Alwyn Infant School Calculation Policy

At Alwyn Infant School, we have focused our Calculation Policy around the Mathematics Curriculum for Early Years Foundation Stage (EYFS) and for KS1. We have worked alongside Courthouse Junior School to help consider the next stages in calculation for the children we teach and to ensure that our calculation methods help children to transition well into maths in KS2.

The statutory framework for the Early Years Foundation Stage (Setting the standards for learning, development and care for children from birth to five), published 31st March 2021 and effective from 1 September 2021 states:

> Developing a strong grounding in number is essential so that all children develop the necessary building blocks to excel mathematically. Children should be able to count confidently, develop a deep understanding of the numbers to 10, the relationships between them and the patterns within those numbers. By providing frequent and varied opportunities to build and apply this understanding - such as using manipulatives, including small pebbles and tens frames for organising counting - children will develop a secure base of knowledge and vocabulary from which mastery of mathematics is built.

The Mathematics Curriculum for England and Wales (2013), states the following about the KS1 curriculum:

> The principal focus of mathematics teaching in key stage 1 is to ensure that pupils develop confidence and mental fluency with whole numbers, counting and place value. This should involve working with numerals, words and the four operations, including with practical resources [for example, concrete objects and measuring tools].

At Alwyn, we use the approach of building up children's understanding of the value of numbers and of calculation by using a CPA approach. CPA stands for Concrete Pictorial Abstract. This means that we model what numbers and calculations (addition, subtraction, multiplication and division) look like using concrete apparatus that children can physically manipulate. Children apply their understanding from using concrete resources to representations such as drawings and to abstract calculations. We have included the models and images that we incorporate into our maths teaching in this calculation policy.

As we plan using White Rose Maths as a guide, we have also considered their Calculation Policies when writing our own.

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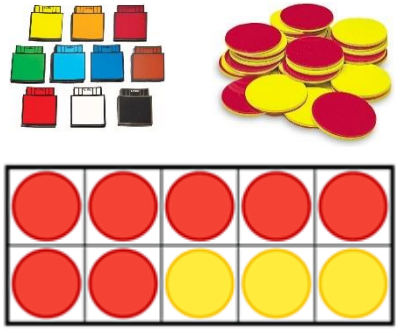
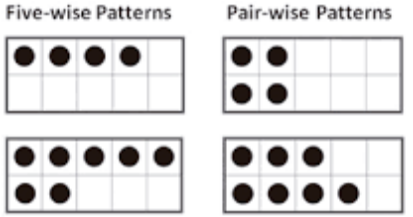
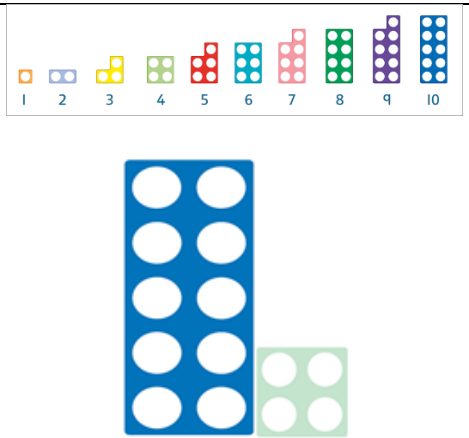
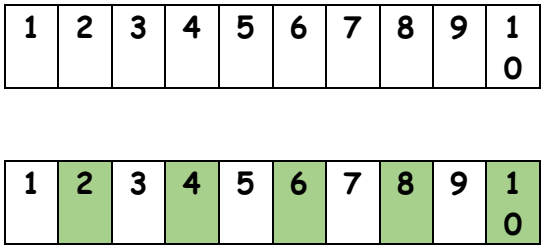
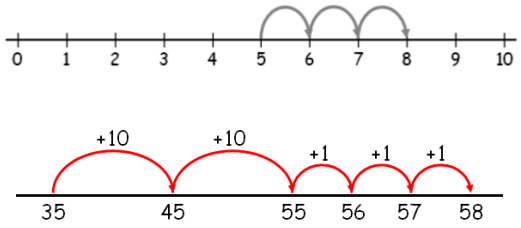
Models and Images that we use at Alwyn:

<table>
<tr>
<td>Cubes and Counters
Children use counters to make numbers, practicing counting 1 at a time by either touching or moving the counters. Cubes can be built together allowing for opportunities to compare the size of numbers. Counters are used along with other resources such as tens frames.</td>
<td>  </td>
<td>Fives frames & Tens frames
Tens frames help children to see how many they have very quickly, helping them to rely less on counting strategies. Sometimes having counters arranged to fill up the row of 5 helps to see the number quickly and grouping counters in 2s on a tens frame links well with the visual resource Numicon.</td>
<td>Fives frame showing 3:
 
Tens frames pictured below:
  </td>
</tr>
<tr>
<td>Numicon
Numicon is a resource which provides a piece for each number from 1 to 10. It is particularly helpful in building images of numbers. Numbers written just as a number (e.g. 7) is quite abstract compared to looking at the Numicon number 7 piece. Numicon also helps build an understanding of tens and ones (place value).</td>
<td>  </td>
<td>Number Tracks
A number track is when each number has its own space to sit in. Using cubes or counters on top of a number line help build an understanding of the structure of a number line. Number lines are useful as they link to previous knowledge children have of jumping steps on board games and they help build a picture of the 100 square.</td>
<td>  </td>
</tr>
<tr>
<td>Bead Strings
Bead strings are useful in practicing counting, allowing children to move a certain number of beads at a time. They show tens and ones really clearly and can help build an understanding of a number track and 100 square.</td>
<td>  </td>
<td>Number Lines
Number lines can be used to help children with counting skills or showing the value of a number by saying where it would fall on a number line. Number lines and empty number lines can be used as a visual way of showing how to add, subtract, multiple or divide.</td>
<td>  </td>
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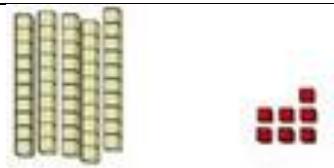
Tens and Ones pieces

We use a variety of different resources to show tens and ones: Dienes blocks, Numicon and coins are a few examples. These help children to understand the value of the digits in numbers and help with drawing out calculations.



100 Squares

100 squares are helpful for allowing children to learn how to add or subtract ones by counting as they land. They also provide opportunities to count in steps and look for patterns. Counting in tens when starting at different numbers is also very easily shown a 100 square.

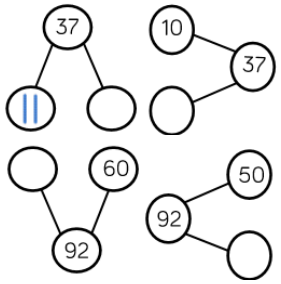
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Arrow Cards

These are useful in helping children to see that the 5 in 57 is worth 50 for example. They help children to learn how to partition and recombine numbers.

Part-Whole Models

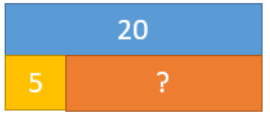
Part- Whole models allow children to think about how numbers are added together and split apart. The whole is the circle on its own and the parts are combined to make the whole.



Bar models

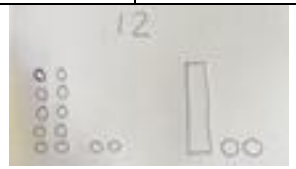
Bar models build on understanding of part whole models. The top bar shows the whole and the bottom sections show the parts that fit together to make the whole.

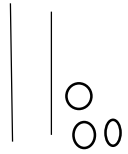
Bar models are also useful in helping children to estimate the size of the missing number – 5 is half of 10, which is half of 20.



Drawing tens and ones

Children progress from drawing numbers like Dienes blocks or Numicons to a more abstract drawing of long lines to show tens and circles arranged in a Numicon pattern to show ones.

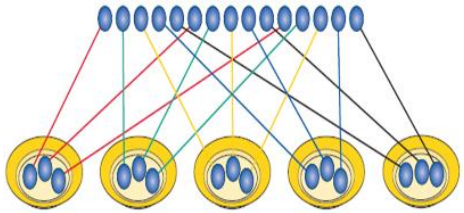




Y1 drawings of 12
Compared to Y2 drawing of 23

Pictures and drawings

Pictures are very important for children when trying to see a problem. In KS1 children use pictures or their own drawings to solve problems. We encourage drawing out and often use the phrase *'If in doubt, draw it out!'*

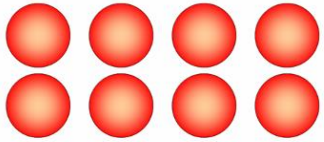


Peg boards

We use peg boards to help show equal groups when multiplying and dividing. It helps build an understanding of arrays.

Arrays

Counters or drawings of counters can be arranged into rows and columns to help with multiplication and division. Here we have 4 groups of 2 or 2 groups of 4.



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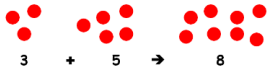
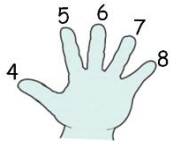
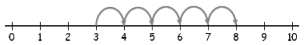
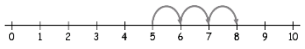
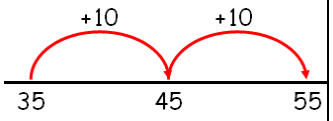
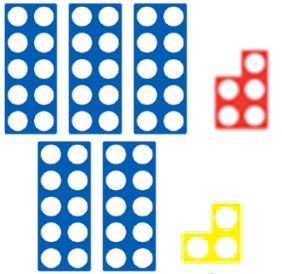
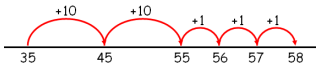
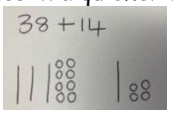
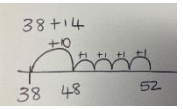
The above shows some of the main resources we use when teaching maths at Alwyn. However, we also use many other resources too. Children love the hands on learning that maths resources allows.

Addition	The early stages of counting focus on teaching children the concept that adding is about combining groups of objects. Children are encouraged to develop mental pictures of the numbers so being able to find numbers of objects or hold up a certain number of fingers helps to develop the understanding of number as an amount. Children handle objects, count groups of objects and physically put them together before counting how many they have.	**Vocabulary for addition:** Add, addition, more, plus, make, sum, total, altogether. One more, two more, ten more How many more? How many more to make …? How many more is … than …? **Mental facts to recall - Number Bonds:** It is so important that children begin to learn addition facts, such as 3 + 5 = 8, as this speeds up their calculation and helps them develop abstract calculating methods in preparation for KS2. By the end of Y2, children should know all the ways of making numbers up to 10. For example, they should know all the ways of making 5, 6, 7, 8, 9, and 10. Bonds of 5 are: 0 + 5, 1 + 4, 2 + 3, 3 + 2, 4 + 1, 5 + 0. By the end of Y2, children start applying these to knowing how to make numbers up to 20 and 100.	**Types of addition – examples of problems:** **Adding 2 or more sets: 4 + 3 = 7** I have 4 marbles and my friend has 3 marbles. How many marbles do we have altogether? **Increasing: 10 + 2 = 12** A plant is 12cm tall. If it grows another 2cm, how tall will it be now?

	Count all	**Count on from**	**Count on from the largest number**	**Count on in ones** **Count on in tens**	**Count on in tens and ones**	**Adding two 2-digit numbers when ones make more than 10**
Examples of how we use models/images	**3 + 5** count out three counters and then five counters and then find the total by moving the counters together and counting all of them.  	**3 + 5** count on from the first number in ones: *'four, five, six, seven, eight'.*  **3'** The children hold the first number in their head and then count on. This is often done with objects or their fingers:  They can then progress to showing the jumps on a number track, number line or a 100 square.  	**Count on from the larger number: 3 + 5** addition can be done in any order so it is more efficient to count on from the largest number as it is fewer jumps.  **'5'** Again, children then progress to showing jumps on a number track, number line or a 100 square.  	**35 + 4 or 35 + 20** Children will use tens and ones equipment, such as dienes or Numicon to make each number. They will have opportunities to discuss which part of the number changes when adding tens (the tens) and what changes when adding only ones. They will progress to drawing out tens and ones pieces to add, using 100 squares and empty number lines to finally mentally adding.  	**35 + 23** Again tens and ones equipment will be used first, moving onto methods such as drawing out, using 100 squares or empty number lines.  *(This can be done with dienes blocks too.)*  	**38 + 14** After using tens and ones equipment, children will move onto drawing out. In this method, children are taught to count in tens and then on in ones, or use their number bonds to add the ones in a quicker way.  In this method, they use an empty number line to count by adding on tens first, then ones. 

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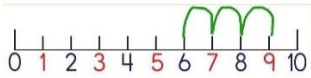
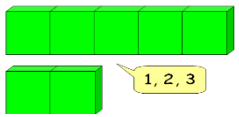
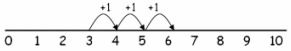
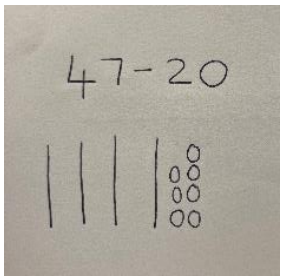
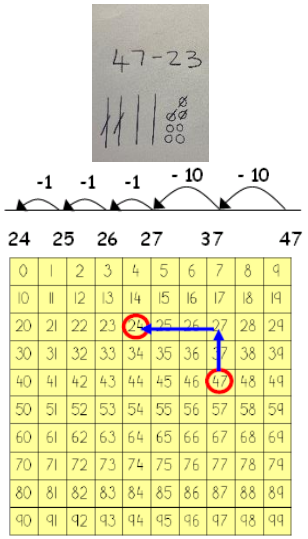
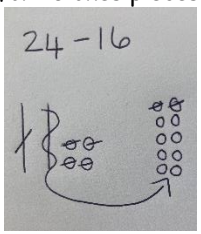
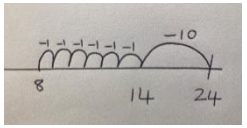
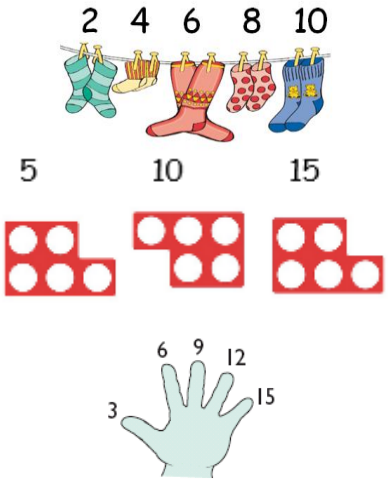
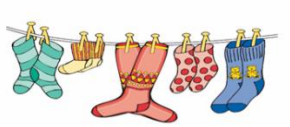
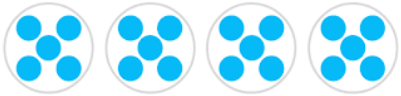
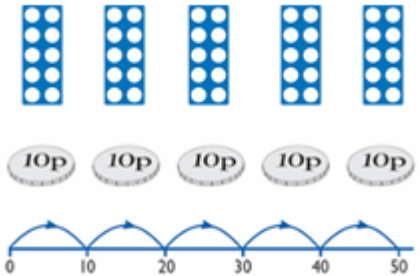
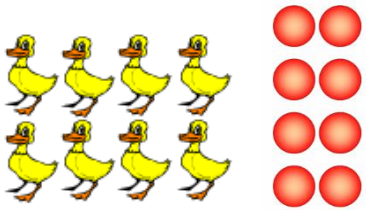
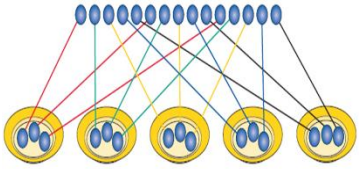
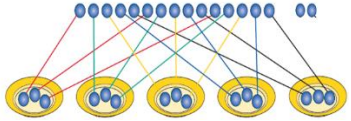
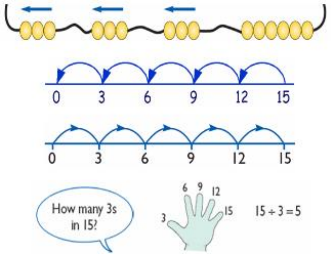
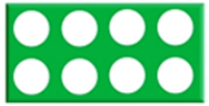
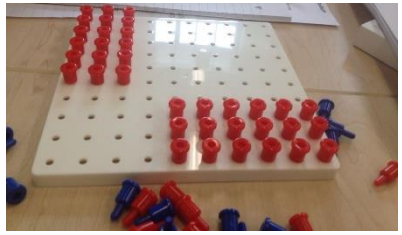
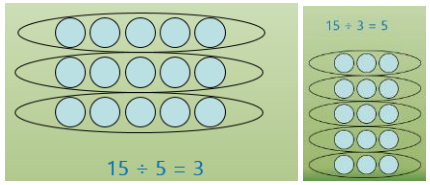
Subtraction	The early stages of counting focus on teaching that subtraction is about taking away groups of objects. We build on this and teach subtraction as comparing amounts too.	**Vocabulary for subtraction:** Take away, leave, minus, subtract One less, two less …ten less, one hundred less. How many are left? How many have gone? What is the difference between? How much less is…? **Mental facts to recall – subtraction facts:** Children will learn that subtraction is an undoing of addition, and that if they know an addition number bond they also know the corresponding subtraction fact: So, if 3 + 5 = 8, then 8 – 3 = 5	**Types of subtraction – examples of problems:** **Take away:** 10 – 3 = 7 I have 10 sweets. If I eat 3, how many do I have left? **Difference:** 5 – 4 = 1 What is the difference between 4 and 5? (5 is 1 more than 4, 4 is 1 less than 5) **Part of a whole:** 8 – 5 = 3 There are 8 fish in a bowl. Some are red, the rest are yellow. If 5 of the fish are red, how may are yellow?

	Using and moving objects	**Counting back from a number**	**Counting on from a number (finding the difference)**	**Counting back in tens**	**Counting back in tens and ones**	**Subtraction with exchange**
Examples of how we use models/images	**8- 3** Using pictures, objects, counters and marks to physically take away objects from a group.  8 spots take away 3 spots means we have 5 left. Numicon pieces are placed on top of each other to show subtraction. So for example the 3 piece will be placed on top of the 8 piece and then what is missing shows the difference. 	**9 – 3** Beadstrings can be used to show how the group gets smaller when counting back. These allow children to move the objects as they count back.  This understanding can be built on by using number lines or number tracks alongside beadstrings and then children move onto counting back mentally. 	**5 - 2** Objects are used to compare numbers and count on or back to find the difference. The difference between 5 and 2 is 3.  **6 - 3** Below, a number line has been used to show 6 subtract 3 – you could either count forwards or backwards to find the difference in value between the numbers. 	**47 - 20** Children use tens and ones equipment to make numbers and discuss which part of the number changes when tens are subtracted. They then move onto practising counting back on number lines, 100 squares, drawing out tens and ones and this then might progress to mental subtraction. 	**47 - 23** Tens and ones pieces are used to make the 1st number and then physically take the 2nd number away. Then, children learn how to draw this out. 	**24 - 16** After lots of practice with tens and ones pieces such as Dienes, children learn how to draw out subtraction with exchange by exchanging a tens piece for 10 ones pieces.  Or, children could use an empty number line to first count back in tens, then count back in ones. 

Multiplication	Children will be encouraged to manipulate objects and toys into equal groups and describe them. They will work on practical problem solving activities involving equal sets or groups.	**Vocabulary for multiplication:** Lots of, groups of, times, multiply, multiplied by, multiple of, repeated addition, array, double Once, twice, three times … ten times **Mental facts to recall – subtraction facts:** Y2 children learn the 2x, 5x and 10x tables after using concrete resources to learn what times tables mean, for example 10 X 5 means counting in 10s five times.	**Types of multiplication – examples of problems:** **Repeated addition:** 2 X 5 = 10 There are 5 children, and they each get 2 sweets. How many sweets were handed out? **Scaling:** 2 x 3 = 6 I have 2 marbles. My friend has 3 times as many marbles as me. How many marbles does my friend have?

	Counting in equal steps	**Describing a group of objects or pictures**	**Repeated Addition**	**Describing and drawing an array**
Examples of how we use models/images	Children begin by grouping and counting objects and move onto counting both forwards and backwards in steps. In Reception, children join in with counting in rhymes and practice counting verbally beyond 20. In Y1, children move onto counting both forwards and backwards in 1s up to 100. In Y2 children progress to counting forwards and backwards in 2s, 3s, 5s and 10s. 	Children in Y1 have opportunities to solve simple problems by using concrete objects. For example, they may place counters onto plates to work out how to solve: A mum has 3 children. She gives each child 2 biscuits. How many biscuits did she need? Y2 children use stem sentences to describe equal groups and this helps them move towards understanding how to write matching number sentences.  **There are 5 groups of 2.** **5 lots of 2 is 10** **We are counting in 2s five times.**  **There are 4 groups of 5.** **4 lots of 5 is 20.** **We are counting in 5s four times.**	In Y2, children move onto adding equal groups by first understanding this as repeated addition. They write number sentences using the plus sign.  10 + 10 + 10 + 10 + 10 = 50 The children then move onto learning that repeated addition can be written as a multiplication number sentence, using the times sign: 10 X 5 = 50	An array is formed by arranging a set of objects or dots into rows and columns. Each column must contain the same number of objects as the other columns, and each row must have the same number as the other rows.  Y2 children learn to write matching number sentences for the arrays: 2 X 4 = 8 4 X 2 = 8 In Y2, children learn about commutativity in multiplication and how 2 X 4 gives the same answer as 4 X 2

Division	Children will understand equal groups and share items out in play and problem solving.	**Vocabulary for division:** share, share equally, one each, two each, three each …, group in pairs, threes…tens, equal groups of, divide, divided by, divided into, left, left over **Mental facts to recall - Division facts:** Y2 children learn the matching division facts for the 2x, 5x and 10x tables. For example, if they know 2 x 5 = 10, they should also know 10 ÷ 5 = 2. Knowing halves of numbers up to 20 will be useful in remembering facts for dividing by 2.	**Type of division – examples of problems:** **Division as sharing: 10 ÷ 2 = 5** There are 10 sweets. If they are shared out between 2 children, how many sweets will each child get? (The answer comes from finding out how many in each group, which is 5.) **Division as grouping: 70 ÷ 10 = 7** There are 70 sweets. If a sweet shop owner puts them into bags of 10 sweets in each bag, how many bags will he/she need? (The answer comes from finding out how may groups there are, which is 7.)

	Sharing	**Grouping**	**Arrays**	**Repeated subtraction**
Examples of how we use models/images	Reception children will have opportunities to share out toys and food and consider whether sharing has been done fairly. In Y1, children will be given simple sharing problems and use objects and then move onto using drawings to solve the problem. In Y2, children progress to using the division number sentence after using objects or pictures to find the answers. Y2 children might also begin to just know the answer because they know their division facts.  15 shared out between 5  The concept of remainders is introduced using concrete objects.	These show some examples of how we would solve grouping problems using models/images: How many groups of 3 can be made from 15?  How many 2s can fit onto a Numicon 8 piece?  How many 10p coins are there in 50p?  Y2 children will also move onto writing matching number sentences, such as: 15 ÷ 3 = 5 8 ÷ 2 = 4 50 ÷ 10 = 5	Pegboards are used as a way to begin understanding how to group into an array.  In Y2 children progress to drawing their own arrays using the squares in their maths books.  It doesn't matter which way the array is drawn. Children are taught to find what was unknown.	Some children may find it useful to use a number line to subtract repeatedly if they are confident with counting backwards in 2s, 3s, 5s or 10s.