters. 

	One Less/Fewer Children cover one hole with their hand and are then encouraged to visualise the Numicon number line and say what is one less. 	**One Less/Fewer** Children use five frames and objects to make a number. They then remove or cross out one object to find one less.  *One less than 3 is 2.*

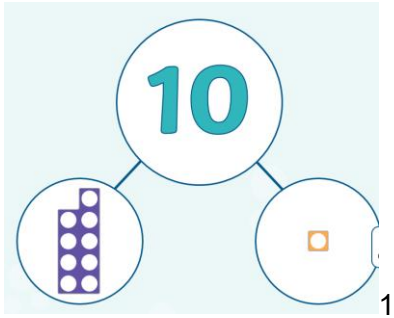
	Introducing the part-whole model Children use Numicon to identify the part – whole model  The whole is 8. 5 is a part. 3 is a part.	**Introducing the part-whole model** Children use counters or cubes to represent objects in a part-whole model.  *The whole is 5.* *2 is a part.* *3 is a part.*

Finding number bonds to 5 then 10.

Children partition 5 into different groups to find the number bonds to 5.



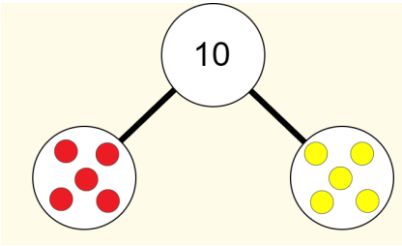
5 is the whole. 4 is a part. 1 is a part.



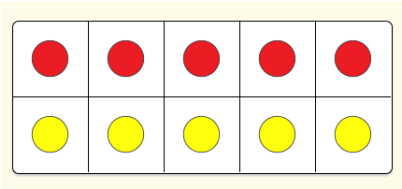
10 is the whole. 9 is a part. 1 is a part.

Finding number bonds to 5 then 10.

Children use part-whole models, ten frames and counters to find the number bonds to 10.

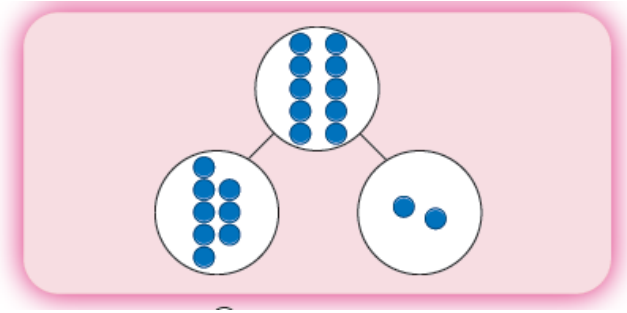


10 is the whole.
5 is a part and 5 is a part.

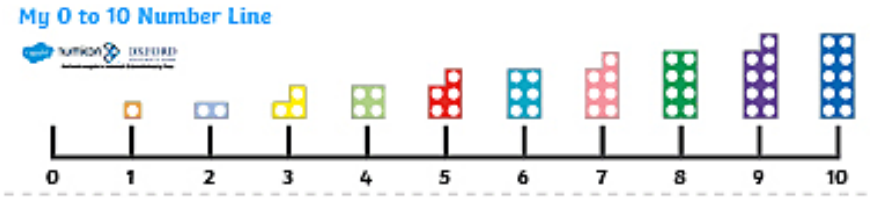
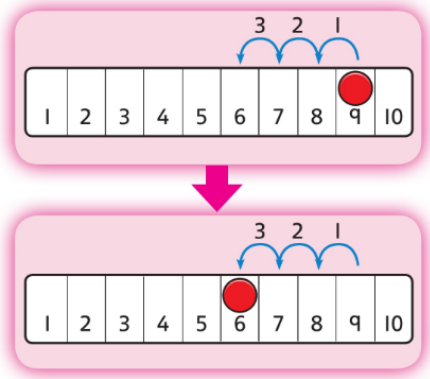


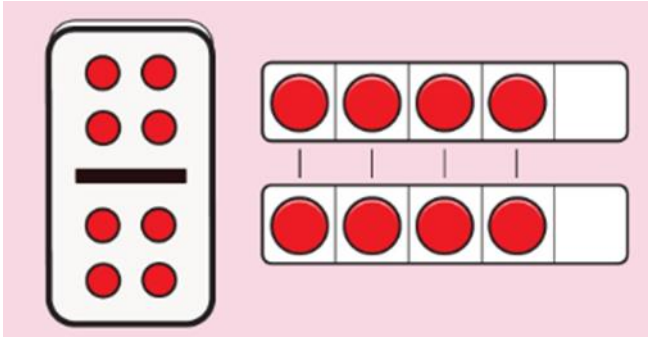
10 is the whole.
5 is a part and 5 is a part.

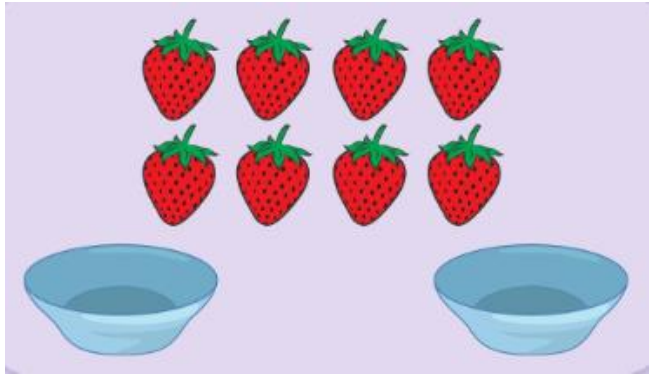
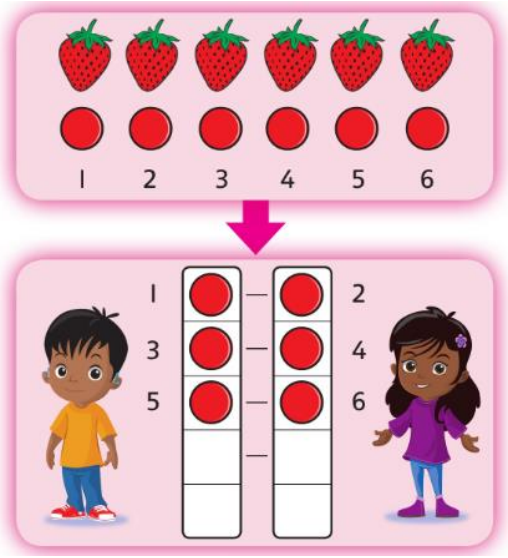
Children use part-whole models, and counters to find missing parts and the subtraction number bonds to 10.



The parts are 8 and 2.
10 is the whole.

	Counting back and taking away (number track) Children use a Numicon number line to subtract by counting back.  *9 take away 3 equals 6* *9…8…7…6*	**Counting back and taking away (number track)** Children use a number track and a counter. They start at the larger number and count back the smaller number to find the answer.  *9 take away 3 equals 6* *9…8…7…6*

Multiplication	**Making doubles** Children explore doubles in their environment including in games such as on dominoes or dice. They focus on the understanding of doubles being 2 equal groups.  *Double 4 is 8.* *Double 2 is 4.* *Double 3 is 6.*	**Making doubles** Children use five frames to find doubles by lining up counters or cubes.  *Double 4 is 8.*

Division	**Halving and sharing** Children explore halving and sharing through practical sharing using real life scenarios including sharing fruit or classroom equipment.  *Half of 8 is 4.*	**Halving and sharing** Children use five frames to share amounts fairly and to check that the groups are equal. They share the counters/cubes one by one.  *Half of 6 is 3.*